EXPLORING THE EFFECT OF TEACHERS' SELF-REPORTED PRACTICES AND MATHEMATICS TOPICS TAUGHT ON FOURTH-GRADE STUDENTS' ACHIEVEMENT ON THE SIMCE 2011 EXAMINATION IN CHILE

by

RAYÉN VALERIA ANTILLANCA QUINTREQUEO

(Under the Direction of Andrew G. Izsak)

ABSTRACT

The present study explores the association between self-reported teaching practices used by teachers and the students' achievement. Also, this study includes the extent to which teachers taught some topics and their self-reported perception to teach these topics. To this end, a regression analysis was performed to select the teaching practices and the most influential topics with students' achievement; their association was studied with multilevel analysis. I used the data from a test taken in Chile, called 2011 SIMCE. This data contains the result of the standardized examination of the subjects of Spanish, mathematics, and science. In addition, this dataset includes answers of questionnaires for teachers, parents and students.

The main results gave evidence that the most influential teaching practices in Chilean classrooms were *students' group work*, and *solving HW* and *explaining the workbook and textbook exercises solutions to the whole class.* This practices work better together than separately. In addition, this study identified *fractions* and *decimals* as the weak topics among fourth grade teachers in Chile. These types of teaching practices work better with a specific topic

taught, e.g. the *solve HW* and *explain the workbook and textbook exercise solutions to the whole class* work better together with the fractions topic. From all the variables used, the best predictor of students' achievement was the teachers' self-reported expectation of their students' future schooling.

INDEX WORDS: Multilevel analysis, Teaching practices, Standardized test, Elementary teachers, Chilean teachers, SIMCE

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A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2016

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December 2016

DEDICATION

I dedicate this study to my parents, Mamerto and María,

My sister, María Elisa,

My nephews, Malén, Daniel and Paulo,

My Guatón,

My brother in law, Michael

And all my friends, in the U. S. and Chile,

For their love and support.

ACKNOWLEDGEMENTS

I would like to thank to my major professor, Andrew Izsak, for his support, patience and good advice. I extend this thanks to my committee members, Denise Spangler, Dorothy White and Seock-Ho Kim for their valuable feedback and support. I owe a debt of gratitude to my friends, Anángelica Rivera, Angel Carreras, Y-Long Lee, Juan Paulo Jimenez, and Helen Rogers for helping me with paperwork/money/accommodation in the U.S. after my return to Chile, I could not have done it without your help. Also, I am grateful for my friends in Chile, Paola Chavez and Guillermo Maldonado, thanks a lot for your patience and advice in dissertation editing.

I am grateful to the Fulbright and Conicyt programs for their sponsorship and support throughout my doctoral program at the University of Georgia.

I am also grateful for my professors in Chile:—Claudio Silva Zamora, Patricio Montero Lagos, Claudia Matus Correa, Alma Placencia Cofré, and Marcos Caroli—and the staff of the Universidad de Santiago de Chile, in particular Maritza Araya, Soledad Cabañas, Claudia Arenas, and Cristobal García, for their feedback, support, patience, advice and help editing.

I am grateful for my parents, María and Mamerto, my sister, María Elisa, my nephews, Malén, Daniel and Paulo, my Guatón, my brother in law, Michael, and all my friends, in the U. S. and Chile, for their love and support.

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CHAPTER 1

INTRODUCTION

Numerous researchers have recognized a variety of factors are important for students' achievement in mathematics. Some of these factors include language facility (Harlaar, Kovas, Dale, Petrill, and Plomin; 2012; Pimperton & Nation, 2010), socio economic status (SES) (Mizala, A., & Romaguera, P., 2000), characteristics of teachers and their teaching practices (Clotfelter, Ladd, & Vigdor, 2007; Darling-Hammond, 2000; Harris, & Sass, 2011; Kukla-Acevedo, 2009; Walker, 2011; Wallace, 2009), and which mathematics topics are covered to greater or lesser extant (Desimone, Smith, & Phillips, 2013). Few reports have examined relationships among all of these factors in a single study.

Statement of the Problem

Some researchers have emphasized the importance of teaching practices (Kersting, Givvin, Thompson, Santagata, & Stigler, 2012; Schoen, Cebulla, Finn, & Fi, 2003); however, Good (2010) stated that there is little literature regarding teaching practices and their effects on students' learning. Kane, Taylor, Tyler, and Wooten (2010) added that there is not much information about what specific practices "are most important in promoting achievement" (p. 589). In addition, Chen, Hendricks, and Archibald (2011) commented that "Although teaching practices reflect the general core work of teaching across subject areas, teaching practices are specific to content and context" (Chen et al., 2011, p. 15).

Because the specific teaching practices that affect students' achievement are still not clear, identifying those practices which most influence students' achievement is necessary. A Chilean national data set called the System for the Measurement of Educational Quality (SIMCE, 2015) provides an opportunity to examine the relationship between teaching practices and students' achievement. Although, most Chilean literature based on SIMCE is focused on SES (McEwan & Carnoy, 2000; Sapelli & Vial, 2005), the SIMCE data provide information about reading skills (since now Spanish) students' achievement, SES of school, and teachers' characteristics, as well as teaching practices. Thus, SIMCE data give the opportunity to explore what specific practices are associated with higher student achievement. Therefore, the purpose of this study is to explore teaching practices in the Chilean context, using the results of a nationally administered standardized test called the SIMCE. The SIMCE examination measure achievement in different subjects. In addition to assessing student achievement related to the curriculum, additional questionnaires are given to teachers and parents. This information is used to contextualize and analyze the results of the SIMCE tests.

Purpose of the Study

The purpose of this study was to explore the association of practices used by teachers to teach some mathematics topics with students' achievement as measured by the SIMCE examination. Furthermore, information about that association was enriched with teachers' view of their students and SES of the school. In order to achieve this purpose, I used ANOVA, regression, and multilevel analysis, also known as hierarchical linear model (HLM)

Research Questions

I used linear regressions to answer the first three research questions because the goal of those questions was to select the strategies and topics related to students' achievement. The questions were:

1. Which self-reported teaching practices were associated with students' achievement on the SIMCE 2011 Mathematics examination?
2. Which topics taught were associated with students' achievement on the exam?

3a. Which teachers' self-reported perceptions of their preparation to teach topics identified in Question 2 were associated with students' achievement?

3b. Which teachers' perceptions of students were associated with their students' achievement?

I used multilevel analysis to answer the last four questions, because the goal of these questions was to analyze the association between strategies and topics previously selected and the students' achievement. The questions were:

4. To what extent were practices identified in Question 1 associated with students' achievement?
5. To what extent did the teaching practices selected in Question 1 and the topics selected in Question 2 predict students' achievement on the SIMCE mathematics examination?
6. Were teachers' perceptions of their preparation to teach topics identified in Question 2 or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?

7. Did the association between reported teaching practices examined in Question 1 and students' achievement differ across schools? In particular, to what extent were school characteristics, such as funding model and SES, associated with students' achievement?

The main result of this study identified three teaching practices that were associated with students' achievement as measured by the SIMCE mathematics examination: *students' group work, solve HW* and *explain the workbook and textbook exercises solutions to the whole class*. Also this study identified *fractions* and *decimals* as the weakness topics for Chilean teachers. According to the HLM, the economic factors of the school had little influence on students' achievement. One plausible explanation for that is the SES of the school was include in the teaching of the teachers, because teachers used the school resources to teach.

Rationale

In the Chilean system, fourth-grade students have just one teacher for all subjects. By analyzing data from fourth-grade classes, I can isolate the effect that one teacher has on a whole class. However, I cannot evaluate the effect of the teachers in the previous grades.

The teaching practices reflect the teacher content knowledge (Chen, Mason, Staniszewski, Upton, & Valley, 2012; Hill, Rowan, & Ball, 2005). The topics that have been taught and how teachers feel about their preparedness is an interesting relation to connect with teaching practices and students' achievement that I explored.

With regard to Chile, the country has a National curriculum—the current one being implemented in 1996. Since then, some modifications have been made, but the Chilean curriculum has kept the same requirements, values and orientations of learning (Unidad de

Currículum y Evaluación, 2013). According to the curriculum, the purpose of teaching mathematics in elementary school is to facilitate the selection of strategies for solving problems, to contribute to critical thinking, to analyze quantitative information, and to help students analyze and build strategies to solve real life problems (Unidad de Currículum y Evaluación, 2013). Thus, because Chile has a unique curriculum for the entire country, I have the opportunity to analyze in a large population how some specific topics addressed by teachers are associated with teaching practices and student achievement.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature related to teaching practices, the Chilean education context, and variables used in the present study. The first part of the review examines research on the connection between teaching practices and teachers' content knowledge. The second part of the review explains the Chilean educational system, including what the SIMCE is, the different types of school funding, and Chilean teachers. The last part of this chapter reviews literature about variables used in the present study.

Teaching Practices

Connections Among Content Knowledge for Teaching, Teaching Practices, and Student Achievement

Teaching practices are connected with the teachers' content knowledge. Hill, Rowan, and Ball (2005) analyzed the effect of teachers' knowledge on students' achievement, which started a line of inquiry about how teachers' content knowledge affects instruction. Hill et al. (2005) used a sample of 1,190 first-grade and 1,773 third-grade students and 334 first-grade and 365 third-grade teachers. Students' achievement was measured using the CTB/McGraw-Hill's Terra Nova Complete Battery. Due to the fact that the CTB includes a wide range of mathematics topics, the researchers selected three focal topics to construct their mathematical knowledge for teaching measure—number concepts, operations, and pre-algebra or algebra. The teachers' content

knowledge for teaching was measured using items included in an "annual questionnaire filled out during each year of the study" (p. 381). To increase the number of items, the authors constructed new items using information from the overall questionnaire answered by the teachers. Hill et al. reported a positive relationship between teachers' content knowledge and gains in students' achievement; however, this study could not determine whether teachers' content knowledge is general or knowledge of specific topics accounted for the gains in students' achievement. This study opened a new line of inquiry about how teaching practices are affected by teachers' content knowledge: "what knowledgeable teachers *do* in classrooms—or how knowing mathematics affects instruction—has yet to be studied and analyzed" (p. 401). To motivate this line of inquiry, Hill et al. mentioned previous studies which suggested that more knowledgeable teachers had better explanations related to mathematics, connections, and understanding of students' methods.

More recent work has examined connections between teacher knowledge and instructional practices. Kersting, Givvin, Thompson, Santagata, and Stigler (2012) studied the relationship between teacher knowledge, teaching practices, and students' learning. Thirty-six teachers from 10 different states volunteered to participate in this study. Each teacher had to complete a background survey, a mathematical content knowledge test, and the Classroom Video Analysis (CVA) assessment. From the background survey, researchers obtained information about teachers' preparation and experience. The mathematical content knowledge test consisted of 15 questions from the Learning Mathematics for Teaching Mathematical Knowledge for Teaching item bank. To complete the CVA, each teacher had to analyze short videos of mathematics instruction and answer the following prompt: "Discuss how the teacher and the

student(s) in the clip interacted around the mathematical content'' (p. 574). Researchers scored written answers for teachers' ability to recognize mathematical content, pay attention to the students' thinking, make suggestions for improving the instruction, and interpret instruction in depth. Volunteer teachers administered to their students a quiz before and after the start of a fractions unit they taught (the difference between pre and post scores measured students' learning as gained knowledge). Also, teachers videotaped a class during their fractions unit (the analysis of this videotaped class measured teachers' instructional quality). Each teacher had to choose a class in which a new concept or idea about fractions was introduced. This class video was scored with three rubrics "that together comprised our [the researchers] measure of instructional quality" (p. 576). These rubrics describe "whether the underlying mathematics was made visible in a lesson" (p. 576). The quiz for students consisted of 15 items and was designed by the researchers based on released items from fifth- through seventh-grade state tests in California, Texas, and New York. In addition, researchers adapted one protocol used for the second Third International Mathematics and Science (TIMSS) Video Study in 1999. Kersting et al., assessing the teachers' analysis of the videotaped classroom interactions allowed the researchers to assess the knowledge that a teacher could apply in his/her own classroom instruction, in other words they found evidence that the teachers' mathematical content knowledge is positively related to instruction. Also, authors found evidence that higher teacher' content knowledge produces higher quality classroom instruction, and the higher quality instructions provide more opportunities for students to learn. However, Kersting et al. indicated that the CVA measures only one part of the knowledge that can affect students' learning (through analyzing quality instruction).

Baumert et al. (2010) investigated connections among teachers' content knowledge (CK), teachers' pedagogical content knowledge (PCK), and students' progress mediated by the quality of the instruction. To this end, Baumert and colleagues used the COACTIV[1] framework, which assumes that "CK [content knowledge] is theoretically distinguishable from PCK [pedagogical content knowledge]" (p. 142). Baumert et al. hypothesized that PCK is more necessary "to stimulate insightful learning" (p. 145) than CK and that PCK is more necessary for instruction than CK. To measure CK, the researchers used a paper-and-pencil test that covered arithmetic, algebra, geometry, functions, and probability, and all solutions had to be explained by the teacher. To measure PCK, the teachers were presented different tasks in which three dimensions of the PCK were represented: tasks, students, and instruction. In the *tasks* dimension, teachers' ability to identify different solutions for the given tasks was assessed; in the *students* dimension, teachers' ability to recognize misconceptions, difficulties, and students' solution strategies was assessed; and in the *instruction* dimension, teachers' ability to detect, analyze, predict students' errors, or comprehend students' difficulties in the classroom was assessed. To measure instruction, the researchers assessed three aspects: cognitively activating opportunity to learn, individual learning support, and classroom management. To assess the *cognitively activating opportunity to learn* dimension, researchers asked the teachers to submit all examinations, and examples of the homework and tasks used to introduce two topics in 10th-grade mathematics. To assess the *individual learning support* dimension, the researchers used six student rating scales. The scales asked whether teachers provided flexible explanations, whether teachers' responses were emphatic, and if student-teacher interactions were respectful and caring. To assess the *classroom management* dimension, the researchers used scales for students' and teachers'

[1] Professional Competence of Teachers, Cognitively Activating Instruction, and the Development of Students' Mathematical Literacy.

perceptions of their classrooms. To measure the students' mathematical achievement, students were evaluated at the end of tenth grade by a standardized test conducted by federal states' curricula. In addition, the PISA literacy test was used to assess mathematics and reading literacy at the end of ninth grade. According to the findings, PCK was a better predictor for students' progress than CK, and "CK defines the possible scope for the development of PCK and for the provision of instruction offering both cognitive activation and individual support" (pp. 166-167). These results supported the claim that expertise in subject matter specific to teaching supports students' achievement.

Teaching practices have been associated with the type of curriculum used in a classroom. For instance, Schoen, Cebulla, Finn, and Fi (2003) analyzed the association between a standards-based curriculum and high school students' achievement. Schoen et al. found evidence for positive association between teachers' characteristics, such as experience in professional development workshops focused on teaching effectively using the standards-based curriculum, with students' achievement. Also, this study found a positive correlation between students' achievement and teacher's self-reported perception of their ability to teach with the standards-based curriculum (National Council of Teachers of Mathematics [NCTM], 1989, 1991, 2000; National Research Council, 1989, 1990).

Saxe, Gearhart, and Seltzer (1999) analyzed the association between students' performance and the alignment of reform principles (e.g., National Council of Teachers of Mathematics, 1989). The study was situated in fifth grade, during fractions lessons. Students were classified in two groups. Students who achieved a high score on a pre-test about continuous quantity tasks involving fractions were classified as having rudimentary knowledge; while students who achieved a low score were classified as not having that knowledge. To create the

scale *alignment of classroom practices with reform principles*, the authors analyzed and coded videotaped lessons and field notes from classroom observations. That coding system was based on two classroom practices: integrated assessment and conceptual issues. The *integrated assessment* practice referred to the degree to which classroom interactions elicited and built upon students' ideas. In the *conceptual issues* practice, the teacher extended the opportunity to students "to consider the mathematical concepts that underlie methods for solving problems" (p. 11). In the Saxe et al. study, the focus was on assessing the students' skills using a computer program and their ability to solve problems. When alignment of classroom practices with reform principles was above average, there was a significant effect on students' performance on the post-test. The authors reported a positive relationship between students' post-test performance and the classroom alignment with reform principles when students had rudimentary knowledge. Thus, the new curriculum—with reform principles—seemed to work better than the traditional one with students who had rudimentary knowledge.

Teaching Practices and Students' Achievement

According to Kane, Taylor, Tyler, and Wooten (2011), overall classroom practices are beneficial for students' achievement. Their study examined a portion of the Cincinnati Public Schools' Teachers Evaluation System (TES) data, which consisted of observations of the classroom conducted by trained individuals who used a detailed rubric during the academic year 2000-2001. Because the focus of this study was teaching practices, just two of the four TES domains were considered, *creating an environment for learning* and *teaching for learning*. The domain *creating an environment for learning* had three standards to evaluate teacher performance—to create inclusive and caring environment, to establish effective routines and

procedures for maintaining a safe and orderly environment, and to manage and monitor students' behavior to effectively use the time. The domain *teaching for learning* had five standards to evaluate teacher performance—to communicate objectives, expectations, directions, procedures and assessment criteria; to demonstrate content knowledge using specific strategies; to use standards-based instructional activities; to engage students in discourse and use provoking questions; and to provide feedback to students. In addition to the TES observation data, there was a panel on Cincinnati students from the academic year 2003-2004 through the academic year 2008-2009. This panel collected demographic data, information about participation in special education or gifted and talented programs, and class and teacher assignments by subject and standardized test score to match with students from the TES data. Those results indicated that the combination of *creating an environment for learning* and *teaching for learning* domains were more beneficial for students' achievement in mathematics and reading than these domains separately. However, this study did not indicate what specific routines and procedures of the *creating an environment for learning* standard were the most influential.

Allen, Gregory, Mikami, Lun, Hamre, and Pianta (2013) described three domains of teacher-student interactions to predict students' future achievement. To this end, researchers used a 2-level HLM to predict the outcome, which was performance on the end-year Standard of Learning (SOL) achievement test. The predictors at the student level were grade level, gender, family poverty status, and pre-test score. The predictors at the teacher level were class size and quality of teacher-student interaction. The quality of teacher-student interaction variable was constructed by analyzing videotaped classrooms and coding them with the Classroom Learning Assessment Scoring System—Secondary (CLASS-S). The researchers found three domains of teacher-student interactions. The first domain was *emotional support*; in this domain the teacher

displays responsiveness to student academic/emotional needs. The second domain was *classroom organization*; and, this domain had three sub-domains, behavior management, productivity, and instructional learning formats. In the sub-domain behavior management the teacher uses effective methods for preventing or redirecting misbehavior and encouraging better behavior as a result. In the productivity sub-domain the teacher manages the classroom and maximizes instructional time. In the last sub-domain, instructional learning formats, the teacher teaches using varied and interesting materials and teaching techniques. The last domain found by the researchers was *instructional support*. In this domain the teacher displays content understanding (the teacher exhibits a broader intellectual framework), analysis and problem solving (the teacher emphasizes higher-order thinking in students), and quality of feedback (the teacher provides feedback for a better understanding of a concept). The researchers reported that the three domains of teacher-student interactions were predictive of students' achievement. *Emotional support* seemed to be independent from the students' background and seemed dependent on individual teacher characteristics. The researchers added that *instructional support* and *classroom organization* are important to predict students' achievement; however, those domains likely reflected both teachers' skill and students' background.

The Chilean Educational System

Since 2003, students in Chile have been required to complete 12 years of school, 8 years of elementary school and 4 years of high school. Chilean elementary education is called Basic Education with a national curriculum and consists of two cycles of 4 years each. The first cycle includes the first four grades (first to fourth grade) and consists of basic content where one teacher teaches all subjects—Spanish, mathematics, science, history, geography, social sciences,

and art. The second cycle of elementary education goes from fifth to eighth grade, during which all subjects are taught by teachers who are specialists in one of the following subjects: Spanish, mathematics, science, history, geography, social science, and art.

For high school there is a common national curriculum for the two first grades (tenth and eleventh), but for the last 2 years the curriculum differs depending on whether the high school is scientist-humanist or technical-professional. The goal of a scientist-humanist high school is to provide skills needed to attend college. On the other hand, the goal of a technical-professional high school is to provide skills to prospective technicians in such areas as mechanics, secretarial work, or accounting. The National curriculum determines elementary and high school education, and has learning standards for each of the grades in both elementary and high school. These learning standards are related to the knowledge, skills, and abilities that benefit the integral development of students and their performance in different aspects of their lives.

SIMCE

The SIMCE examination is a set of tests to evaluate the quality of education in Chile. SIMCE is managed by the Agency of Quality of Education,[2] a group within the Ministry of Education of Chile (MINEDUC). The SIMCE was first administered in 1988 and was taken only by fourth-grade students in the subjects of mathematics, Spanish, and science, but in alternate years. As time has passed, more grades and subjects have been added. Currently, the SIMCE examination is taken by all students attending second, fourth, sixth, eighth, tenth, and eleventh grade. Since 2013, an annual second-grade Spanish examination has been added. Moreover,

[2] The Agency of Quality of Education has the mission to promote quality education for all students and to ensure that each student develops to his or her highest potential. Retrieved from: http://www.agenciaeducacion.cl/nosotros/quienes-somos/

since 2013, the subjects of Spanish and mathematics have been evaluated yearly in fourth, sixth, eighth, and tenth grades. Science and social science exams are administered in alternate years. In 2014, students in fourth and eighth grade were given the social science examination, and 6th and 10th grade students were given the science examination. In 2015, fourth- and eighth-grade students were given the science examination, and sixth- and tenth-grade students were given the social science examination. Eleventh-grade students take English as a foreign language, including in 2016. In addition to the information about students' achievement, SIMCE uses different questionnaires to collect information about teachers, students, and parents.

The SIMCE examination is administered every year in October—by that date, most content areas of the national curriculum have been taught because the academic year starts in March and finishes in December. The result of the SIMCE examination is usually published the following year in May. The most important goal of the SIMCE examination is to collect information from schools regarding students' learning so that each school will be able to identify strengths and weaknesses in their teaching processes, so as to improve the students' learning. The information collected by SIMCE is also used for policy-makers to make decisions for improving the quality of education for all students (Agencia de Calidad de la Educación, 2015). Each school is classified based upon their SIMCE result and measure of SES. Parents can decide to keep their children in the same school or take them to a higher-ranking school. Also, the schools (public and subsidized) which achieved the best results in their SES group receive prizes from the government (Law N°19,410, year 2007).

In 2011, the SIMCE assessed the subjects of Spanish, mathematics, and science. The SIMCE mathematics was constructed to evaluate fourth-grade students' achievement in Numbers, Geometry, and Data analysis. For Numbers, the main topics assessed were to read and

write natural numbers and establish relations among them; to understand fractions, identifying them in graphic contexts and in relation to part of the whole; to use algorithms to make calculations (addition, subtraction, multiplication and division); and to select data to verify results. For geometry, main topics assessed were to make relations between the points where an object is observed with its graphical representation and to assemble and disassemble geometric objects in 2D and 3D. Finally, for data analysis, main topics assessed were to read, interpret, and organize information from tables and graphs (Ministry of Education of Chile, 2011).

The SIMCE examination is a paper-pencil test. According to the Technical Report SIMCE 2012 (Agencia de Calidad de la Educación, 2014) to construct the mathematics test, as well as the others, the portion of the curriculum to be assessed is delimited. As this portion of the curriculum is too copious to cover in one test, the test is divided in different booklets called *forms*. The total of these forms are the SIMCE mathematics examination. In 2011[3] the mathematics test had four forms and 84 questions. Because the goal is to measure what students know and are capable of, not their speed, the time to answer the test is 90 minutes. Since 1998, the SIMCE examination has been analyzed using Item Response Theory (IRT), also that year the mean and standard deviation for all subject matter evaluated were fixed as 250 and 50 points respectively. To construct the items, a logistic model with three parameters for difficulty, discrimination, and guessing has been used. To be included in the SIMCE examination, an item has to meet the following requirements: The difficulty has to fall in the range from -2.4 to +2.4, with a value close to +2.4 reflecting a high level of difficulty. The discrimination parameter should have values equal or greater than 0.6. The values of the guessing parameter range from 0 to 0.35, the higher the value, the greater the probability that answers reflect guessing. Items that

[3] Information retrieved from: https://sites.google.com/site/educandoamanda/simce

do not fit the previous parameters are rejected, but they are analyzed to find their failures. Besides this IRT analysis, students' answer choices are analyzed for associations between the score of the test and the selection of the correct choice, percentage of selection of the different choices, percentage of students who answer correctly, and percentage of omitted responses.

Type of School Funding

The Chilean educational system is influenced by the type of school funding. In 1981 the Chilean government implemented the *voucher system* as an incentive to develop public and private education (Hsieh & Urquiola, 2006). The Chilean government gives an amount of money in the form of a voucher for each student attending a school.[4] As a consequence of the voucher system, three types of school funding have emerged, public, subsidized, and private (Ministry of Education of Chile, 2015). Educational corporations from Chilean municipalities manage the public schools; those corporations receive the vouchers from the government. Subsidized schools also receive vouchers from the government, in addition to payments from students' parents. At the same time, these schools are managed by private institutions. Private schools are managed by private corporations and do not receive any vouchers. Parents pay tuition for their children. Overall, the lowest average scores in SIMCE examination come from public schools, and the highest average score come from subsidized and private schools.[5]

[4] Each school receives a voucher per student up 45 students per classroom.
[5] These are the average results of fourth-grade scores in the SIMCE mathematics examination in 2012. Public schools reached 248 points, private subsidized schools reached 265, and private fee paying schools reached 299 points.

Chilean Teachers

In terms of statistics from the Ministry of Education of Chile (MINEDUC), in 2011 there were 195,260 teachers in Chile, and 71.99% of them were female. The distribution of teachers in terms of type of school funding was as follows: 43.77% of the teachers were teaching in public schools, 46.93% were teaching in subsidized schools, and 9.30% were teaching in private schools. Most of the teachers, 87.99%, taught in urban schools. Eighty-two point forty-two [82.42] percent of the teachers were classroom teachers, and 17.58% of the teachers worked in the school administration as principals, school counselors, and pedagogical unit heads. At least 37.52% of the Chilean teachers had 4 years of teaching experience, and 48.83% had more than 30 years of experience in 2011. I found only a few studies of Chilean teachers and the role of teachers in students' achievement.

Lara, Mizala, and Repetto (2010) performed a linear regression on a sample of fourth-grade students using the SIMCE dataset from 2002 to analyze characteristics of teachers who teach in public and subsidized schools. The first conclusion of that study indicated that most teachers are female, have a certification as a school teacher, and a high percentage have more than 20 years of teaching experience. Furthermore, this study described the differences between students' achievement based on the variability in students' background and their families and the schools' and teachers' backgrounds. Students whose teachers were female achieved a higher score than students whose teachers were male in the Spanish examination; this difference was not significant in the mathematics examination. The fact that the teacher was certified was highly correlated with students' achievement. Finally, the effect of teaching experience on students' achievement was not linear, especially in Spanish; students gained more in their achievement when their teachers were starting to teach. According to the authors, students scored higher in

classrooms where teachers reported that their students would go to college than in classrooms where teachers reported the opposite.

The identity of Chilean teachers was investigated by Avalos and de los Rios (2013). These authors interviewed elementary and high school teachers. They defined identity "as a construction of meanings based both on the cultural attributions provided by society, as well as on teachers' own role definition and meanings about their work" (p. 172). These authors reported that Chilean teachers' identity was determined by external factors such as the type of school funding where they teach—public, subsidized, or private. According to Chilean law, only teachers who teach in public schools have to be evaluated. However, the teachers who teach in the subsidized schools feel vulnerable because their job is not protected by the teachers' union as are the jobs of teachers in the public schools. Teachers who teach in private schools feel satisfied with their job condition but feel pressured but the demands from the school. Most teachers thought that their profession is not adequately respected by society and the government but felt appreciated by their students, colleagues, friends, and family. In this study, the teachers were asked their opinions about their students' background. According to the results, teachers in the public and subsidized schools thought that socio-economic and cultural factors of the students "are important in relation to what they are able to do in the classroom" (p. 165), and students' behavior is key to teaching, especially in the public and subsidized schools. The identity of Chilean teachers is not entirely clear; however, the type of school funding affects the teachers' expectations about their students. For example, for teachers in public and subsidized schools the *pupil condition of socio-economic and cultural background* is significant, while *pupil behavioral factors* are significant just for teachers in public schools. This result is illustrated by the opinion of one teacher in a subsidized school given in one focus group: "Students' rights are overrated or

misinterpreted. Students' rights are fine but students' obligations or responsibilities seem not to exist and that is quite problematic" (p. 166).

There is little literature about content knowledge of Chilean teachers. Díaz and Poblete's (2007) study examined professional skills of sixth-grade teachers. To this end, Díaz and Poblete implemented a professional development course focused on developing teaching skills through problem solving strategies; this study also evaluated the current skills of the teachers who attended. The professional development lasted 9 months, with 37 elementary teachers from 28 different schools in Los Lagos, in the South of Chile.

The professional develoment consisted of two steps. The first was to use manipulatives and different strategies to change the traditional expository method used by these teachers. The second step was to check when the teachers used similar estrategies in their own classroom. This second step included school visits from teachers trained to help the school teachers to implement using manipulatives and other new strategies in their classroom. Those trained teachers supported teachers and reported how the implementation was working. In the first step of the professional development, each teacher was assigned randomly to a different generic group activity, then each group created their activities and evaluation which were shown at the end of the class. While teachers participated in the professional development, they started to teach using their new knowledge and the trained teachers started observing and reporting on the lessons. In the beginning, most of the school teachers prefered to teach as they had done before, but as time passed, they started to use their new knowledge and the activities they developed in the professional development. To analyze the impact of the professional develoment, a pre-test and post-test were administered to the teachers' students. According to the quantitative analysis, students improved their results on the post test. Analyzing the contents of the pre- and post-test,

the content related to numbers and equations was the most difficult for the students. Analyzing the questionnaire that teachers had to answer in the beginning of the professional development, most of the teachers had no capacity to introduce new teaching strategies in their classroom. Also, in the questionnaire teachers indicated that they had some problems using some activities taught in the professional development. According to the authors, evidence from the analysis of the questionnaire indicated that these elementary teachers had difficulty with the mathematics content knowledge and they had little capacity to follow, develop, and expose mathematical reasoning. All schools particpating in this professional development were evaluated in the SIMCE 2004. Most schools improved their scores from the SIMCE 2000 to the SIMCE 2004. The result, which included the teachers' self-reports, indicated that the content related to numbers was the easiest for their students, and geometry was the most difficult. At the same time, children appreciated working in groups during mathematics class, a practice emphasized in the professional development.

Espinoza, Barbé, and Gálvez (2011) studied Chilean students' low level of mathematics achievement at the end of elementary school, and how teachers influence that achievement. In particular, they identified the curriculum and teacher-student interactions as factors contributing to the slow progress during the last grades of elementary school. The researchers analyzed the curriculum for arithmetic, geometry, and problem-solving content. They reported that fractions are introduced as numbers which allow students to solve problems about sharing fairly and that the amount to be shared should be broken in small pieces. However, this idea is not emphasized in mathematics textbooks or Chilean teaching practices.

The second factor studied was the way that teachers and students interact with mathematics in the classroom. Espinoza et al. (2011) studied fourth and fifth grades, observing

six arithmetic classes and six geometry classes. They reported that in fourth grade, most teachers used the traditional algorithm to teach multiplication and division in spite of the prompt[6] in the national curriculum; researchers also reported that little class time was devoted to solving problems. The fraction lessons in fourth grade showed that students understood the concept of fraction as a part of a whole, which was the only model studied. The part-whole model is useful at the beginning of teaching fractions, but it can become an obstacle when trying to understand a fraction as a measure. Another observation was that the concept of natural numbers appeared dissociated from fractions; and the operations (addition, sustraction, multiplication, division) seem independent from each other. These results suggest that the schooling inhibits, unintentionally, the mathematics development of students. The researchers suggested spreading the new curriculum to teachers and all people related to education, so as to empower the new curriculum.

Teaching Practices in Chile

There is little literature about mathematics teaching practices in Chile. Most of the existing studies have found a relationship between school SES and SIMCE results (Mizala & Romaguera, 2000; Larrañaga, 2004; Redondo, Descouvieres, & Rojas, 2005; Mizala, 2008; Baltra, 2010). Other studies have proposed another explanation for the SIMCE results. Ramirez (2007) modeled the performance of Chilean students in mathematics by using the SIMCE 1999 data to compare variance among six different levels. The bigger levels were the geographic national distribution—as regions, provinces, and municipalities—and schooling level—as schools, classes, and students. According to her findings, differences between regions were small due to

[6] The Chilean curriculum promotes meaningful learning more than routinely procedures to teach mathematics. (Ministerio de Educación, Actualización curricular, 2009)

the centralization of Chilean education (one national curriculum which depends on the Ministry of Education), and differences between municipalities were medium. Ramirez explained that larger differences between municipalities occurred because each municipality has to manage the public schools located there. The differences of variance among schools were larger; the main reason was due to the social-economic stratification of the schools in Chile. Differences in variance among classes in the same school were small because there is no tracking system in Chile, and classrooms are heterogeneous with respect to students' performance. Thus, in one classroom there are students at different levels of learning which could refute the idea that all students in determined grades have the same level of learning.[7] Moreover, Ramirez indicated that even though several studies have shown that SES is a strong predictor of students' achievement when the students are initially assigned to a classroom, SES is not an important predictor of their performance later on; in other words, students' SES was associated with initial classroom placement but not subsequent achievement. According to Ramirez, students' beliefs and attitudes are more important for their later achievement. For example, a student who wants to go to college will work harder than a student who does not. Based upon this finding, Ramírez emphasized the difficulty of teaching students with different levels of performance and aspirations. One important implication is that Chilean teachers need to know a variety of teaching strategies to reach diverse students.

As indicated above, there are few studies about teaching practices in Chile (Cardemil, 2002). Cardemil summarized several studies about teaching practices and their influence in Chilean education; I report three of them in this section. The first study cited by Cardemil, Filp and Schiefelbein (1983), examined teaching practices in Argentina, Bolivia, Colombia, and Chile

[7] The SIMCE examination assumes that all students have the same level of learning in the different grades that the SIMCE test assesses.

(1978-80) and reported that teaching practices in poor Chilean schools focused more on moral punishment (ridicule and threats), and sometimes physical punishment than on developing students' thinking. This first study did not indicate specific teaching practices used by teachers in the classroom. Another study cited by Cardemil, Román (2001) analyzed four schools from the Chilean Program P 900 (the 900 poorest Chilean schools[8]). In the schools whose SIMCE average score was lower than the national average, teachers had low expectations for their students' academic future. As a result, their teaching practices focused on routine tasks and maintaining discipline in the classroom. In contrast, in schools with higher average SIMCE scores, teachers had more positive opinions about their students' academic future and skills. As a result, these teachers' practices focused on developing their students' skills, allowing their students to interact with the teacher during class, and providing feedback to students. According to Cardemil, the academic expectations that teachers have for their students shape their teaching practices and the responsibility that they take for their students' learning. Thus, the students' achievement seems to be mediated by teachers' expectations.

The third study reported in this section from Cardemil (2002), Arzola, Vizacarra, Cardemil, Latorre, and Marfán (1997) evaluated the incorporation of manipulatives into teaching practices in the P 900 Programme. This study identified three types of teaching practices with manipulatives: different strategies focused on the same learning goal, a motivation activity using games or manipulatives without a specific learning goal, and an activity using manipulatives with a specific learning goal. Cardemil recognized that in this study teachers lacked knowledge to make connections between concepts and procedures to help students learn. According to

[8] P 900 was a programme which identified the 900 poorest elementary schools in Chile based on their SIMCE score in mathematics and Spanish (1990-1997). The goal of this programme was to help the schools improve their SIMCE score with resources and professional development for the schools and their teachers.

Cardemil, the need for teacher professional development is not recognized in Chilean education; teachers need more preparation to improve their teaching practices.

A more recent study about teaching practices in Chilean schools of Martinic, Vergara, and Huepe (2013) analyzed teacher-student interactions in the classroom using the discursive method. This method describes and interprets procedures used by subjects to produce discourse in a communicative situation. The findings of this analysis indicated that the teachers devoted 51% of their instruction time to present the subject matter to the whole class. Another 19.8% of the time students worked quietly on tasks assigned by the teacher. Finally, 14.2% of the instruction time was used by students to ask about the tasks assigned by the teacher. In a more detailed analysis, the researchers observed that the presentation of the content was just 9.5% of the instruction time used by Spanish teachers and 9.1% of the instruction time used by the mathematics teachers. According to the researchers, this type of interaction (teacher talking and students listening) is more common in low SES schools, because teachers devote more attention to maintaining discipline in the classroom than their students' learning. Some school characteristics associated with this type of interaction would be the type of school funding, public policy, class size, and curriculum. Martinic et al. (2013) added that teachers tend to teach the way they were taught when they were students.

Arancibia and Alvarez (1994) identified the most effective teacher characteristics in the SIMCE examination. To this end, the researchers considered the students' score in fourth grade on SIMCE 1988 as a measure of their teachers' effectiveness: The higher the students' achievement was, the more effective the teacher was. Arancibia and Alvarez considered the teachers' indirect factors (age, experience, and background retrieved from the teachers' questionnaire) and teachers' direct factors (teaching practices and management of discipline in

the classroom, both retrieved from observations). The analysis indicated that effective teachers had good opinions of the school conditions and felt responsible for the success or failure of their students. In addition, those teachers thought that school resources were adequate, and they had high verbal skills. The teaching practices of those effective teachers emphasized positive feedback to students, opportunities for students to start a task in short time, avoiding wasting time managing discipline, and devoting class time to instruction. In other words, effective teachers kept their students working the entire class and managed classroom discipline effectively.

Analyzed Variables

The two main economic variables which have been related to Chilean students' achievement scores are SES and type of school funding. Arzola and Troncoso (2011) found that the type of school funding was correlated with students' learning. The researchers studied the same students in two different SIMCE examinations, fourth grade and eighth grade. To be sure that the students were in the same school, they matched the national identication number[9] for 142,981 students. The researchers decomposed the SIMCE score to recognize contributions from the students and from school characteristics. Low SES students attending subsidized schools achieved higher scores than low SES students attending public schools. In the overall result, all students attending subsidized schools achieved better scores than students attending public schools.

Drago and Paredes's (2011) meta-analysis indicated that students who attended subsidized schools performed better than students who attented public ones. Drago and Paredes

[9] Each baby born in Chile is assigned an ID number called RUT.

analyzed 17 studies which estimated SIMCE test scores using multiple regressions with ordinary least squares (OLS), the Heckman correction (HE), propensity score matching (PSM), and hierarchical linear modelling (HLM). The researchers found evidence that students from subsidized schools performed better than students from public schools. However, the results indicated that despite increased investment in improving public schools, this has not been enough to improve student achievement. "What these findings do suggest, however, is that attention should be focused on determining what [teaching] practices and what constraints are holding back progress in the country's municipal [public] schools" (p. 172).

Because most literature has connected SIMCE scores with SES factors of schools (Merino & Maldonado, 2014; Hsieh & Urquiola, 2006), I added the score in SIMCE Spanish examination to my analysis. Also, Harlaar, Kovas, Dale, Petrill, and Plomin (2012) suggested a specific link between mathematics and reading skills. In that study, researchers had volunteers between 11 and 12 years of age, children with neurological conditions or specific medical syndromes (e.g. cerebral palsy, organic brain damage) were excluded from the study. The children completed an online battery of cognitive, reading, and mathematics ability tests. The mathematics ability was measured using three tests from the National Foundation for Educational Research, Mathematics Series and Understanding Number. Word decoding ability and reading comprehension were assessed using the Woodcock–Johnson Reading Fluency Test, the TOWRE, the Peabody Individual Achievement Test and the GOAL Formative Assessment in Literacy. The mathematics, word decoding, and reading comprehension scores were used as variables in a multivariate model equation. The main finding was a higher correlation between reading skill and mathematics ability than between word decoding and mathematics ability. The

SIMCE Spanish examination evaluates the reading and writing skills of the fourth grade students.

Chilean Teachers and Fractions

Some authors have indicated that teachers have many of the same problems with fractions as their students (Ball, 1990; Klein & Tirosh, 1997; Llinares & Sánchez, 1991; Ma, 1999; Pinto & Tall, 1996). Problems with fractions are not exclusive to one country, since Chilean teachers have many similar problems. Rojas (2010) analyzed the case of an elementary teacher teaching the concept of fraction. In the Chilean curriculum, the first time that students are introduced to the concept of fractions is in fourth grade. The teacher was an elementary teacher with no specialization in mathematics, but he had been teaching mathematics to elementary students for 20 years, and to fourth-grade students for the last 11 years. Rojas (2010) analyzed just the first class when the concept of fraction was introduced. The analysis of this class showed that the teacher had good verbal skill and moderate mathematics knowledge because he paid more attention to the presentation of the contents instead of promoting generalizations to solve problems with different procedures. This teacher did not promote mathematics conversation in the class, which meant that students did not have many opportunities to contribute to the class discussion.

Olfos and Guzmán (2011) analyzed difficulties in students' fractions learning and teachers' content knowledge. To this end, the researchers analyzed incorrect answers from students on a multiple-choice test. This test was administered to fourth-grade students and was based on the Chilean curriculum standards. The teachers were given a questionnaire with questions about students' knowledge. For example, one item for students asked for the amount of

money left after spending one third of the total money. Then, teachers were asked "what choice do you think most of your students would choose?" The teachers had to answer a test with 11 multiple-choice questions related to fractions. Besides this type of question, the questionnaire asked about years of teaching experience, number of mathematics courses taken, and gender. Finally 1,532 students and their 43 teachers answered the test and the questionnaire, respectively. According to the researchers, there was an association between teachers' knowledge and their effectiveness; however, this association was not significant. Another analysis made in this study analyzed students' wrong answers by the SES of their school. The results were not surprising, since students from low SES schools had more incorrect answers than students from higher SES schools. However, students in schools at all levels of SES answered fractions items incorrectly.

Summary

The literature reviewed identified important aspects to consider in my study. The connection between teacher content knowledge and teaching practices has been studied qualitatively as has the connection between teaching practices and students' achievement. However, this kind of literature is quite limited in the Chilean context. Thus, a Chilean study that focuses on this connection is needed.

CHAPTER 3

METHODOLOGY

This chapter describes how I selected the sample for the present study, chose variables to include, constructed some of these variables, and analyzed the SIMCE data.

Sample

I used SIMCE 2011 data for the present study. That year in fourth grade the SIMCE examination assessed achievement in mathematics, Spanish, and science. I used two criteria to select the sample. First, I selected schools with just one fourth-grade classroom. This reduced the potential of misleading teacher effects—for instance, there are not highly qualified teachers assigned to higher performing students or less highly qualified teachers assigned to lower performing students in a given school. Second, I selected those teachers for whom there was complete information regarding the teachers' questionnaire (In Appendix T you can see the original Spanish version of this questionnaire, and the English translation in Appendix U). The original dataset included 9,713 teachers; the sample size after applying the two criteria was 4,244 teachers and their *56,474* students.

Variables

I selected variables at three different levels. For the first level, the student level, the variables came from those included in the SIMCE dataset. These data provided information about

students' scores in the examinations of mathematics, Spanish, and science. For this study, I focused on mathematics and Spanish scores.

For the second level, the teacher level, the variables came from questions on the teachers' questionnaire. The teachers' questionnaire consisted of 41 questions. The first 10 questions asked for demographic information (e.g., age, sex) and for professional information (when the teacher started to teach, how many years they had been teaching in their current school, etc.). The following 31 questions asked for information about teaching (e.g., what subject matter do you teach to this fourth grade?). Most of the questions were Likert questions related to some statement about the classroom (e.g., To what extent do you agree or disagree with the following statements concerning the fourth grade assessed?). However, just four questions were specific to the mathematics class in fourth grade. Two of these questions were related to teaching practices and another two questions were related to topics addressed in the mathematics class. For enriching my analysis I used two another questions related to teachers' perceptions of their students. For this study, I selected these six questions from the teachers' questionnaire.

The first question related to teaching practices was Question 14: *How often do you use the following teaching strategies during your mathematics class?* This question covers activities to promote student learning (e.g., group work, individual work, field trips), organizing instruction (e.g., express learning objectives, questions-answer lesson[10]); and opportunities for students to demonstrate what they had learned (students' presentations, forums on issues of the subject, and design and implementation of group projects with written reports). The "students' group work" strategy, in my experience, is used to help students to achieve learning goals, and a similar rationale for the use of "small groups" is given by Hiebert and Grouws (2007).

[10] The *questions-answer lesson* refers to when the teacher asks provoking questions in order to push their students to understand a new concept.

The second question related to teaching practices was Question 17: *How often do you use the following activities to provide students with feedback in your mathematics class?* This question covers two main strategies for improving student learning, homework and explanations to the class. Teachers and students have considered homework as a strategy to improve students' achievement (Hong, Wang, & Peng, 2011). In addition, according to Maltese, Tai, and Fan (2012), homework assignments are highly correlated with standardized test scores. Furthermore, Zhu and Leung (2012) indicated that doing homework helped students in Hong-Kong reach high scores in TIMSS 2003. However, Mikk (2006), in his study about homework in 46 countries where the TIMSS 2003 was administered, did not find any significant correlation between doing mathematics homework and the TIMSS score. The impact of homework on students' achievement is still not clear.

Question 17 asks teachers about their use of explanations: explain the content until all students understand, explain the test solution to the whole class, and explain the workbook and textbook exercise solutions to the whole class. According to Cobb and Bauersfeld (1995), in an inquiry classroom, explanations are as challenging for teachers as they are for the students when the mathematical symbolic representations are little described. The SIMCE teachers' questionnaire provided self-report data and the question about explanations asked "how often do you use", and the possible answers were 'never', 'sometimes', 'often,' or 'always.' Therefore, specific explanations given by teachers during instruction is beyond the scope of this study.

The first question related to topics addressed in the mathematics class was Question 18: *Given that class time is limited and you are not likely able to address all curricular content, we ask you to indicate to what extent you taught the following topics in your mathematics class?* The second question was Question 19: *Considering your preparation and experience in curriculum*

content and teaching practices, how prepared do you feel to teach the following content areas in your mathematics class? To examine teachers' perceptions of their students, I included question 12: *Looking at the fourth-grade students who took SIMCE 2011, what future schooling do you predict for most of them?* I also included Question 22*: Considering what usually happens in this school, do you agree or disagree with the following statements?* The statements included in this question are focused on teachers, students and principal relationship within the school, and students' behavior.

For the last level, the school level, the variables came from the dataset with school information, which included the school number identification; average scores in math, Spanish and science; school socio-economic status (SES); and type of school funding. For this study, I selected SES and the type of school funding.

According to Agencia de Calidad de Educación (2015), the goal for constructing the SES for each school was to make fair comparisons among schools. The method of clusters was used to construct SES groups for similar schools. This method separates schools into different groups, each with its own distinct set of characteristics. Since 2006, the SIMCE has assessed two grades per year, and the construction of SES groups is made for each grade independently. In 2011, fourth and eighth grades were assessed by SIMCE and, if a school contained both grades, it was classified into SES groups separately for each grade.

The following variables were used to perform the cluster method:

1. Mother's educational level.
2. Father's educational level.
3. Family's monthly income.
4. Index of vulnerability (IVE-SINAE by its acronym in Spanish).

The first three variables came from the parents' questionnaire in 2011, and the last variable came from the National Board of Scholarship and Help for Students (JUNAEB by its acronym in Spanish).

The variables which came from the questionnaire were not used directly. The questions related to the educational level of the parents asked for the highest grade reached by the parents. The response options ranged from no education at all to doctoral degree. Then, each option was changed into years of schooling—for example, a parent who marked no education at all was assigned 0 years of schooling, a parent who chose first grade was assigned 1 year of schooling, and so on (Appendix A has the complete table used to determine years of schooling).

The family's monthly income was calculated based on the information from a question that asked parents to choose from various intervals. The final information used was the middle point of the interval of income. Appendix B shows in dollars the equivalent money in Chilean pesos. The National Board of Scholarship and Help for Students calculates the index of vulnerability; the value is from 0 (children are not vulnerable) to 100% of vulnerability –children in a deprived situation. (Agencia de Calidad de la Educación, 2013).

After that, another three variables were calculated, the average years of schooling for fathers for each school, the average years of schooling for mothers for each school, and the average family income for each school. In contrast, the index of vulnerability was not transformed. Finally, the four variables were standardized with mean 0 and standard deviation 1. As a result of the cluster analysis, five groups were obtained for school SES. School SES was coded 1 for 'low,' 2 for 'middle low', 3 for 'middle,' 4 for 'middle high,' or 5 for 'high.'

1. Low (A),
2. Middle low (B),

3. Middle (C),

4. Middle high (D), and

5. High (E).

Because this study examined how teaching practices affect students' achievement in mathematics, the dependent variable was the SIMCE 2011 mathematics score. The independent variables are listed by the level to which they belong (see Table 1). At the student level, a single variable considered, the students' Spanish score in SIMCE 2011. The SIMCE Spanish examination assessed the students' reading and writing skills, and this variable is named span_score.

Table 1
Variables Studied

	Constructs and variables	Questionnaire/Data set item name	Coding for
Dependent variable	Student achievement	math_score	Continuous
Independent variables	Spanish score	span_score	Continuous
	Teaching practices	Q14 and Q17	1= never; 2= sometimes; 3= often; 4= always
	Extent to which topics are addressed	Q18	1= not included; 2= not yet taught; 3= some of it; 4= most of it; 5= all of it
	Teacher' perception about preparation	Q19	1= not prepared; 2= somewhat; 3= quite; 4= well prepared
	Teachers' perception about schooling future	Q12	1= will not graduate from high school; 2= will graduate from high school; 3= will gain university degree
	Teachers' perception about students' behavior	Q22	1= agree; 2=disagree
	School SES	SES_school	1= low; 2= middle low; 3= middle; 4= middle high; 5= high
	Type of school funding	Admin	1= public; 2= subsidized; 3= private

Again, the variables at the teacher level related to teachers' practices were selected using answers to Question 14 and Question 17. Question 14 asked teachers to report on their use of students' group work (Q14_1), students' individual work (Q14_2), express learning objectives (Q14_3), questions-answer lesson[11] (Q14_4), students' presentations (Q14_5), forums on issues of the subject (Q14_6), field trips (Q14_7), and design and implement group project with written

[11] The questions-answer lesson in when the teacher asks provoking questions in order to push their students to understand a new concept.

report (Q14_8). For each question, teachers responded on a Likert-type scale. The code was 1 if the teacher answered ‘never,’ 2 if the teacher answered ‘sometimes,’ 3 if the teacher answered ‘often,’ and 4 if the teacher answered ‘always.’

Question 17 asked teachers to report on their use of check homework (Q17_1), solve homework in class (Q17_2), explain topic again if a student asks (Q17_3), explain the content until all students understand (Q17_4), explain the test solution to the whole class (Q17_5), and explain the workbook and textbook exercise solutions to the whole class (Q17_6). As in Question 14, teachers responded on a Likert-type scale with the same codes as in Question 14. The code was 1 if the teacher answers ‘never,’ 2 if the teacher answered ‘sometimes,’ 3 if the teacher answered ‘often,’ 4 if the teacher answered ‘always.’

Question 18 asked teachers to report on 15 different topics they taught. For each topic, the answers were coded 1 if the content was ‘not included that academic year,’ 2 if the content was ‘not yet taught,’ 3 if ‘some of it was taught,’ 4 if ‘most of it was taught,’ or 5 if ‘all of it was taught’.

Question 19 asked how well teachers felt prepared to teach about natural numbers and place value (Q19_1), fractions and decimals (Q19_2), arithmetic operations and calculations using strategy of decomposition of numbers (Q19_3), geometric figures (Q19_4), 3D geometric shapes (Q19_5), perimeter and area (Q19_6), and solving problems related to the content (Q19_7). For each topic, the answers were coded with 1 if the teacher felt ‘not prepared,’ 2 if the teacher felt ‘somewhat prepared,’ 3 if the teacher felt ‘quite prepared,’ or 4 if the teacher felt ‘well prepared’ to teach each area indicated.

Question 12 asked teachers to predict their students’ future schooling and presented the following response options: (a) I do not think they will graduate from high school, (b) They will

graduate from technical high school, (c) They will graduate from scientific-humanistic high school, (d) They will graduate from technical institution, (e) They will graduate from college, and (f) They will attend graduate school. Because choices (b), (c) and (d) refer to graduating from high school and (e) and (f) relate to university, I merged those options as follows: 1 represents 'teachers expected their students will not graduate from high school,' 2 represents 'teachers expected their students will graduate from high school,' and 3 represents 'teachers expected their students to gain some university degree (attend college and/or the graduate school).'

Question 22 asked teachers to agree or disagree with the following statements: There is a respectful relationship among teachers (Q22_1), There is a respectful relationship between teachers and students (Q22_2), There is a respectful relationship between teachers and the directive team (Q22_3), I feel confident asking for support from other teachers when I have a problem (Q22_4), I feel confident asking for support from the directive team when I have a problem (Q22_5), The principal is concerned about the education of students (Q22_6), As teachers we have a difficult time teaching because of the disorder and indiscipline in the classroom (Q22_7), Order and discipline are respected (Q22_8), and Students care about the furniture and infrastructure of the school (Q22_9). This question gave the following response options: 'strongly agree,' 'agree,' 'disagree,' and 'strongly disagree.' I collapsed the responses as follows: 1 when teachers selected strongly agree or agree and 2 when teachers selected disagree or strongly disagree.

For the third level, the school level, I considered school SES and type of school funding. School SES was coded 1 for 'low,' 2 for 'middle low,' 3 for 'middle,' 4 for 'middle high,' and 5

for 'high.' The type of school funding was coded 1 for 'public,' 2 for 'subsidized,' and 3 for 'private.'

Data Analysis

I broke the analysis for this study into three steps. The first step was a descriptive analysis of all variables considered in this study. The second step was a series of linear regressions conducted to answer research questions 1, 2, and 3. The dependent variable was the average SIMCE 2011 mathematics score reached by students attending the same school. The third step was to perform a multilevel analysis to answer research questions 4, 5, 6, and 7. To conduct these models, the dependent variable (the outcome) was fourth-grade students' SIMCE 2011 mathematics score.

The main characteristic of multilevel analysis, also known as Hierarchical Linear Model (HLM)[12] analysis is the decomposition of the covariance in level 1 and level 2 (Bryk & Raudenbush, 1992). The first model used is the null model to ensure there is sufficient variability between and within classrooms for further analyses. This model is also called the fully unconditional model (no predictors are included in the model). From this model, it is possible to estimate the within-classroom (σ^2) and between-classroom (τ_{00}.) variability. With those estimates, I calculated the intraclass correlation coefficient (ICC), which is the proportion of the variance in the outcome (students' SIMCE 2011 mathematics score) that is between the level-2 units (teachers). Appendix C shows formulas used in the HLM analysis.

The equation for the unconditional model is as follows:

Level-1 model:

[12] In this dissertation the terms HLM and multilevel analysis were used interchangeably

$Y_{ij} = \beta_{0j} + r_{ij}$, r_{ij} is normally distributed with mean 0 and variance σ^2

Level-2 model:

$\beta_{0j} = \gamma_{00} + u_{oj}$, u_{0j} is normally distributed with mean 0 and variance τ_{00}

Mixed model:

$$Y_{ij} = \gamma_{00} + u_{0i} + r_{ij}$$

For a clearer explanation, I will just describe the components of the mixed model (the two levels together): Y_{ij} is the SIMCE 2011 mathematics score of student i taught by teacher j. The fixed effect, γ_{00}, is the point estimate for the grand mean of students' SIMCE 2011 mathematics scores across all fourth-grade classrooms. The random effects (u_{0j} and r_{ij}) represent the variation in students' SIMCE 2011 mathematics scores between teachers' classroom means (u_{0j}) and the variation among students within classrooms (r_{ij}). In the multilevel analysis, I added more variables in order to answer the research questions.

CHAPTER 4

RESULTS

In this chapter, I present results of the data analysis for the three steps described in Chapter 3: the descriptive analysis, the regression analysis, and the multilevel analysis. The descriptive analysis is a general view of the variables for students, teachers, and schools. The analysis of the students' variables indicated that Spanish scores were higher than mathematics scores. The analysis of the teachers' variables indicated that most of the teachers used the strategies and activities listed on questions 14 and 17. The analysis of questions 18 and 19 indicated that the greater extent to which topics were addressed, the higher students' scores were, and the more confident teachers were, the higher the students' scores were.

Regression analyses is the method used to answer research questions 1, 2, and 3. The main idea of these regressions was to select the teaching practices, topics addressed, and self-reported perception to teach content areas that predicted students' achievement. According to this analysis, the best predictors of students' achievement were the frequency with which teachers self-reported using the practices strategies *students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6); the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), *communication of information provided by charts and graphics* (Q18_14); and the teachers' self-reported

perception to teach *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4).

I used multilevel analysis to answer research questions 4, 5, 6, and 7. I used 2-level models which included the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), *communication of information provided by charts and graphics* (Q18_14) with the frequency with which teachers self-reported using the practices selected in the regression analysis. Results indicated that the model with the extent to which teachers self-reported addressing *meaning, read and write simple fractions* explained the most variance; the models which included the extent to which teachers self-reported addressing *meaning, read and write simple fractions (Q18_7), recognize net and flat representations of 2D & 3D figures (Q18_13), communication of information provided by charts and graphics (Q18_14)* accounted for more variance than the teachers' self-perception to teach that content areas. Also, I used multilevel analysis to explore the effect of the teachers' perception to teach *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D geometric figures* (Q19_4) on the same practices cited above. To analyze the effect of the school variables, I constructed a 3-level model. According to this analysis, variables added at level 3 reduce considerably the unexplained variance, in particular the type of school funding.

Descriptive Analysis

I conducted the descriptive analysis of all the variables included in this study in the same order as they were shown in Table 1.

Student Variables

The outcome variable was students' score in the SIMCE mathematics examination. The skewness and kurtosis values in Table 2 show that the mathematics and Spanish scores had normal distributions. Since the SIMCE examination was designed as a standardized examination, it was not surprising that the mathematics and Spanish scores were normally distributed. Table 2 also shows that, on average, Spanish scores were higher than mathematics scores. A *t*-test confirmed that the difference between the Spanish and mathematics scores was statistically significant, $t(55691) = 64.437, p < .001$. However the Cohen' $d = .213$ indicated a small effect size, it means there was a small difference between Spanish and mathematics scores. The correlation between the Spanish score and the mathematics score was quite high 0.689 (*p*-value < .01), which can be interpreted as the higher the Spanish score, the higher the mathematics score.

Table 2
Summary of Statistics of the Continuous Variables in This Study

	N	***M***	***SD***	**Skew**	**Kurtosis**
Math Score	56,474	249.1	49.942	-0.029	-0.335
Spanish Score	56,575	259.8	50.364	-0.211	-0.613

Note: This data does not eliminate observations with missing values.

Teacher Variables

I report descriptive results for teachers' responses to questions 14, 17, 18, 19, 12, and 22 on the teachers' questionnaire.

How often do you use the following teaching strategies during your mathematics class? (Question 14)

Observing Table 3, most of the teachers self-reported that they 'often' or 'always' used strategies such as: *students' individual work* (81%), *express learning objectives* (60.4%), *organization based on questions-answers to organize lesson* (76.7%). However, students' mean scores did not increase with reported usage of these strategies (See Table 4), except those students whose teachers self-reported 'often' or 'always' using the *express learning objectives* (249.2 points).

According to a series of ANOVA tests conducted on the variables in Table 4, there were no significant differences between average mathematics scores for students whose teachers self-reported 'never', 'sometimes', 'often' or 'always' using the *expression of learning objectives* strategy. In other words, whether teachers reported using this strategy or not, did not affect the students' achievement scores.

Table 3
Percentage of Teachers' Answers to Question 14: How Often Do You Use the Following Strategies During your Mathematics Class? N=4,244

STRATEGY	ANSWER	% FREQ.
Students' group work (Q14_1)	Never	2.1
	Sometimes	52.1
	Often	34.0
	Always	11.7
Students' individual work (Q14_2)	Never	0.6
	Sometimes	18.4
	Often	54.7
	Always	26.3
Express learning objectives (Q14_3)	Never	2.0
	Sometimes	37.4
	Often	33.2
	Always	27.3
Questions-answer lesson (Q14_4)	Never	1.0
	Sometimes	22.3
	Often	42.9
	Always	33.8
Students' presentations (Q14_5)	Never	8.3
	Sometimes	56.6
	Often	24.7
	Always	10.3
Forums on issues of the subject (Q14_6)	Never	22.7
	Sometimes	56.0
	Often	16.3
	Always	5.0
Field trips (Q14_7)	Never	26.3
	Sometimes	61.3
	Often	8.9
	Always	3.5
Group project with written report (Q14_8)	Never	24.5
	Sometimes	59.9
	Often	11.7
	Always	3.9

Note: This data does not eliminate observations with missing values.

The ANOVA also indicated significant differences for the frequency with which teachers self-reported use the other three strategies listed in Table 4 [*students' group work* (Q14_1), *students' individual work* (Q14_2), *questions-answer to organize lesson* (Q14_4)], but the differences

among groups of answer were dissimilar. With respect to teachers' self-reported use of the *students' group work* strategy, the Scheffé test for contrasting pairwise average scores indicated that all groups were different at the .05 level of significance. Nevertheless, there was not a positive relationship between the groups: Students of teachers who self-reported 'never' using *students' group work* as a strategy reached the highest average score (256.5 points), while students of teachers who self-reported 'always' using that strategy reached the lowest average score (243.6 points). This means that teachers' self-reported use of *students' group work* as a strategy corresponded with a difference in terms of the students' achievement, in other words, the strategy used to improve student achievement did not improve it.

Average scores for students whose teachers self-reported 'never' and 'often' using the *students' individual work* strategy were statistically different, but average scores for students whose teachers self-reported 'never' and 'always' using this strategy were not statistically significant. These results suggest that the frequency with which teachers used the *students' individual work* strategy was not relevant.

The average score for students whose teachers self-reported 'never' using *questions-answers to organize a lesson* was statistically different from the other teachers' answer. Due to the fact that this group of students reached the highest average score, not using this strategy appears to result in higher student' achievement. The Scheffé test indicated no statistical differences in average scores among students of teachers who reported 'sometimes', 'often' or 'always' using this strategy. These results suggested that the questions-answer instructional format was not associated with high average SIMCE scores in mathematics. Nevertheless, the η^2 across all variables in Table 4 indicated a very small size effect, meaning that the significant differences between students' score maybe was significant but very no meaningful.

Table 4
The Mean Score of SIMCE Mathematics Examination by Frequency With Which Teachers' Self-Reported Use the Following Strategies. N = 56,474

Score Mean (% students)	**Students' group work Q14_1**	**Students' individual work Q14_2**	**Express learning objectives Q14_3**	**Questions-answer to organize a lesson Q14_4**
Never	256.5 (1.7)	257.7 (0.5)	247.8 (1.9)	256.7 (0.9)
Sometimes	250.3 (59.7)	245.2 (14.7)	249.4 (34.6)	248.6 (18.4)
Often	247.6 (30.7)	249.4 (58.3)	248.7 (33.3)	248.9 (41.9)
Always	243.6 (7.9)	250.2 (26.5)	249.2 (30.3)	249.3 (39.6)
ANOVA				
(n, m)	(3,56470)	(3,56470)	(3,56470)	(3,56470)
F	36.755**	22.205**	1.003	4.533**
η^2	.002	.001	.0	.0

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

Looking at Table 5, we can see that students whose teachers self-reported 'never' using those strategies reached the highest score in the SIMCE examination. We can see that the percentage of teachers who self-reported 'never' using these strategies was greater compared to the previous four strategies discussed above and summarize in Table 3. The percentage of teachers that answered 'never' was as follow: *students' presentations* (8.3%), *forums on issues of the subject* (22.7%), *field trips* (26.3%), and *group project with written report* (24.5%). More than 50% of teachers answered this question with 'sometimes.' In Chile, these kinds of strategies occur more often in Spanish, history, or science class. That could be the reason why the percentage of teachers who answered 'often' or 'always' was low.

According to the ANOVA conducted on the four variables in Table 5, there were significant differences in all groups of teachers' answers. The Scheffé test indicated that there were differences in the average score for students whose teachers self-reported 'never' using the

strategy of *students' presentation* and those students whose teachers reported 'sometimes' using this strategy. The average scores of students whose teachers self-reported use of *forums on issue of the subject* strategy 'never' and 'always' was significantly different. There was a significant difference between these teachers who self-reported using this strategy 'sometimes' and 'always. With regard to the *field trips* strategy, there were differences between average scores of students if their teachers self-reported 'always' using this strategy versus the other three options. Regarding the frequency with which teachers self-reported use the *group project with written report* strategy there were not significant differences between the average scores of students whose teachers self-reported 'never' and 'sometimes' using this strategy; in contrast, there were significant differences in the other groups. An overview on the average scores of students in Table 5 suggests that not using those strategies was positively related to the students' achievement. As in variables in Table 4, the effect size was quite small.

Table 5
The Mean Score of SIMCE Mathematics Examination by Frequency With Which Teachers' Self-Reported Use the Following Strategies. N students = 56,474

Score Mean (% students)	**Students' presentations Q14_5**	**Forums on issues of the subject Q14_6**	**Field trips Q14_7**	**Group projects with written report Q14_8**
Never	252.7 (10.3)	249.5 (23.1)	249.2 (33.9)	249.4 (26.2)
Sometimes	249.7 (55.0)	249.5 (54.6)	249.3 (56.8)	249.8 (58.6)
Often	247.3 (24.0)	248.1 (16.8)	248.1 (6.5)	246.9 (11.2)
Always	246.4 (10.7)	246.1 (5.5)	243.5 (2.8)	242.0 (4.0)
		ANOVA		
(n, m)	(3,56470)	(3,56470)	(3,56470)	(3,56470)
F	23.536**	5.962**	7.376**	21.705**
η^2	.001	.0	.0	.001

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

In summary, increases in the frequency with which teachers reported using *students' group work* (Q14_1), *students' individual work* (Q14_2), *express learning objectives* (Q14_3), and *questions-answer lesson* (Q14_4) were associated with higher student mathematics scores; on the other hand, the frequency of using *students' presentations* (Q14_5), *forums on issues of the subjec*t (Q14_6), and *field trips* (Q14_7) apparently had negative effects on students' achievement. It is pertinent to note that in Chile those strategies are usually used by Spanish, history or science teachers more than by mathematics teachers. The effect size of variables from question 14 from teachers' questionnaire was very small.

How often do you use the following activities to provide students with feedback in your mathematics class? (Question 17)

Looking at Table 6, for all questions most teachers self-reported 'often' or 'always' using these activities, namely: *check HW* (98.3%), s*olve HW* (83.9%), e*xplain topic again if a student asks* (98.8%), e*xplain the content until all students understand* (99.1%), e*xplain the test solution to the whole class* (89.2%), e*xplain the workbook and textbook exercises solutions to the whole class* (93.1%). The percentage of teachers that self-reported 'never' using these same activities was extremely low (0% to 1.5%).

Table 6
Percentage of Teachers' Answer to Question 17: How Often do You Use the Following Activities to Provide Students With Feedback in your Mathematics Class? N=4,244

STRATEGY	ANSWER	% FREQ.
Check HW (Q17_1)	Never	0.2
	Sometimes	1.5
	Often	19.8
	Always	78.5
Solve HW (Q17_2)	Never	1.5
	Sometimes	14.7
	Often	38.4
	Always	45.5
Explain topic again if a student asks (Q17_3)	Never	0
	Sometimes	1.3
	Often	14.5
	Always	84.3
Explain the content until all students understand (Q17_4)	Never	0
	Sometimes	0.8
	Often	24.8
	Always	74.3
Explain the test solution to the whole class (Q17_5)	Never	0.6
	Sometimes	10.3
	Often	30.6
	Always	58.6
Explain the workbook and textbook exercises solutions to the whole class (Q17_6)	Never	0.4
	Sometimes	6.5
	Often	30.5
	Always	62.6

Note: This data does not eliminate observations with missing values.

According to the ANOVA conducted on the variables in Table 7, students' mean scores across all teacher answer groups were different. For the activity *check HW* the Scheffé test indicated that students whose teachers self-reported *check HW* 'sometimes' reached a significantly different lower average score than students' whose teachers self-reported 'never', 'often' or 'always' using this activity. The total amount of teachers who answered 'never' and 'something' was less than 2%, then the students' score could suffer a distortion due this. For the other activity related to homework, *solve HW*, there were no significant differences between average scores of

students whose teachers self-reported ‘never’ and ‘always’ *solve HW*. The difference was significant in all other teachers’ answers. Students whose teachers self-reported ‘sometimes’ solved homework reached the lowest average score.

Table 7
The Mean Score of SIMCE Mathematics Examination by Frequency With Which Teachers’ Self-Reported Use the Following Activities. N = 56,474

Score Mean (% students)	**Check HW Q17_1**	**Solve HW Q17_2**	**Explain a topic again if a student asks Q17_3**	**Explain the content until all students understand Q17_4**	**Explain the test solution Q17_5**	**Explain the workbook and textbook-exercise solutions Q17_6**
Never	257.6 (0.3)	255.5 (1.6)	- (0)	212.5 (0.06)	249.4 (0.5)	262.7 (0.3)
Sometimes	239.2 (1.5)	244.8 (12.3)	248.2 (1.0)	245.7 (1.0)	246.2 (9.1)	239.7 (9.1)
Often	248.1 (21.9)	246.9 (37.4)	245.5 (12.8)	248.4 (26.6)	248.0 (28.2)	247.3 (28.2)
Always	249.5 (76.4)	251.6 (48.7)	249.6 (86.2)	249.3 (72.4)	249.9 (62.3)	250.2 (62.3)
ANOVA						
(n, m)	(3,56470)	(3,56740)	(3,56470)	(3,56470)	(3,56470)	(3,56470)
F	15.057**	57.602**	20.872**	8.301**	11.482**	42.120**
η^2	.001	.003	.001	.0	.001	.002

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

Looking at Table 7, if we ignore the ‘never’ category due to a small sample, and if we just pay attention to the ‘sometimes’, ‘often’, and ‘always’ answer categories, the results suggest that the frequency of *check HW* and *solve HW* were positively associated with a higher score. Also looking at Table 7, the η^2 was small, that means a small effect size.

The other four variables in Table 7 were related to the ‘explanation’ that takes place in the classroom. A Scheffé post-hoc test indicated that there was a significant difference in the

average score between those students whose teachers self-reported that they ‘often’ and ‘always’ *explain a topic again if a student asks*.

A Scheffé test conducted on the frequency with which teachers self-reported use *explain the content until all students understand* activity indicated that the average score (212.5 points) of students whose teachers self-reported ‘never’ using this activity was significantly different from students whose teachers self-reported using this activity ‘sometimes’, ‘often’ or ‘always’. At the same time, there was no significant difference in the average score among students whose teachers self-reported that they ‘sometimes’, ‘often’ or ‘always’ e*xplain the content until all students understand*’. This result suggested that even limited use of this strategy positively affects students’ achievement.

For the frequency with which teachers self-reported use *explain the test solution* activity, the Scheffé test indicated no significant difference between teachers who self-reported ‘never’ or ‘always’ using this activity in their class. However, there was a significant difference between students whose teachers self-reported ‘always’ using this activity and students whose teachers self-reported ‘sometimes’ and ‘often’ using this activity. Then, ignoring the ‘never’ category, apparently, this activity positively affected the score, since the more explanations were given in the classroom the higher the students’ scores were.

For the frequency with which teachers self-reported use last activity, *explain the workbook and textbook exercise solutions*, there were significant differences in all teachers’ answers. However, the highest score was reached just by 0.3% of the students. This took place due to the fact that one teacher self-reported that he or she ‘never’ uses this activity and his or her students reached the highest score. If we ignore this teacher’s answer, we can see that the frequency of the explanations reported by the remaining teachers was positively associated with

the students' average score. This means that the more teachers self-reported providing these explanations the higher their students' average scores were.

In summary, the results suggested that checking and solving homework were positively associated with the students' achievement. The results also suggested that explanation as a broad strategy was positively related to higher scores in the SIMCE examination. However, the eta-squared was quite small indicating quite small effect size.

Given that class time is limited and you are not likely able to address all curricular content, we ask you to indicate to what extent you taught the following topics in your mathematics class? (Question 18)

Question 18 asked about topics that belong to one of the three main content areas in the Chilean curriculum for fourth grade in 2011[13]. According to the **Brochure of Orientations to Measure for SIMCE** 2011 Examination (Agencia de Calidad de la Educación, 2011) the first content was *Numbers*. This content includes reading and writing natural numbers and establishing relationship among them, understanding the concept of fractions from a graphics and as a part of a whole; using algorithms for addition, subtraction, multiplication and division. The second main content was *Geometry*. This content includes spatial orientation, meaning to locate a point in a figure or representation of the figure; recognizing 2D and 3D figures. Finally, the third content was *Data and probability*, which content includes reading and interpreting simple tables and bars graphs. Thus, I classified the topics from question 18 as follow, in Numbers content (Q18_1, Q18_2, Q18_3, Q18_4, Q18_5, Q18_6, Q18_7, Q18_8, Q18_9,

[13] According to the "Orientations to measure 2011" [Orientaciones para la medición 2011"], the examination assess the curriculum from 1st to 4th grade established by Decree Nº 232 of 2002, presenting in the curricular adjustment according to Decree N° 256 of 2009.

Q18_11), Geometry (Q18_13, Q18_12), and Data and probability (Q18_14, Q18_15). Table 8 lists variables related to Numbers content from Q18_1 until Q18_11 (this table did not include the variable related to the use of a calculator); Table 9 lists all the other variables.

Tables 8 and 9 show the percentages of teachers' answers for question 18 by topic taught. The SIMCE examination was given to the students almost at the end of the academic year (Agencia de Calidad de la Educación, 2014). As a result, only a small percentage of the teachers answered that content areas were 'not included' in the academic year. For each topic, most teachers answered they taught 'most of it' or 'all of it'. Due to the importance of this examination, most of the teachers wanted to teach all of the content before the examination.

According to Table 8, the topics related to natural numbers, *read, write and form natural numbers up to 1,000,000* (Q18_1), *recognition value represented by 1,000,000* (Q18_2), and *put number on number line* (Q18_3), were the topics that were reported as completely taught by most teachers. On the other hand, for some topics related to fractions and decimals [*written calculation products and quotients* (Q18_4), *rounding numbers* (Q18_6), *meaning, read and write simple fractions* (Q18_7), and *reading, writing and recognizing decimal numbers between 0 and 1* (Q18_8)] teachers self-reported teaching 'most of it'; this means these topics were not taught completely before the SIMCE examination was given. Also, 21.6% of the teachers self-reported teaching 'some of it' with regards to the topic *meaning, read and write simple fractions* (Q18_7). *Reading, writing and recognizing decimal numbers between 0 and 1* (Q18_8) was reported 'not yet taught' by 21.9% of the teachers.

Table 8

Percentage of Teachers' Answers to Question 18: Given that Class Time is Limited and you are not Likely Able to Address all Curricular Content, We Ask You to Indicate to What Extent You Taught the Following Topics in Your Mathematics Class. Content Related: Numbers. N=4,244

CONTENT	ANSWER	% FREQ.
Read, write and form natural numbers up to 1,000,000 Q18_1	Not included	0.0
	Not yet taught	0.6
	Some of it	3.5
	Most of it	39.6
	All of it	56.2
Recognition value represented by 1,000,000 (Q18_2)	Not included	0.0
	Not yet taught	0.6
	Some of it	3.1
	Most of it	36.1
	All of it	60.2
Put number on number line Q18_3	Not included	0.1
	Not yet taught	0.6
	Some of it	6.6
	Most of it	43.9
	All of it	48.8
Written calculation products and quotients (Q18_4)	Not included	0.1
	Not yet taught	0.7
	Some of it	12.6
	Most of it	55.7
	All of it	30.9
Mental and written calculations (Q18_5)	Not included	0.1
	Not yet taught	0.7
	Some of it	14.6
	Most of it	55.8
	All of it	28.9
Rounding numbers (Q18_6)	Not included	0.2
	Not yet taught	0.9
	Some of it	13.0
	Most of it	52.6
	All of it	33.4
Meaning, read and write simple fractions (Q18_7)	Not included	0.1
	Not yet taught	4.6
	Some of it	21.6
	Most of it	41.4
	All of it	32.2

(Continued)

Table 8 (Continued)

CONTENT	ANSWER	% FREQ.
Reading, writing and recognizing decimal numbers between 0 and 1 (Q18_8)	Not included	1.6
	Not yet taught	21.9
	Some of it	31.4
	Most of it	31.2
	All of it	13.9
Problem solving (Q18_9)	Not included	0.0
	Not yet taught	0.8
	Some of it	10.6
	Most of it	56.6
	All of it	32.4
Transforming a number applying reiteratively rule addition (Q18_11)	Not included	0.6
	Not yet taught	5.5
	Some of it	26.8
	Most of it	49.9
	All of it	17.2

Note. This data does not eliminate observations with missing values

Table 9 shows the extent to which teachers reported addressing the other topics related to the other main content areas in the Chilean curriculum were taught. As far as the topic *using calculator* (Q18_10), which is considered more a tool than a topic, most of the teachers (40%) reported teaching 'some of it'. With regards to the topics listed in Table 9, more than 20% the teachers self-reported teaching 'some' of the following topics: *using grids to estimate areas* (Q18_12), c*ommunication of information provided by charts and graphics* (Q18_14), and s*olving problems using information from tables and charts* (Q18_15). In addition, regarding the topic *using grids to estimate areas* (Q18_12), 0.9% of teachers reported that this topic was 'not yet taught,' which was higher percentage compared with the other topics. Looking across Tables 8 and 9, the topics that belong to the numbers content area were more completely taught than the other topics.

Comparing percentages in Tables 8 and 9, most of the teachers seemed to devote more time teaching one of the main content areas assessed in SIMCE 2011 mathematics: the content of Numbers.

Table 9
Percentage of Teachers' Answers to Question 18: Given that Class Time is Limited and you are not Likely Able to all Curricular Content, We Ask you to Indicate to What Extent You Taught the Following Topics in Your Mathematics Class. Contents Related: Geometry, and Data and Probability. N=4,244

CONTENT	ANSWER	% FREQ.
Using calculator (Q18_10)	Not included	0.6
	Not yet taught	9.4
	Some of it	40.4
	Most of it	37.0
	All of it	12.5
Using grids to estimate areas (Q18_12)	Not included	0.9
	Not yet taught	15.8
	Some of it	29.7
	Most of it	36.1
	All of it	17.5
Recognize net and flat representations of 2D & 3D figures (Q18_13)	Not included	0.2
	Not yet taught	4.3
	Some of it	15.3
	Most of it	42.7
	All of it	37.5
Communication of information provided by charts and graphics (Q18_14)	Not included	0.1
	Not yet taught	7.2
	Some of it	23.6
	Most of it	39.6
	All of it	29.5
Solving problems using information from tables and charts (Q18_15)	Not included	0.1
	Not yet taught	7.7
	Some of it	23.0
	Most of it	42.2
	All of it	27.0

Note. This data does not eliminate observations with missing values

Tables 10, 11, and 12 show students' average SIMCE mathematics scores by teachers' answers to question 18. An overall view of these three tables shows that students whose teachers self-

reported teaching 'all of it' (the topic) reached the highest average scores. There were some groups of students who reached a score higher than 250 points, even though their teachers self-reported that the topic was 'not included' that year such as *reading, writing and recognizing decimal numbers between 0 and 1* (Q18_8), *using calculator* (Q18_10), and *recognize net and flat representations of 2D & 3D figures* (Q18_13).

Table 10
The Mean Score of SIMCE Mathematics Examination by the Extent to Which Teachers Self-Reported Addressing the Following Topics. N = 56,474

Score Mean (% students)	**Read, write and form natural numbers up to 1,000,000 Q18_1**	**Recognition value represented by 1,000,000 Q18_2**	**Put number on number line Q18_3**	**Written calculation products and quotients Q18_4**	**Mental and written calculations Q18_5**
Not included	227.7 (0.06)	227.7 (0.06)	245.1 (0.2)	227.8 (0.07)	246.5 (0.1)
Not yet taught	233.2 (0.3)	231.8 (0.3)	230.5 (0.4)	230.5 (0.4)	238.2 (0.4)
Some of it	230.2 (2.0)	225.6 (1.7)	235.3 (4.7)	240.6 (9.9)	239.6 (10.9)
Most of it	241.9 (30.7)	241.3 (27.5)	244.5 (35.6)	246.3 (51.9)	247.1 (52.5)
All of it	253.0 (66.9)	252.8 (70.4)	253.0 (59.0)	255.3 (37.7)	254.9 (36.1)
ANOVA					
(n, m)	(4,56469)	(4,56469)	(4,56469)	(4,56469)	(4,56469)
F	194.994**	211.548**	152.709**	158.082**	139.266**
η^2	.014	.015	.011	.011	.010

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

According to the ANOVA conducted on variables in Table 10, students' mean scores were different across 'all of it', 'most of it', and 'some of it' teachers' answer for all five topics asked. On the other hand, the Scheffé test indicated that there was no significant difference between the teachers' answers of 'all of it' and 'not included' for the following variables: *read, write and*

form natural numbers up to 1,000,000 (18_1), *recognition value represented by 1,000,000* (18_2) and *written calculation products and quotients* (18_4). However, the score differences between 'all of it' and 'not included' for these three teachers' answer were large—25.3, 25.1 and 27.5 points respectively—which suggests that the average scores across teachers' answers should be different. A plausible explanation for this is that the formula for calculating Scheffé statistics (See appendix E) requires the sample size of the teachers' answers, but the sample size of the 'not included' teachers' answer was disproportionally smaller than the 'all of it' teachers' answer. The sample size of the 'not included' group was at most 40 students; in contrast, the sample size of the 'all of it' teachers' answer was at least 21,386 students. Taking into account the previous explanation, if we ignore the 'not included' teachers' answer in the five variables in Table 11, we can see a positive relationship between the frequency with which teachers self-reported teaching these topics and the students' score. In other words, the extent to which teachers self-reported teaching these topics corresponded to higher average SIMCE mathematics scores.

The Scheffé test conducted on variables in Table 11 indicated dissimilar results compared to Table 10. There were no significant differences between average SIMCE scores of students whose teachers self-reported 'not included' and averages score of students whose teachers gave other responses to questions about *rounding numbers* (Q18_6), *reading, writing and recognizing decimal numbers between 0 and 1* (Q18_8) and *using calculator* (Q18_10). Actually, those average scores were relatively high. If we ignore the 'not included' teachers' answer, there were significant differences among the remaining groups of teachers' answer. Again, we can see a positive relationship between the extent to which teachers self-reported addressing a topic and the students' achievement.

Table 11
The Mean Score of SIMCE Mathematics Examination by the Extent to Which Teachers Self-Reported Addressing the Following Topics. N = 56,474

Score Mean (% students)	**Rounding numbers Q18_6**	**Meaning, read and write simple fractions Q18_7**	**Reading, writing and recognizing decimal numbers between 0 and 1 Q18_8**	**Problem solving Q18_9**	**Using calculator Q18_10**
Not included	249.0 (0.3)	222.0 (0.07)	255.7 (2.0)	220.8 (0.06)	253.5 (0.6)
Not yet taught	237.8 (0.6)	226.1 (2.76)	246.7 (22.6)	234.9 (0.5)	243.7 (10.6)
Some of it	237.0 (10.6)	239.7 (16.6)	245.5 (28.6)	236.1 (8.1)	248.9 (42.4)
Most of it	246.4 (48.4)	246.6 (39.5)	248.8 (29.8)	246.7 (51.9)	248.4 (33.9)
All of it	255.6 (40.1)	256.7 (41.1)	257.9 (17.0)	255.0 (39.4)	255.6 (12.5)
ANOVA					
(n, m)	(4,56469)	(4,56469)	(4,56469)	(4,56469)	(4,56469)
F	210.859**	323.305**	109.190	182.887**	49.694**
η^2	.015	.022	.008	.013	.004

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

The ANOVA performed on variables in Table 12 indicated that students' mean scores across all teachers' answer groups were different. We can see that the more the topic was addressed, according to teachers' self-reports, the better the student' scores were. The only exception was the variable *recognize net and flat representations of 2D & 3D figures* (Q18_13). The Scheffé test did not indicate significant difference between the 'not included' teachers' answer and the 'all of it' teachers' answer, being those average score were the highest. However, the scores in the other groups increased in a positive direction. In summary, ignoring the 'not included' teachers' answer of students, the extent to which teachers self-reported addressing a

topic had a positive relationship with their students' SIMCE scores. However, the η^2 was quite small indicating quite small effect size.

Table 12
The Mean Score of SIMCE Mathematics Examination by the Extent to Which Teachers Self-Reported Addressing the Following Topics. N Students = 56,474.

Score Mean (% students)	**Transforming a number applying reiteratively rule addition Q18_11**	**Using grids to estimate areas Q18_12**	**Recognize net and flat representations of 2D & 3D figures Q18_13**	**Communication of information provided by charts and graphics Q18_14**	**Solving problems using information from tables and charts Q18_15**
Not included	241.7 (0.7)	247.3 (1.2)	250.6 (0.2)	245.6 (0.2)	234.6 (0.2)
Not yet taught	241.9 (4.7)	245.1 (12.5)	237.4 (2.8)	241.6 (5.5)	243.0 (6.0)
Some of it	245.0 (21.8)	244.5 (25.2)	237.8 (9.7)	243.8 (17.2)	243.7 (17.4)
Most of it	247.6 (50.4)	249.2 (37.4)	245.4 (39.9)	246.7 (37.2)	247.3 (40.1)
All of it	258.0 (22.4)	255.8 (23.8)	255.1 (47.5)	254.5 (40.0)	254.6 (36.4)
ANOVA					
(n, m)	(4,56469)	(4,56469)	(4,56469)	(4,56469)	(4,56469)
F	145.488**	102.912**	222.379**	124.941**	113.020
η^2	.010	.007	.016	.009	.008

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

Considering your preparation and experience in curriculum content and teaching practices, how prepared do you feel to teach the following content areas in your mathematics class? (Question 19)

According to Table 13, the majority of the teachers self-reported feeling 'quite' or 'well prepared' to teach all of the included content areas. For *fractions and decimals* (Q19_2), almost 9% of teachers self-reported feeling 'not' or 'somewhat' prepared to teach, and only 50% self-

reported feeling ‘well prepared’ to teach *fractions and decimals* (Q19_2). This distribution demonstrates that the teachers felt the least prepared to teach fractions, which is related to content in question 18: *meaning, read and write simple fractions* (Q18_7) and *reading, writing and recognizing decimal numbers between 0 and 1* (Q18_8). It is pertinent to note that 20% of the teachers self-reported teaching ‘some of’ this content.

Table 13 shows that only 50% of the teachers self-reported feeling ‘well prepared’ to teach *fractions and decimals,* representing the lowest percentage in the ‘well prepared’ response category. This analysis seems to indicate that *fractions and decimals* were a weakness in the Chilean teachers’ self-perceptions. Another possible weakness of Chilean teachers could be the content of *perimeter and area* where teachers self-reported feeling ‘not prepared’ to teach in 1.2% of cases; although this percentage was relatively small, it was the highest percentage for this reported preparation.

Table 13
Percentage of Teachers' Answers to Question 19: Considering Your Preparation and Experience in Curriculum Content and Teaching Practices, How Prepared Do You Feel to Teach the Following Content Areas in your Mathematics Class? N=4,244

CONTENT	ANSWER	% FREQ.
Natural numbers and place value (Q19_1)	Not prepared	0.4
	Somewhat	1.6
	Quite	30.6
	Well prepared	67.4
Fractions and decimals (Q19_2)	Not prepared	0.6
	Somewhat	8.1
	Quite	41.2
	Well prepared	50.0
Arithmetic operations and calculations using strategy of decomposition of numbers (Q19_3)	Not prepared	0.5
	Somewhat	3.0
	Quite	36.3
	Well prepared	60.3
2D Geometric figures (Q19_4)	Not prepared	0.4
	Somewhat	3.6
	Quite	31.5
	Well prepared	64.5
3D Geometric figures (Q19_5)	No prepared	0.4
	Somewhat	4.1
	Quite	31.9
	Well prepared	63.7
Perimeter and area (Q19_6)	Not prepared	1.2
	Somewhat	8.4
	Quite	36.0
	Well prepared	54.5
Solving problems related to the content (Q19_7)	Not prepared	0.4
	Somewhat	4.1
	Quite	36.8
	Well prepared	58.7

Note. This data does not eliminate observations with missing values

Table 14 and 15 show the average score reached by students according to teachers' responses to question 19. The highest average scores were reached by those students whose teachers self-reported feeling 'well prepared' to teach what was asked about content areas. However, a Scheffé test did not indicate a significant difference in average scores between students whose

teachers self-reported feeling ‘not prepared’ and ‘well prepared’ with regards the content areas of *arithmetic operations and calculations using strategy of decomposition of numbers* (Q19_3) in Table 14, and *2D geometric figures* (Q19_4), and *3D geometric figures* (Q19_5) in Table 15. This result apparently indicates that teachers’ perceptions of preparation to teach these content areas were not related to differences in the students’ SIMCE scores. In contrast, the teachers’ perceptions of preparation in the other areas had a monotonic relationship with students’ SIMCE scores.

Table 14

The Mean Score of SIMCE Mathematics Examination by the Teacher's Self- Reported Perception of Preparation to Teach the Following Topics: Natural Numbers and Place Value (Q19_1), Fractions and Decimals (Q19_2), Arithmetic Operations and Calculations Using Strategy of Decomposition of Numbers (Q19_3). N = 56,474

Score Mean (% students)	**Natural numbers and place value Q19_1**	**Fractions and decimals Q19_2**	**Arithmetic operations and calculations using strategy of decomposition of numbers Q19_3**
Not prepared	247.9 (0.4)	240.2 (0.6)	249.7 (0.5)
Somewhat	236.3 (1.2)	244.0 (7.7)	241.0 (2.5)
Quite	243.8 (27.2)	246.3 (39.0)	244.3 (33.4)
Well	251.3 (71.2)	251.9 (52.7)	251.9 (63.6)
	ANOVA		
(n, m)	(3,56470)	(4,56470)	(3,56470)
F	97.833**	73.041**	106.669**
η^2	.005	.004	.006

Note: (n,m) degrees of freedom of F; *significant at .05; **significant at .001

Table 15

The Mean Score of SIMCE Mathematics Examination by the Teacher's Self-Reported Perception of Preparation to Teach the Following Topics: 2D Geometric Figures (Q19_4), 3D Geometric Figures (Q19_5), Perimeter and Area (Q19_6), Solving Problems Related to the Content (Q19_7). N = 56,474

Score Mean (% students)	**2D Geometric figures Q19_4**	**3D Geometric figures Q19_5**	**Perimeter and area Q19_6**	**Solving problems related to the content Q19_7**
Not prepared	250.8 (0.5)	252.2 (0.5)	247.7 (0.9)	247.6 (0.4)
Somewhat	237.1 (2.7)	237.0 (3.1)	237.3 (6.9)	233.9 (3.6)
Quite	242.9 (27.6)	243.1 (28.2)	247.4 (33.8)	246.0 (34.1)
Well	251.9 (69.3)	252.0 (68.3)	251.4 (58.4)	251.6 (61.9)
		ANOVA		
(n, m)	(3,56470)	(3,56470)	(3,56470)	(3,56470)
F	151.243**	154.977**	104.653**	118.071**
η^2	.008	.008	.006	.006

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

The Scheffé test conducted on variables in Table 14 and 15 indicated significant differences among all groups of students whose teachers self-reported feeling ‘somewhat’, ‘quite,’ and ‘well prepared’ to teach these content areas. However, the Scheffé test indicated no differences between the groups of students whose teachers self-reported feeling ‘not prepared’ and ‘well prepared’. Actually, those scores were similar. Just by looking at the groups of students whose teachers self-reported feeling ‘somewhat’, ‘quite,’ and ‘well prepared’ to teach these content areas, we can see a positive relationship between the teachers’ perception of their preparation to teach and the average SIMCE score of their students. However, the eta-squared was quite small indicating quite small effect size.

Looking at the fourth-grade students who took SIMCE 2011, what future schooling do you predict for most of them? (Question 12)

According to Table 16, most teachers self-reported thinking their 'students will graduate of high school', and a small portion thought that their 'students will not graduate from high school'.

Table 16
Percentage of Teachers' Answer to Question 12: Looking at the Fourth-Grade Students Who Took SIMCE 2011, What Future Schooling do You Predict for Most of Them? N=4,244

STATEMENT	**% FREQ.**
They will not graduate from high school	3.7
They will graduate from high school	65.5
They will obtain some university degree	30.7

According to Table 17, the students of teachers who self-reported thinking their 'students will obtain some university degree' had the highest score. The score increased if the teacher reported thinking their students would achieve a more advanced level of education. According to the Scheffé test, mean scores for students were significantly different for all groups of teachers' responses. However, the $\eta^2$was quite small indicating quite small effect size.

Table 17
The Mean Score of SIMCE Mathematics Examination by the Teachers' Self-Reported Expectations for Their Students' Future Schooling. N =56,474

STATEMENT	**Percentage of students**	**Score Mean**
They will not graduate from high school	2.6	226.84
They will graduate from high school	60.7	242.03
They will obtain some university degree	36.7	262.15
ANOVA		
(n,m)	(2,56471)	
F	1250.583	
η^2	.042	

Note: (n,m) degrees of freedom of *F*; *significant at .05; **significant at .001

Considering what usually happens in this school, do you agree or disagree with the following statements? (Question 22)

Looking at table 18, for all statements, more than 90% of teachers agreed. The lowest percentage of agreement was for *students care about the furniture and infrastructure of the school* (Q22_9). The only statement with which most teachers disagreed was *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), a little more than the 50% of teachers disagreed.

Table 18
Percentage of Teachers' Answer to Question 22: Considering What Usually Happens in this School, Do You Agree or Disagree with the Following Statements? N=4,227

STATEMENT	ANSWER	% FREQ.
There is a respectful relationship among teachers (Q22_1)	Yes	97.5
	No	2.5
There is a respectful relationship between teachers and students (Q22_2)	Yes	96.1
	No	3.9
There is a respectful relationship between teachers and the directive team (Q22_3)	Yes	96.1
	No	3.9
I feel confident to ask for support from other teachers when I have a problem (Q22_4)	Yes	95.8
	No	4.2
I feel confident to ask for support to the directive team when I have a problem (Q22_5)	Yes	94.2
	No	5.8
The principal is concerned about the education of students (Q22_6)	Yes	96.1
	No	3.9
As teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom (Q22_7)	Yes	46.6
	No	53.4
Order and discipline are respected (Q22_8)	Yes	91.8
	No	8.2
Students care about the furniture and infrastructure of the school (Q22_9)	Yes	89.3
	No	10.7

Information in Table 19 indicates that the higher score came from students whose teachers self-reported agreement with these statements. According to the ANOVA performed on these variables, there was no significant difference between the average score among students whose teachers agreed and disagreed with the *there is a respectful relationship among teachers* (Q22_1) statement. For the other statements in Table 19 the differences were significant.

Table 19
The Mean Score of SIMCE Mathematics Examination by the Teachers' Self-Reported Agreement with the Following Statements. N = 56,474

Score Mean (% students)	**There is a respectful relationship among teachers (Q22_1)**	**There is a respectful relationship between teachers and students (Q22_2)**	**There is a respectful relationship between teachers and the directive team (Q22_3)**	**I feel confident to ask for support from other teachers when I have a problem (Q22_4)**	**I feel confident to ask for support to the directive team when I have a problem (Q22_5)**
Yes	249.1 (97.3)	249.6 (95.2)	249.2 (96.6)	249.2 (95.5)	249.3 (92.82)
No	247.7 (2.7)	240.2 (4.8)	246.7 (3.4)	246.0 (4.9)	245.7 (7.2)
Differences between groups	Not	Yes**	Yes*	Yes*	Yes**
ANOVA					
(n, m)	(1,56263)	(1,56263)	(1,56263)	(1,56263)	(1,56263)
F	1.268	88.624**	4.631*	10.500*	20.075**
η^2	.0	.002	.0	.0	.0

Note: (n,m) degrees of freedom of *F*, *significant at .05; **significant at .001

Looking at Table 20, the average scores of students whose teachers self-reported disagreeing with the statement *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) were the highest. This score was also the highest among all teachers' answers. According to the ANOVA, there were significant differences between the students' whose teachers agreed and disagreed with the statements. However, the η^2 was quite small indicating quite small effect size.

Table 20
The Mean Score of SIMCE Mathematics Examination by the Teachers' Self-Reported Agreement with the Following Statements. N = 56,474

Score Mean (% students)	**The principal is concerned about the education of students (Q22_6)**	**As teachers we have a difficult time when teaching, because of the disorder and indiscipline in the classroom (Q22_7)**	**Order and discipline are respected (Q22_8)**	**Students care about the furniture and infrastructure of the school (Q22_9)**
Yes	249.2 (95.4)	244.3 (45.8)	250.1 (89.4)	250.5 (87.1)
No	246.1 (4.6)	253.1 (54.2)	240.0 (10.6)	239.1 (12.9)
Differences between groups	yes*	yes**	yes**	yes*
ANOVA				
(n, m)	(1,56263)	(1,56263)	(1,56263)	(1,56263)
F	9.860*	444.463	219.353**	333.476**
η^2	.0	.008	.004	.006

Note: (n,m) degrees of freedom of *F*, *significant at .05; ** significant at .001

School Variables

Table 21 shows that private schools comprised a little more than 3% of the sample and that less than 3% of schools were high SES. In addition, the number of 'public schools' was twice as many as the 'subsidized schools.'

Table 21
Percentage of Schools by Type of Funding and SES

Variable	*N*	Categories	% Freq.
Type of school funding	4244	Public	61.3
		Subsidized	35.7
		Private	3.1
School SES	4244	Low	38.5
		Middle low	37.3
		Middle	15.4
		Middle high	6.2
		High	2.6

Note: This data does not eliminate observations with missing values.

Table 22 shows the frequency of SES by type of school funding. Most of the schools belonged to the 'low' and middle low class; 91% of the 'public schools' belonged to the 'low' or 'middle low' class (for more detail see Appendix F). Table 21 also shows that there were 'subsidized schools' at all SES levels and that no 'private school' belonged to low or middle low SES categories.

Table 22
SES of the School by Type of Funding

		School SES					
		Low	**Middle low**	**Middle**	**Middle high**	**High**	**Total**
Type of school funding	**Public**	1179	1203	198	18	2	2600
	Subsidized	456	380	453	217	8	1514
	Private	0	0	2	29	99	130
Total		1635	1583	653	264	109	4244

Table 23 shows the average score by SES and the type of school funding. We can see an increasing relationship between type of school funding and the students' average SIMCE score:

The lowest average score was reached by students attending ‘public schools,’ and the highest average score was reached by students attending ‘private schools.’ Something similar occurred regarding school SES—the higher the SES of the school, the higher the students’ average SIMCE score. These results replicate those reported in earlier studies (Duarte, Moreno, & Morduchowicz, 2013; Mujica, 2012).

Table 23
The Mean Score of SIMCE Mathematics Examination by Type of the School Funding and SES. N = 57,802

Variable	*% Freq.*	Categories	Mean score
Type of school funding	61.3	Public	242.6
	35.7	Subsidized	252.9
	3.1	Private	283.0
School SES	38.5	Low	236.1
	37.3	Middle low	243.1
	15.4	Middle	253.6
	6.2	Middle high	271.4
	2.6	High	289.0

Note: This data does not eliminate observations with missing values.

Regression Analysis

The purpose of the regression analyses was to find those variables from the teachers' questionnaire (questions 14, 17, 18, 19, 12, and 22) that most appropriately predict students' achievement, and then to answer the research questions 1, 2 and 3. I performed regressions on variables from questions 14 and 17 to find these practices whose frequency of use most appropriately predict students' achievement. To find those variables related to the extent to which teachers taught particular topics that might predict students' achievement, I conducted regressions on variables from question 18 on the teachers' questionnaire. Finally, I conducted regressions on teachers' self-reported feeling of preparation to teach topics from question 19 to find those variables that most appropriately predict students' achievement. I re-coded categorical variables based on questions from the teachers' questionnaires as dummy variables for the regression analysis.

Research Question 1: Which self-reported teaching practices were associated with students' achievement on the SIMCE 2011 mathematics examination?

As mentioned above, I re-coded categorical variables as dummy variables to perform the regression. For example, for the strategy *students' group work* (Q14_1), I created three dummy variables using as reference the 'always' answer. Thus, the dummy variable DQ14_1_1 took the value 1 if the teacher answered that he or she 'never' used *students' group work* and 0 elsewhere. The next dummy variable DQ14_1_2 took the value 1 if the teacher answered that he or she 'sometimes' used *students' work* and 0 elsewhere. Finally, the dummy variable DQ14_1_3 took the value 1 if the teacher answered that he or she 'often' used *students' work* and 0 elsewhere.

All other dummy variables were constructed using the same procedure. The outcome variable was the average SIMCE mathematics score for each teacher's group of students.

Since the practices were represented by questions 14 and 17, I included those variables in the regressions. I removed all variables that were not significant in successive regressions until the final regression equation contained just the significant variables. Table 24 shows a summary of the final regression equation containing the three significant variables and its coefficients (R^2=.018, F (9, 4220) = 8,775, $p < .01$) As can be seen in Table 24, the practices whose frequency of use reported by teachers which more appropriately predict students' achievement were *students' group work*, *solve HW* and *explain the workbook and textbook exercises solutions to the whole class*.

Table 24
The Best Model for the Teaching Practices Selected from Questions 14 and 17

Variable		***b***
Constant		242.6**
Students' group work DQ14_1	Never	11.0**
	Sometimes	6.8**
	Often	3.9*
Solve HW DQ17_2	Never	0.1
	Sometimes	-6.4**
	Often	-4.6**
Explain the workbook and textbook exercises solutions to the whole class DQ17_6	Never	2.6
	Sometimes	-7.3**
	Often	-5.0**
R-square	1.8%	

Note: * significance at .05; ** significance at .001

If we solve *Regression Equation 1* to calculate the predicted score of a student whose teacher self-reported 'always' using the s*tudents' group work*, *solve HW*, and *explain the workbook and textbook exercises solutions to the whole class* strategies, we obtained a score of

242.6 points. On the other hand, if we calculate the predicted score for a student whose teacher self-reported 'sometimes' using these activities the score was 235.7 points. This result indicated a positive association between the frequencies reported by the teachers with regards to using those strategies, and the activities in the mathematics class, with students' achievement.

Regression Equation 1:

$$\widehat{Mean}_{MATH} = 242.6 + 11 * DQ14\_1\_1 + 6.8 * DQ14\_1\_2 + 3.9 * DQ14\_1\_3 - 6.4 * DQ17\_2\_2 - 4.6 * DQ17\_2\_3 - 7.3 * DQ17\_6\_2 - 5 * DQ17\_6\_3$$

In summary, the teaching practices whose frequency which more appropriately predicted students' achievement were s*tudents' group work, solve HW,* and *explain the workbook and textbook exercises solutions to the whole class* strategies. The association between these practices and the students' achievement was positive.

Research Question 2: Which topics taught were associated with students' achievement on the exam?

I constructed dummy variables for the question related to the topics addressed in the following way. For the topic *read, write and form natural numbers up to 1,000,000* (Q18_1), I created four dummy variables using as reference the 'all of it' answer. Thus, the dummy variable DQ18_1_1 took the value 1 if the teacher answered the topic *read, write and form natural numbers up to 1,000,000* was 'not included' during that school year and 0 elsewhere. The next dummy variable DQ18_1_2 took the value 1 if the teacher answered the topic *read, write and form natural numbers up to 1,000,000* was 'not yet taught' and 0 elsewhere. The next dummy variable DQ18_1_3 took the value 1 if the teacher answered 'some' of the topic *read, write and*

form natural numbers up to 1,000,000 was taught and 0 elsewhere. Finally, the dummy variable DQ18_1_4 took the value 1 if the teacher answered 'most' of the topic *read, write and form natural numbers up to 1,000,000* was taught and 0 elsewhere. All other dummy variables were constructed using the same procedure.

Table 25 shows the regression model which contains the significant extent to which teachers reported teaching these topics from question 18, and its coefficients (R^2= .091, F (12, 4217) = 35,010, p <.01). Ten of the 15 topics that were asked about were related to the content of Numbers; however, the extent to which teachers reported addressing *meaning, read, and write simple fractions* was the only significant topic from that content area that predicted students' achievement. The other significant topic to which teachers reported addressing were *recognize net and flat representations of 2D & 3D figures* and *communication of information provided by charts and graphics*.

Table 25
The Best Model for Topics Addressed from Question 18

Variable		***b***
Constant		258.5**
Meaning, read and write simple fractions (Q18_7)	Not included	-50.5**
	Not yet taught	-23.1**
	Some of it	-11.6**
	Most of it	-6.7**
Recognize net and flat representations of 2D & 3D figures (Q18_13)	Not included	25.7
	Not yet taught	-12.9**
	Some of it	-11.2**
	Most of it	-4.9**
Communication of information provided by charts and graphics (Q18_14)	Not included	-26.5
	Not yet taught	-10.3**
	Some of it	-8.5**
	Most of it	-4.8**
R-square	9%	

Note: * significance at .05; ** significance at .001

Looking at the expected parameters in Table 25, we can see that 'not including' the topic *meaning, read and write simple fractions* meant losing 50.5 points from the predicted score. Also, answers of 'not yet taught', or 'some of,' or 'most of it' meant losing more points in the students' predicted score compared to the same answers for the other two topics selected. Apparently, the extent to which teachers' self-reported teaching the topic *meaning, read and write simple fractions* had more influence on the predicted score than the other two topics.

Regression Equation 2:

$$\widehat{Mean}_{MATH} = 258.5 - 50 * DQ18\_7\_1 - 23.1 * DQ18\_7\_2 - 11.6 * DQ18\_7\_3 - 6.7 * DQ18\_7\_4 - 12.9 * DQ18\_13\_2 - 11.2 * DQ18\_13\_3 - 4.9 * DQ18\_13\_4 - 10.3 * DQ18\_14\_2 - 8.5 * DQ18\_14\_3 - 4.8 * DQ18\_14\_4$$

The predicted score for a student whose teacher self-reported 'taught all of it' is 258.5 points (*Regression Equation 2*). In contrast, the estimated-score for a student whose teacher self-reported 'not yet teaching' those topics is 212.2 points. This result indicated a positive association between the extent to which these topics were addressed during instruction and students' achievement.

In summary, the extent to which teachers reported addressing *meaning, read, and write simple fractions, recognize net and flat representations of 2D & 3D figures,* and *communication of information provided by charts and graphics* were the most appropriately to predict students' achievement. The association between students' achievement and the extent to which these topics were addressed was positive. The most influential topic was *meaning, read, and write simple fractions.*

Research Question 3a: Which teachers' self-reported perceptions of their preparation to teach topics identified in Question 2 were associated with students' achievement?

I constructed the dummy variables for the question related to teachers' self-reported perceptions of preparation to teach the content area listed in question 19 from the teachers' questionnaires in the following way. For the content *natural numbers and place value* (Q19_1), I created three dummies variables using as reference the 'well prepared' answer. Thus, the dummy variable DQ19_1_1 took the value 1 if the teacher answered that he or she felt 'not prepared' to teach the content *natural numbers and place value* and 0 elsewhere. The next dummy variable DQ19_1_2 took the value 1 if the teacher answered that he or she felt 'somewhat' prepared to teach *natural number* and 0 elsewhere. Finally, the dummy variable DQ19_1_3 took the value 1 if the teacher answered that he or she felt 'quite' prepared to teach the content *natural number* and 0 elsewhere. All other dummy variables were constructed using the same procedure.

As shown in Table 26, teachers' self-reported perception about their preparation to teach *natural numbers and place value* and *2D Geometric figures* were significant predictors of the students' achievement ($R^2 = .028$, $F(6, 4223) = 20{,}072$, $p < .01$). Replacing values in *regression equation 3*, the predicted score for a student whose teacher self-reported feeling 'well prepared' to teach *natural numbers and place value* and *2D geometric figures* is 247.4 points. On the other hand, if the teacher self-reported feeling 'somewhat' prepared, the predicted score is 222.7 points.

Table 26
The Best Model for the Content Areas Selected from Question 19

Variable		*b*
Constant		247.4
Natural numbers and place value DQ19_1	Not prepared	-19.9
	Somewhat	-9.3*
	Quite	-5.6**
2D Geometric figures Q19_4	Not prepared	2.6
	Somewhat	-15.4**
	Quite	-5.9**
R-square	2.8%	

Note: * significance at .05; ** significance at .001

Regression Equation 3

$$\widehat{Mean}_{MATH} = 247.4 - 9.3 * DQ19\_1\_2 - 5.6 * DQ19\_1\_3 - 15.4 * DQ19\_4\_2 - 5.9 * DQ19\_4\_3$$

This result indicated a positive relationship between teachers' self-reported perceptions about their preparation and their students' achievement. In summary, the self-reported perception to teach *natural numbers and place value* and *2D geometric figures* were positively associated with students' achievement.

Research Question 3b: Which teachers' perceptions of students were associated with their students' achievement?

A regression analysis on question 12 indicated that the three possible answers for self-reported perception of students' 'future schooling for most of them' are significant. The reference was '*they will obtain some university degree.*' Table 27 shows these estimated values ($R^2 = .082$, F (2, 4227) = 189,037, $p < .01$). According to the regression analysis, question 12

was significantly and positively related to the score. Replacing values in regression equation 4, the better the teachers' expectation for students' schooling, the better students' scores were. If a teacher reported thinking their students will not graduate, the students' score on average would be 224 points, if a teachers self-reported thinking their students would graduate high school the students' average score would be 237.3 points, and if the teacher self-reported thinking that their students would obtain some university degree, the score would be 257.6.

Table 27
The Best Model for Teachers' Prediction of Future Schooling for Most of Their Students from Question 12

Variable	***b***
Constant	257.6**
DQ12_1 They (students) will not graduate from high school	-33.63**
DQ12_2 They will graduate from high school	-20.26**
R-square	8.2%

Note: * significance at .05; ** significance at .001

Regression Equation 4:

$$\widehat{Mean}_{MATH} = 257.6 - 33.6 * Q12\_1 - 20.26 * Q12\_2$$

Table 28 shows the best model for teachers' self-reported perceptions about students' behavior from question 22 ($R^2 = .015$, F (2, 4210) = 32,015, $p < .01$). According to the information in Table 28, the *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9) statements were the only statements that significantly

predict students' achievement. The coefficient of the *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* statement was negative, meaning that if the teacher agreed with this statement, their students were predicted to get lower scores; in contrast, if the teacher agreed with *students care about the furniture and infrastructure of the school* (Q22_9), their students were predicted to get higher scores.

Table 28
The Best Model for Teachers' Agreement with Statements from Question 22

Variable		***b***
Constant		240.4**
As teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom Q22_7	Yes	-7.0**
Students care about the furniture and infrastructure of the school Q22_9	Yes	6.7**
R-square		1.5%

Note: * significance at .05; ** significance at .001

Replacing values in the regression equation 5, the students' predicted score decreased by 7 points if their teachers agreed that *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), but increased by 6.7 points if their teachers agreed that *students care about the furniture and infrastructure of the school* (Q22_9).

Regression Equation 5:

$$\widehat{Mean}_{MATH} = 240.4 - 7.0 * Q22\_7 + 6.7 * Q22\_9$$

Multilevel Analysis

I performed a multilevel analysis to analyze the association between teaching practices and students' achievement through the teachers' self-reported teaching practices, topics addressed, and self-perception of preparation to teach those topics. The main reason to use multilevel analysis was the fact that students in the same classroom were influenced by the same teacher, and this type of analysis takes that fact into account. I used the variables selected in the regression analyses to construct the models which helped to answer research questions 4, 5, 6, and 7.

The variables selected from the regression analyses were the frequency with which teachers' self-reported using the *students' group work* (Q14_1) strategy and the instructional practices *solve HW* (Q17_2), *explain the workbook and textbook exercises solutions to the whole class* (Q17_6). The selected topics were *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), *communication of information provided by charts and graphics* (Q18_14). The regression analysis on the contents in question 19 in the teachers' questionnaire indicated that *natural numbers and place value* (Q19_1) and *2D geometric figures* (Q19_4) were the content areas significantly associated with students' achievement. Because the research question 6 asks about those content areas related to topics from question 18, I added *fractions and decimals* (Q19_2) which is related to the topic *meaning, read and write simple fractions* (Q18_7) for the multilevel analysis. For a clearer interpretation, the Spanish score was centered to its grand mean (259.8 points), where the grand mean of this level-1 predictor was subtracted from each level-1 case; and the variables selected from the regressions analyses and the school variables were centered by using its lowest category

as references (Bryk, & Raudenbush, 1992). Since now, all the variables names standing a "C" means that the variable was centered to its grand mean or its lowest category.

Any multilevel analysis starts with the fully unconditional model, which provides information about how much variation in mathematics students' achievement lies within and between teachers. This model has no variables at any level. To answer research questions 4, 5, and 6 I used 2-level models which follow the next structure:

Level 1–the student level—the variable was the Spanish score in the 2011 SIMCE examination.

Level 2–the teacher level—the variables were the teaching practices. The variables selected in the regression analyses were: *students' group work* (Q14_1), *solve HW* (Q17_2), *explain the workbook and textbook exercises solutions to the whole class* (Q17_6), *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), *communication of information provided by charts and graphics* (18_14), *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4).

To answer the research question 7, I constructed a model with 3 levels: level 1 (students), level 2 (teachers) and level 3 (schools), this last level took into consideration the following variables from the school.

Level 3–the school level—the variables were school SES and type of school funding.

The Unconditional Model

Level-1 model:

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model:

$$\beta_{0j} = \gamma_{00} + u_{oj}$$

Mixed model:

$$SCORE\_MATH_{ij} = \gamma_{00} + u_{0i} + r_{ij}$$

The intraclass correlation coefficient (ICC) was .278; it means that 27.8% of the total variance was accounted for within classroom difference. Looking at Table 29, we can see that the variance within classrooms (σ_ε^2) was greater than the variance among classrooms (τ_{00}). It means that there was more variability within the classroom than among classrooms. This result was in line with the literature (Ramirez, 2007, Duarte et al., 2013).

Table 29
The Unconditional Model for Student's Achievement

	MODEL 0
Fixed effects	
Intercept	244.85**
Variance components	
Level-1 Within classroom (σ_ε^2)	1843.02**
Level-2 Between classrooms (τ_{00})	709.59**

Note: * significance at .05; ** significance at .001

The unconditional model provides an estimation of the grand mean of the SIMCE mathematics examination score (γ_{00}); 244.85 point is the average achievement across all classroom averages.

In order to answer the research questions, I added all the variables considered in this study to this unconditional model, according to the research question asked. Therefore, the new

models were conditioned by the variables added. The analysis was based upon the potential proportion of the variance explained by the models. I report these analysis in the next section of this chapter.

The Conditional Models

I classified the conditional models in five main models: Model 1 is a set of 2-level models where I added the frequency with which teachers self-reported using the *students' group work* (Q14_1) strategy and the instructional practices of *solve HW* (Q17_2) and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6). This model allowed me to answer the research question 4: *To what extent were practices identified in Question 1 associated with students' achievement?* Model 2 is a set of 2-level models to answer the research question 5: *To what extent did the teaching practices selected in Question 1 and the topics selected in Question 2 predict students' achievement on the SIMCE mathematics examination?* I constructed this set of models by combining the teaching practices *students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6) with the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), and *communication of information provided by charts and graphics* (Q18_14).

Model 3 is a set of 2-level models for answering research question 6: *Were teachers' perceptions of their preparation to teach topics identified in Question 2 or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?* Thus, I constructed two models: Model 3a for answering: *Were teachers' perceptions of their preparation to teach topics identified in Question 2 good predictors of students' achievement on*

the SIMCE mathematics examination? This set of models was constructed by combining the same set of teaching practices as before (*students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6)) with teachers' self-reported perceptions to teach *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D geometric figures* (Q19_4). I constructed a second model, Model 3b, for answering: *or their [teachers] perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?* In this set of models I added the answer for question 12 about what teachers think about their students' future schooling and their self-reported agreement with that statements *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) and the *students care about the furniture and infrastructure of the school* (Q22_9).

The Model 4 is a set of 2-level models I constructed to explore the behavior of the Spanish score in the most significant models from Model 1, Model 2 and Model 3.

Model 5 is a set of 3-level models to answer research question 7: *Did the association between reported teaching practices examined in Question 1 and students' achievement differ across schools? In particular, to what extent were school characteristics, such as funding model and SES, associated with students' achievement?* These models included student-level, teacher-level and school-level variables.

Research Question 4: To what extent were practices identified in Question 1 associated with students' achievement?

Model 1

For this set of models I used the strategy and activities related to teaching practices which were significant in the previous regression analyses: *students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6). I constructed models to analyze how each of these teacher practices behaved on their own. Thus model 1.1 was for the *students' group work* (Q14_1), model 1.2 was for *solve HW* (Q17_2), and model 1.3 was for *explain the workbook and textbook exercises solutions to the whole class* (Q17_6). Finally, in model 1.4, I used the previous variables in different combinations.

In model 1.1 I centered the frequency with which teachers self-reported using the *students' group work* (Q14_1) strategy to its lowest category. Thus, CQ14_1=0 if a teacher self-reported 'never' using *students' group work* as strategy in the classroom; CQ14_1=1 if a teacher self-reported 'sometimes' using it as strategy; CQ14_1=2 if a teacher self-reported 'almost every time' using it as strategy; and CQ14_1=3 if a teacher self-reported 'always' using it as strategy.

Model 1.1

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ14\_1_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ14\_1_j + u_{0j} + r_{ij}$$

Table 30 shows the estimates of the model 1.1. The frequency with which teachers self-reported using the *students' group work* strategy was significant but negatively related to the score in mathematics. For example, teachers who self-reported 'never' using *students' group work* as a strategy, had students whose estimated score was 249.31 points; but if the teacher self-reported 'always' using this strategy, their students' predicted score decreased to 240.49 points.

The proportion of variance accounted for[14] by the *students' group work* (CQ14_1) strategy was low, 0.62%. Based upon this percentage, this variable did not help predict the students' score.

Table 30
The Conditional Model With Teachers' Self-Reported Use of Students' Group Work (CQ14_1) Strategy

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	249.31	1.1676	213.52	<.0001
CQ14_1(γ_{01})	-2.94	0.6988	-4.20	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^2)	1843.09	11.3823	161.93	<.0001
Intercept (τ_{00})	705.13	21.4012	32.95	<.0001
Proportion of variance (%)	0.62			

Model 1.2

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} CQ17\_2_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ17\_2_j + u_{0j} + r_{ij}$$

[14] The formula for computing variance accounted for by a variable on level-2 is in Appendix C.

According to the values in Table 31, the frequency with which teachers self-reported using the *solve HW* (CQ17_2) activity was significant and positively associated with their students' mathematics score. Students whose teacher self-reported 'always' using this strategy attained a predicted score of 247.39 points, almost 11 points more than students whose teachers self-reported 'never' using this activity in class. The proportion of variance accounted for by the frequency with which teachers reported using the *solve HW* activity was 1%. This predictor was a better predictor than the frequency with which teachers self-reported using the *students' group work* activity in the classroom, but the proportion of variance accounted for by this model was still low.

Table 31
The Conditional Model With Teachers' Self-Reported Use of Solve HW (CQ17_2) Activity

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	236.49	1.5513	152.44	<.0001
CQ17_2 (γ_{01})	3.64	0.6401	5.68	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_ε^2)	1842.98	11.3806	161.94	<.0001
Intercept (τ_{00})	702.46	21.3147	32.96	<.0001
Proportion of variance (%)	1			

Model 1.3

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ17\_6_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ17\_6_j + u_{0j} + r_{ij}$$

Table 32 shows the estimates for *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) activity. The frequency with which teachers reported using this activity was positively related to their students' mathematics score. Thus, when teachers self-reported 'always' *explaining the workbook and textbook exercises solutions to the whole class*, their students' estimated score was 14 points higher than those whose teacher self-reported 'never' using this activity. The proportion of variance explained by this model was almost 1%. This proportion was almost the same for the model 1.3 (using the activity CQ17_2).

Table 32
The Conditional Model With the Teachers' Self-Reported Use of the Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) Activity

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	232.24	2.1415	108.45	<.0001
CQ17_6 (γ_{01})	4.89	0.8037	6.05	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^2)	1842.81	11.3788	161.95	<.0001
Intercept (τ_{00})	702.54	21.2944	32.99	<.0001
Proportion of variance (%)	0.99			

Each of the three previous models suggested that the frequency of using the specific strategies and activities were related to student achievement. However, the amount of variance accounted for by each one of them was low. Using the activities *solve HW* (CQ17_2) and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) were positively related to student's achievement, but the *students' group work* (CQ14_1) strategy was negatively related to students' achievement.

Model 1.4

For model 1.4, I added the previous variables in systematically different combinations. Thus, in model 1.4.1 I added teachers' self-reported use of the *students' group work* (CQ14_1) strategy and the *solve HW* (CQ17_2) and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) instructional practices. In model 1.4.2 I added just self-reported use of *students' group work* (CQ14_1) and *solve HW* (CQ17_2). In model 1.4.3 I added teachers' self-reported use of *solve HW* (CQ17_2) and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6). Finally, in model 1.4.4 I added self-reported use of *students' group work* (CQ14_1) strategy and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6). The equations for these models are in Appendix G.

Table 33 shows that self-reported use of *students' group work* (CQ14_1) was negatively related to the mathematics score across all models, but self-reported use of *solve HW* (CQ17_2) and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) were positively related to the mathematics score. Model 1.4.1 explained the most variance. These results suggested that the frequency with which teachers' self-reported using *students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6) together were more appropriate for predicting students' achievement than using each one separately.

Table 33
Summary of the Fixed Effects, Variance Component and Proportion of Variance Accounted for by Conditional Models 1.4.1 to 1.4.4. Models Included the Following Teaching Practices: Students' Group Work (CQ14_1), Solve HW (CQ17_2), Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6)

	Model 1.4.1	***Model 1.4.2***	***Model 1.4.3***	***Model 1.4.4***
Fixed effects				
Intercept	233.24**	240.89**	228.98**	236.51**
CQ14_1	-3.55**	-3.45**		-3.24**
CQ17_2	2.99**	4.01**	2.65**	
CQ17_6	3.90**		3.77**	5.11**
Variance components				
Level-1 σ_ε^2	1842.89**	1843.06**	1842.83**	1842.86**
Level-2 τ_{00}	692.80**	696.44**	699.03**	697.36**
Proportion of variance (%)	2.36	1.85	1.49	1.72

Note: * significance at .05; ** significance at .001

Based upon the proportion of variance shown in Table 33, the second best model was model 1.4.2; the frequency of using *students' group work* (CQ14_1) strategy was still negatively related to the mathematics score, and *solve HW* (CQ17_2) was the more positively related than in any of the other models. Thus, if a teacher self-reported 'never' using *students' group work* strategy and *solve HW* activity, the estimated score of a student would be 240.89 points; if the teacher self-reported 'sometimes' using these activities, the estimated score would be 241.45 points; if the teacher self-reported 'almost every time' the estimated score would be 242.01; and, if the teacher self-reported 'always,' the estimated score would be 242.57. From that data, it can be said that the increase of the score was not too high.

In summary, these results suggested that the teaching practices worked better together than separately. Despite the fact that *students' group work* (CQ14_1) was negatively related to students' achievement, the positive effect of the other two activities seemed to eliminate the negative effect of that strategy.

Research Question 5: To what extent did the teaching practices selected in Question 1 and the topics selected in Question 2 predict students' achievement on the SIMCE mathematics examination?

Model 2

To answer this research question, I modeled systematically different combinations of the teaching practices *students' group work* (CQ14_1), *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6), and the topics *meaning, read and write simple fraction* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13), and *communication of information provided by charts and graphics* (Q18_14). In particular, I explored how the teaching practices behaved with respect to the topics. But first, I modeled the extent to which teachers self-reported addressing each topic separately. Thus, in model 2.1 I used *meaning, read and write simple fractions* (Q18_7), in model 2.2 I used *recognize net and flat representations of 2D & 3D figures* (Q18_13), and in model 2.3 I used *communication of information provided by charts and graphics* (Q18_14). Then I combined all four topics in model 2.4. Finally, in model 2.5 I combined the practices in model 1 with the topics addressed.

Model 2.1

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_7_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_7_j + u_{0j} + r_{ij}$$

In model 2.1 I centered the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7) to its lowest category. Thus, CQ18_7=0 if a teacher self-reported the topic was 'not included' in the academic year; CQ18_7=1 if a teacher self-reported the topic was 'not yet taught'; CQ18_7=2 if a teacher self-reported that 'some of' the topic was taught; CQ18_7=3 if a teacher self-reported teaching 'most of' the topic; and CQ18_7=4 if a teacher self-reported teaching 'all of' the topic.

Table 34
The Conditional Model With the Extent to Which Teachers Self-Reported Addressing the Topic Meaning, Read and Write Simple Fractions (CQ18_7)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	214.35	1.7979	119.22	<.0001
CQ18_7 (γ_{01})	9.91	0.5619	17.64	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_ε^2)	1842.61	11.3732	162.01	<.0001
Intercept (τ_{00})	643.38	19.8111	32.48	<.0001
Proportion of variance (%)	9.33			

According to the estimated values in Table 34, the proportion of variance explained by this model was 9.33%. This result suggested that the extent to which *meaning, read and write simple fractions* was addressed was a good predictor of students' score. The more the topic *meaning, read and write simple fractions* was taught, the better students' scores were. Replacing the estimates in the model equation, the predicted mathematics score for a student whose teacher

self-reported ‘not yet teaching’ this topic was 224.26 points, and the predicted score for a student whose teacher self-reported he taught ‘all of it’ was 253.99 points.

Model 2.2

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_13_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_13_j + u_{0j} + r_{ij}$$

In model 2.2 I centered the extent to which teachers self-reported addressing *recognize net and flat representations of 2D & 3D figures* (Q18_13) to its lowest category. Thus, CQ18_13=0 if a teacher self-reported the topic *recognize net and flat representations of 2D & 3D figures* was ‘not included’ in the academic year; CQ18_13=1 if a teacher self-reported this topic was ‘not yet taught’; CQ18_13=2 if a teacher self-reported teaching ‘some of’ this topic; CQ18_13=3 if a teacher self-reported teaching ‘most of’ ‘this topic; and CQ18_13=4 if a teacher self-reported teaching ‘all of’ this topic.

Table 35
The Conditional Model With the Extent to Which Teachers Self-Reported Addressing the Topic Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	215.15	1.9337	111.27	<.0001
CQ18_13 (γ_{01})	9.27	0.5837	15.89	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1842.40	11.3702	162.04	<.0001
Intercept (τ_{00})	656.99	20.0712	32.73	<.0001
Proportion of variance (%)	7.41			

Table 35 shows that the extent to which *recognize net and flat representations of 2D & 3D figures* was addressed was positively related to the estimated average score. Thus, the estimated score of a student whose teacher self-reported that this topic was 'not included' was 215.15, and the estimated score of a student whose teacher reported teaching 'all of it' was 252.23. However, the proportion of the variance accounted for by this model was lower than the model 2.1 (the variance accounted for by this model was 7.41%)

Model 2.3

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_14_{j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_14_{j} + u_{0j} + r_{ij}$$

In model 2.3 I centered the extent to which teachers self-reported addressing *communication of information provided by charts and graphics* (Q18_14) to its lowest category.

Thus, CQ18_14=0 if a teacher self-reported the topic *communication of information provided by charts and graphics* was 'not included' in the academic year; CQ18_14=1 if a teacher self-reported this topic was 'not yet taught'; CQ18_14=2 if a teacher self-reported teaching 'some of' this topic; CQ18_14=3 if a teacher self-reported teaching 'most of' this topic; and CQ18_14=4 if a teacher self-reported teaching 'all of' this topic.

Table 36
The Conditional Model With the Extent to Which Teachers Self-Reported Addressing the Topic Communication of Information Provided by Charts and Graphics (CQ18_14)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	223.71	1.6498	135.60	<.0001
CQ18_14 (γ_{01})	7.09	0.5283	13.42	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1842.14	11.3690	162.03	<.0001
Intercept (τ_{00})	674.29	20.4838	32.92	<.0001
Proportion of variance (%)	4.97			

As happened with the two previous topics, the extent to which *communication of information provided by charts and graphics* was addressed was positively related to the students' estimated score (see Table 36). However, the proportion of variance accounted for by this model was low, being only 4.97%.

We can see a positive relationship between the extent to which teachers self-reported addressing the three previous topics and students' achievement. The extent to which *meaning, read and write simple fractions* was addressed explained the most variance. Thus, the analysis of the three topics addressed separately suggested that the extent to which *meaning, read and write simple fractions* was addressed by teachers was the most influential topic on students' achievement. In the next set of models, I added the three topics in different combinations.

Model 2.4

In this set of models I examined systematically different combinations of the extent to which teachers self-reported addressing the previous topics. Thus, in model 2.4.1 I added *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13), and *communication of information provided by charts and graphics* (CQ18_14); in model 2.4.2 I used *meaning, read and write simple fractions* (CQ18_7) and *recognize net and flat representations of 2D & 3D figures* (CQ18_13); in the model 2.4.3 I used *recognize net and flat representations of 2D & 3D figures* (CQ18_13) and *communication of information provided by charts and graphics* (CQ18_14); and, in model 2.4.4 I used *meaning, read and write simple fractions* (CQ18_7) and *communication of information provided by charts and graphics* (CQ18_14). The equations for each of these models are in Appendix H.

An overview of the models in Table 37 shows that the extent to which teachers self-reported addressing these topics was positively related to the average mathematics score. Also, we can see that model 2.4, which included the three topics analyzed, explained the most variance. The extent to which teachers self-reported addressing *meaning, read and write simple fraction* had a greater contribution to the estimated score, when compared to the other two topics; the minimum contribution came from the topic *communication of information provided by charts and graphics*. According to the estimated values in Table 37, the second best model was model 2.4.2 which included the topics *meaning, read and write simple fractions* and *recognize net and flat representations of 2D & 3D figure.*

Table 37
Summary of the Fixed Effects, Variance Component and Proportion of Variance Accounted for by Conditional Models 2.4.1 to 2.4.3. Models Included the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13), Communication of Information Provided by Charts and Graphics (CQ18_14)

	Model 2.4.1	***Model 2.4.2***	***Model 2.4.3***	***Model 2.4.4***
Fixed effects				
Intercept	198.54	202.44**	208.83**	205.10**
CQ18_7	6.91	7.46**		8.35**
CQ18_13	4.73	6.07**	7.22**	
CQ18_14	3.31		4.32**	4.71**
Variance components				
Level-1 σ_ε^2	1842.14	1842.39**	1841.99**	1842.29**
Level-2 τ_{00}	619.46	624.91**	646.59**	629.15**
Proportion of variance (%)	12.70	11.93	8.88	11.34

Note: * significance at .05; ** significance at .001

The four models in Table 37 explained more variance than the individual models (Model 2.1 for CQ18_7, Model 2.2 for CQ18_13, and Model 2.3 for CQ18_14). With regards to the estimated coefficients, the largest coefficients were for *meaning, read and write simple fractions* and the smallest were for *communication of information provided by charts and graphics.*

Model 2.5

This set of models combined the practices and the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13) and *communication of information provided by charts and graphics* (Q18_14).

Model 2.5.1

In this model I used the frequency with which teachers self-reported using *students' group work* (CQ14_1), *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) with the extent to which the following topics were addressed: *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) and *communication of information provided by charts and graphics* (CQ18_14).

Table 38
The Conditional Model Included the Teaching Practices of Use Students' Group Work (CQ14_1), Solve HW (CQ17_2), Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) and the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14)

	Estimates
Fixed effects	
Intercept	198.19**
CQ14_1	-3.36**
CQ17_2	2.11*
CQ17_6	0.76
CQ18_7	6.58**
CQ18_13	4.68**
CQ18_14	3.24**
Variance components	
Level-1 σ_{ε}^{2}	1842.28**
Level-2 τ_{00}	610.14**
Proportion of variance (%)	14.02

* significance at .05; ** significance at .001

As shown in Table 38, this model explained 14.02% of the variance, which was more variance explained than by model 2.4.1. Also in Table 38 *students' group work* (CQ14_1) is again

negatively related to students' achievement, and *meaning, read and write simple fractions* (CQ18_7) is the topic with the largest coefficient.

In order to analyze the combinations of the variables selected in the regression analyses, I added topics selected from question 18 in the following way:

Model i/viii/xv = Q14_1/Q17_2/Q17_6 + Q18_7 + Q18_13 + Q18_14

Model ii/ix/xvi = Q14_1/Q17_2/Q17_6 + Q18_7 + Q18_13

Model iii/x/xvii = Q14_1/Q17_2/Q17_6 + Q18_7

Model iv/xi/xviii = Q14_1/Q17_2/Q17_6 + Q18_14

Model v/xii/xix = Q14_1/Q17_2/Q17_6 + Q18_13

Model vi/xiii/xx = Q14_1/Q17_2/Q17_6 + Q18_13 + Q18_14

Model vii/xiv/xxi = Q14_1/Q17_2/Q17_6 + Q18_7 + Q18_14

In this section I report models which explained more variance. The complete set of models performed are in appendices cited below.

Models 2.5.2

I constructed models in Table 39 by keeping the frequency with which teachers self-reported using the *students' group work* (CQ14_1) strategy and adding the three topics from question 18: *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) and *communication of information provided by charts and graphics* (CQ18_14). For the complete set of models performed, see Appendix I.

Of the models in Table 39, the *model i* explained the most variance. Furthermore, although the self-reported *students' group work* (Q14_1) strategy was negatively related to

students' achievement, the extent to which the three topics were addressed had a positive effect on students' achievement, and the extent to which *meaning, read and write simple fractions* (Q18_7) was addressed had the greatest effect on students' achievement. The model which explained the second most variance was *model ii*. The teachers' self-reported use of *students' group work* (Q14_1) is still negatively related to students' achievement; however, it was less negative than in *model i*. On the other hand, the effect of the extent to which *meaning, read and write simple fractions* (CQ18_7) was addressed in this model is equal to the extent to which *recognize net and flat representations of 2D & 3D figures* (CQ18_13) was addressed. A review of all models in Table 39, shows that the extent to which *meaning, read and write simple fractions* (CQ18_7) was addressed makes a greater contribution to students' estimated scores than the other topics. Nevertheless, when *meaning, read and write simple fractions* (CQ18_7) was the only topic included (see *model iii*), that model explained the least variance. I can safely say that the *meaning, read and write simple fractions* (CQ18_7) topic is apparently important, but it needs other topics, such as *recognize net and flat representations of 2D & 3D figures* (CQ18_13) to be a better explanatory variable. Maybe there is some connection between fractions and geometry after all? I will come back to this in the discussion chapter.

Table 39
The Conditional Models Keeping the Teachers' Self-Reported Use of the Students' Group Work (CQ14_1) and Combining the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (Q18_14)

	Model i	***Model ii***	***Model iii***	***Model vii***
Fixed effects				
Intercept	203.08*	206.87*	218.69*	209.62*
CQ14_1	-3.05*	-2.91*	-2.79*	-3.02*
CQ18_7	6.84*	7.41*	9.88*	8.29*
CQ18_13	4.75*	7.41*		
CQ18_14	3.40*			4.80*
Variance components				
Level-1 σ_ε^2	1842.27*	1842.51*	1842.71*	1842.41*
Level-2 τ_{00}	613.35*	619.43*	638.55*	623.32*
Proportion of variance (%)	13.6	12.71	10.01	12.16

* significance at .001; ** significance at .05

Model 2.5.3

In this set of 2-level models I kept the frequency with which teachers self-reported use the *solve HW* (Q17_2) activity, and I added the extent to which teachers self-reported teaching *meaning, read and write simple fractions* (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13) and *communication of information provided by charts and graphics* (Q18_14). For the complete set of models performed, see Appendix J.

Table 40
The Conditional Models Keeping the Teachers' Self-Reported Use of the Solve HW (CQ17_2) and Combining the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14).

	Model viii	**Model xix**	**Model x**	**Model xiii**
Fixed effects				
Intercept	195.02*	198.35*	209.00*	203.92*
CQ17_2	1.93**	2.16*	2.34*	2.51*
CQ18_7	6.73*	7.25*	9.65*	
CQ18_13	4.72*	6.00*		7.13*
CQ18_14	3.19*			4.14*
Variance components				
Level-1 σ_{ε}^{2}	1842.17*	1842.40*	1842.62*	1842.02*
Level-2 τ_{00}	616.33*	621.55*	639.80*	642.79*
Proportion of variance (%)	13.14	12.40	9.84	9.41

* significance at .001; ** significance at .05

The model in Table 40 that explained the most variance was *model viii* which contained all the topics from question 18. As in the previous models, the model which explained the second most variance, *model ix*, was the one that contained *meaning, read and write simple fractions* (Q18_7) and *recognize net and flat representations of 2D & 3D figures* (Q18_13).

Model 2.5.4

I constructed this set of 2-level models keeping the frequency with which teachers' self-reported using the *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) activity, and I added the extent to which *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) and *communication of information provided by charts and graphics* (CQ18_14) were addressed. For the complete set of models performed, see Appendix K.

The models in Table 41 that explained the most variance were *model xv* and *model xvi*. The frequency with which teachers self-reported use of *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) activity was not significant in *model xv*; however, this activity was significant across all other models. *Model xvi* contained the extent to which *meaning, read and write simple fractions* (Q18_7) and *recognize net and flat representations of 2D & 3D figures* (Q18_13) were addressed.

In all models, the topic which contributed the most to students' scores was *meaning, read and write simple fractions* (Q18_7). There was definitely a connection between teachers' responses to questions about fractions and geometry. I will return to this in the discussion chapter.

Table 41

The Conditional Models Keeping the Teachers' Self-Reported Use of the Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) and Combining the Extent to Which Teachers Self-Reported addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14).

	Model xv	***Model xvi***	***Model xvii***	***Model xx***	***Model xxi***
Fixed effects					
Intercept	195.93**	199.10**	208.94**	204.10**	201.47**
CQ17_6	1.33	1.65*	2.46*	2.26*	1.77*
CQ18_7	6.79**	7.31**	9.59**		8.17**
CQ18_13	4.64**	5.91**		6.99**	
CQ18_14	3.23**			4.18**	4.57**
Variance components					
Level-1 σ_ε^2	1842.12**	1842.35**	1842.52**	1841.96**	1842.24**
Level-2 τ_{00}	618.13**	623.58**	641.40**	644.99**	627.69**
Proportion of variance (%)	12.89	12.12	9.61	9.10	11.54

Note: * significance at .05; ** significance at .001

In summary, when topics addressed were considered one at a time, the extent to which *meaning, read and write simple fractions* (CQ18_7) was addressed explained the most variance 9.33% (see Table 34); however, the three topics together explained more variance (12.70%, see Table 37). Besides, the three topics together plus the three practices explained still more variance (14.02%, see Table 38), which is much better. Although the frequency with which teachers self-reported using *students' group work* (Q14_1) was still negatively related to students' achievement, this strategy plus all the topics addressed had a very fair behavior.

Research Question 6: Were teachers' perceptions of their preparation to teach topics identified in Question 2 or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?

To answer research question 6, I analyzed two model. I used model 3a for answering: *Were teachers' perceptions of their preparation to teach topics identified in Question 2 good predictors of students' achievement on the SIMCE mathematics examination?* And, I used model 3b for answering: *or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?*

Model 3a

Model 3a is a set of models that I constructed to answer the first part of the research question 6— *Were teachers' perceptions of their preparation to teach topics identified in Question 2 better predictors of students' achievement on the SIMCE mathematics examination?*. To answer this question, I modeled different combinations of the teaching practices *students'*

group work (CQ14_1), *solve HW* (CQ17_2), *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) and teachers' self-reported perceptions of their preparation to teach *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4). But first, I modeled teachers' self-reported perceptions of their preparation to teach the content areas named previously one at a time. Thus, in model 3.1.a I used *natural numbers and place value* (Q19_1), in model 3.2 I used *fractions and decimals* (Q19_2), and in model 3.3.a I used *2D Geometric figures* (Q19_4). After that, in model 3.4.a I used different combinations of the previous content areas. Finally, model 3.5.a is a set of models where I used a combination of the practices in model 1 and teachers' self-reported perception of their preparation to teach the following content areas: *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4).

Model 3.1.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} CQ19\_1_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ19\_1_j + u_{0j} + r_{ij}$$

In this model I centered teachers' self-reported perception of their preparation to teach *natural numbers and place value* (Q19_1) to its lowest category. Thus, CQ19_1=0 if a teacher self-reported feeling 'not prepared' to teach this topic; CQ19_1=1 if a teacher self-reported feeling 'somewhat prepared' to teach this topic; CQ19_1=2 if a teacher self-reported feeling 'quite prepared' to teach this topic; and CQ19_1=3 if a teacher self-reported feeling 'well prepared' to teach this topic.

Table 42
The Conditional Model With the Teachers' Self-Reported Perception of Their Preparation to Teach: Natural Numbers and Place Value (CQ19_1)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	222.10	2.54	87.51	<.0001
CQ19_1 (γ_{01})	8.53	0.93	9.14	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1842.58	11.38	161.97	<.0001
Intercept (τ_{00})	693.22	21.04	32.93	<.0001
Proportion of variance (%)	2.31			

Teachers' self-reported perception of their preparation to teach *natural numbers and place value* (CQ19_1) was positively related to students' achievement (see Table 42). If the teacher reported feeling well prepared to teach *natural numbers and place value* her students were estimated to gain 25.56 points more than students whose teacher reported feeling 'not prepared' to teach the topic. However, the proportion of variance accounted for by this model was low, being only 2.31%.

Model 3.2.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} CQ19\_2_{j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ19\_2_{j} + u_{0j} + r_{ij}$$

In this model, I centered teachers' self-reported perception of their preparation to teach *fractions and decimals* (Q19_2) to its lowest category. Thus, CQ19_2=0 if a teacher self-reported feeling 'not prepared' to teach *fractions and decimals*; CQ19_2=1 if a teacher self-

reported feeling 'somewhat prepared' to teach this topic; CQ19_2=2 if a teacher self-reported feeling 'quite prepared' to teach this topic; and CQ19_2=3 if a teacher self-reported feeling 'well prepared' to teach this topic.

Table 43
The Conditional Model With the Teachers' Self-Reported Perception of Their Preparation to Teach Fractions and Decimals (CQ19_2)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	230.58	1.8438	125.06	<.0001
CQ19_2 (γ_{01})	5.90	0.7341	8.03	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^2)	1842.63	11.3771	161.96	<.0001
Intercept (τ_{00})	697.27	21.1584	32.96	<.0001
Proportion of variance (%)	1.74			

Teachers' self-reported perception of their preparation to teach *fractions and decimals* (CQ19_2) was positively related to students' achievement (see Table 43). The students' estimated score was 17.69 points higher when the teacher self-reported feeling 'well prepared' to teach *fractions and decimals* than when the teacher self-reported feeling 'not prepared' to teach that topic. Nevertheless, the proportion of variance accounted for by this model was just 1.74%.

Model 3.3.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} CQ19\_4_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ19\_4_j + u_{0j} + r_{ij}$$

In this model I centered teachers' self-reported perception of their preparation to teach *2D geometric figures* (Q19_4) to its lowest category. Thus, CQ19_4=0 if a teacher self-reported feeling 'not prepared' to teach this topic; CQ19_4=1 if a teacher self-reported feeling 'somewhat prepared' to teach this topic; CQ19_4=2 if a teacher self-reported feeling 'quite prepared' to teach this topic; and CQ19_4=3 if a teacher self-reported feeling 'well prepared' to teach this topic.

Table 44
The Conditional Model With the Teachers' Self-Reported Perception of Their Preparation to Teach 2D Geometric Figures (CQ19_4)

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	221.95	2.29	96.87	<.0001
CQ19_4 (γ_{01})	8.72	0.85	10.24	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1842.68	11.37	161.97	<.0001
Intercept (τ_{00})	687.68	20.92	32.87	<.0001
Proportion of variance (%)	3.09			

Table 44 shows the estimated values for this model. We can see that teachers' self-reported perception of their preparation to teach *2D geometric figures* was positively related to the students' achievement: When the teacher reported feeling more confident, the students estimated score increased. The proportion of variance accounted for by this model was 3.09%. This proportion was greater than the proportion explained by the previous models.

Model 3.4.a

For this set of 2-level models, I used teachers' self-reported perception of their preparation to teach the content areas selected from question 19 in different combinations. Thus, in model 3.4.1 I used the three content areas *natural numbers and place value* (CQ19_1),

fractions and decimals (CQ19_2), and *2D Geometric figures* (CQ19_4); in model 3.4.2 I used *natural numbers and place value* (CQ19_1) and *fractions and decimals* (CQ19_2), in model 3.4.3 I used *fractions and decimals* (CQ19_2) and *2D Geometric figures* (CQ19_4); and in model 3.4.4 I used *natural numbers and place value* (CQ19_1) and *fractions and decimals* (CQ19_2). The equations for each of these models are in Appendix L.

Table 45
Summary of the Fixed Effects, Variance Component and Proportion of the Variance Accounted for by Conditional Models 3.4.1 to 3.4.3. Models Included Teachers' Self-Reported Perception of Their Preparation to teach: Natural Numbers and Place Value (CQ19_1), Fractions and Decimal (CQ19_2), and 2D Geometric Figures (CQ19_4)

	Model 3.4.1.a	***Model 3.4.2.a***	***Model 3.4.3.a***	***Model 3.4.4.a***
Fixed effects				
Intercept	217.35**	221.45**	220.23**	217.38**
CQ19_1	3.21*	6.30**		4.09**
CQ19_2	1.44	2.72*	2.47**	
CQ19_4	5.89**		7.11**	6.32**
Variance components				
Level-1 σ_ε^2	1842.53**	1842.52**	1842.59**	1842.55**
Level-2 τ_{00}	686.04**	691.24**	686.72**	686.12**
Proportion of variance (%)	3.31	2.59	3.22	3.31

Note: * significance at .05; ** significance at .01

The proportion of variance accounted for by the models in Table 45 was low. The models that explained more variance were model 3.4.1.a and model 3.4.4.a. In these models, the largest coefficient came from the self-reported feeling of preparation to teach *2D Geometric figures* (CQ19_4). Across all models that included *fractions and decimals* (CQ19_2), this coefficient was the smallest. In model 3.4.4.a the topic *fractions and decimal* (CQ19_2) was not included, and this was one of the models that explained the most variance. This situation was curious, since in model 2 the extent to which *meaning, read and write simple fractions* was addressed was the largest coefficient. However, all these models explained less variance than any model in

Table 37 (models with Q18). The extent to which teachers self-reported addressing topics selected from question 18 explained more variance than teachers' self-reported perceptions of their preparation to teach content areas selected from question 19.

Model 3.5.a

In this set of 2-level models I took combinations of the frequency with which teachers self-reported using *students' group work* (CQ14_1), *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) with the teachers' perception of their preparation to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), and *2D Geometric figures* (CQ19_4).

Model 3.5.1.a

This model included the practices of using *students' group work* (CQ14_1), *solve HW* (CQ17_2), *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) and teachers' perception of their preparation to teach *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4).

Table 46
The Model Included the Teaching Practices of Using Students' Group Work (CQ14_1), Solve HW (CQ17_2), Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6; and the Teachers' Self-Reported Perception of Their Preparation to Teach Natural Numbers and Place Value (CQ19_1), Fractions and Decimal (CQ19_2), and 2D Geometric Figures (CQ19_4)

	Estimates
Fixed effects	
Intercept	211.59**
CQ14_1	-3.44**
CQ17_2	2.67**
CQ17_6	2.78**
CQ19_1	3.13*
CQ19_2	1.03
CQ19_4	5.45**
Variance components	
Level-1 σ_ε^2	1842.52**
Level-2 τ_{00}	672.15**
Proportion of variance (%)	5.28

* significance at .05; ** significance at .001

The model in Table 46 explained less variance than the model in Table 38 that included the same three practices and the three topics selected from question 18. Apparently, teachers' perception about their preparation to teach the topics addressed was not as good a predictor as the extent to which they report addressing the topics in their instruction.

In order to analyze systematically the combinations of variables, I kept one of the strategies or activities selected in the regression analyses and added the content areas selected from questions 19-in the following way:

Model i/viii/xv = Q14_1/Q17_2/Q17_6 + Q19_1 + Q19_2 + Q19_4

Model ii/ix/xvi= Q14_1/Q17_2/Q17_6 + Q19_1 + Q19_2

Model iii/x/xvii= Q14_1/Q17_2/Q17_6 + Q19_1

Model iv/xi/xviii = Q14_1/Q17_2/Q17_6 + Q19_4

Model v/xii/xix = Q14_1/Q17_2/Q17_6 + Q19_2

Model vi/xiii/xx = Q14_1/Q17_2/Q17_6 + Q19_2 + Q19_4

Model vii/xiv/xxi = Q14_1/Q17_2/Q17_6 + Q19_1 + Q19_4

In this section, I report the models which explained the most variance. The complete set of models performed are in appendices cited below.

Model 3.5.2.a

This set of models kept the frequency with which teachers self-reported using *students' group work* (CQ14_1), and varying the teachers' perception to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), and *2D Geometric figures* (CQ19_4). Table 47 shows the models which explained the most variance. The complete set of models performed are in Appendix M.

Table 47
The Conditional Models Keeping the Teachers' Self-Reported Use of Students' Group Work (CQ14_1) and Combining the Teachers' Self-Reported Perception of Their Preparation to Teach Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model i	***Model vi***	***Model vii***
Fixed effects			
Intercept	221.89**	224.72**	221.88**
CQ14_1	-2.94**	-2.97**	-2.92**
CQ19_1	3.11*		4.04**
CQ19_2	1.53	2.52*	
CQ19_4	5.88**	7.07**	6.34**
Variance components			
Level-1 σ_ε^2	1842.63**	1842.69**	1842.65**
Level-2 τ_{00}	680.25	681.05**	680.64**
Proportion of variance (%)	4.13	4.02	4.08

* significance at .05; ** significance at .001

According to the estimated values shown in Table 47, the model which explained the most variance was *model i*. In comparison to *model i* in Table 39, the current model explained less variance. As a result, presumably combining *students' group work* (Q14_1) with the topics addressed was better for predicted students' scores than teachers' perception of their preparation to teach the content areas.

Models 3.5.3.a

In this set of 2-level models I kept the frequency with which teachers self-reported using *solve HW* (CQ17_2), and I systematically added different combinations of teachers' perceptions of their preparation to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), and *2D Geometric figures* (CQ19_4). The complete set of models performed are in Appendix N.

Table 48
The Conditional Models Keeping the Teachers' Self-Reported Use of Solve HW (CQ17_2) and Combining the Teachers' Self-Reported Perception of Their Preparation to Teach Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model viii	***Model xi***	***Model xiii***
Fixed effects			
Intercept	211.51**	215.83**	214.54*
CQ17_2	3.00**	3.09**	2.97**
CQ19_1	3.32*		
CQ19_2	1.09		2.15*
CQ19_4	5.69**	8.36**	6.96**
Variance components			
Level-1 σ_ε^2	1842.50**	1842.64**	1842.57**
Level-2 τ_{00}	680.15**	681.99**	681.13
Proportion of variance (%)	4.15	3.89	4.01

* significance at .05; ** significance at .001

The model which explained the most variance was *model viii*, which included teachers' perception of the preparation to teach the three topics listed above, but teachers' self-reported perception of their preparation to teach *fractions and decimals* (CQ19_2) was not significant for the model. The model which explained the second most variance was *model xiii,* which included the teachers' self-reported perception of their preparation to teach *fractions and decimals* (CQ19_2) and *2D geometric figures* (CQ19_4). A review of these models indicated that the proportion of variance which can be explained by them is lower when compared to the models that used the extent to which those topics were addressed by teachers in their instruction.

Models 3.5.4.a

In this set of 2-level models I kept the frequency with which teachers self-reported using *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6), and I systematically added different combinations of the teachers' perceptions of their preparation to

teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), and *2D Geometric figures* (CQ19_4). The complete set of models performed are in Appendix O.

Table 49
The Conditional Models Keeping Teachers' Self-Reported Use of the Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) Activity and Combining the Teachers' Self-Reported Perception of Their Preparation to Teach Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model xv	***Model xx***	***Model xxi***
Fixed effects			
Intercept	209.81*	212.55*	209.72*
CQ17_6	3.58*	3.61*	3.64*
CQ19_1	3.12**		3.83**
CQ19_2	1.18	2.18*	
CQ19_4	5.55*	6.73*	5.89*
Variance components			
Level-1 σ_ε^2	1842.42*	1842.48*	1842.44*
Level-2 τ_{00}	681.28*	682.13*	681.49*
Proportion of variance (%)	3.99	3.87	3.96

Note: * significance at .05; ** significance at .001

According to the estimated values shown in Table 49, the model that explained the most variance was *model xv*, but the teacher' perception of their preparation to teach *fractions and decimals* (CQ19_2) was not significant. The model which explained the second most proportion of variance was *model xxi*. In this model all variables were significant, but the proportion of the variance explained was low when compared to similar models using the extent to which these topics were addressed in instruction.

In summary, when teachers' self-reported perceptions of their preparation to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), *and 2D geometric figures* (CQ19_4) were modeled individually, they explained a little of the variance.

Adding the three practices, the proportion of the variance accounted for increased a little. However, the self-reported perception of preparation to teach content areas cited previously was not as good a predictor as the extent to which teachers reported addressing topics in their instruction.

Model 3b

Model 3b is a set of models that I constructed to answer the second part of research question 6 — *Were teachers' perceptions of their preparation to teach topics identified in Question 2 or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?* —I answered this question using teachers' self-reported expectation of their students' future schooling (Q12), and their self-reported agreement with the following statements: *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9). I modeled different combinations of the teaching practices [*students' group work* (CQ14_1) , *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6)] and the teachers' expectations for and agreements with statements about their students. First, I modeled teachers' self-reported expectations of their students' future schooling and agreement with the statement related to students' behavior one at a time. Thus, in model 3.1.b I used the teachers' self-reported expectations of students' future schooling (Q12), in model 3.2.b I used teachers' self-reported agreement with the statement *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and in model 3.3.b I used the teachers' self-reported agreement with the statement *students care about the furniture and infrastructure of the school* (Q22_9). After that,

in model 3.4.b I used different combinations of the teachers' expectations and agreements. Finally, model 3.5.b is a set of models where I used a combinations of the practices in model 1 and self-reported expectations for students' future schooling and agreement about students' behavior.

Model 3.1.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} CQ12_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} CQ12_j + u_{0j} + r_{ij}$$

In this model I centered teachers' self-reported expectations for their students' future schooling (Q12) to its lowest category. Thus, CQ12=0 if a teacher self-reported expecting 'their students will not graduate from high school'; CQ12=1 if a teacher self-reported expecting 'their students will graduate from high school'; and CQ12=2 if a teacher self-reported expecting 'their students will obtain some university degree.

Table 50
The Conditional Model With the Teachers' Self-Reported Expectation of their Students' Future Schooling From Question 12

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	220.18	1.2262	179.57	<.0001
CQ12 (γ_{01})	19.19	0.8781	21.86	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1844.04	11.3875	161.94	<.0001
Intercept (τ_{00})	602.11	18.9669	31.75	<.0001
Proportion of variance (%)	15.15			

Results indicated that teachers' expectations of their students' future schooling was positively related to students' achievement. The proportion of variance accounted for by teachers' self-reported expectations for their students' future schooling (CQ12) was 15.15%', this proportion of variance was higher than for teachers' self-reported perception to teach any of the content areas from question 19.

Model 3.2.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Q22\_7_{j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} Q22\_7_{j} + u_{0j} + r_{ij}$$

Because the variable *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) is a dichotomy, I did not need to make a dummy variable. Thus Q22_7=0 if a teacher self-reported disagreeing with the statement, and Q22_7=1 if a teacher self-reported agreeing with the statement.

Table 51
The Conditional Model With the Teachers' Self-Reported Agreement with As Teachers we Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (Q22_7) Statement

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	248.42	0.6608	375.92	<.0001
Q22_7 (γ_{01})	-7.58	0.9730	-7.79	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_{ε}^{2})	1842.22	11.3983	161.62	<.0001
Intercept (τ_{00})	693.01	21.1554	32.76	<.0001
Proportion of variance (%)	2.33			

According to results reported in Table 51, if teachers agreed with the statement as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom students lost 7.58 points in their estimated score. Then, this result suggested that when a teacher reported discipline problems their students achieved lower scores than the teachers who reported not having those problems. The proportion of variance accounted for by teachers' self-reported agreement with *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) statement was 2.33%. This proportion was low, and was similar to the proportion of variance accounted for by teachers' self-reported perception of their preparation to teach content areas from question 19.

Model 3.3.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Q22\_9_j + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} Q22\_9_j + u_{0j} + r_{ij}$$

Variable Q22_9 was dichotomy as well. Thus, Q22_9=0 if a teacher disagreed with the statement, and Q22_9=1 if a teacher agreed with the statement.

Table 52
The Conditional Model With the Teachers' Self-Reported Agreement With Students Care About the Furniture and Infrastructure of the School (Q22_9) Statement.

Fixed Effects	***Estimate***	***St. Error***	***t-stat***	***p-value***
Intercept (γ_{00})	236.88	1.4103	167.97	<.0001
Q22_9 (γ_{01})	9.12	1.5024	6.07	<.0001
Variance Components	***Estimate***	***St. Error***	***z-stat***	***p-value***
Residual (σ_ε^2)	1842.32	11.3993	161.62	<.0001
Intercept (τ_{00})	697.91	21.2785	32.80	<.0001
Proportion of variance (%)	1.65			

Estimates in Table 52 indicated that when a teacher self-reported agreeing with the statement *students care about the furniture and infrastructure of the school* (Q22_9), their students gained 9.12 points in their estimated score. Agreement with this statement was positively related to students' achievement. However, the proportion of variance accounted for by teacher's agreement with the statement was just 1.65%.

In summary, all three variables analyzed were positively related to the students' achievement, but teachers' expectations of their students' future schooling (CQ12) was the variable which explained the most variance. Furthermore, this variable explained more variance than any of the teachers' self-reported perceptions of their preparation to teach content areas from question 19.

Model 3.4.b

For this set of 2-level models, I used the teachers' expectation of their students' future schooling (CQ12) and agreement with the statements, *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9) in different combinations. Thus, in model 3.4.1.b I used the three previous variables named; in model 3.4.2.b I used the teachers' expectation of their students' future schooling (CQ12), and response to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7); in model 3.4.3.b I used teachers' response to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and to *students care about the furniture and infrastructure of the school* (Q22_9) and in model 3.4.4.b I used teachers' expectation of their students' future schooling (CQ12), and their response to *students care about the furniture and infrastructure of the school* (Q22_9). The equations for each of these models are in Appendix P.

Table 53
Summary of the Fixed Effects, Variance Component and Proportion of the Variance Accounted for by Conditional Models 3.4.1.b to 3.4.3.b. Models Included the Teachers' Expectation of Their Students' Future Schooling (Q12), and Agreement with As Teachers We Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (Q22_7), and Students Care About the Furniture and Infrastructure of the School (Q22_9)

	Model 3.4.1.b	***Model 3.4.2.b***	***Model 3.4.3.b***	***Model 3.4.4.b***
Fixed effects				
Intercept	218.70**	223.50**	241.29**	215.01**
CQ12	18.30**	18.57**		18.80**
Q22_7	-4.90**	-5.33**	-6.94**	
Q22_9	5.62**		7.78**	6.50**
Variance components				
Level-1 σ_ε^2	1843.33**	1843.13**	1842.50**	1843.24**
Level-2 τ_{00}	589.91**	594.38**	684.90**	596.26**
Proportion of variance (%)	16.87	16.24	3.48	15.97

Note: * significance at .05; ** significance at.001

Results presented in Table 53 indicate that the model which explained the least variance was model 3.4.3.b. This model included teachers' responses to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9). The proportion of variance accounted for by this model (with Q22_7 and Q22_9) and by the models 3.2.b (with Q22_7) and 3.3.b (with Q22_9) suggested that these variables were not good predictors of students' achievement. On the other hand, the models which include teachers' expectations of their students' future schooling (CQ12) explained more variance. In other words, teachers' expectations of their students' future schooling (CQ12) was a better predictor of students' achievement.

The second model that explained the most variance was model 3.4.2.b, which included teachers' expectations of their students' future schooling (CQ12), and *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7).

These two variables together were good predictors of students' achievement. It means that if a teacher self-reported that her students would graduate from high school and disagreed with the *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) , their students gain 18.57 points on their estimated score.

Model 3.5.b

In this set of 2-level models I combined the frequency with which teachers self-reported use *students' group work* (CQ14_1), *solve HW* (CQ17_2), *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) with their expectation of their students' future schooling (CQ12), and their response to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9).

Model 3.5.1.b

This model included teachers' self-reported use of *students' group work* (CQ14_1), *solve HW* (CQ17_2), *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) and the teachers' expectation of their students' future schooling (CQ12), the their responses to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9).

Table 54
The Conditional Model Included the Teaching Practices Students' Group Work (CQ14_1), Solve HW (CQ17_2), and Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6); and the Teachers' Self-Reported Expectation of their Students' Future Schooling (CQ12), and Teachers' Agreement with as Teachers we Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (*Q22_7), and Students Care About the Furniture and Infrastructure of the School* (Q22_9)

	Estimates
Fixed effects	
Intercept	211.88**
CQ14_1	-3.74**
CQ17_2	2.47**
CQ17_6	2.72*
Q12	17.97**
Q22_7	-4.75**
Q22_9	5.74**
Variance components	
Level-1 σ_ε^2	1843.21
Level-2 τ_{00}	577.38
Proportion of variance (%)	18.63

* significance at .05; ** significance at .001

Results reported in Table 54 indicated that the model in table 54 explained more variance than the model in Table 46 (model in Table 38 includes the three teachers' perceptions about their preparation to teach content areas selected from question 19). Apparently, teachers' self-reported expectation of their students' future schooling (CQ12) and the their agreement with the two statements selected from question 22 were better predictors of students' achievement than the teachers' perception of their preparation to teach content areas from question 19.

In order to analyze the combinations of the variables, I kept one of the strategies or activities selected in the regression analyses, and systematically used different combination of teachers' self-reported expectation of their students' future schooling (CQ12); and agreement with the two statements selected from question 22 in the following way:

Model i/viii/xv = Q14_1/Q17_2/Q17_6 + Q12 + Q22_7 + Q22_9

Model ii/ix/xvi = Q14_1/Q17_2/Q17_6 + Q12 + Q22_7

Model iii/x/xvii = Q14_1/Q17_2/Q17_6 + Q12

Model iv/xi/xviii = Q14_1/Q17_2/Q17_6 + Q22_9

Model v/xii/xix = Q14_1/Q17_2/Q17_6 + Q22_7

Model vi/xiii/xx = Q14_1/Q17_2/Q17_6 + Q22_7 + Q22_9

Model vii/xiv/xxi = Q14_1/Q17_2/Q17_6 + Q12 + Q22_9

In this section I report the models which explained most variance. The complete set of models performed are in different appendices cited below.

Model 3.5.2.b

This set of models kept the frequency with which teachers self-reported use of *students' group work* (CQ14_1), and use different combinations of teachers' expectations of their students' future schooling (CQ12) and responses to the statements *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9). Table 55 shows the models which explained the most variance. The complete set of models performed are in Appendix Q.

Table 55

The Conditional Models Keeping Teachers' Self-Reported Use of Students' Group Work (CQ14_1) and Combining the Teachers' Expectation of Their Students' Future Schooling (CQ12), and Using Combinations of the Teachers' Agreement with As Teachers we Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (Q22_7), and Students care About the Furniture and Infrastructure of the School (Q22_9).

	Model i	***Model ii***	***Model iii***	***Model vii***
Fixed effects				
Intercept	223.11**	228.03**	225.03**	219.79**
CQ14_1	-3.29**	-3.13**	-3.28**	-3.43**
CQ12	18.40**	18.68**	19.29**	18.88**
Q22_7	-4.69**	-5.16**		
Q22_9	6.02**			6.88**
Variance components				
Level-1 σ_ε^2	1843.47**	1843.26**	1844.17**	1843.39**
Level-2 τ_{00}	583.88**	588.91**	596.14**	589.70**
Proportion of variance (%)	17.72	17.00	15.99	16.90

* significance at .05; ** significance at .001

According to the results shown in Table 55, teachers' expectations of their students' future schooling (CQ12) is a good predictor contributing the most to the students' estimated score, *model iii* with only this variable is the largest coefficient. Also looking at Table 55 the *model i* with teachers' expectations of their students' future schooling (CQ12) and teachers' self-reported agreement with *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and the *students care about the furniture and infrastructure of the school* (Q22_9) explained the most variance.

Besides, the proportion of the variance accounted for by the models in Table 55 (CQ14_1 with CQ19) was greater than the proportion explained by the models in Table 47 (The CQ14_1 with CQ19).

Models 3.5.3.b

In this set of 2-level models I kept the frequency with which teachers self-reported using *solve HW* (CQ17_2), and added systematically different combination of the teachers' expectation of their students' future schooling (CQ12), and their responses to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7) and *students care about the furniture and infrastructure of the school* (Q22_9). The complete set of models performed are on Appendix R.

Table 56
The Conditional Models Keeping the Teachers' Self-Reported Use of Solve HW (CQ17_2) ; and Combining the Teachers' Expectation of Their Students' Future Schooling (CQ12), and Using Combinations of Teachers' Agreement with As Teachers we Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (Q22_7), and Students Care About the Furniture and Infrastructure of the School (Q22_9)

	Model viii	***Model ix***	***Model x***	***Model xiv***
Fixed effects				
Intercept	212.84**	217.26**	214.02**	209.22**
CQ17_2	2.79**	2.87**	2.82**	2.73**
CQ12	18.06**	18.31**	18.94**	18.57**
Q22_7	-4.98**	-5.40		
Q22_9	5.39**			6.29**
Variance components				
Level-1 σ_ε^2	1843.22**	1843.03**	1843.95**	1843.13**
Level-2 τ_{00}	586.12**	590.27**	598.10**	592.64**
Proportion of variance (%)	17.40	16.82	15.71	16.48

* significance at .05; ** significance at .001

Table 56 shows that the models which explained more variance as well as model 3.5.2.b, included CQ12. Looking at Table 48, CQ17_2 plus Q19, and Table 56, CQ17_2 plus CQ12+Q22, these last models explained more variance that models in Table 48.

Models 3.5.4.b

In this set of 2-level models I kept the frequency with which teachers self-reported using *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6), and I added systematically different combination of teachers' expectation of their students' future schooling (CQ12) and responses to the statements *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and the *students care about the furniture and infrastructure of the school* (Q22_9). The complete set of models performed are in Appendix S.

Table 57
The Conditional Models Keeping Teachers' Self-Reported Use of Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) and Combining the Teachers' Expectation of Their Students' Future Schooling (CQ12), and Using Combinations of Teachers' Agreement with As Teachers We Have a Difficult Time When Teaching Because of the Disorder and Indiscipline in the Classroom (Q22_7), and Students care About the Furniture and Infrastructure of the School (Q22_9)

	Model xv	***Model xvi***	***Model xvii***	***Model xxi***
Fixed effects				
Intercept	210.22**	214.69**	211.20**	206.55**
CQ17_6	3.46**	3.54**	3.61**	3.45**
CQ12	18.02**	18.27**	18.89**	18.52**
Q22_7	-4.91**	-5.33**		
Q22_9	5.46**			6.35**
Variance components				
Level-1 σ_ε^2	1843.11**	1842.93**	1843.84**	1843.03**
Level-2 τ_{00}	586.88**	591.07**	598.63**	593.24**
Proportion of variance (%)	17.29	16.84	15.64	16.36

Note: * significance at.01; ** significance at.05

Table 57 shows the estimates for model 3.5.4.b as well as models 3.5.2.b and 3.5.3.b. The models which explained the most variance were ones that included teachers' expectations of their students' future schooling (CQ12).

In summary, the teachers' expectations for their students' future schooling (CQ12), and their responses to *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9) were better predictors of students' achievement than the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) and *communication of information provided by charts and graphics* (CQ18_14); and their self-reported perception of their preparation to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), and *2D Geometric figures* (CQ19_4).

Model 4

In this model I added the SIMCE Spanish score at the student level. The main idea was to add the language scores to Models 2 and 3 and analyze the proportion of variance that explained. The Spanish score was centered to its mean, then CSpanish = span_score - 259.8

Model 4.0

This model just used the SIMCE Spanish score centered to its mean to model the SIMCE mathematics score.

Table 58
The Conditional Model With the Spanish Score

	Model 4.0
Fixed effects	
Intercept	246.47*
CSpanish	0.62*
Variance components	
Level-1 σ_{ε}^{2}	1110.45*
Level-2 τ_{00}	233.34*
Proportion of variance (%)	39.75

* significance at 0.05

The model in Table 58 shows that the proportion accounted for by this model is large, nearly 40%. This result is in line with the research indicating a correlation between mathematics score and Spanish score (Harlaar, Kovas, Dale, Petrill, & Plomin, 2012).

To perform the next models I added the Spanish score to just the models which explained more variance, namely *model i*, *model vii*, *model viii*, *model xv* and *model xxi*. All these models have two versions, one version with the topics *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) *and communication of information provided by charts and graphics* (CQ18_14), and the other version with the content area of *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), *and 2D geometric figures* (CQ19_4).

After that, I calculated the Pseudo-R^2 which computes the variance components and the reduction of variance accounted for by models with and without the Spanish score added at level-1.

Model 4.1

These models added the SIMCE Spanish score to models 2.4. Each model was constructed using the Spanish score and systematically combined the frequency with which teachers self-reported using the *students' group work* (CQ14_1), *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6) one at a time and systematically combined different combinations of the extent to which teachers self-reported covering *meaning, read and write simple fractions* (CQ18_7), *recognize net and flat representations of 2D & 3D figures* (CQ18_13) *and communication of information provided by charts and graphics* (CQ18_14).

Table 59
The Conditional Models Keeping Teachers' Self-Reported Use of Students' Group Work (CQ14_1) and the Spanish Score; and Combining the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14)

	Model i	***Model ii***	***Model vii***
Fixed effects			
Intercept	221.15*	223.45*	225.72*
CQ14_1	-2.44*	-2.35*	-2.43*
CSpanish	0.62*	0.62*	0.62*
CQ18_7	4.05*	4.37*	5.03*
CQ18_13	3.25*	4.05*	
CQ18_14	2.00*		2.94*
Variance components			
Level-1 σ_ε^2	1109.55*	1109.64*	1109.64*
Level-2 τ_{00}	198.23*	200.50*	202.83*
% Pseudo-R^2	39.77	39.78	39.77

* significance at .05

Table 59 shows the estimated values for the models which kept *students' group work* (CQ14_1) and varied the topics addressed by teachers (as in Table 39) with the Spanish score added. The

Pseudo-R^2 indicated that the inclusion of the Spanish score reduces by approximately 39% the proportion of variance unexplained.

Table 60
The Conditional Models Keeping Teachers' Self-Reported Use of the Solve HW (CQ17_2) and the Spanish Score and Combining the Extent to Which Teachers Self-Reported addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14)

	Model viii	***Model ix***
Fixed effects		
Intercept	215.58**	217.59**
CQ17_2	1.08*	1.20*
CSpanish	0.62**	0.62**
CQ18_7	4.01**	4.29**
CQ18_13	3.23**	3.97**
CQ18_14	1.86**	
Variance components		
Level-1 σ_ε^2	1109.52**	1109.60**
Level-2 τ_{00}	200.51**	202.46**
% Pseudo-R^2	39.77	39.77

* significance at .001; ** significance at .05

Table 60 shows the estimated values for the models which kept (CQ17_2) and varied the topics addressed by teachers (as in Table 40) with the Spanish score added. The Pseudo-R^2 indicates that the inclusion of the Spanish score reduces in approximately 39% the proportion of variance unexplained.

Table 61
The Conditional Models Keeping Teachers' Self-Reported Use of the Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) and the Spanish Score; and Combining the Extent to Which Teachers Self-Reported Addressing Meaning, Read and Write Simple Fractions (CQ18_7), Recognize Net and Flat Representations of 2D & 3D Figures (CQ18_13) and Communication of Information Provided by Charts and Graphics (CQ18_14)

	Model xv	***Model xvi***	***Model xxi***
Fixed effects			
Intercept	215.06*	216.96*	218.92*
CQ17_6	1.26**	1.44**	1.55**
CSpanish	0.62*	0.62*	0.62*
CQ18_7	3.99*	4.27*	4.92
CQ18_13	3.15*	3.89*	
CQ18_14	1.87*		2.76*
Variance components			
Level-1 σ_ε^2	1109.50*	1109.58*	1109.57*
Level-2 τ_{00}	200.71*	7.61*	205.10*
% Pseudo-R^2	39.77	39.77	39.77

Note: * significance at .05; ** significance at .001

Table 61 shows the estimated values for the models which kept (CQ17_6) and varied the topics addressed by teachers. The Pseudo-R^2 indicated that the inclusion of the Spanish score reduces by approximately 39% the proportion of variance unexplained, the same reduction as in models in Table 60.

Thus, the addition of the Spanish score reduced the proportion of variance unexplained by almost the same percentage, regardless of the other variables I added to the model.

Model 4.2

This set of models included the teaching practices *students' group work* (CQ14_1), *solve HW* (CQ17_2), *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6), and teachers' self-reported perceptions of their preparation to teach *natural numbers*

and place value (CQ19_1), *fractions and decimals* (CQ19_2), *and 2D geometric figures* (CQ19_4).

The estimated values of keeping the strategy *students' group work* (CQ14_1) and varying teachers' perception of their preparation to teach *natural numbers and place value* (CQ19_1), *fractions and decimals* (CQ19_2), *and 2D geometric figures* (CQ19_4).are in Table 62.

Table 62
The Conditional Models Keeping the Teachers' Self-Reported Use of the Students' Group Work (CQ14_1) and the Spanish Score and Combining the Teachers' Self-Reported Perceptions of their Preparation to Teach: Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model 1	***Model 2***	***Model 7***
Fixed effects			
Intercept	232.68**	235.26**	232.67**
CQ14_1	-2.39**	-2.38**	-2.37**
CSpanish	0.62**	0.62**	0.62**
CQ19_1	1.75*	3.72**	2.50**
CQ19_2	1.22*	2.01**	
CQ19_4	3.71**		4.07**
Variance components			
Level-1 σ_ε^2	1110.07**	1110.02**	1110.09**
Level-2 τ_{00}	221.21**	223.82**	221.49**
% Pseudo-R^2	39.76	39.76	39.76

* significance at .05; ** significance at .001

The pseudo-R^2 in Table 62 is almost the same as in the previous tables. The proportion of reduction of the unexplained variance was around 39%.

Table 63
The Models Keeping the Self-Reported Use of Solve HW (CQ17_2) and the Spanish Score and Combining the Teachers' Self-Reported Perception their Preparation to Teach: Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model 8	***Model 9***
Fixed effects		
Intercept	225.83**	228.18**
CQ17_2	1.65**	1.73**
CSpanish	0.62**	0.62**
CQ19_1	1.91*	3.81**
CQ19_2	0.96	1.71**
CQ19_4	3.58**	
Variance components		
Level-1 σ_ε^2	1109.98**	1109.95**
Level-2 τ_{00}	222.75**	225.11**
% Pseudo-R^2	39.76	39.76

* significance at .05; ** significance at .001

Table 63 shows the estimated values for the models which kept (CQ17_2) varied the content areas teachers reported being prepared to teach and added the Spanish score. The Pseudo-R^2 indicated that the inclusion of the Spanish score reduced by approximately 39% the proportion of variance unexplained

Table 64

The Models Keeping the Self-Reported Use of Explain the Workbook and Textbook Exercises Solutions to the Whole Class (CQ17_6) and the Spanish Score and Combining the Teachers' Self-Reported Perceptions of their Preparation to Teach Natural Numbers and Place Value (CQ19_1), Fractions and Decimals (CQ19_2), and 2D Geometric Figures (CQ19_4).

	Model 15	***Model 16***	***Model 21***
Fixed effects			
Intercept	223.56*	225.62*	223.48*
CQ17_6	2.58*	2.74*	2.63*
Cspanish	0.62*	0.62*	0.62*
CQ19_1	1.79**	3.60*	2.37**
CQ19_2	0.97	1.69**	
CQ19_4	3.45*		3.73*
Variance components			
Level-1 σ_ε^2	1109.93*	1109.89*	1109.94*
Level-2 τ_{00}	222.22*	224.45*	222.40*
% Pseudo-R^2	39.76	39.76	39.76

Note: * significance at .05; ** significance at .001

Table 64 shows the estimated values for the models which kept (CQ17_6) and varied the content areas teachers reported being prepared to teach and added Spanish score. The Pseudo-R^2 indicated that the inclusion of the Spanish score reduced by nearly 39% the proportion of the variance unexplained.

In summary, the addition of the Spanish score homogeneously effected students' achievement. The proportion of variance accounted for by this model was almost the same across the models. The Spanish score accounted for much more of variance and overshadowed associations among the other variables. Thus, I did not add the Spanish score to any other model.

Research Question 7: Did the association between reported teaching practices examined in Question 1 and students' achievement differ across schools? In particular, to what extent were school characteristics, such as funding model and SES, associated with students' achievement?

Model 5

In this set of models I added the school level. These were 3-level models, and I needed to start with the unconditional model which has no variables included. Table 65 shows the estimated values for the unconditional 3-levels model.

Table 65
The Unconditional 3-Levels Model for Student's Achievement

	MODEL 0	**PROPORTION OF VARIANCE (%)**
Fixed effects		
Intercept	244.85**	
Variance components		
Level-1 Within classroom, across students (σ^2)	1843.02**	72.20
Level-2 Within school, across classrooms (τ_π)	649.09**	25.43
Level-3 Across schools (τ_β)	60.50**	2.37

The ICC[15] s among scores for students in the same school was 27.80% and the ICC among scores for students for different classrooms in the same school was 2.37%. These results indicate that the classroom-related factors that mostly have to do with the teachers were more associated

[15] The formulas used in these calculations are in the Appendix C.

with students' achievement than the school-related factors. This means that the SES school and type of school funding did not have as great an effect on students as the teacher factors. Analyzing the potential proportion of explained variance the greatest proportion of variance was explained by student factors (72.2%), and the next greatest proportion of variance was explained by teacher factors (25.43%). Again, the school factors explained the smallest proportion of variance.

I centered SES and the type of school funding to its lowest category. Thus, CSES_school=0 if the school was low SES; CSES_school=1 if the school was a middle low SES; CSES_school=2 if the school was middle school SES; CSES_school=3 if the school was middle high SES: and CSES_school=5 if the school was high SES. I centered the type of school funding in the following way, CTypo of school funding=0 if the school was a public; CTypo of school funding=1 if the school was subsidized, and CTypo of school funding=2 if the school was private.

The reduction of variance unexplained between the unconditional model and the model with SES and type of school funding is shown in Table 66.

Table 66
Estimates of the SES of the School and Type of Funding, and the Reduction of Proportion of Variance Between the Unconditional Model and Models 1, 2, and 3.

	Model 1	***Model 2***	***Model 3***
Fixed effects			
Intercept	233.39**	232.99**	240.74**
CSES_school	11.96**	10.90**	
CType of school funding	-3.38**		9.00**
Variance components			
Level-1 σ^2	1845.94**	1846.13**	1844.71**
Level-2 τ_π	491.88**	492.24**	587.74**
Level-3 τ_β	70.81**	71.61**	84.93**
Proportion of variance explained at			
Level 1	76.64	76.60	73.28
Level 2	20.42	20.43	23.35
Level 3	2.94	2.98	3.37
Reduction of variance (%)	17.04	18.36	40.38

* significance at .05; ** significance at .001

The economic variables added at level 3 imply a considerable reduction of the unexplained variance, in particular the type of school funding reduced in almost 40% the unexplained variance.

To analyze how self-reported use of teaching practices were affected by the school variables I took models from Table 53 and added the *students' group work* (CQ14_1), *solve HW* (CQ17_2), and *explain the workbook and textbook exercises solutions to the whole class* (CQ17_6). Table 67 shows these new models.

Table 67
Models with SES of the School and Type of Funding, and the Practices.

	Model 1	***Model 2***	***Model 3***
Fixed effects			
Intercept	222.40**	221.33**	227.12**
SES_school	11.61**	10.66**	
Type of funding	-3.06*		8.83**
CQ14_1	-1.52*	-1.38*	-2.57**
CQ17_2	2.38**	2.39**	2.87**
CQ17_6	3.10	3.28**	4.24**
Variance components			
Level-1 σ^2	1845.85**	1846.03**	1844.59**
Level-2 τ_π	486.47**	486.76**	577.98**
Level-3 τ_β	68.07**	68.53**	79.47**
Proportion of variance explained at			
Level 1	76.90	76.88	73.72
Level 2	20.27	20.27	23.10
Level 3	2.83	2.85	3.18

* significance at .05; ** significance at .001

The reduction of unexplained variance by adding the teaching practices was low. Thus, the reduction of unexplained variance in model 1 when teaching practices were added as 1.09%, when teaching practices were added to model 2 the reduction of unexplained variance as 1.11%, and the reduction in model 3 when teaching practices were added was 1.66%. Thus, self-reported use of teaching practices explained less than 2% of students' achievement when economic characteristics of the school were added.

In summary, the addition of the economic school factors does not affect considerably the practices and the students' achievement.

CHAPTER 5
DISCUSSION AND CONCLUSIONS

This chapter begins with a discussion of interesting observations that emerged from the descriptive analyses. After that, I review results one research question at a time.

Discussion

Descriptive Analysis

Recall that question 14 from the teachers' questionnaire asked "How often do you use the following teaching strategies during your math class?" One of the strategies that most of the teachers self-reported using 'often' or 'always' was *express learning objectives,* and their students achieved a quite high score: 249.2 points. This result suggests that making the objectives clear to students of a class may help students achieve a higher score in mathematics. This kind of teaching strategy is suggested in *Marco para la Buena Enseñanza* (Framework for the Good Teaching), also known by its acronym in Spanish "MBE" (Ministry of Education of Chile, 2008). The Ministry of Education of Chile published the MBE in 2003 to give teachers guidance for good teaching. The Framework for the Good Teaching is based upon four domains: Preparation for teaching, creation of environment to teach, teaching to allow all students to learn, and professional responsibilities of teachers. In the domain *teaching to allow all students to learn,* the MBE encourages teachers to communicate learning objectives in a clear and precise way. Results from the descriptive analysis suggest that this recommendation of the ministry is contributing to higher mathematics achievement scores.

Another interesting result from the analysis of question 14 was the inverse relationship between the *students' group work* strategy and students' achievement: If a teacher self-reported 'never' using this strategy, his or her students achieved a higher score. In the MBE there is no suggestion about *students' group work*; however, the domain *teaching to allow all students to learn* suggests that the strategies used in the class have to be challenging, coherent, and significant. Also, this domain indicates that teachers have to optimize the lesson time. In my personal experience, the *students' group work* is a good strategy but it takes too much time to organize students, and sometime students believe that the group work is for chatting and not for working. Then, based just on my experience, using this strategy takes too much time to be used as an effective strategy for learning.

Use of the *students' individual work* strategy was not significantly different among the teachers' response groups. Apparently, the frequency with which a teacher self-reported using this strategy was not relevant. For instance, students whose teachers self-reported 'never' using the *students' individual work* strategy achieved 257 points on average; and the score of the students whose teachers answered 'always' using the strategy was 250.2 points on average.

In most Chilean schools, the strategies of using *students' presentations* (8.3%), *forums on issues of the subject* (22.7%), *field trips* (26.3%) are more common in other subjects such as history, Spanish or science, instead of mathematics. That could be the reason that the percentage of teachers who answered 'often' or 'always' using these strategies was low.

Recall that question 17 from the teachers' survey asked "How often do you use the following activities to provide students with feedback in your mathematics class?" The activities *check HW* and *solve HW* seemed to have had a positive relationship with students' achievement. The more frequently teachers used these activities, the higher their students' scores were. This

result gives evidence that homework was a positive activity for students to increase their achievement.

Another interesting result was that various forms of explanation [*explain topic again if a student asks* (Q17_3*), explain the content until all students understand* (Q17_4), *explain the test solution to the whole class* (Q17_5*), explain the workbook and textbook exercises solutions to the whole class* (Q17_6)] were positively associated with students' scores in mathematics. This result provides evidence to support that explanations help increase students' mathematics achievement.

On a side note, some social psychology research has reported that people tend to believe they are better than the regular person, especially in "socially desirable attributes" (Favero & Meirs, 2013). In the case of the present study, if part of teaching is to explain, it is not surprising that few teachers declared 'never' or 'sometimes' giving explanations to their students.

Recall that question 18 asked "Given that class time is limited and you are not likely able to address all curricular content, we ask you to indicate to what extent you taught the following topics in your mathematics class?" Teachers reported covering most of the topics, probably because the SIMCE examination is taken by the students in October when the academic year is almost done. Furthermore, given the importance of the examination, most schools trained their students to answer multiple choice tests and focused their teaching on the most usual topics asked in the examination. This situation is constantly criticized because teachers devote more time teaching topics assessed by the SIMCE examination (Ramirez, 2011) than other topics also included in the curriculum.

Knowing something about SIMCE items would be interesting. The SIMCE 2011 test assessed the curriculum from 1st to 4th grade established by Decree Nº 232 of 2002 presenting in

the curricular adjustment according to the Decree N° 256 of 2009 (Agencia de Calidad de la Educación, 2011). The main mathematics content areas assessed by SIMCE from 2010 through 2012 were numbers, geometry, and data and probability.

Unfortunately, I do not have access to the SIMCE 2011 mathematics examination, but I did find a model of the SIMCE 2007 mathematics examination (See Appendix V). The Agencia de Calidad de la Educación released one **Brochure of Orientation to Measure** for teachers about the SIMCE examination each year. The goal of the yearly **brochure** is to provide information about the subject matter that will be assessed, the dates of the examination, and the specific content areas assessed by each subject matter. The yearly brochure explained that the SIMCE assessed not only knowledge, but also skills and abilities developed by students from first grade through fourth grade. Besides, the brochure emphasized that problem-solving skill would be assessed in each content area included in the exam. The brochure provided examples of the response page and the items asked. Comparing the 2007 and 2011 brochures (Agencia de Calidad de la Educación 2007 and 2011) both brochures indicated that the SIMCE mathematics examinations contained 30 items, most of them multiple choice and one short-answer item. Then. I did an analysis to check if the model for the SIMCE 2007 could be similar to the model for the SIMCE 2011. However the main content areas were not the same. Table 68 shows the details of the content and abilities assessed in both examinations.

Table 68
Comparison of Content Areas Assessed on SIMCE 2007 and SIMCE 2011

SIMCE 2007		SIMCE 2011	
Content area	**Ability to**	**Content area**	**Ability to**
Numbers	Read, and write natural numbers, and establish relationship among natural numbers making comparisons, ordering and looking for simple regularities or finding numbers to complete equalities. Understand fractions from their graphic representations and making relation of fraction as a part of the whole. Finally, the examination will assess the use of numbers to read and organize information in charts and graphs and making relation of fraction as a part of the whole. Problem solving will be assessed with tasks related to formation of numbers based on their digits. In this problem the capacity assessed will be decompound and ordered digits according to their decimal representation.	**Numbers**	Read and write natural numbers, and establish relationship among natural numbers making comparisons, ordering and looking for simple regularities. Understand fractions from their graphic representations and making relation of fraction as a part of the whole. Use algorithmic procedures (addition, subtraction, multiplication and division) with natural numbers. Choose information and operations to make calculations and check results.
Arithmetic Operations	Use addition, subtraction, multiplication, and division of natural numbers in different contexts, and use their algorithms. Solve problems using the procedural algorithms for addition, subtraction multiplication and division.	**Geometry**	Spatially oriented; i.e. relate the point where an object is observed with the graphical representation of this. Recognize, compare, and classify 2D geometric figures and 3D figures and their elements. Compose and decompose geometric shapes of two or three dimensions.

Table 68 (Continued)

SIMCE 2007		SIMCE 2011	
Content area	**Ability to**	**Content area**	**Ability to**
Shapes and spatial orientation	Spatial orientation to describe and interpret trajectories and locate a point in maps and the capacity to relate the point where an object is observed with the graphical representation of this. Recognize, compare, and classify 2D geometric figures and 3D figures and their elements. Composing and decomposing geometric shapes of two or three dimensions.	**Data and probability**	Read, interpret, and organize information from simple charts and bar graphs.

The comparisons between the content areas assessed in both show that the assessed content was very similar, but organized somewhat differently. In the brochure of orientations for the SIMCE 2011 mathematics indicated a new content area: Data and probability. That content was included in Numbers in SIMCE 2007. The content area Arithmetic Operations from 2007 was included in Numbers in 2011. Thus, the SIMCE 2007 mathematics examination is likely similar to the SIMCE 2011 mathematics examination.

To analyze the SIMCE 2007 mathematics examination, I classified each question into one of the three content areas assessed in SIMCE 2011 mathematics. Table 69 shows a summary of the number of questions, the content area, and the ability assessed. In Table 69, 19 out of 30 items were related to Numbers. Thus, just as the teachers' questionnaire asked more question about content related to Numbers, the SIMCE 2007 examination, and perhaps the SIMCE 2011 examination emphasized the same content.

Table 69
Classification of Questions of SIMCE 2007 Mathematics Examination by Content Areas of SIMCE 2011 Mathematics Examination

Content Area	Item Numbers	Main Ability Assessed
Numbers	17, 23, 24, 30	Read, and write natural numbers, and establish relationship among natural numbers making comparisons, ordering and looking for simple regularities
	18, 19	Understand fractions from their graphic representations and making relation of fraction as a part of the whole
	4, 20, 22, 29	Use algorithmic procedures (addition, subtraction, multiplication and division) with natural numbers
	5, 6, 7, 11, 12, 13, 22, 26, 27, 28, 29, 30	Choose information and operations to make calculations and check results.
Geometry	2, 10	Spatially oriented; i.e. relate the point where an object is observed with the graphical representation of this.
	1, 3, 8,9	Recognize, compare, and classify 2D geometric figures and 3D figures and their elements.
	21, 25	Compose and decompose geometric shapes of two or three dimensions
Data and Probability	14, 15, 16	Read, interpret, and organize information from simple charts and bar graphs

Teachers' answers for question 18 and 19 suggest an association between the feeling of preparation and the extent to which they reported addressing the topics. Looking at Table 8 (Results chapter), teachers self-reported that the topic *reading, writing and recognition of decimal numbers between 0 and 1* (Q18_8) was taught 'all of it' in 13.9% of the classrooms, one of the lowest percentages in the 'all of it' answer group, compared to the other topics. Also, in Table 13, just 50% of the teachers self-reported feeling 'well prepared' to teach *fractions and decimals*, which represents the lowest percentage of teachers' self-reported feeling of 'well prepared'.

This result seems to indicate that *fractions and decimals* are a weakness in the Chilean teachers' perceptions of their preparation. In terms of teaching fractions in the Chilean classrooms, literature indicates that teachers in Chile have limited strategies to teach fractions (Rojas, 2010; Espinoza et al., 2011). According to Espinoza et al. (2011), the analyzed teachers introduced the concept of fraction as a part of a whole as the unique model studied, this model used by teachers to teach fractions is useful as a presentation of this topic, but using this model is not useful at the time that rational numbers should be taught. Then, Espinoza et al. suggest that teachers in Chile have a limited variety of ways to teach fractions that are not sufficient for teaching the full breadth of rational number.

Research Questions

This study provides evidence for the idea that the frequency of using teaching practices has a greater effect on students' achievement when those practices are connected to a specific topic taught. Also, in the regression analysis for this study, I identified fractions as the most influential topic on students' achievement, and the extent to which teachers self-reported addressing this topic was more influential than the self-reported feeling of preparation to teach this topic. And in the multilevel analysis I quantified, in terms of the variance explained, these associations.

I organized this section according to the type of analysis used to answer each research question; then I discuss each research question at a time.

Regression Analysis

Research Question 1: Which self-reported teaching practices were associated with students' achievement on the SIMCE 2011 mathematics examination?

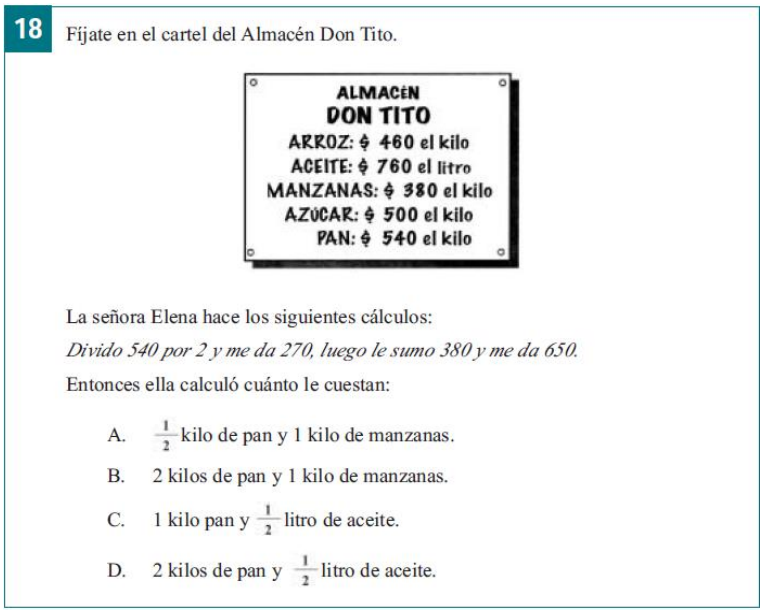
According to the analysis, the frequency with which teachers self-reported using *students' group work, solve HW* and *explain the workbook and textbook exercises solutions to the whole class* were positively and significantly associated with students' achievement. These types of practices seemed to indicate that work under the supervision of the teacher was one of the factors that predicted the students' achievement.

Research Question 2: Which topics taught were associated with students' achievement on the exam?

The topics that teachers reported teaching that were positively and significantly associated with students' achievement were: *meaning, read and write simple fractions*; *recognize net and flat representations of 2D & 3D figures*, and *communication of information provided by charts and graphics*. If the teacher self-reported the *meaning, read and write simple fractions* topic as 'not taught yet', his or her students lost more than 50 points on average[16]. The topics related to fractions seemed to be important for students' achievement (see Table 25), if the teachers self-reported teaching a topic more frequently, his or her students achieved a better score. Apparently, how thoroughly topics were addressed had a positive relationship with students' achievement; in particular, teaching *meaning, read and write simple fractions* was positively related to students' achievement. However, looking at Table 69, just two items from

[16] The predicted score for a student whose teacher self-reported 'taught all of' topic *meaning, read and write simple fractions* is 258.5 points (*Regression Equation 2*). In contrast, the estimated-score for a student whose teacher self-reported 'not yet teaching' those topics is 212.2 points. This result indicated a positive association between the extent to which these topics were addressed during instruction and students' achievement.

the model SIMCE 2007 were related to fractions (Figure 1 shows these items), in regard to *recognize net and flat representations of 2D & 3D figures* there were 4 items, and for *communication of information provided by charts and graphics* there were 3 items.



18 Fíjate en el cartel del Almacén Don Tito.

ALMACÉN
DON TITO
ARROZ: $ 460 el kilo
ACEITE: $ 760 el litro
MANZANAS: $ 380 el kilo
AZÚCAR: $ 500 el kilo
PAN: $ 540 el kilo

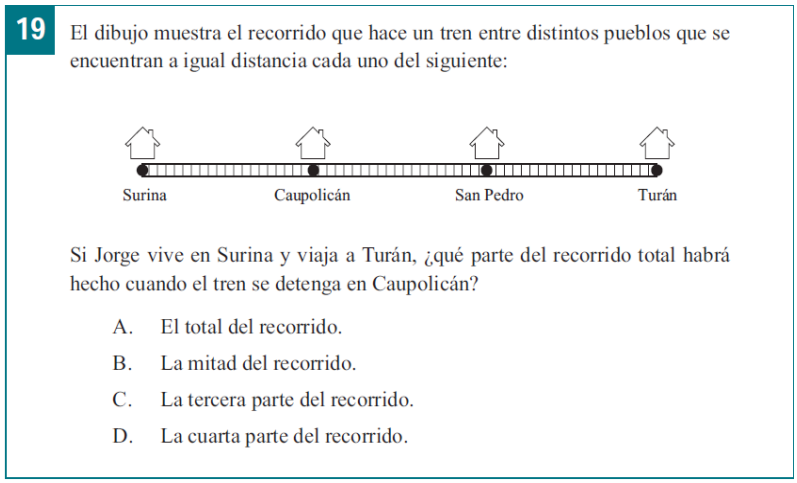
La señora Elena hace los siguientes cálculos:

Divido 540 por 2 y me da 270, luego le sumo 380 y me da 650.

Entonces ella calculó cuánto le cuestan:

A. $\frac{1}{2}$ kilo de pan y 1 kilo de manzanas.
B. 2 kilos de pan y 1 kilo de manzanas.
C. 1 kilo pan y $\frac{1}{2}$ litro de aceite.
D. 2 kilos de pan y $\frac{1}{2}$ litro de aceite.

Translation: *Look at Don Titos' market poster.*
Mrs. Elena makes the following calculations: I divide 540 by 2 then I got 270, after that I add 380 and I got 650.
Then she calculated how much money she has to pay for different items such as:



19 El dibujo muestra el recorrido que hace un tren entre distintos pueblos que se encuentran a igual distancia cada uno del siguiente:

Surina Caupolicán San Pedro Turán

Si Jorge vive en Surina y viaja a Turán, ¿qué parte del recorrido total habrá hecho cuando el tren se detenga en Caupolicán?

A. El total del recorrido.
B. La mitad del recorrido.
C. La tercera parte del recorrido.
D. La cuarta parte del recorrido.

Translation: *The figure shows the route of a train across small towns of equal distance.*
If Jorge lives in Surina and goes to Turán, what part of the total travel has he completed when the train stops in Caupolicán?

Figure 1. Two fractions items from Model SIMCE 2007

Research Question 3a: Which teachers' self-reported perceptions of their preparation to teach topics identified in Question 2 were associated with students' achievement?

According to the regressions performed, the self-reported perception to teach *natural numbers and place value* and *2D geometric figures* had a positive and significant relationship with students' achievement, meaning that if teachers reported feeling better prepared to teach these content areas, their students achieved better scores. In the brochures of orientations (versions for 2007, 2009, 2010, and 2011) I found that the examples for the mathematics examinations were related to the main content area of Numbers. Looking at Table 69, most items were related to the content of Numbers (19 items). It is possible that teachers emphasized topics related to Numbers in their instruction and felt more confident to teach such topics.

Because research question 6 asked specifically for teachers' self-perception of their preparation to teach the topics selected in research question 2, I added the content *fractions and decimals* (Q19_2) to the multilevel analysis.

Research Question 3b: Which teachers' perceptions of students were associated with their students' achievement?

The teachers' expectations of their students' future schooling (Q12) was positively and significantly associated with students' achievement: When teachers predicted more schooling for their students, their students achieved higher scores on average. This result is also reported by Cardemil (2002) in her review of teaching and learning practices in the Chilean classrooms.

With regard to teachers' perception about students' behavior, the statements *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and *students care about the furniture and infrastructure of the school* (Q22_9) were the

only ones significantly associated with students' achievement. When teachers agreed with the statement *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), their students achieved lower score than when teachers disagreed. Less clear was why there was a positive association between students' achievement and teachers' agreement with the *students care about the furniture and infrastructure of the school* (Q22_9).

Multilevel Analysis

Research Question 4: To what extent were practices identified in Question 1 associated with students' achievement?

According to the result in Table 29 (Results chapter), we can see that the within classroom (σ_{ε}^{2}) variance was greater than the between classroom (τ_{00}) variance, which means that there was more variability within the classroom than between classrooms. Some researchers have found the same result (Ramirez, 2007; Duarte, Bos, Moreno, & Morduchowicz, 2013). Duarte et al (2013) analyzed the SIMCE score of mathematics and the SIMCE score of Spanish from 1999 to 2011 for 4th, 8th and 10th grades and reported that the variability decreased as the grade-level increased and was small by 10th grade. According to Duarte el al. (2013), Chilean high schools selected their students by entrance examination, so each classroom shows more homogeneity. Chilean schools have no tracking system. For this reason, in elementary school, classes have more diversity regarding the students' achievement. This relationship between the within-classroom variance and the between-classroom variance was present in all models performed in this study.

According to the individual analysis of frequency of using the *students' group work* (Q14_1), the *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6) were the significant practices on students' achievement. The *students' group work* (Q14_1) strategy was negatively related to students' achievement. This means that if the teacher used this strategy more frequently, his or her students had a lower average score. According to Díaz and Poblete (2007), students appreciated group work implemented by their teachers after a professional development. Looking at the descriptive analysis, this type of strategy was used frequently in Chilean classroom, but the effect was not the expected one. This strategy apparently was not helping students to improve their score.

The negative association between *students' group work* and the SIMCE mathematics score could have occurred for several reasons. The first plausible reason could be that teachers were not completely honest about using this strategy, considering that the teachers' questionnaire was self-reported. Espinoza et al. (2011) interviewed elementary teachers about what students needed in the classroom to improve their mathematics learning. Teachers indicated that their students needed to emphasize skills and abilities to use the knowledge for solving real life problems. Also teachers indicated that students need more *students' group work.* However, when Espinoza et al. analyzed videotaped classes, they found that most teachers just taught procedural and routine exercises and did not include real life problems in their teaching. Furthermore, students had few opportunities to interact with teachers and classmates. Thus, I am not sure if all teachers who self-reported using *students' group work* really used it in their classes.

On the other hand, if teachers really used students' group work, there were another possible reasons for the negative association with the SIMCE mathematics score. Atkins, Rowan, and Correnti (2001) analyzed the environment of the assessment of early students (kindergarten

and first grade). Students were assessed individually and in groups. The result suggests that the group-assessment was the most difficult one and, also, students in the group-assessment answered less questions than the students in the individual-assessment. They emphasized not having any reason to explain why students acted differently in both environments. Even though this study analyzed a smaller number of students than my study, the group-assessment can be compared to the students' group work, "The group setting in our study was characterized by a variety of student behaviors that were disruptive and distracting for students" (p. 18). I think Chilean teachers at school have similar issues when their students work in small groups, since they get distracted.

Another plausible explanation could be that the types of tasks used for the *students' group work* during class and on the SIMCE examination were different I made an analysis of some SIMCE mathematics items that I found. The brochure 2011 (Agencia de Calidad de la Educación, 2011) just provided one example of the mathematics items. The example is in Figure 2. I added the images of the original Spanish version and wrote the English translation of the item analyzed.

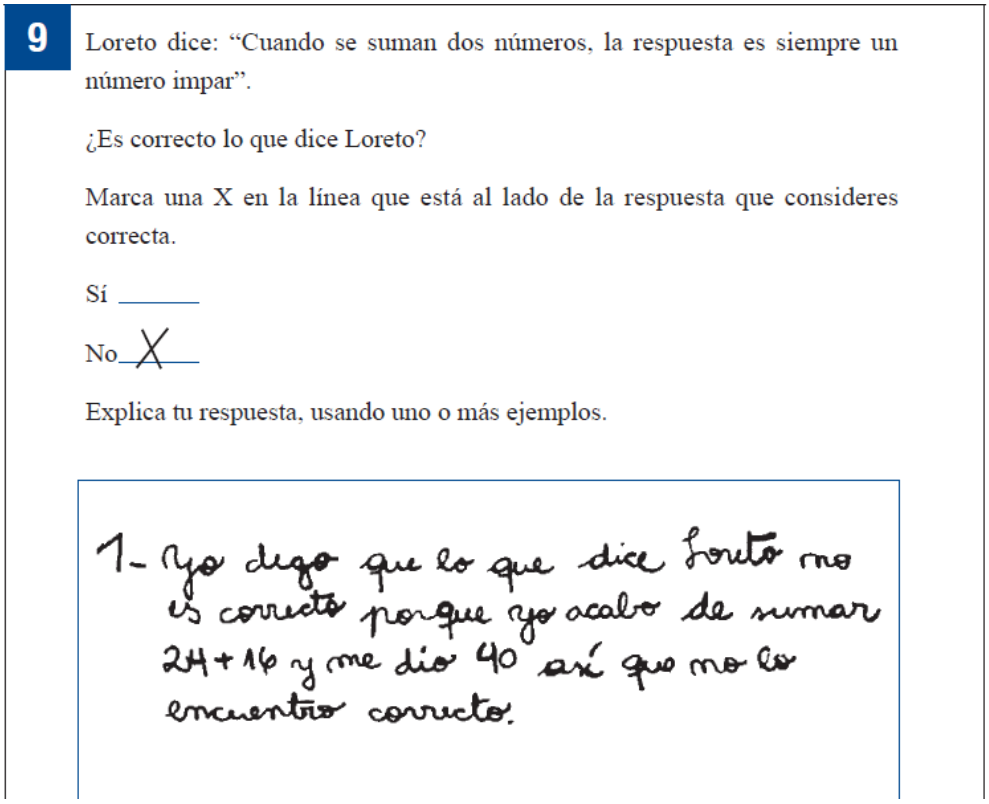


Figure 2. Short answer example from 2011 brochure

English translation of question 9

Loreto says: "When two numbers are added, the answer always is an odd number".

It what Loreto says correct?

Mark with an X on the line next to the answer that you consider correct.

Sí ____

No ____

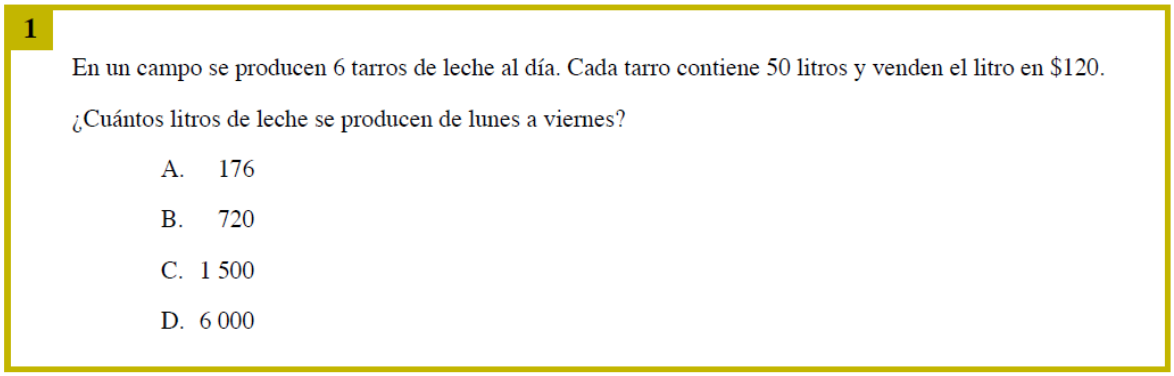
English translation of answer

"I say what Loreto said is wrong because I just made this addition 24 + 16, and I got 40 thus I did not find it correct" (p. 9)

Because Espinoza et al. (2011) indicated that teachers taught using routine exercises more than real life problems, the example in Figure 2 could be hard to answer for any student, alone or

in group. The type of tasks used in the classroom with the *students' group work* strategy would be crucial for improving the SIMCE mathematics score.

The brochure for the 2010 examination provided the same example as the brochure for 2011. Although the SIMCE 2009 mathematics examination (Agencia de Calidad de la Educación, 2009) covered different content areas (numbers, arithmetic operations and spatial orientation) and was based on curriculum established by Decree Nº 232 of 2002, different from the 2011 SIMCE, the 2009 brochure kept the same characteristics (30 multiple choice items and one short answer item). I added the three mathematics examples provided by this brochure. This brochure also included the correct answer, the content, and the ability assessed for each of these three questions.


1

En un campo se producen 6 tarros de leche al día. Cada tarro contiene 50 litros y venden el litro en $120.

¿Cuántos litros de leche se producen de lunes a viernes?

A. 176

B. 720

C. 1 500

D. 6 000

Figure 3. Multiple choice question 1 from 2009 brochure (p. 11)

English translation of question 1

A dairy farm produces 6 big cans of milk daily. Each big cans contains 50 liters and each liter is sold at $120. How many liters are produced from Monday to Friday?

English translation of brochure explanation

> *Correct answer **C***
>
> *This question corresponds to **Arithmetic Operations**, and evaluates the ability to solve problems in a real life context. For example, the capacity to organize and select information, and develop procedures using the four basic operations [addition, subtraction, multiplication and division]. To answer correctly, students should select information discarding information not needed (e.g., the cost of the liter of milk) and the number of days needed (e.g. just the weekdays, 5 days). Student also can apply repeated additions (p. 11)*

This multiple choice question, as the 2009 brochure indicated, was a real life problem where students had to use different operations and make decisions about what information is useful to answer correctly.

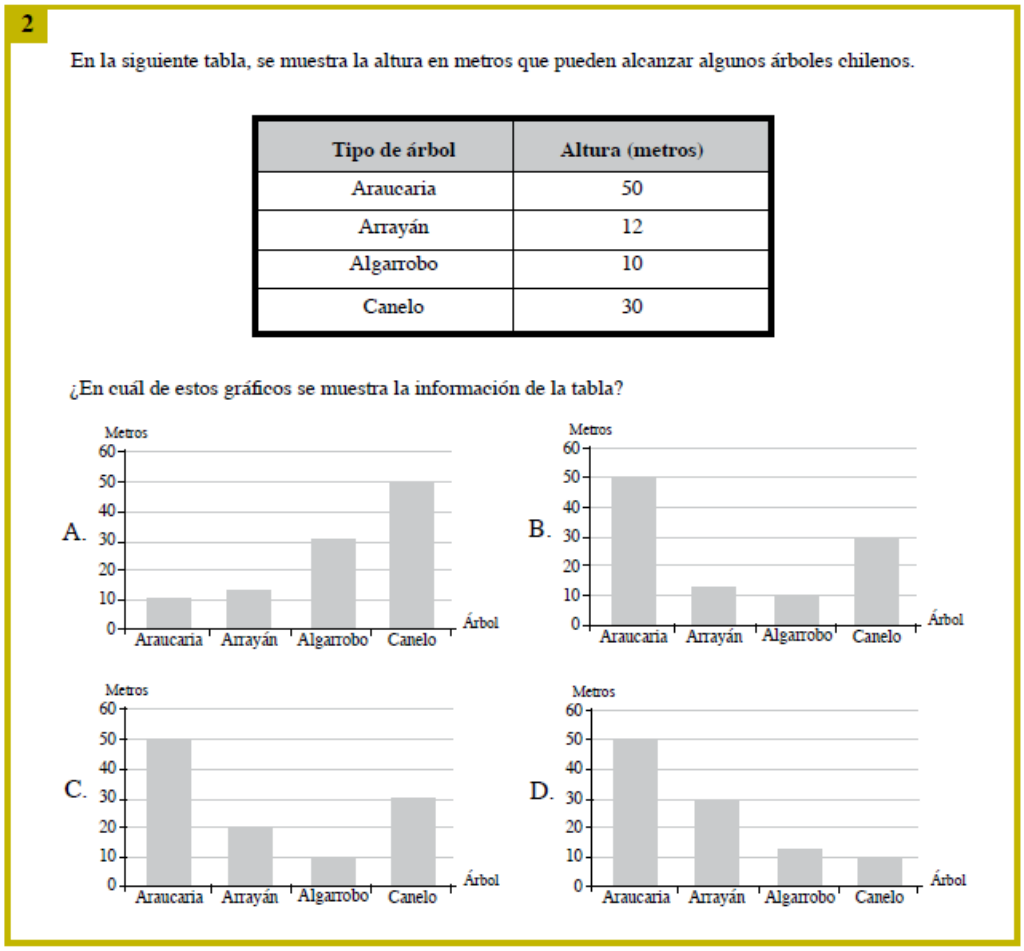


Figure 4. Multiple choice question 2 from 2009 brochure (p. 12)

English translation of question 2

The following table shows the height in meters that Chilean trees can reach.

What graphic shows the same information as the table?

English translation of brochure explanation

Correct answer B

This question corresponds to the content of ***Numbers****. The ability asked is to use procedures to organize information to build charts and bars graphs. To answer correctly, the student has to identify the graph that shows the same information as the table. (p. 12)*

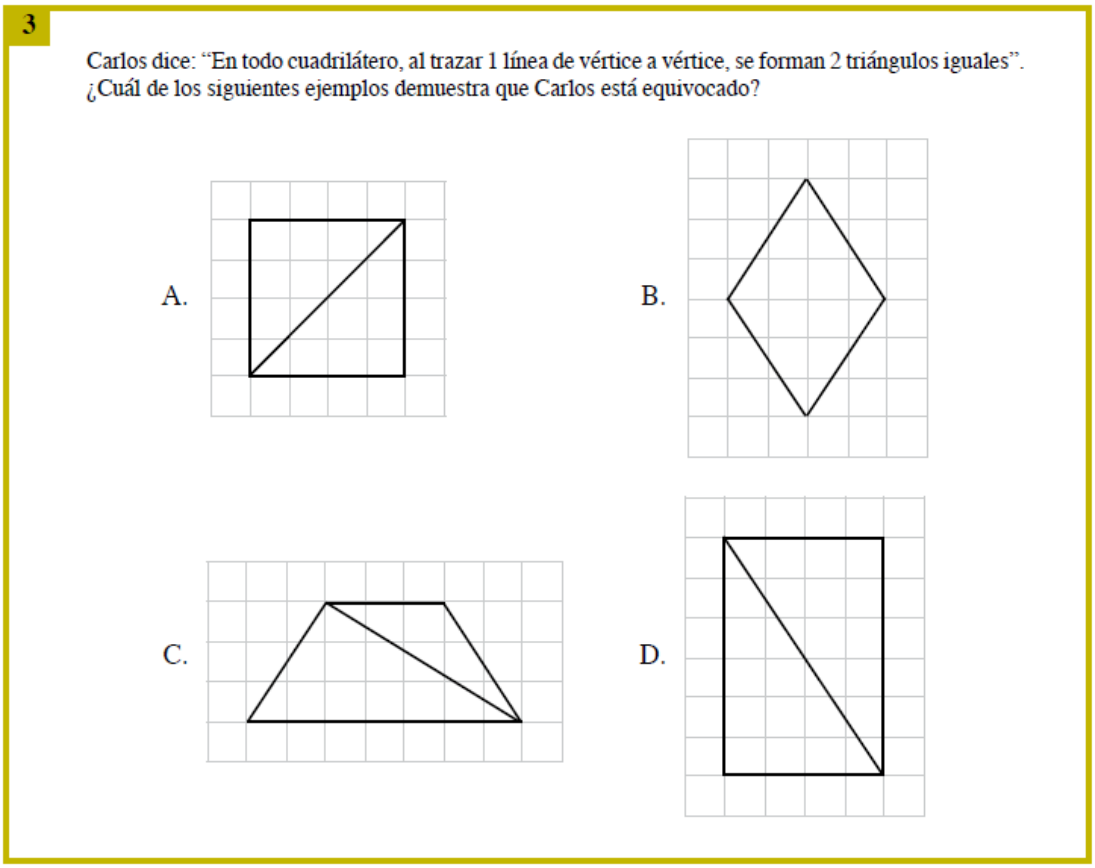


Figure 5. Multiple choice question 3 from 2009 brochure (p. 13)

English translation of question 3

Carlos says: "In all quadrilateral figures, when drawing a line from one vertex to another vertex, two congruent triangles are formed. Which example of the following ones shows that Carlos is wrong?

English translation of brochure explanation

*Correct answer **C**.*

*This question corresponds to the content of **Spatial Orientation**. The ability asked is to determine if a statement is true in one or more examples. To answer correctly, the student has to refute that when drawing a line from one vertex to another two congruent triangles are formed. In particular, the student has to recognize the counterexample, where the*

statement is false, then the student has to select the figure where the two triangles are not congruent.

These problem-solving examples from the 2009 brochure, combined with Espinoza et al.'s (2011) report that most teachers did not teach solving problems in their classes, suggests that the type of task used in the students' group work during class was different from the items asked in the SIMCE examination. An implication of this result is to propose professional development to improve teachers' problem-solving skills. As Rojas (2010) and Espinoza et al. (2011) suggest, most Chilean teachers devote more time teaching procedural exercises than to problem-solving tasks. In addition, the professional development would focus on the creation of teachers' own problems considering students' context. When students are faced with real life situations their learning is more meaningful.

I analyzed a series of different combinations of teachers' self-reported use of three teaching practices [*students' group work* (Q14_1), *solve HW* (Q17_2), and *explain the workbook and textbook exercises solutions to the whole class* (Q17_6)]. The model which explained the most variance was the one that included the three practices together. However, the association between using the strategy *students' group work* (Q14_1) and students' achievement was still negative. Nevertheless, this new model can only explain 2.36% of the variance, which is very low.

The main conclusion of this set of analyses is that the use of these teaching practices together can explain the students' achievement better than each practice separately. This conclusion is in line with the literature reviewed (Kane et al., 2011). However, these practices together or separately explain a low proportion of the variance. Thus, focusing just on these

practices in the classroom was not enough to explain the students' SIMCE mathematics achievement.

Research Question 5: To what extent did the teaching practices selected in Question 1 and the topics selected in Question 2 predict students' achievement on the SIMCE mathematics examination?

According to the multilevel analysis, the extent to which the topic *read and write simple fractions* (Q18_7) was addressed can explain more variance (9.33%). Since fractions is a challenging topic for both teachers and students (Ball, 1990; Klein & Tirosh, 1997), this result showed evidence that the extent to which this topic was addressed was associated with students' achievement. When teachers reported giving fractions more attention, students achieved a better score. Making a speculation about the tasks used in SIMCE 2011 based on the model found for 2007 SIMCE, just two out of 30 items were related to fractions (See Table 69). An analysis of the two related fractions items shows that item 18 (Figure 1) was a hard one. I do not know how many students answered correctly, but this item also asked for the procedural algorithm for addition, multiplication and division. Additionally, this item asked students to choose information and operations to answer and check results. Item 19 (Figure 1) asked for making a relation of a fraction as a part of the whole. However, Espinoza et al. (2011) indicate that students did not have problems understanding that a fraction is a part of the whole, but most teachers used a procedural algorithm in their classes, instead of word problems. I can conclude that the way in which fraction was taught could be influential on the SIMCE score.

Of the models that explored relationships among the three topics addressed and the students' achievement, the one that explained the most variance was the model that contained the

extent to which the three topics considered were addressed (14.02% of the variance). Thus, the frequency with which teachers self-reported using the three practices together and the extent to which teachers self-reported teaching the three topics explained more variance than each practice used separately. Although the frequency with which teachers used the *students' group work* strategy was still negatively associated with SIMCE mathematics scores, the combination of this practice with the other two practices seemed to eliminate the negative effect of the *students' group work* on students' achievement.

An analysis of each of the frequency with which teachers self-reported using the three practices selected with combinations of the three topics selected indicated that the *students' group work* (Q14_1) and *solve HW* (Q17_2) practices were the most effective to explain variance in the students' achievement. *Solve HW* had a positive association with students' achievement. Homework in Chile has not been studied much. Cardemil (2002) indicated that giving homework is one of the characteristics of the good teacher, according to the literature review about teaching and learning practices in Chilean classrooms.

Analyzing the other models in Table 39 (Results chapter), the model where the frequency with which *students' group work* (Q14_1) was used and the extent to which the topics *meaning, read and write simple fractions* (Q18_7) and *recognize net and flat representations of 2D & 3D figures* (Q18_13) together explained more variance than this strategy with any other combination of the topics addressed. Rojas (2010) indicated in her study that the teacher observed did not promote mathematics conversation in his class nor promoted sharing thinking among students. So even if most teachers self-reported using the *students' group work* (Q14_1) in Chile, Rojas's study gives evidence that not all teachers used this strategy when introducing the topic of "fractions". An implication of this result is to promote conversations about fractions and

geometry, allowing students to improve their achievement. Then, a possible focus for professional development would be to focus on developing some teaching practices to use with specific topics. My first suggestion would be to promote the practice of *students' group* to discuss the topics of fraction and/or geometry to develop the mathematical thinking of the students.

The model that combined the frequency with which teachers reported using *solve HW* (Q17_2) with the combinations of the extent to which teachers reported addressing *meaning, read and write simple fractions* (Q18_7*)* and *recognize net and flat representations of 2D & 3D figures* (Q18_13) explained the most variance. Again, these two topics were good predictors of students' achievement. Finally, the frequency with which *explain the workbook and textbook exercises solutions to the whole class* (Q17_6) was used alone and the extent to which teachers self-reported addressing *meaning, read and write simple fractions* (Q18_7) and *recognize net and flat representations of 2D & 3D figures* (Q18_13) were the best predictors of students' achievement. An implication of this result would be to have another task to develop in the professional development suggested before, related to an induction for teachers to use the textbook. In Chile the Ministry of Education gives the same textbook to public and subsidized schools, for example the textbook for fourth grade in 2015 was from a Galileo Editorial (MINEDUC, 2015). On certain occasions, the Ministry changes the editors of the books. Also, novice teachers will likely need an induction to use the textbook and explain how to make the most of it.

To summarize, this study gives evidence that there is some association between fractions and geometry. Apparently, the extent to which these topics were addressed influenced students' achievement regardless of the teaching practice used. This could be taken as a piece of evidence

that not all practices are useful to teach all topics. Then, by improving teaching practices focusing on specific topics we can improve students' achievement. And the implications identified below would help to achieve that result.

Research Question 6: Were teachers' perceptions of their preparation to teach topics identified in Question 2 or their perceptions of students better predictors of students' achievement on the SIMCE mathematics examination?

To answer the first part of the research question 6: *Were teachers' perceptions of their preparation to teach topics identified in Question 2 good predictors of students' achievement on the SIMCE mathematics examination?* I built a series of multilevel models with the frequency with which teachers reported using the teaching practices selected in research question 1 fixed and the teachers' perception to teach the contents varying.

The first models I performed were those that included the self-reported feeling of preparation to teach each content area one at a time. The model with the reported feeling of preparation to teach *2D geometric figures* (CQ19_4) was the one that explained the most variance (3.09%). As in the previous research question, the teachers' perception to teach the content area of geometry was a good predictor of the students' achievement, but the number of items (based upon model of SIMCE 2007) was just 8. Geometry historically has been recognized as an important part of mathematics. According to Lastra (2005) since the birth of the modern mathematics, geometry started to lose importance. However in the second part of the 20th century, geometry started to be considered in the curriculum again. Also, in Chile, at the end of the 90's and thanks to the educational reform, geometry started to be considered in the classrooms. Unfortunately some damage was caused, I did not receive any geometry class in

high school, finally graduating in 1991. I think, the situation regarding geometry could be a problem if teachers are weak in their content knowledge. To address this situation, I propose paying attention to teachers' preparation. Some teachers' programs have modified their study programs to solve some critical situations such as geometry instruction. For example, the teaching program that I completed included only one geometry course. This program was modified in 2012 and now includes two geometry courses and one course on geometry didactics. As a result, by improving the preparedness of the pre-service teachers we can fix the geometry problem. However, for in-service teachers the MINEDUC should promote professional development focused on geometry. I propose professional development which includes two main approaches: First, using didactic computational programs to introduce the definition of the geometry figures and constructions of these figures and second solving problems which use geometry. Also, in this program I would include class observations of the participant teachers to give them suggestions when they teach geometry.

In the discussion of research question 5, fractions was one of the most significant topics for explaining students' achievement. However, in Table 45 we can see that the content *fractions and decimal* (CQ19_2) was not significant (in model 3.4.1) and the contribution to the score was the lowest among all the contents.

I think teachers may feel not well prepared to teach fractions, but the extent to which fractions were addressed by teachers was more important than their feeling regarding student's achievement. Another possible explanation is that when the teachers feel unprepared to teach, they prepare lessons more thoroughly. This would imply that teachers teach fractions well but still feel unprepared. This result gives some evidence that, in Chile, teachers do not feel

confident when teaching fractions. The latest longitudinal national survey of teachers (Bravo, Peirano, & Falck, 2006) indicates that most teachers declared feeling confident to teach what is included in the curriculum. However, teachers of public schools feel less confident to teach than teachers in subsidized and private schools. This survey was answered by 6,088 teachers, and around 30% of them teach in elementary school. Unfortunately, this survey asked about 'the curriculum' in a general way, not focusing on specific aspects of the curriculum or subject. Results of the current study are not completely consistent with those of the longitudinal survey results.

To analyze the *Spanish score in the 2011 SIMCE examination* at the student level, I added this variable to the models which considered the topics addressed and teachers' perceptions of their preparation to teach them. The model with the Spanish score added explained almost 40% of the variance, meaning that the Spanish score was a very good predictor of students' achievement. When the Spanish score was added to the models, the variance explained was almost the same 40%.

According to the brochure 2011 (Agencia de Calidad de la Educación, 2011), SIMCE assessed reading skills as extracting information from text (to find data directly presented in the text or data which is implicit), as interpreting and making connections between the information of a text (to identify cause and effects from facts present in the text, infer the feeling of a character, interpret the meaning of a figurative expression in the text, understand unfamiliar words according to the context of the text), and as thinking about the text (to find the purpose of the text and give opinions about it). The focus of the SIMCE Spanish examination was to understand a text, and one of the main purpose of the SIMCE mathematics was to assess problem

solving (words and real life problems). As the Spanish examination was the variable which explained a lot of variance, when students developed reading skills, they could understand mathematics questions in a proper way. Therefore, these students made less mistakes answering the question. I concluded that the contribution of the SIMCE Spanish score was so high that it overshadowed the contribution of the teachers' variables analyzed in this study. The goal of this study was to relate some teaching practices and some mathematics topics, and since the Spanish score overshadowed these contributions, I did not consider the Spanish score for any other analysis.

To answer the second part of the research question 6: *Were teachers' perceptions of students better predictors of students' achievement on the SIMCE mathematics examinations?*, I built a series of multilevel models in which I fixed the frequency with which teachers reported using the teaching practices selected in research question 1 and combined different subsets of teachers' self-reported expectations of their students' future schooling (Q12), self-reported agreement with *as teachers we have a difficult time when teaching because of the disorder and indiscipline in the classroom* (Q22_7), and self-reported agreement with *students care about the furniture and infrastructure of the school* (Q22_9).

According to the results, when teachers have higher expectations of their students' academic future, the students have a better score. A similar result was reported by Cardemil (2002). Also, these teachers emphasized developing their students' skills. On the other hand, teachers with low expectations just asked their students to work on routine tasks. Actually, in my study the best predictor of students' achievement was the teachers' self-reported expectation of their students' future schooling.

As the teachers' self-reported expectation of their students' future schooling was the best predictor in this study, analyzing why this happened is necessary. In 2004, the Ministry of education and United Nations International Children's Emergency Fund (UNICEF) published a book which reviewed studies of successful poor schools in Chile in standardized tests (Unicef, 2004). This book analyzed different studies about the good results in these schools. One of the reasons was the commitment of parents with their children. Parents feel part of the education of their children, participating in parent-teacher conferences and all activities promoted by the school. Another reason, to explain the success of the school, was that teachers worked as a team. Teachers at the school had the same goal: they wanted their students to learn and be successful in their lives. Teachers worked thinking that their students can do everything and anything. The teachers' team work, in these schools, was under the principal's direction. Those principals were focused on the pedagogical skills of the teachers and strengthen teachers' leadership. At the same time, these principals always supported their teachers. Principals were leaders of their schools, convincing parents and teachers that the students can be successful in their lives. Horn and Marfán (2010) added that international research indicated that the leadership of the principal and his/her team has the potential to impact the learning of students. Then, professional development focused on principals would impact teachers. In fact, this is not an original idea, due to that fact in 2005 the Ministry of Education published the Marco para la Buena Dirección (Framework for good leadership at school, MBD by its acronyms in Spanish). In 2010, MINEDUC created a plan for preparedness of schools' principals through the Center of Pedagogical Research of Professional Development, and Experimentation (CPEIP by its acronyms in Spanish). The goal of this Center is to improve the preparedness of education professionals by providing knowledge and skills to become the finest principals of Chile (MINEDUC, 2016a). As a result, teachers

participating in this professional development have the opportunity to apply for a fellowship and stay in another country for 3 months.

Regarding one of the crucial issues in Chilean education, most of teachers declared having problems with students' behavior (Avalos & de los Rios, 2013). However, most of the literature relates the social economic status of the students to their lack of discipline in the school (Avalos & de los Rios, 2013; Arancibia, 1994). Besides, Cardemil (2002) indicated that regarding the discipline in the classroom some studies have indicated the importance of the management of the discipline to allow the students' learning, so for that reason the discipline is positively related to students' achievement. However, the statistical significance of the agreement with the *students care about the furniture and infrastructure of the school* (Q22_9) statements was a surprise. However, I could not find any information about the specific statement [the *students care about the furniture and infrastructure of the school* (Q22_9)].

To my mind, the reason for including this question is related to the mission of MINEDUC: "The mission of the Ministry of Education is to ensure an inclusive and high quality educational system that contributes to developing people of integrity to develop the country through formulation and implementation of policies, rules and regulations, from preschool education to higher education" (MINEDUC, 2016b). Part of the integrity that we have as society is by respecting the public and private property; thus, that could be the reason that the statement about furniture and infrastructure of the school was asked in the questionnaire. Then, the people who care most about them had a better score in the SIMCE examination.

Research Question 7: Did the association between reported teaching practices examined in Question 1 and students' achievement differ across schools? In particular, to what extent were

school characteristics, such as funding model and SES, associated with students' achievement?

According to the results in Table 65 (Results chapter) which shows the fully unconditional 3-level model, the proportion that can be explained at the students' level was more than 70%, and the proportion generated from the teachers' factors was more than 25%. On the other hand, the proportion of variance that can be explained by the school factors was less than 3%, meaning that the school factors explained just a little of the variance. This result gives evidence that school factors were included in the teacher level. Thus, associated with the SES of their schools, teachers may have better teaching tools that affect students' achievement, more access to professional development to improve their teaching, or a school environment that supports student learning.

Table 66 in the results chapter shows estimates for three models that include the economic factors of the school. The variance that can be explained by the different models had similar distributions to the variance explained by each level. The school level explained around 3% of the variance. Furthermore, this table shows the reduction of variance between the unconditional model and the model with the economic factors. The model which reduces more variance was model 3 with the *type of funding* variable incorporated. This model reduced the unexplained variance by more than 40%. The type of funding of the school was a decisive factor in the Chilean education. Avalos and de los Rios (2013) indicated the factors that define the identity of the Chilean teachers are external factors such as the type of school funding.

After adding the frequency with which teachers reported using teaching practices to the 3-level model, the proportion which can be explained by each level was almost the same. And the reduction of the variance at the teacher level compared to the model without the practices

was very little, less than 2% of the reduction. In conclusion, the school level was not a necessary level for this analysis.

Summary

This study found influential variables some, but not all, of which had to do with mathematics directly. With regard to the mathematics variables, the extent to which fractions were addressed was the most influential on students' achievement. Fractions is a crucial topic for students' achievement on SIMCE 2011. Also, the items of the SIMCE 2007 showed that solving problems is the way that this topic is asked. Although the items shown in this study are not the ones used in SIMCE 20111, we can get an idea about how the real items were. According to the literature reviewed, most teachers used procedural methods to teach fractions. In my opinion, due to my experience with fractions, most teachers are very good when it comes to algorithms to compute fractions, but we do not understand what fractions really are, maybe for that reason teachers at school teach fractions in the same way they were taught. Teachers in particular at elementary school need to know how the algorithm works and different methods to introduce and teach fractions. I think, I know a little more about fractions due to some of my classes at UGA (MATH 5020/7020). In Chile we need our elementary teachers to have a deep understanding of school mathematics, especially crucial topics such as fractions. To propose any intervention for teachers at school, I need to know the real way that elementary teachers teach fractions at school. I will start visiting some schools. These schools would be those with the higher SIMCE score in mathematics. Of course I will ask to visit them when teachers introduce the fraction topic. After that I will design the intervention to promote other ways to teach, for example some of the ways that I leaned at UGA.

With regard to variables that did not relate to mathematics directly, the most influential variables were the Spanish scores, teachers' self-reported expectations of their students' future schooling, and the type of school funding. All of these variables explained more variance than those related directly to mathematics, which is curious. As I said before, the Spanish score was related to the reading and understanding skills of the students, which influences students' understanding of the items asked in the SIMCE examination. In addition, the type of school funding is crucial for Chilean teachers, considering that they feel more confident when teaching in state-funded schools than in private schools. The other influential variables were "external" to the mathematics or other school subjects, for example the teachers' perceptions of their students. In 2006, a Latin American standardized test was applied in 15 countries to third and sixth grade. This was the Second Regional Comparative and Explanatory Study, SERCE by its acronym in Spanish (UNESCO, 2006); according to this study school climate was the most important factor for students' achievement. Also, a similar result was obtained in PERCE 1997, the first of these studies, concluding that in Latin America the school climate is crucial. Then, students in the classroom are influenced by their classmates and their stories and customs. I, as a Latin American person, think that something in our nature influences that factor. Actually, I do not know why we are so "sociable" depending on the others. We are strongly influenced by external factors. I think a large study about schools in Latin America would be interesting, the PERCE and SERCE and more recently TERCE were standardized test with questionnaires that included self-reported sections by students, teachers, parents and principals of the schools. Now is the moment to do a qualitative research to go beyond the responses to ask **why an answer took place**.

One implication of my study is that we need more research about relationships among teachers' knowledge, instructional practices, and students' achievement. These kinds of studies could give tips about what practices work better with different types of students or specific topics for specific practices. Because this study provided evidence of Chilean teachers' weakness, this kind of study could help identifying teachers' weakness. I think promoting this type of study in countries with similar type of data (e.g., countries with a national examination) would allow to the field know what practices and weakness of teachers are crucial in each country. As I said before, in Latin American classrooms the school climate is crucial for students' achievement, it is possible that in another countries (e.g., from Europe or Asia) there are other crucial factors.

The crucial effect of school climate should be studied, this non-mathematical factor is crucial for Latin American countries. This result of my study was one of the most interesting for me, also I think, to focus on school climate is a good topic for some international study. Another interesting result for me was to realize that teachers in Chile feel not well prepared to teach fractions. I was very confident of my fraction skills until I attended MATH 7020. One lesson for people who read this study is that the type school funding is crucial for Chilean people. In Chile we have large differences regarding quality of education when students attend public or private schools.

Study Limitations

The first limitation of this study was the source of the data used. Since the teachers' questionnaires were self-reported, teachers could answer the way they thought they were supposed to answer. I did not have the opportunity to contrast written answers with the real classroom instruction. Another limitation related to the data was the type of data used. Because the questions were fixed, I had to fit my research questions to the type of information provided by this data set. To address this limitation I would propose a mixed methods study. Then, with the statistics of the SIMCE, I would interview elementary teachers about why they answered the way that they did. The reason why teachers answered using the *solve homework* strategy or not using the *students' group work* strategy could be more informative when analyzing how a teacher teaches in the classroom.

Another limitation is that conclusions from this study apply only to schools with just one fourth grade; they are not generalizable for all fourth grades in Chile. A future study that includes schools with more than one fourth grade would be a new challenge.

The potentially measurement error due the small number of fractions items analyzed, we should view these result with caution.

Conclusions

By studying the teaching practices and the mathematics topics which affect students' achievement, this study goes beyond the economic factors that affect students' achievement.

This study identified three self-reported teaching practices that affect considerably students' achievement on the SIMCE mathematics examination.

The most influential teaching practices on students' achievement were *students' group work, solve HW* and *explain the workbook and textbook exercises solutions to the whole class*. The most important topics had to do with fractions and geometry.

In this study, I identified the topic of *fractions* and *decimals* as weaknesses among fourth grade teachers in Chile. In addition, fractions was the topic that teachers self-reported feeling the least prepared to teach. Then, a suggestion for the Chilean authorities would be to provide professional development for elementary teachers in those topics where they feel less confident, and also to promote problem-solving tasks in a professional development.

Also this study identified that over all predictors studied, the best predictor of students' achievement was the teachers' self-reported expectations of their students' future schooling.

The school economic factors had little influence on students' achievement maybe because those factors were incorporated to the teaching practices by the teachers of the school.

I proposed professional development focused on teaching practices specific for some topics and on developing problem-solving tasks considering the context (e.g. social, economic) of the students.

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APPENDICES

Appendix A: Parents' Years of Schooling (Chile)

This table shows the translation of the table used by SIMCE to calculate the years of the school for mothers and fathers:

Educational Level	*Years of schooling*
No school	0
1° grade	1
2° grade	2
3° grade	3
4° grade	4
5° grade	5
6° grade	6
7° grade	7
8° grade	8
9° grade	9
10° grade	10
11° grade	11
12° grade	12
12° or 13° grade Technician	12
Incomplete technician education	14
Graduated from technician education	16
Incomplete college	15
Graduated from college	17
Master degree	19
Doctor degree	22
Do not remember	It does not change to school years

Appendix B: Family Income (Chile)

The conversion from Chilean pesos to U.S. dollars I used the currency Google convertor on September 9th, 2015. 1 dollar = 685.79 Chilean pesos. The next table shows the family income in terms of U.S. dollars.

Range of the monthly income	***Monthly Income imputed to the student***
Less than $145.82	$72.99
Between $145.82 and $291.63	$218.72
Between $292.63 and $437.45	$364.54
Between $438.45 and $585.26	$510.36
Between $586.26 and $729.08	$656.17
Between $730.08 and $874.9	$801.99
Between $875.9 and $1,166.53	$1,020.71
Between $1,167.53 and $1,458.16	$1,312.35
Between $1,459.16 and $1,749.79	$1,603.98
Between $1,750.79 and $2,041.43	$1,895.61
Between $2,042.43 and $2,333.06	$2,187.24
Between $2,333.06 and $2,624.69	$2,478.87
Between $2,625.69 and $2,916.32	$2,770.51
Between $2,917.32 and $3,207.96	$3,062.14
More than $3,207.96	$3,353.77

Appendix C: Some Formulas Used in this Study

For the 2-level Model

Intra-class correlation coefficient (ICC) is computed just in fully unconditional model.

$$ICC = \rho = \frac{\tau_{00}}{\tau_{00}+\sigma^2},$$

where, σ^2 represents the within-group variability, and τ_{00} captures the between-group variability from the fully unconditional model.

Proportion of variance that can be explained by variable W at level-2.

$$\frac{\hat{\tau}_{00}(ANOVA)-\hat{\tau}_{00}(W)}{\hat{\tau}_{00}(ANOVA)},$$

where, $\hat{\tau}_{00}(ANOVA)$ is the estimate between-group variability from the fully unconditional model (which is known as the ANOVA model), and $\hat{\tau}_{00}(W)$ is the estimate between-group variability from the model with W as predictor.

Proportion of variance that can be explained by variable Z at level-1.

$$\frac{\hat{\sigma}^2(ANOVA)-\hat{\sigma}^2(Z)}{\hat{\sigma}^2(ANOVA)},$$

where, $\hat{\sigma}^2(ANOVA)$ is the estimate within-group variability from the fully unconditional model (which is known as the ANOVA model), and $\hat{\sigma}^2(Z)$ is the estimate within-group variability from the model with Z as predictor.

Conditional intra-class correlation is a measure of the dependence within schools that are the same category of variable X at level-2.

$$ICC_C = \rho_C = \frac{\hat{\tau}_{00}(X)}{\hat{\tau}_{00}(X)+\hat{\sigma}^2(X)},$$

where, $\hat{\tau}_{00}(X)$ is the estimate between-group variability from the model with X as predictor, and $\hat{\sigma}^2(X)$ is the estimate of the within-group variability from the model with X as predictor.

Pseudo-R^2 computes the variance components and the reduction of variance accounted for by model 2 compare to model 1 at level-1.

$$\text{Pseudo} - \text{R}^2 = \frac{\sigma_e^2(Model\ 1)-\sigma_e^2(Model\ 2)}{\sigma_e^2(Model\ 1)},$$

where, $\sigma_e^2(Model\ 1)$ in the estimate of the within-group variability from the model 1, and $\sigma_e^2(Model\ 2)$ is the estimate of the within-group variability from the model 2.

For the 3-level Model

Variance partitioning

The proportion of variance over level-1 units is:

$$\frac{\sigma^2}{\sigma^2+\tau_\pi+\tau_\beta}.$$

The proportion of variance over level-2 units is:

$$\frac{\tau_\pi}{\sigma^2+\tau_\pi+\tau_\beta}.$$

The proportion of variance over level-3 units is:

$$\frac{\tau_\beta}{\sigma^2+\tau_\pi+\tau_\beta}.$$

ICC for 3 levels model (just the unconditional model)

The proportion of variance in the outcome that is between schools:

$$ICC = \frac{\tau_\beta}{\sigma^2+\tau_\pi+\tau_\beta}.$$

The proportion of variance in the outcome that is the same classroom and the same school (but different students):

$$ICC = \frac{\tau_\pi+\tau_\beta}{\sigma^2+\tau_\pi+\tau_\beta}.$$

The proportion of variance between schools relative to (classroom + school):

$$ICC = \frac{\tau_\beta}{\tau_\pi+\tau_\beta}.$$

Appendix D: Summary Curriculum 4th Grade (Chile)

Unit 1: *Numbers until 10,000 and solving problems.*

The purpose of this unit is to allow students to extend basic operations (addition, subtraction, multiplication and division) with natural numbers. Also, students use these operations to solve problems.

Unit 2: *Translations, 3D figures and measurements (time, length).*

This unit is focused on geometry using the Cartesian system to locate movement of a point; also, students have to recognize 3D figures. Another topic considered in this unit is collect data in terms of centimeters and meters. In addition, students collect data as a first attempt to probabilities (e. g. dices and coins)

Unit 3: *Recognizing fractions as part of a whole number. In geometry, geometric constructions.*

The purpose of this unit is to extend the fractions knowledge (e.g. improper fractions). In geometry, students make geometric constructions with ruler and compass (e. g. Reflections, rotations, angles).

Unit 4: *Decimal numbers starting with mixed numbers and their pictorial representation.*

Students continue working with fractions and discover decimal numbers starting with mixed numbers. Students deepen their understanding of fractions and decimal numbers as whole and partial amounts.

Appendix E: Scheffé's Statistics

Let μ_1 ... μ_r be the means of some variable in r disjoint populations. An arbitrary contrast is defined by

$$C = \sum_{i=1}^{r} c_i \mu_i,$$

where

$$\sum_{i=1}^{r} c_i = 0.$$

If μ_1 ... μ_r are all equal to each other, then all contrasts among them are 0. Otherwise, some contrasts differ from 0.

Technically there are infinitely many contrasts. The simultaneous confidence coefficient is exactly 1 − α, whether the factor level sample sizes are equal or unequal. (Usually only a finite number of comparisons are of interest. In this case, Scheffé's method is typically quite conservative, and the experimental error rate will generally be much smaller than α.)

We estimate *C* by

$$\hat{C} = \sum_{i=1}^{r} c_i \bar{Y}_i,$$

for which the estimated variance is

$$s_{\hat{C}}^2 = \hat{\sigma}_e^2 \sum_{i=1}^{r} \frac{c_i^2}{n_i},$$

where

n_i is the size of the sample taken from the *i*th population (the one whose mean is μ_i), and $\hat{\sigma}_e^2$ is the estimated variance of the errors.

It can be shown that the probability is 1 − α that all confidence limits of the type

$$\hat{C} \pm S_{\hat{C}} \sqrt{(r-1)\, F_{\alpha;\, r-1;\, N-r}},$$

are simultaneously correct, where as usual N is the size of the whole population.

Retrieved from: http://www.itl.nist.gov/div898/handbook/prc/section4/prc472.htm

Appendix F: SES of the School by Type of Funding

SES of the School by Type of Funding

		SES Schools					Total
		Low	Middle low	Middle	Middle high	High	1
Type of school funding	Public	1179	1203	198	18	2	2600
		45.3%	46.3%	7.6%	0.7%	0.1%	100.0%
		72.1%	76.0%	30.3%	6.8%	1.8%	61.3%
	Subsidized	456	380	453	217	8	1514
		30.1%	25.1%	29.9%	14.3%	0.5%	100.0%
		27.9%	24.0%	69.4%	82.2%	7.3%	35.7%
	Private	0	0	2	29	99	130
		0.0%	0.0%	1.5%	22.3%	76.2%	100.0%
		0.0%	0.0%	0.3%	11.0%	90.8%	3.1%
Total		1635	1583	653	264	109	4244
		38.5%	37.3%	15.4%	6.2%	2.6%	100.0%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix G: 2-Level Models Teaching Practices Selected

Model 1.4.1

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{02} * CQ17\_2_{2j} + \gamma_{03} * CQ17\_6_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{02} * CQ17\_2_{2j} + \gamma_{03} * CQ17\_6_{3j} + u_{0j} + r_{ij}$$

Model 1.4.2

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{02} * CQ17\_2_{2j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{02} * CQ17\_2_{2j} + u_{0j} + r_{ij}$$

Model 1.4.3

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{02} * CQ17\_2_{2j} + \gamma_{03} * CQ17\_6_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{02} * CQ17\_2_{2j} + \gamma_{03} * CQ1\ 7\_6_{3j} + u_{0j} + r_{ij}$$

Model 1.4.4

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{03} * CQ17\_6_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ14\_1_{1j} + \gamma_{03} * CQ17\_6_{3j} + u_{0j} + r_{ij}$$

Appendix H: 2-Level Models Topics Addressed Selected

Model 2.4.1

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{02} * CQ18\_13_{2j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j}$$

Mixed Model: $SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{02} * CQ18\_13_{2j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j} + r_{ij}$

Model 2.4.2

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{02} * CQ18\_13_{2j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{02} * CQ18\_13_{2j} + u_{0j} + r_{ij}$$

Model 2.4.3

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_13_{1j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_13_{1j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j} + r_{ij}$$

Model 2.4.4

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ18\_7_{1j} + \gamma_{03} * CQ18\_14_{3j} + u_{0j} + r_{ij}$$

Appendix I

Models keeping the activity Q14_1 and varying the topics meaning, read and write simple fractions (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13) and *communication of information provided by charts and graphics* (Q18_14).

	Model 1	***Model 2***	***Model 3***	***Model 4***	***Model 5***	***Model 6***	***Model 7***
Fixed effects							
Intercept	203.08*	206.87*	218.69*	228.42*	219.72*	213.52*	209.62*
CQ14_1	-3.05*	-2.91*	-2.79*	-3.25*	-3.06*	-3.23*	-3.02*
CQ18_7	6.84*	7.41*	9.88*				8.29*
CQ18_13	4.75*	7.41*			9.30*	7.21*	
CQ18_14	3.40*			7.17*		4.41*	4.80*
Variance components							
Level-1 σ_ε^2	1842.27*	1842.51*	1842.71*	1842.24*	1842.50*	1842.09*	1842.41*
Level-2 τ_{00}	613.35*	619.43*	638.55*	668.06*	651.34*	640.89*	623.32*
Proportion of variance (%)	13.6	12.71	10.01	5.85	8.20	9.68	12.16

* significance at 0.001; ** significance at 0.05

Appendix J

Models keeping the activity Q17_2 and varying the topics meaning, read and write simple fractions (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13) and *communication of information provided by charts and graphics* (Q18_14).

	Model 8	***Model 9***	***Model 10***	***Model 11***	***Model 12***	***Model 13***	***Model 14***
Fixed effects							
Intercept	195.02*	198.35*	209*	218.09*	209.23*	203.92*	201.51*
CQ17_2	1.93**	2.16*	2.34*	2.77*	2.87*	2.51*	1.96**
CQ18_7	6.73*	7.25*	9.65*				8.18*
CQ18_13	4.72*	6.00*			9.06*	7.13*	
CQ18_14	3.19*			6.84*		4.14*	4.58*
Variance components							
Level-1 σ_ε^2	1842.17*	1842.40*	1842.62*	1842.16*	1842.40*	1842.02*	1842.31*
Level-2 τ_{00}	616.33*	621.55*	639.80*	669.30*	651.79*	642.79*	626.20*
Proportion of variance (%)	13.14	12.40	9.84	5.68	8.15	9.41	11.75

* significance at 0.001; ** significance at 0.05

Appendix K

Models keeping the activity Q17_6 and varying the topics meaning, read and write simple fractions (Q18_7), *recognize net and flat representations of 2D & 3D figures* (Q18_13) and *communication of information provided by charts and graphics* (Q18_14).

	Model 15	***Model 16***	***Model17***	***Model 18***	***Model 19***	***Model 20***	***Model 21***
Fixed effects							
Intercept	195.93**	199.10**	208.94**	216.15**	209.09**	204.10**	201.47**
CQ17_6	1.33	1.65*	2.46*	3.31**	2.78**	2.26*	1.77*
CQ18_7	6.79**	7.31**	9.59**				8.17**
CQ18_13	4.64**	5.91**			8.92**	6.99**	
CQ18_14	3.23**			6.75**		4.18**	4.57**
Variance components							
Level-1 σ_ε^2	1842.12**	1842.35**	1842.52**	1842.08**	1842.33**	1841.96**	1842.24**
Level-2 τ_{00}	618.13**	623.58**	641.40**	670.33**	654.23**	644.99**	627.69**
Proportion of variance (%)	12.89	12.12	9.61	5.53	7.8	9.10	11.54

Note: * significance at 0.05; ** significance at 0.001

Appendix L: 2-Level Models Content Selected

Model 3.4.1.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{02} * CQ19\_2_{2j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{02} * CQ19\_2_{2j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j} + r_{ij}$$

Model 3.4.2.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{03} * CQ19\_2_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{03} * CQ19\_2_{3j} + u_{0j} + r_{ij}$$

Model 3.4.3.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{02} * CQ19\_2_{2j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{02} * CQ19\_2_{2j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j} + r_{ij}$$

Model 3.4.4.a

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j} + r_{ij}$$

Appendix M

The models keeping the self-reported strategy *students' group work* (CQ14_1), and the teachers' perception to teach: *natural numbers and place value* (Q19_1), *fractions and decimals* (Q19_2), and *2D Geometric figures* (Q19_4).

	Model 1	***Model 2***	***Model 3***	***Model 4***	***Model 5***	***Model 6***	***Model 7***
Fixed effects							
Intercept	221.89**	225.98**	226.59**	226.43**	235.07**	224.72**	221.88**
CQ14_1	-2.94**	-2.94**	-2.90**	-2.94**	-3.00*	-2.97**	-2.92**
CQ19_1	3.11*	6.21**	8.50**				4.04**
CQ19_2	1.53	2.81*			5.93**	2.52*	
CQ19_4	5.88**			8.72**		7.07**	6.34**
Variance components							
Level-1 σ_ε^2	1842.63**	1842.60**	1842.65**	1842.78**	1842.72**	1842.69**	1842.65**
Level-2 τ_{00}	680.25	686.88**	688.15**	682.33**	691.82*	681.05**	680.64**
Proportion of variance (%)	4.13	3.2	3.02	3.84	2.5	4.02	4.08

* significance at 0.05; ** significance at 0.001

Appendix N

Models keeping the reported activity solve HW (CQ17_2)*, and the teachers' perception to teach: natural numbers and place value (Q19_1), fractions and decimals (Q19_2), and 2D Geometric figures (Q19_4).*

	Model 8	***Model 9***	***Model 10***	***Model 11***	***Model 12***	***Model 13***	***Model 14***
Fixed effects							
Intercept	211.51**	215.24**	215.53**	215.83**	224.41**	214.54*	211.43**
CQ17_2	3.00**	3.11**	3.24**	3.09**	3.10**	2.97**	
CQ19_1	3.32*	6.32**	8.19**				6.91*
CQ19_2	1.09	6.32*			5.50**	2.15*	
CQ19_4	5.69**			8.36**		6.96**	6.01**
Variance components							
Level-1 σ_ε^2	1842.50**	1842.50**	1842.55**	1842.64**	1842.62**	1842.57**	1842.52
Level-2 τ_{00}	680.15**	685.86**	686.89**	681.99**	691.38**	681.13	689.31
Proportion of variance (%)	4.15	3.34	3.20	3.89	2.57	4.01	2.86

* significance at 0.05; ** significance at 0.001

Appendix O

Models keeping the reported activity explain the workbook and textbook exercises solutions to the whole class (CQ17_6), *and the teachers' perception to teach: natural numbers and place value (Q19_1), fractions and decimals (Q19_2), and 2D Geometric figures (Q19_4).*

	Model 15	***Model 16***	***Model 17***	***Model 18***	***Model 19***	***Model 20***	***Model 21***
Fixed effects							
Intercept	209.81*	213.12*	213.35*	213.76*	221.40*	212.55*	209.72*
CQ17_6	3.58*	3.84*	3.99*	3.75*	4.03*	3.61*	3.64*
CQ19_1	3.12**	6.02*	7.93*				3.83**
CQ19_2	1.18	2.37**			5.37*	2.18**	
CQ19_4	5.55*			8.14*		6.73*	5.89*
Variance components							
Level-1 σ_ε^2	1842.42*	1842.40*	1842.45*	1842.55*	1842.51*	1842.48*	1842.44*
Level-2 τ_{00}	681.28*	686.77*	687.90*	683.06*	691.80*	682.13*	681.49*
Proportion of variance (%)	3.99	3.22	3.06	3.74	2.51	3.87	3.96

Note: * significance at 0.05; ** significance at 0.001

Appendix P: 2-Level Models Q22 & Q12 Selected

Model 3.4.1.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * Q12_{1j} + \gamma_{02} * CQ22\_7_{2j} + \gamma_{03} * CQ22\_9_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * Q12_{1j} + \gamma_{02} * CQ22\_7_{2j} + \gamma_{03} * CQ22\_9_{3j} + u_{0j} + r_{ij}$$

Model 3.4.2.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * CQ12_{1j} + \gamma_{03} * CQ22\_7_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * CQ19\_1_{1j} + \gamma_{03} * CQ19\_2_{3j} + u_{0j} + r_{ij}$$

Model 3.4.3.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{02} * CQ22\_7_{2j} + \gamma_{03} * CQ22\_9_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{02} * CQ19\_2_{2j} + \gamma_{03} * CQ19\_4_{3j} + u_{0j} + r_{ij}$$

Model 3.4.4.b

Level-1 model

$$SCORE\_MATH_{ij} = \beta_{0j} + r_{ij}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * Q12_{1j} + \gamma_{03} * CQ22\_9_{3j} + u_{0j}$$

Mixed Model:

$$SCORE\_MATH_{ij} = \gamma_{00} + \gamma_{01} * Q12_{1j} + \gamma_{03} * CQ22\_9_{3j} + u_{0j} + r_{ij}$$

Appendix Q

The models keeping the self-reported strategy *students' group work* (CQ14_1), and the Teachers' Expectation of their Students' Future Schooling (Q12), the T*eacher we Have Difficulty Time to Teach Because of the Disorder and Indiscipline in the Classroom* (Q22_7), and the S*tudents care About the Furniture and Infrastructure of the School* (Q22_9) Statements

	Model 1	***Model 2***	***Model 3***	***Model 4***	***Model 5***	***Model 6***	***Model 7***
Fixed effects							
Intercept	223.11**	228.03**	225.03**	241.37**	252.53**	245.38**	219.79**
CQ14_1	-3.29**	-3.13**	-3.28**	-3.16**	-2.74**	-2.96**	-3.43**
CQ12	18.40**	18.68**	19.29**				18.88**
CQ12_7	-4.69**	-5.16**			-7.44**	-6.76**	
CQ22_9	6.02**			9.49**		8.16**	6.88**
Variance components							
Level-1 σ_ε^2	1843.47**	1843.26**	1844.17**	1842.41**	1842.29**	1842.59**	1843.39**
Level-2 τ_{00}	583.88**	588.91**	596.14**	692.44**	688.88**	680.08**	589.70**
Proportion of variance (%)	17.72	17.00	15.99	2.42	2.92	4.16	16.90

* significance at 0.05; ** significance at 0.001

Appendix R

Models keeping the reported activity solve HW (CQ17_2), *and the* Teachers' Expectation of their Students' Future Schooling (Q12), the T*eacher we Have Difficulty Time to Teach Because of the Disorder and Indiscipline in the Classroom* (Q22_7), and the S*tudents care About the Furniture and Infrastructure of the School* (Q22_9) Statements

	Model 8	***Model 9***	***Model 10***	***Model 11***	***Model 12***	***Model 13***	***Model 14***
Fixed effects							
Intercept	212.84**	217.26**	214.02**	229.14**	240.00**	233.46**	209.22**
CQ17_2	2.79**	2.87**	2.82**	3.49**	3.68**	3.55**	2.73**
CQ12	18.06**	18.31**	18.94**				18.57**
CQ22_7	-4.98**	-5.40			-7.63**	-7.02**	
CQ22_9	5.39**			8.81**		7.45**	6.29**
Variance components							
Level-1 σ_ε^2	1843.22**	1843.03**	1843.95**	1842.25**	1842.16**	1842.42**	1843.13**
Level-2 τ_{00}	586.12**	590.27**	598.10**	691.35**	685.60**	678.14**	592.64**
Proportion of variance (%)	17.40	16.82	15.71	2.57	3.38	4.43	16.48

* significance at 0.05; ** significance at 0.001

Appendix S

Models keeping the reported activity explain the workbook and textbook exercises solutions to the whole class (CQ17_6), and the Teachers' Expectation of their Students' Future Schooling (Q12), the Teacher we Have Difficulty Time to Teach Because of the Disorder and Indiscipline in the Classroom (Q22_7), and the Students care About the Furniture and Infrastructure of the School (Q22_9) Statements

	Model 15	***Model 16***	***Model 17***	***Model 18***	***Model 19***	***Model 20***	***Model 21***
Fixed effects							
Intercept	210.22*	214.69*	211.20*	225.09*	236.14*	229.55*	206.55*
CQ17_6	3.46*	3.54*	3.61*	4.64*	4.73*	4.61*	3.45*
CQ12	18.02*	18.27*	18.89*				18.52*
CQ22_7	-4.91*	-5.33*			-7.54*	-6.92*	
CQ22_9	5.46*			8.86*		7.53*	6.35*
Variance components							
Level-1 σ_ε^2	1843.11*	1842.93*	1843.84*	1842.09*	1842.02*	1842.27*	1843.03*
Level-2 τ_{00}	586.88*	591.07*	598.63*	691.58*	686.21*	678.68*	593.24*
Proportion of variance (%)	17.29	16.84	15.64	2.54	3.29	4.36	16.36

Note: * significance at 0.05; ** significance at 0.001

Appendix T: Teachers' Questionnaire Spanish Original Version

Cuestionario Docentes
SIMCE 2011

4° BÁSICO

Datos del establecimiento

RBD del establecimiento	Letra del curso	CLN Curso
☐☐☐☐☐ – ☐	4° ☐	☐☐☐☐☐

INTRODUCCIÓN

El Ministerio de Educación lo invita a participar en el proceso SIMCE 2011 de 4° Básico, respondiendo este cuestionario.

La información que usted nos entregue permitirá comprender mejor los resultados de aprendizaje obtenidos por los y las estudiantes que rinden la prueba y apoyarlos en su proceso de formación escolar.

Las respuestas al cuestionario son confidenciales y en ningún caso será revelada la identidad de la persona que lo contesta. Solo serán utilizadas con fines de investigación, por el MINEDUC y por instituciones que realizan estudios sobre educación.

INSTRUCCIONES

Por favor, conteste todas las preguntas de este cuestionario, pensando en el curso de 4° Básico que rindió la prueba SIMCE 2011 señalado al inicio de este cuestionario.

Para contestar el cuestionario utilice solamente lápiz pasta de punta gruesa y de color negro o azul oscuro.

Lea atentamente cada pregunta y marque una equis (X) en el casillero que corresponda a su respuesta. En algunos casos debe marcar solo un casillero y en otros debe marcar más de uno.

Si se equivoca en su respuesta, rellene todo el casillero y marque una nueva equis (X) en el casillero correcto.

Cuando se le pida anotar números y respuestas escritas, por favor hágalo de manera clara, precisa y fácil de leer. Por favor no doble las hojas y cuide que el cuestionario no se deteriore.

Una vez contestado el cuestionario, guárdelo en el sobre en el que viene, selle el sobre y entréguelo a la persona encargada de la aplicación de la Prueba SIMCE a más tardar el día jueves 13 de octubre.

Muchas gracias por su colaboración.

1. **Usted es:**

   ☐ Hombre ☐ Mujer

2. **¿En qué año nació?**
   Escriba claramente el año, ejemplo, 1971. ☐☐☐☐

3. **¿Posee título de profesor/a?**
   Marque con una equis (X) una sola alternativa.

   ☐ Sí, otorgado por una Escuela Normal
   ☐ Sí, otorgado por una Universidad tradicional de la Región Metropolitana
   ☐ Sí, otorgado por una Universidad tradicional de otra región de Chile
   ☐ Sí, otorgado por una Universidad privada
   ☐ Sí, otorgado por un Instituto Profesional o Centro de Formación Técnica
   ☐ No, pero estoy estudiando o egresé de pedagogía
   ☐ No, pero tengo otro título *(Si marcó No, pero tengo otro título, pase a la pregunta 6)*

4. **¿Su título corresponde a...?**
Marque con una equis (X) todas las alternativas que correspondan.

Educación General Básica

- ☐ Sin mención
- ☐ Con mención Lenguaje
- ☐ Con mención Matemática
- ☐ Con mención Cs. Naturales
- ☐ Con mención Cs. Sociales
- ☐ Otra mención

Enseñanza Media

- ☐ Con especialidad en Lenguaje
- ☐ Con especialidad en Matemática
- ☐ Con especialidad en Biología
- ☐ Con especialidad en Química
- ☐ Con especialidad en Física
- ☐ Con especialidad en Cs. Sociales
- ☐ Con otra especialidad

5. **¿En qué año obtuvo su título de profesor/a?**
Escriba claramente el año, ejemplo, 1996.

☐☐☐☐

6. **¿Ha aprobado alguno de los siguientes estudios de postgrado (de al menos un año de duración) en el área de educación o en un tema relacionado?**

☐ Diplomado ☐ Postítulo ☐ Magíster ☐ Doctorado ☐ Ninguno

7. **¿En qué año comenzó a trabajar como docente en algún establecimiento educacional?**
Escriba claramente el año, por ejemplo, 1996.

☐☐☐☐

8. **¿Desde qué año trabaja como docente en este establecimiento?**
Escriba claramente el año, ejemplo, 2005.

☐☐☐☐

9. **¿Qué tipo de contrato tiene en este establecimiento?**
Marque con una equis (X) una sola alternativa.

- ☐ Contrato indefinido (titular)
- ☐ Contrato plazo fijo (a contrata)
- ☐ Contrato de reemplazo
- ☐ Contrato a honorarios
- ☐ Otro

10. **¿Cuántas horas pedagógicas (45 minutos) a la semana dedica a realizar clases a sus cursos en este establecimiento?**
Escriba claramente el número de horas, considere todos los cursos a los que le hace clases y asegúrese de contestar considerando horas pedagógicas.

☐☐ Horas pedagógicas a la semana

Acerca de su curso de 4° Básico

11. **Pensando ahora en el curso que rinde SIMCE 2011, ¿qué sectores enseña usted en ese curso?**
Marque con una equis (X) todas las alternativas que correspondan.

- ☐ Lenguaje y comunicación
- ☐ Matemática
- ☐ Ciencias naturales
- ☐ Historia, geografía y ciencias sociales

12. Pensando en el futuro, ¿qué nivel educacional cree usted que completará la mayoría de los estudiantes de su curso de 4° Básico que rindió la prueba SIMCE 2011?

Marque con una equis (X) una sola alternativa.

- ☐ No creo que completen 4° Año de Educación Media.
- ☐ Terminarán 4° Año de Educación Media Técnico-Profesional.
- ☐ Terminarán 4° Año de Educación Media Científico-Humanista.
- ☐ Obtendrán un título en un Centro de Formación Técnica o un Instituto Profesional.
- ☐ Obtendrán un título en la Universidad.
- ☐ Obtendrán estudios de postgrado.

13. ¿En qué medida está de acuerdo o en desacuerdo con cada una de las siguientes afirmaciones relacionadas con el curso evaluado?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Los estudiantes tratan con respeto a los profesores.	☐	☐	☐	☐
Los estudiantes escuchan con respeto a sus compañeros de clase.	☐	☐	☐	☐
Hay peleas entre estudiantes durante las clases.	☐	☐	☐	☐
En este curso, cuesta mucho comenzar las clases.	☐	☐	☐	☐
Las clases suelen interrumpirse porque el profesor debe hacer callar o retar a los estudiantes.	☐	☐	☐	☐
Los estudiantes trabajan en orden siguiendo las instrucciones que da el profesor.	☐	☐	☐	☐
Los estudiantes mantienen la sala limpia.	☐	☐	☐	☐

Responda las siguientes preguntas solo si enseñó Matemática en 4° Básico evaluado. De lo contrario, pase a la pregunta 20.

14. ¿Con qué frecuencia realiza las siguientes estrategias de trabajo durante las clases de Matemática de este curso?

Marque con una equis (X) una sola alternativa para cada estrategia de trabajo.

	Siempre	La mayoría de las veces	Algunas veces	Nunca
Trabajo grupal de los estudiantes en clase.	☐	☐	☐	☐
Trabajo individual de los estudiantes en clase.	☐	☐	☐	☐
Exposición de contenidos de aprendizaje.	☐	☐	☐	☐
Organización de la clase sobre la base de preguntas y respuestas.	☐	☐	☐	☐
Exposiciones orales por parte de los estudiantes sobre temas del sector.	☐	☐	☐	☐
Debates o foros en torno a temas del sector.	☐	☐	☐	☐
Salidas a terreno como apoyo a algún contenido del sector.	☐	☐	☐	☐
Preparación y realización de un proyecto grupal con informe escrito por parte de los estudiantes.	☐	☐	☐	☐

15. ¿Con qué frecuencia utiliza las siguientes metodologías de evaluación de aprendizaje en las clases de Matemática con este curso?

Marque con una equis (X) una sola alternativa para cada metodología de evaluación

	Siempre	La mayoría de las veces	Algunas veces	Nunca
Evaluaciones de diagnóstico.				
Pruebas con alternativas o respuestas verdadero o falso.				
Pruebas con preguntas en que los estudiantes deben escribir o resolver problemas.				
Entrega de trabajos o proyectos de investigación, individuales o grupales, que luego evalúa con nota.				
Autoevaluaciones o coevaluaciones.				

16. ¿Con qué frecuencia deja tareas de Matemática para después de la clase a este curso?

Marque con una equis (X) una sola alternativa.

- Todas las clases.
- La mayoría de las clases.
- Algunas clases.
- Nunca deja tareas.

17. ¿Con qué frecuencia hace las siguientes actividades de retroalimentación de Matemática con este curso?

Marque con una equis (X) una sola alternativa para cada actividad.

	Siempre	La mayoría de las veces	Algunas veces	Nunca
Revisa si hicieron las tareas.				
Resuelve en clases las tareas que envía para la casa.				
Vuelve a explicar una materia si algún estudiante se lo pide.				
Explica las materias hasta que todos los estudiantes entiendan.				
Explica la corrección de las pruebas a todo el curso en el pizarrón.				
Explica la corrección de las guías y ejercicios del libro a todo el curso en el pizarrón.				

18. Teniendo en cuenta que el tiempo de clases es limitado y que es probable que no haya podido abordar todos los contenidos curriculares, queremos pedirle que nos indique en qué medida pudo usted enseñar los siguientes contenidos de Matemática en 4º Básico evaluado.

Marque con una equis (X) una sola alternativa para cada contenido.

	No lo he visto todavía	Algo	Bastante	Por completo	No se incluye este año
Lectura, escritura y formación de números naturales hasta el 1.000.000, a partir de los conocimientos adquiridos; interpretación de información proporcionada a través de dichos números y su empleo para comunicar información en diversos contextos.					
Reconocimiento del valor representado por cada dígito en números hasta el 1.000.000, de acuerdo con su posición y su relación con los conceptos de unidad de mil, decena de mil y centena de mil.					
Representación de números naturales o subconjuntos de ellos en la recta numérica y empleo de los símbolos <, > e = para ordenar y comparar números naturales dentro del ámbito numérico estudiado.					
Cálculo escrito de productos y cuocientes con y sin resto, utilizando procedimientos basados en la descomposición aditiva de los números, en las propiedades de la multiplicación y en la relación entre ambas.					
Cálculo mental y escrito en situaciones donde sea significativo realizar este tipo de cálculo, de operaciones combinadas con números naturales en el ámbito numérico estudiado.					
Redondeo de números y su aplicación para estimar cantidades o medidas, el resultado de operaciones o para detectar eventuales errores de cálculo.					
Significado, lectura y escritura de fracciones simples o de uso frecuente (1/2, 1/3, 1/4, 1/8, 3/4, 1/10, 1/100), su empleo para cuantificar y comparar partes de un objeto, de una unidad de medida o de una colección de elementos; comparación entre fracciones y representación en la recta numérica.					
Lectura, escritura y reconocimiento del valor representado por cada dígito en números decimales entre 0 y 1 (hasta las cifras de las centésimas) y su relación con fracciones (1/2, 1/4, 3/4, 1/10, 1/100), empleo para cuantificar magnitudes, comparación entre números decimales y representación en la recta numérica.					
Resolución de problemas en contextos significativos, haciendo uso de la estimación y comparación de cantidades y medidas y de las operaciones conocidas en el ámbito de los números naturales hasta el 1.000.000.					
Uso de calculadora u otras herramientas tecnológicas para el estudio de regularidades numéricas y para facilitar el cálculo numérico, utilizando como criterios la cantidad de cálculos por realizar, el tamaño de los números y la complejidad de los cálculos.					
Transformación de números por aplicación reiterada de una regla aditiva y estudio de secuencias numéricas constituidas por múltiplos de un número.					
Empleo de cuadrículas para cuantificar o estimar el área de rectángulos o de figuras que pueden descomponerse en rectángulos.					
Reconocer redes y representaciones planas de objetos y cuerpos geométricos, e identificación del objeto representado.					
Producción y comunicación de información a partir de datos organizados en tablas y gráficos de barras simples, tanto verticales como horizontales.					
Resolución de problemas en los cuales es necesario extraer información desde tablas y gráficos de barras simples verticales y horizontales, comparación y formulación de afirmaciones respecto a las situaciones o fenómenos a los que se hace referencia.					

19. Considerando su preparación y su experiencia tanto en los contenidos curriculares como en las prácticas de enseñanza, ¿cuán preparado se siente usted para enseñar las siguientes áreas de Matemática en 4º Básico?

Marque con una equis (X) una sola alternativa para cada área.

	Nada preparado	Algo preparado	Bastante preparado	Muy preparado
Números naturales y valor posicional.				
Fracciones y números decimales.				
Operaciones aritméticas y estrategias de cálculo utilizando procedimientos basados en la descomposición aditiva de los números.				
Figuras geométricas.				
Cuerpos geométricos.				
Perímetro y área.				
Resolución de problemas atingentes a los contenidos del nivel.				

20. Considerando su preparación profesional, cuán seguro se siente usted de lograr:

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy seguro	Bastante seguro	Algo seguro	Nada seguro
que los estudiantes con dificultades de aprendizaje comprendan los contenidos.				
que los estudiantes con dificultades económicas aprendan.				
que los estudiantes con baja motivación se interesen y aprendan.				
que los estudiantes con mal comportamiento aprendan.				
que los estudiantes con dificultades emocionales (depresión, trastornos alimenticios, etc.) aprendan y salgan adelante.				
que hombres y mujeres aprendan con la misma profundidad.				

Acerca del establecimiento

21. ¿En qué medida está de acuerdo o en desacuerdo con las siguientes afirmaciones relacionadas con el proyecto educativo y las normas de convivencia de su establecimiento?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
El proyecto educativo es conocido por la comunidad escolar.				
En este establecimiento se cumplen los objetivos del proyecto educativo.				
Las normas de convivencia o disciplina son conocidas por la comunidad escolar.				
Las normas de convivencia o disciplina se respetan.				
Los profesores y los directivos aplican las normas de convivencia o disciplina con el mismo criterio.				
Se solicita justificativo del apoderado a los estudiantes, en caso de inasistencia.				

22. Considerando lo que sucede generalmente en su establecimiento, ¿en qué medida está de acuerdo o en desacuerdo con cada una de las siguientes afirmaciones?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Hay una relación de respeto entre profesores.				
Hay una relación de respeto entre profesores y estudiantes.				
Hay una relación de respeto entre los profesores y el equipo directivo.				
Siento confianza para pedir apoyo a otros profesores cuando tengo un problema.				
Siento confianza para pedir apoyo a miembros del equipo directivo cuando tengo un problema.				
El director o directora muestra preocupación por la formación de los estudiantes.				
A los profesores nos resulta difícil hacer clases por el desorden e indisciplina.				
El orden y disciplina se respetan.				
Los estudiantes cuidan el mobiliario e infraestructura del establecimiento.				

23. Durante este año escolar, ¿con qué frecuencia se han producido los siguientes tipos de agresiones en su establecimiento?

Marque con una equis (X) una sola alternativa para cada situación.

	Todos los días	Varias veces a la semana	Varias veces al mes	Un par de veces al año	Nunca
Robos o hurtos.					
Rumores mal intencionados, aislamiento ("ley del hielo") entre estudiantes.					
Peleas entre estudiantes (empujones, pateaduras, combos, etc.).					
Insultos, garabatos, burlas y descalificaciones entre estudiantes.					
Amenazas u hostigamiento entre estudiantes.					
Agresiones con armas blancas (cuchillos, cortaplumas) o manoplas, linchacos, etc.					
Agresiones o amenazas con armas de fuego.					
Estudiantes que rompen o dañan el establecimiento (rompen bancos, vidrios, sillas, computadores, etc.).					
Peleas entre estudiantes y profesores (empujones, golpes, etc.).					
Insultos, garabatos, burlas y descalificaciones entre estudiantes y profesores.					

Bullying es una manifestación de violencia en la que un estudiante es agredido y se convierte en víctima al ser expuesto, de forma repetida y durante un tiempo, a acciones negativas por parte de uno o más compañeros.

24. Considerando esta definición, señale si han ocurrido los siguientes tipos de bullying a los estudiantes de los cursos en los que ha hecho clases durante este año en este establecimiento.

Marque con una equis (X) una sola alternativa para cada situación.

	Sí	No	No sabe
Físico (a algún estudiante lo han golpeado o le han roto sus cosas, en forma sistemática).			
Verbal (algún estudiante ha sido objeto de burlas o ha sido amenazado, reiteradamente).			
Social (algún estudiante ha sido excluido de un grupo y menoscabado frente a sus compañeros en forma sistemática).			
Electrónico (algún estudiante ha sido objeto de intimidación o acoso por internet, correos electrónicos o mensajes de textos, por parte de sus compañeros reiteradamente).			

25. Basándose en su experiencia concreta en este establecimiento, ¿en qué medida está de acuerdo o en desacuerdo con cada una de las siguientes afirmaciones sobre bullying?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Existen normas para enfrentar situaciones de bullying.				
Todos los profesores conocen las normas para enfrentar situaciones de bullying.				
Los directivos y los profesores toman las medidas pertinentes frente a denuncias de bullying.				
El equipo directivo del establecimiento promueve instancias de trabajo y discusión para que los profesores puedan enfrentar eficazmente situaciones de bullying.				

26. ¿Con qué frecuencia ocurren las siguientes situaciones en su establecimiento?

Marque con una equis (X) una sola alternativa para cada situación.

	Todos los días	Varias veces a la semana	Varias veces al mes	Un par de veces al año	Nunca
Un estudiante roba la colación de un compañero.					
Un estudiante roba dinero, un celular o algo valioso a un compañero.					
Los estudiantes hacen la cimarra.					
Los estudiantes copian en las pruebas.					
Los estudiantes copian sus trabajos desde internet.					
Los estudiantes mienten para evitar un castigo.					

27. En general, ¿ocurren las siguientes situaciones entre estudiantes de 7° y 8° Básico de este establecimiento?

Marque con una equis (X) una sola alternativa para cada situación.

	Sí	No	No sabe
Hay estudiantes que fuman cigarrillos durante la jornada escolar.			
Hay estudiantes que consumen bebidas alcohólicas (cerveza, vino, ron) durante la jornada escolar.			
Hay estudiantes que consumen drogas (marihuana, pasta base o cocaína) durante la jornada escolar, en fiestas o paseos escolares.			

28. Durante este año, ¿algún estudiante del establecimiento ha sido descalificado, excluido o maltratado por otros estudiantes, sus profesores o los directivos, por alguno de los siguientes motivos?

Marque con una equis (X) una sola alternativa para cada motivo.

	Sí	No	No sabe
Sus notas o calificaciones.			
La ropa que usa.			
Su apariencia física.			
El lugar donde vive.			
Ser de otro país.			
Pertenecer a un pueblo originario.			
Su religión.			
Tener una discapacidad.			
Ser hombre.			
Ser mujer.			
Otro motivo.			
Escriba cuál:			

29. ¿En qué medida está de acuerdo o en desacuerdo con las siguientes afirmaciones relacionadas con el director o directora de este establecimiento?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Creo que el director o directora de este establecimiento hace bien su trabajo.				
Siento que puedo confiar en el director o directora de este establecimiento.				
Creo que las decisiones que el director o directora toma están bien orientadas para enfrentar los desafíos de este establecimiento.				
Es efectivo y oportuno en resolver los problemas del establecimiento.				
Comunica de manera clara las metas del establecimiento para el año.				
Gestiona los recursos económicos y humanos de manera adecuada.				
Es capaz de generar que todos o la mayoría de los profesores se comprometan con las metas del establecimiento.				
Genera instancias y actividades de encuentro entre estudiantes, apoderados y profesores.				
Involucra a los apoderados en las actividades del establecimiento.				
Está atento a las necesidades de los profesores.				
Está atento a las necesidades de los estudiantes.				
Genera instancias de toma de decisiones donde se involucra la opinión de los profesores.				
Informa a la comunidad escolar sobre los logros académicos del establecimiento.				
Da cuenta de su gestión anual a la comunidad escolar.				
Promueve una buena convivencia y clima en el establecimiento.				

30. ¿En qué medida está de acuerdo o en desacuerdo con las siguientes afirmaciones relacionadas con el equipo directivo de este establecimiento?

Marque con una equis (X) una sola alternativa para cada afirmación.

El equipo directivo:	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Favorece el trabajo autónomo de los profesores.				
Tiene altas expectativas del trabajo de los profesores.				
Involucra a los profesores en la definición de metas pedagógicas.				
Tiene altas expectativas respecto a los logros de aprendizaje que pueden alcanzar los estudiantes en este establecimiento.				
Promueve instancias sistemáticas en que los profesores tienen la posibilidad de discutir sobre asuntos y estrategias pedagógicas.				
Evalúa el impacto de la labor docente en los logros de los estudiantes.				
Observa y supervisa sistemáticamente los métodos utilizados por los docentes en la sala de clases.				
Después de la observación y supervisión, ayuda y apoya a los docentes para mejorar su rendimiento.				
Propone a los docentes estrategias pedagógicas específicas para mejorar el aprendizaje de los estudiantes.				
Realiza un seguimiento sistemático de la situación y progreso del aprendizaje de los estudiantes.				
Define con claridad metas de aprendizaje para el año escolar.				
Evalúa las metas de aprendizaje a través de pruebas de nivel.				
Se hace responsable y participe de los resultados obtenidos por los estudiantes.				
Promueve el perfeccionamiento de los profesores (becas, tiempo para capacitaciones).				
Procura que los profesores no se distraigan de su labor principal (enseñanza) a través de la reducción de presiones externas o administrativas.				

31. En un año común, ¿cuáles de las siguientes actividades se realizan en el establecimiento?

Marque con una equis (X) SI o No según corresponda.

	SI	No
Actividades de inicio y cierre de períodos académicos (Inicio de año, Fin de año, Licenciatura 8° Básico, Egreso 4° Medio).		
Actividades recreativas (bingos, kermeses, festivales, etc.).		
Actividades deportivas (campeonatos de estudiantes, encuentros deportivos padres-hijos, campeonatos interescolares, etc.).		
Actividades académicas y culturales (concursos de debate, feria de ciencia y tecnología, encuentros literarios, exposiciones de arte, etc.).		
Campañas solidarias (colectas de dinero o alimentos, etc.).		
Actividades conmemorativas (Fiestas Patrias, ceremonias religiosas, efemérides).		

32. ¿En qué medida está de acuerdo o en desacuerdo con las siguientes afirmaciones acerca de este establecimiento?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy de acuerdo	De acuerdo	En desacuerdo	Muy en desacuerdo
Me siento orgulloso de trabajar en este establecimiento.	☐	☐	☐	☐
Hablo bien de este establecimiento a otras personas.	☐	☐	☐	☐
Recomendaría este establecimiento a familiares y amigos para que matriculen a sus hijos.	☐	☐	☐	☐
Recomendaría este establecimiento a otros profesores para trabajar.	☐	☐	☐	☐

33. ¿Cambiaría de establecimiento educacional si le ofrecieran un trabajo que tuviera condiciones similares (sueldo, horario, condiciones físicas, etc.)?

☐ Sí ☐ No

Acerca de los resultados SIMCE

34. El *Informe de Resultados para Docentes y Directivos SIMCE 4º Básico 2010* es un documento donde aparecen los resultados de SIMCE que obtuvo el establecimiento. Durante el año 2011, ¿tuvo acceso a dicho informe?

☐ Sí ☐ No. *(Si marcó No, pase a la pregunta 37)*

35. Pensando en el *Informe de Resultados para Docentes y Directivos SIMCE 4º Básico 2010*, ¿cómo evalúa la claridad de los siguientes aspectos?

Marque con una equis (X) una sola alternativa para cada afirmación.

	Muy claro	Bastante claro	Poco claro	Nada claro
Presentación de los resultados nacionales (puntajes promedio y niveles de logro).	☐	☐	☐	☐
Comparaciones de los resultados nacionales.	☐	☐	☐	☐
Presentación de los resultados de su establecimiento (puntajes promedio y niveles de logro).	☐	☐	☐	☐
Comparaciones de los resultados de su establecimiento.	☐	☐	☐	☐
Taller de Análisis de Resultados SIMCE.	☐	☐	☐	☐

36. ¿Cuán útil considera el *Informe de Resultados para Docentes y Directivos SIMCE 4º Básico 2010* para realizar las siguientes estrategias?

Marque con una equis (X) una sola alternativa para cada estrategia.

	Muy útil	Bastante útil	Poco útil	Nada útil
Identificar los conocimientos y habilidades alcanzados por los estudiantes.	☐	☐	☐	☐
Identificar los conocimientos y habilidades que requieren mayor trabajo con los estudiantes.	☐	☐	☐	☐
Retroalimentar sus prácticas de aula.	☐	☐	☐	☐
Redefinir la metodología y el tipo de evaluaciones que realiza en este nivel.	☐	☐	☐	☐
Complementar la información que usted obtiene a partir de las evaluaciones internas (por ejemplo, pruebas aplicadas al finalizar una unidad de contenidos).	☐	☐	☐	☐
Trabajar en conjunto con otros profesores del nivel, un plan de trabajo para mejorar los aprendizajes de los estudiantes.	☐	☐	☐	☐

37. Las *Orientaciones para la Medición SIMCE 4º Básico 2011* es un documento que entrega información de los niveles que deben rendir las pruebas, los conocimientos y habilidades que se evaluarán, entre otros aspectos. ¿Tuvo usted acceso a este documento?

Marque con una equis (X) una sola alternativa.

☐ Sí ☐ No ☐ No sabe o no recuerda

Acerca de sus hábitos de lectura

38. ¿Se considera una persona lectora?

☐ Sí ☐ No

39. ¿Qué tipo de texto lee por lo menos una vez a la semana?

Marque con una equis (X) todas las alternativas que correspondan.

☐ Novelas.
☐ Otros textos literarios (por ejemplo: poemas, obras dramáticas, cuentos).
☐ Periódicos.
☐ Revistas.
☐ Correos electrónicos.
☐ Blogs y páginas de internet.
☐ Textos de trabajo (informes, documentos).
☐ Periódicos o revistas en formato digital / electrónico.
☐ Información en redes sociales en internet (facebook, twitter).

40. Considerando todos los tipos de textos mencionados, ¿cuánto tiempo a la semana le dedica a la lectura?

Marque con una equis (X) una sola alternativa.

☐ Más de siete horas a la semana.
☐ Entre tres y siete horas a la semana.
☐ Menos de tres horas a la semana.
☐ No leo.

41. Usted lee principalmente para:

Marque con una equis (X) una sola alternativa.

☐ Entretenerse en el tiempo libre.
☐ Aprender a realizar alguna tarea.
☐ Obtener conocimientos generales.
☐ Obtener información de actualidad.
☐ Desempeñarse adecuadamente en el trabajo.

¡Muchas gracias por su tiempo y colaboración!

Appendix U: Teachers' Questionnaire English Translation Version

Teachers' questionnaire
SIMCE 2011 4º **BÁSICO [Fourth grade]**

School information		
RBD del establecimiento	Letra del curso	CLN Curso
__ __ __ __ - __	4º __	__ __ __ __ __

Introduction
The Ministry of Education invites you to participate in the process SIMCE 2011 4th Grade by answering this questionnaire.
The information you provide will allow us to better understand the learning outcomes achieved by student test takers and support their schooling process.
The questionnaire responses are confidential and no event shall be revealed the identity of the person who answers it. The questionnaire responses only will be used for research purposes by the Ministry of Education and institutions conducting studies on education.
Directions
Please answer all questions in this questionnaire, thinking about the 4th graders that took SIMCE 2011 test mentioned at the beginning of this questionnaire.
Mark the questionnaire using only blue or black ink.
Read each question and mark with an 'X' in the box for your answer. In some cases you must mark only one box and other cases you must mark more than one.
If you mark the wrong box, fill around the box and mark a new 'X' in the appropriate box
When you are asked to enter numbers and/or write respons, please do so in a clear, precise and easy way to read. Please do not fold this questionnaire and take care that the questionnaire does not become damaged.
Once you have completed the questionnaire, put it in the envelope provided that comes in, seal the envelope and return it to the person responsible for the implementation of the test SIMCE before Thursday, October 13.

Thank you very much for your feedback

1. You are:
☐ Male ☐ Female

2. What year did you born?
Write the year of your birth date, for example, 1971.

__ __ __ __

3. Do you have the teacher's certificate?
Mark with an 'X' only one option.
☐ Yes, from a Normal School
☐ Yes, from a traditional university in Santiago
☐ Yes, from a traditional university outside Santiago
☐ Yes, from a private university
☐ Yes, from an Professional Institution or Technical Institution
☐ No, but I am studying or I am finishing my teacher program
☐ No, but I have a certificate in another field (if you marked this box follow question 6)

4. Your certificate is…
Mark with an 'X' all options that apply.

Elementary school	High school
☐ No specialty	☐ Major in language
☐ Specialty in Language	☐ Major in mathematics
☐ Specialty in Mathematics	☐ Major in science
☐ Specialty in Science	☐ Major in chemistry
☐ Specialty in Social science	☐ Major in physics
☐ Another specialty	☐ Major in social science
	☐ Anothe major

5. ¿what year did you obtain your teacher's certificate?
Write the year, for example, 1996.

__ __ __ __

6. Have you done any of the following graduate studies (at least one year) in the area of education or a related major?
__ Diploma ___ Post tittle ___ Master degree___ Doctorate __ None

7. What year started teaching in any school?
Write the year, for example, 1996.

__ __ __ __

8. From what year have you teach in this school?
Write the year, for example, 2005.

__ __ __ __

9. What kind of job contract do you have in this school? *Mark with a cross (X) only one option.*
☐ Permanent contract (titular)
☐ Non permanent contract (a contract)
☐ Replacement contract
☐ Contract fees
☐ Other

10. How many teaching-hours (45 minutes each) a week you devote to teach in any classroom at this school?
Clearly write the number of teaching-hours, consider all the courses and classes which you teach in this school.
__ __ teaching-hours per week

About this 4th Grade

11. Thinking now about this 4th grade that took SIMCE 2011, which subject matter do you teach in this 4th grade? *Mark with* an 'X' *all options that apply*.
☐ Language
☐ Mathematics
☐ Science
☐ History, geography and social science

12. Looking at the fourth-grade students who took SIMCE 2011, what future schooling do you predict for most of them?

Mark with an 'X' *only one.*

☐ I do not think they will graduate from high school.
☐ They will graduate from technical high school.
☐ They will graduate from scientific-humanistic high school.
☐ They will graduate from a technical institution.
☐ They will graduate from college.
☐ They will attend the graduate school.

13. To what extent do you agree or disagree with each of the following statements concerning the 4th grade assessed?

Mark with an 'X' *only one of the options per statement*.

	Strongly agree	Agree	Desagree	Strongly desagree
Students treat teachers with respect				
Students listen respectfully to their classmates				
There are fights between students during the class				
In this 4th grade is hard to start to teach the class				
The instruction is usually discontinued because the teacher must be silenced or call attention to the students.				
Students work following the instructions given by the teacher				
Students keep the classroom clean				

Answer the following questions only if you taught mathematics in the 4th grade assessed. Otherwise, go to question 20.

14. How often do you use the following strategies during your mathematics class?

Mark with an 'X' *only one of the options per strategy*.

	Always	Often	Sometimes	Never
Students' group work during the class				
Students work individually in class				
Express learning objetives				
Uses students feedback (questions and answers) to organize lesson				
Students' presentation on a topic				
Students participate in forums on issues of the subject				
Field trips to support any topic of the subject.				
Design and implement group projects with written report.				

15. How often do you use the following assessment methodologies of learning in the math class in this 4th grade?

Mark with an 'X' *only one of the options per assessment methodology*.

	Always	Often	Sometimes	Never
Diagnostic tests				
Tests with true or false answers				
Tests with solving problem answer				
Written report or research Project individual or groupal to be graded				
Self-evaluations or peer-evaluations				

16. How often do you leave Mathematics homework to this 4th grade?

Mark with an 'X' *only one of the options.*

☐ All classes.
☐ Most of the classes.
☐ Some clases.
☐ Never.

17. How often do you use the following activities to provide students with feedback in your mathematics class?

Mark with an 'X' *only one of the options per activity.*

	Always	Often	Sometimes	Never
Check homework				
Solve homework problems in class				
Explain topic again if a student asks				
Explain the content until all students understand				
Explain the test solution to the whole class				
Explain the workbook and textbook exercises solutions to the whole class				

18. Given that class time is limited and you are not likely able to address all curricular content, we ask you to indicate to what extent you taught the following topics in your mathematics class?
Mark with an 'X' *only one of option per content.*

	Not yet taught	Some of it	Most of it	All of it	Not included this year
1. Read, write and form natural numbers up to 1,000,000, as a result of the learning; interpretation of information provided through these numbers; and use them to communicate information in different contexts					
2. Recognition value represented by 1,000,000. Recognition of the value represented by each digit in numbers up to 1,000,000, according to its position and its relation to the concepts of unit thousand, ten thousand, and hundred thousand					
3. Put number on number line. Representation of natural numbers or subsets of them on the number line and use the symbols <,> and = to order and compare whole numbers within the number set studied.					
4. Written calculation of products and quotients with and without remainder, using methods based on the additive decomposition of numbers, in the properties of multiplication and the relationship between the two procedures.					
5. Mental and written calculations when it is appropiate, combined with natural numbers in the numerical field calculation operations studied.					
6. Rounding Numbers and their application to estimate quantities or measures, results of operations or to detect any miscalculations.					
7. Meaning, read and write simple fractions or frequently used (1/2, 1/3, 1/4, 1/8, 3/4, 1/10, 1/100), its use to quantify and compare parts of an object, a unit of measurement or a collection of items; comparing fractions and representation on the number line.					
8. Reading, writing and recognizing decimal numbers between 0 and 1. Reading, writing and recognition of the value represented by each digit decimal number between 0 and 1 (up to hundredths place) and its relationship with fractions (1/2, 1/4, 3/4, 1/10, 1 / 100), employment figures to quantify, and place decimal numbers on the number line.					
9. Solving problem in meaningful contexts, using estimation and comparison of quantities and					

measures and operations known in the field of natural numbers up to 1,000,000.					
10. Using calculator or other technological tools to study numerical regularities and to facilitate the numerical calculation tools, using as criteria the number of calculations to be performed, the size of the numbers and complexity of the calculations					
11. Transforming numbers applying reiteratively rule addition and study of number sequences formed by multiples of a number.					
12. Using grids to estimate areas. Using grids to quantify or estimate the area of rectangles or figures that can be decomposed into rectangles.					
13. Recognize net and flat representations of 2D and 3D figures, and identification of the object represented					
14. Communication of information provided by charts and graphics organized in simple bar, vertical and horizontal					
15. Solving problems using information from tables and charts, and graphs of simple vertical and horizontal bars, comparison and making statements about the situations or phenomena to which reference is made.					

19. Considering your preparation and experience in curriculum content and teaching practices, how prepared do you feel to teach the following content areas in your mathematics class?

Mark with an 'X' *only one of the option per area.*

	Not prepared	Somewhat prepared	Quite prepared	Well prepared
Natural numbers and place value.				
Fractions and decimals.				
Arithmetic operations and calculation using strategies of decomposition of numbers				
2D Geometric figures				
3D Geometric figures				
Perimeter and area				
Solving problems related to the content of this grade				

20. Considering your professional preparation, how sure do you feel to achieve?:

Mark with an 'X' *only one of the options per statement.*

	Very sure	enough sure	some sure	unsure
That the students with learning disabilities to understand the content				
That the students with financial difficulties learn				
That the students with low interest and motivation learn				
That misbehaved students learn.				
That students with emotional difficulties (depression, eating disorders, etc.) learn and get ahead				
That men and women learn the same depth				

About this school

21. To what extent do you agree or disagree with the following statements related to the educational project and the terms of use in this school?

Mark with an 'X' *only one of the statements.*

	Strongly agree	Agree	Disagree	Strongly disagree
The educative project of the school is known for the school community.				
At this school, the educative-project- objectives are met.				
The rules of behavior or discipline are known for the school community.				
The rules of behavior or discipline are respected				
The teachers and the school administrative apply the rules of behavior or discipline with the same criteria.				
Students are requested justification from their parents in the event of absence at the school.				

22. Considering what usually happens at school, do you agree or disagree with the following statements?
Mark with an 'X' *only one of the options per statement.*

	Strongly agree	Agree	Disagree	Strongly disagree
There is a respectful relationship among teachers.				
There is a respectful relationship between teachers and students.				
There is a respectful relationship between teachers and the school administrative.				
I feel confident to ask for support from other teachers when I have a problem.				
I feel confident to ask for support to the school administrative when I have a problem.				
The principal is concerned about the education of the students.				
The teachers we have difficulty time to teach because of the disorder and indiscipline in the classroom.				
Order and discipline are respected.				
Students care about the furniture and infrastructure of the school.				

23. During this school year, how often have occurred the following types of attacks on this school?
Mark with an 'X' *only one option for each situation.*

	Everyday	Several times a week	Several times a month	A few times a year	Never
Robbery or theft					
Malicious rumors, isolation ("silent treatment") among students.					
Fights between students (pushing, kicking, fists, etc.)					
Insults, swear, taunts and insults between students.					
Threats or harassment between students.					
Assaults with knives (knives, knife) or steel knuckles, Nunchaku, etc.					
Attacks and threats with firearms.					
Students who break or damage property (broken banks, glasses, chairs, computers, etc.).					
Fights between students and teachers (pushing, hitting, etc.).					
Insults, swear, taunts and insults between students and teachers					

Bullying is a form of violence in which a student is attacked and becomes a victim to be exposed, repeatedly and over time, to negative actions by one or more classmates

24. Considering this definition, indicate whether the following types of bullying to the students in this 4th grade in this school.

Mark with an 'X' *only one option for each situation.*	Yes	No	Do not know
Physical (a student has been hit or his stuff have been broken in a systematic way).			
Verbal (a student has been teased or been threatened repeatedly).			
Social (a student has been excluded from a group and prejudiced against their peers in a systematic way).			
Electronic (a student has received intimidation or harassment by internet, email or text messages for his/her peers repeatedly).			

25. Relying on your specific experience in this school, to what extent do you agree or disagree with each of the following statements about bullying?

Mark with an 'X' *only one of the options per statement.*	Strongly Agree	Agree	Disagree	Strongly disagree
There are rules to address bullying situations.				
All teachers know the rules to address bullying situations.				
Administratives of the school and teachers take the appropriate measures against delation of bullying.				
The school administrative promotes workshop and discussion for teachers to deal effectively with bullying situations.				

26. How often these situations occur in this school?

Mark with an 'X' *only one of the option per statement.*

	Everyday	Several times a week	Several times a month	A few times a year	Never
A student steals the snack to a classmate.					
A student steals money, a cell phone or something valuable to a classmate.					
Students make truancy.					
Students cheat on the tests.					
Students copy their homework from internet.					
Students lie to avoid punishment.					

27. In general, the following situations happen between 7th grade students and 8th grade students at this school?

Mark with an 'X' *only one the options per situation.*	Yes	No	Do not know
There are students who smoke cigarettes during the school day.			
There are students who drink (beer, wine or rum) during the school day.			
There are students who use drugs (marijuana, cocaine or pasta base) during the school day, at parties or field trips.			

28. During the year in this school, did any student was disqualified, excluded or mistreated by other students, teachers or school administrative for any of the following reasons?

Mark with an 'X' *only one of the option per statement.*

	Yes	No	Do not know
Their grades.			
Theirs clothes.			
Their physical appearance.			
The neiborhood where they live.			
Being a foreign country.			
Belong to some native people.			
Their religion.			
Having a disability.			
Being male.			
Being female.			
Another reason.			
Write which one:			

29. How much do you agree or disagree with the following statements related to the principal of the school?

Mark with an 'X' *only one of the options per statement.*

	Strongly agree	Agree	Disagree	Strongly disagree
I think the school's principal does her job well.				
I feel I can trust the school's principal.				
I think the principal's decisions are well geared to meet the challenges of this school.				
The principal is effective and appropriate in solving the problems of the school.				
The principal communicates clearly setting goals for the academic year.				
Manages the financial and human resources adequately.				
The principal is able to generate that all or most of the teachers are committed to the goals of the school				
Generates instances and activities to meet students, parents and teachers				
Involve parents in the school's activities of the establishment.				
She is attentive to the needs of the teachers.				
She is attentive to the needs of students.				
Generates instances of decision making where the opinion of the teachers is involved.				
Inform the school community about the academic achievement of the school.				
Informs her annual management to the school community.				
Promotes good relations and climate in the school.				

30. To what extent do you agree or disagree with the following statements related to the school administrative.

Mark with an 'X' *only one of the options per statement.*

The school administrative:	Strongly agree	Agree	Disagree	Strongly disagree
It promotes self-work of teachers.				
Has high expectations of teachers' work.				
Involves teachers in defining educational goals				
Have high expectations for learning achievements that can reach students at this school.				
Promotes systematic instances where teachers have the opportunity to discuss issues and teaching strategies.				
Evaluate the impact of teaching on students' achievement.				
Observe and monitor systematically the methods used by teachers in the classroom.				
After observation and supervision, assists and supports teachers to improve their performance.				
Propose to teachers specific instructional strategies to improve the students' learning.				
Make a systematic monitoring of the status and progress of student learning.				
Clearly defined learning goals for the school year.				
Evaluates learning goals through placement tests.				
It is responsible and accountable for the results achieved by students.				
Promotes the development of teachers (grants, training time).				
Make sure that teachers are not distracted from their main task (teaching) through reducing external pressures or administrative.				

31. In a typical year, which of the following activities are made in the school?

Mark with an 'X' *Yes or No as appropriate.*

	Yes	No
Activities start and end of academic periods (Home of the year, end of the academic year, graduation 8th grade, graduation 12th grade).		
Recreational activities (bingos, kermeses, festivals, etc.).		
Sports activities (championships students, parent-child sports events, inter-schools championships, etc.).		
Academic and cultural activities (debate contests, science fair, literary events, art exhibitions, etc.).		
Solidarity campaigns (collecting money or food, etc.).		
Commemorative activities (Fiestas Patrias, religious ceremonies, anniversaries)		

32. To what extent do you agree or disagree with the following statements about this school?
Mark with an 'X' *only one of the options per statement.*

	Strongly agree	Agree	Disagree	Stongly disagree
I am proud to teach in this school.				
I speak highly of this school to the others.				
I would recommend this school to family and friends to enroll their children.				
I would recommend this school to other teachers to work.				

33. Would you move to another school if you were offered a job that had similar conditions (wages, hours, physical condition, etc.)

☐ Yes ☐ No

About SIMCE results

34. The Report Results for Teachers and Schools' principals of SIMCE 4th Grade 2010 is a document where the results obtained in SIMCE of this school appears. During 2011, did you have access to this report?

☐ Yes ☐ No *(if you marked **No** follow question 37)*

35. Thinking Results Report for Teachers and schools' principals SIMCE 4th Grade 2010, how do you rate the clarity of the following statement?
Mark with an 'X' *only one option per statement.*

	Very clear	Enough clear	Little clear	Unclear
Presentation of national results (mean scores and achievement levels).				
Comparisons of national performance.				
Presentation of the results of this school (average scores and achievement levels).				
Comparisons of the results of this school.				
Workshop of analysis of SIMCE results.				

36. How useful you consider the Results Report for Teachers and school's principals SIMCE 4th Grade 2010 to perform the following strategies? *Mark with* an 'X' *only one of the options per strategy.*

	Very useful	Useful	Some useful	No useful
Identify the knowledge and skills acquired by students.				
Identify the knowledge and skills which still need to develop with the students.				
Feedback their classroom practices				
Refine the methodology and type of assessments conducted at this level				
Supplement the information that you get from internal evaluations (e. g. tests administered at the end of a unit of contents).				
Work with another teachers of the level (same grade) in a plan to improve students' learning.				

37. The Guidelines for Measuring SIMCE 4th Grade 2011 is a document that provides information on the grades to take the test, knowledge and skills to be assessed, among other things. Did you have access to this document?

Mark with an 'X' *only one of the options*.

☐ Yes ☐ No ☐ Do not know or remember

About your reading habits

38. **¿ Are you a reader person?**

☐ Yes No

39. What type of text do you **read at least once a week?**

Mark with an 'X' *all options that apply.*

☐ Novels.	☐ Blogs and Internet sites.
☐ Other literary texts (e.g. poems, plays, short stories).	☐ Working texts (reports, documents).
☐ Newspapers.	☐ Newspapers or magazines in digital/electronic form.
☐ Magazines	☐ Information on social network sites (Facebook, twitter).
☐ Emails.	

40. Considering all the above types of texts, how much time per week you spend on reading?

Mark with an 'X' *only one of the options).*

☐ More than seven hours a week
☐ Three to seven hours a week.
☐ Less than three hours a week.
☐ I do not read.

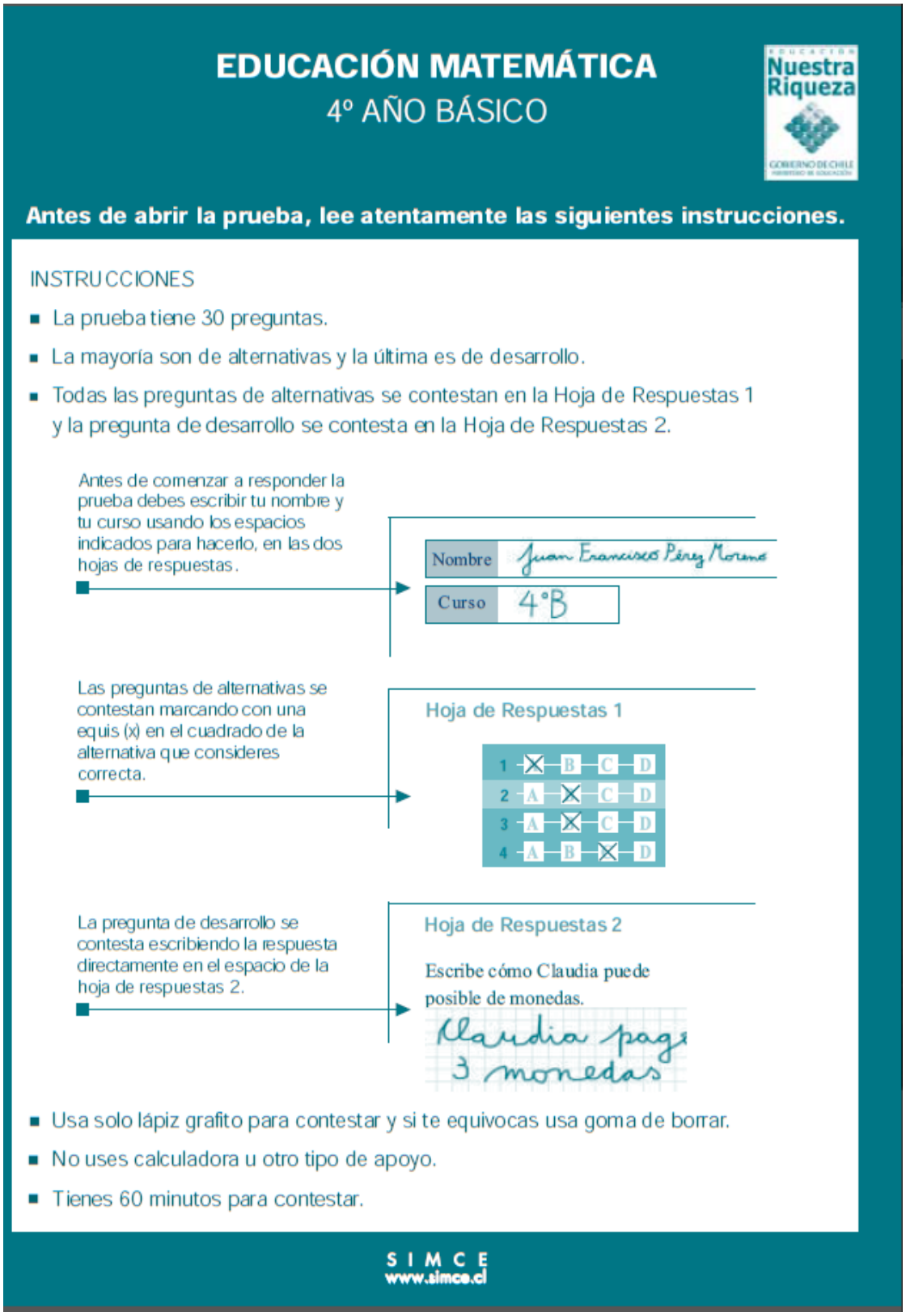
41. You read mostly for:

Mark with a an 'X' *only one of the options.*

☐ For fun in your free time.
☐ Learning to perform some task.
☐ Get general knowledge.
☐ Get current information.
☐ Perform adequately at work.

Thank you very much for your feedback!

Appendix V: Model of SIMCE Mathematics Examination 2007 Spanish Original Version



EDUCACIÓN MATEMÁTICA

4º AÑO BÁSICO

Antes de abrir la prueba, lee atentamente las siguientes instrucciones.

INSTRUCCIONES

- La prueba tiene 30 preguntas.
- La mayoría son de alternativas y la última es de desarrollo.
- Todas las preguntas de alternativas se contestan en la Hoja de Respuestas 1 y la pregunta de desarrollo se contesta en la Hoja de Respuestas 2.

Antes de comenzar a responder la prueba debes escribir tu nombre y tu curso usando los espacios indicados para hacerlo, en las dos hojas de respuestas.

Nombre: Juan Francisco Pérez Moreno

Curso: 4°B

Las preguntas de alternativas se contestan marcando con una equis (x) en el cuadrado de la alternativa que consideres correcta.

Hoja de Respuestas 1

	A	B	C	D
1		X		
2			X	
3			X	
4		X		

La pregunta de desarrollo se contesta escribiendo la respuesta directamente en el espacio de la hoja de respuestas 2.

Hoja de Respuestas 2

Escribe cómo Claudia puede
posible de monedas.

Claudia paga
3 monedas

- Usa solo lápiz grafito para contestar y si te equivocas usa goma de borrar.
- No uses calculadora u otro tipo de apoyo.
- Tienes 60 minutos para contestar.

SIMCE
www.simce.cl

1 ¿Cuál de los siguientes objetos puede ser representado con un cilindro?

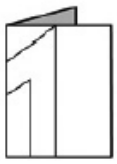
A. 

B. 

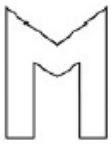
C. 

D. 

2 Se dobla una hoja y se dibuja en ella la mitad de una letra. Al recortar la hoja doblada se forma la letra completa, como se muestra en los siguientes dibujos.



Hoja doblada



Recorte de la letra

¿Cuál de las siguientes letras se puede dibujar y recortar, usando esta misma técnica?

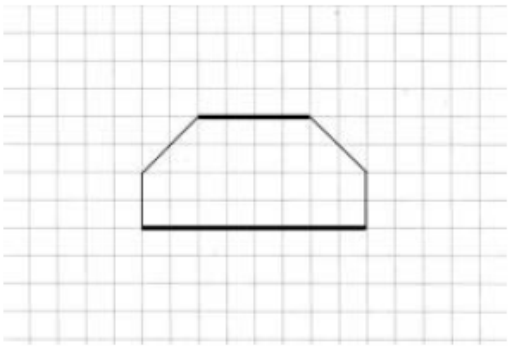
A. 

B. 

C. 

D. 

3 Para los dos lados gruesos de esta figura, ¿cuál de las siguientes afirmaciones es verdadera?



A. Son paralelos y de igual largo.
B. Son paralelos y de distinto largo.
C. Son perpendiculares y de distinto largo.
D. Son perpendiculares y de igual largo.

4 Señala cuál es el resultado de

$$234 + 826 + 48$$

A. 1 008
B. 1 098
C. 1 108
D. 1 508

5 Para calcular cuánta guirnalda comprar, varios niños midieron el ancho de la sala de clases, pero anotaron distintos resultados.

¿Cuál resultado podría ser el correcto?

A. 5 centímetros.
B. 50 centímetros.
C. 5 metros.
D. 50 metros.

6 En una promoción de bebidas, dan una figura por cada tres tapas marcadas. Ramón tiene 6 tapas marcadas, ¿cuántas figuras le tienen que dar por las 6 tapas marcadas?

A. 2
B. 3
C. 9
D. 18

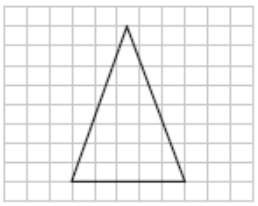
7 Francisca perdió 14 láminas de su colección.

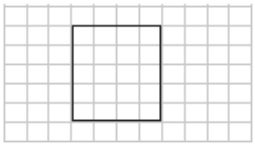
Para averiguar cuántas láminas tiene ahora, ¿qué necesita saber?

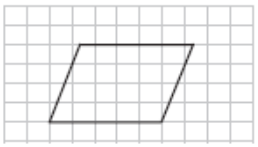
A. Cuántas láminas tiene repetidas.
B. Cuántas láminas quiere juntar.
C. Cuántas láminas tenía antes.
D. Cuántas láminas perdió.

8 ¿Cuál de las siguientes figuras tiene ángulos rectos?

A. 

B. 

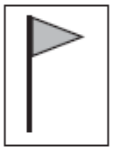
C. 

D. 

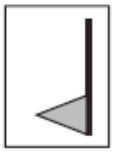
9 La siguiente caja está cerrada. ¿Cuántos vértices tiene?

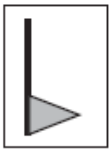
A. 6
B. 7
C. 8
D. 12

10 Una lámina se encuentra en la siguiente posición:



¿Cómo se verá la lámina si se gira a la derecha, en la dirección que indica la flecha?

A. 

B. 

C. 

D. 

11 En una familia, todos los días se ocupan 5 bolsitas de té.

Antes de comprar una caja de 100 bolsitas de té, la mamá hizo el siguiente cálculo:

$$100 : 5 = 20$$

¿Cuál de las siguientes preguntas puede responder la mamá con el resultado de este cálculo?

A. ¿Cuánto dinero cuesta cada bolsita de té?
B. ¿Cuántas tazas de té prepara con una bolsita?
C. ¿Cuántas bolsitas de té contiene la caja?
D. ¿Cuántos días le durará la caja de té?

12 Marcela tiene una colección de 184 estampillas, de las cuales 52 son de América, 65 son de Europa y las demás son de África.

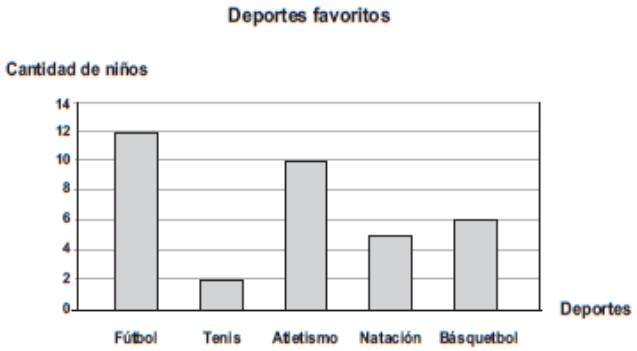
¿Cuántas estampillas de la colección de Marcela son de África?

A. 13
B. 67
C. 117
D. 301

13 Si 4 bebidas cuestan $ 3 800, ¿cuál es el valor que más se aproxima al precio de 8 bebidas del mismo tipo?

A. $ 4 000
B. $ 8 000
C. $ 10 000
D. $ 24 000

14 A un grupo de niños se le preguntó cuál es su deporte favorito. En el siguiente gráfico se muestran los resultados de esta encuesta.



¿Cuántos niños contestaron la encuesta?

A. 5

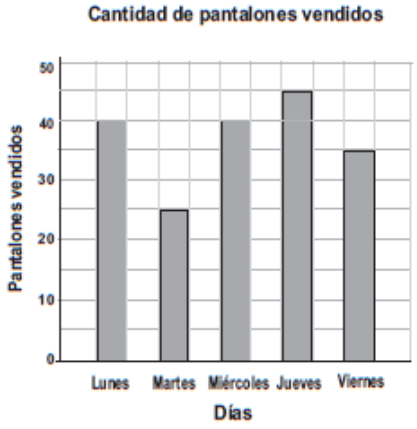
B. 13

C. 14

D. 35

Observa el siguiente gráfico y responde las preguntas 15 y 16.

En el gráfico se muestra la cantidad de pantalones vendidos en una tienda durante 5 días de una semana.



15 ¿En qué días se vendieron exactamente 40 pantalones?

A. El miércoles y el jueves.
B. El lunes y el viernes.
C. El lunes y el miércoles.
D. El jueves y el viernes.

16 ¿Cuántos pantalones se vendieron durante esos 5 días?

A. 40
B. 45
C. 170
D. 185

17 ¿Cuál de los siguientes problemas podría resolver Ricardo multiplicando 6 por 12?

A. Tengo 6 platos con 12 galletas cada uno.
¿Cuántas galletas tengo en total?

B. Tengo 6 autitos rojos y 12 azules.
¿Cuántos autos tengo en total?

C. Tengo 12 lápices de colores en mi estuche y presto 6.
¿Cuántos me quedan?

D. Tengo 12 bolitas y las reparto entre mis 6 amigos.
¿Cuántas bolitas son para cada uno?

18 Fíjate en el cartel del Almacén Don Tito.

La señora Elena hace los siguientes cálculos:

Divido 540 por 2 y me da 270, luego le sumo 380 y me da 650.

Entonces ella calculó cuánto le cuestan:

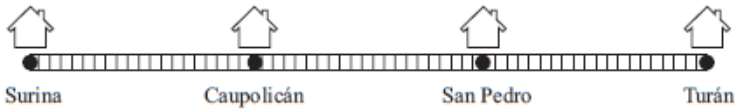
A. $\frac{1}{2}$ kilo de pan y 1 kilo de manzanas.

B. 2 kilos de pan y 1 kilo de manzanas.

C. 1 kilo pan y $\frac{1}{2}$ litro de aceite.

D. 2 kilos de pan y $\frac{1}{2}$ litro de aceite.

19 El dibujo muestra el recorrido que hace un tren entre distintos pueblos que se encuentran a igual distancia cada uno del siguiente:



Si Jorge vive en Surina y viaja a Turán, ¿qué parte del recorrido total habrá hecho cuando el tren se detenga en Caupolicán?

A. El total del recorrido.
B. La mitad del recorrido.
C. La tercera parte del recorrido.
D. La cuarta parte del recorrido.

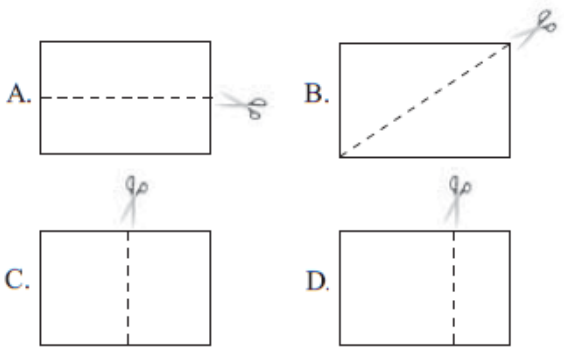
20 Señala cuál es el resultado de

$$42 - 20 : 2$$

A. 2
B. 10
C. 11
D. 32

21 Si tienes un rectángulo como este 

¿con cuál de los siguientes cortes podrías obtener un cuadrado?



22 En la siguiente multiplicación, ¿qué número está tapado por ■ ?

$8 \cdot \blacksquare = 80$

A. 10
B. 8
C. 1
D. 0

23 Eduardo tiene más autitos rojos que amarillos y menos autitos rojos que verdes. ¿Cuál de las opciones muestra los autitos correctamente ordenados de MAYOR a MENOR cantidad?

A. rojos — amarillos — verdes
B. verdes — rojos — amarillos
C. rojos — verdes — amarillos
D. verdes — amarillos — rojos

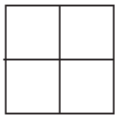
24 Al multiplicar cualquier número por 0 el resultado siempre es:

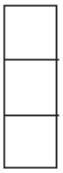
A. 0
B. 1
C. el mismo número.
D. la mitad del número.

25 El siguiente dibujo representa la mitad de una figura.

¿Cuál de los siguientes dibujos representa la figura completa?

A. 

B. 

C. 

D. 

26 En una colecta se reunió la siguiente cantidad de billetes y monedas:

1 billete de $ 10 000

3 billetes de $ 1 000

4 monedas de $ 100

10 monedas de $ 1

¿Cuánta plata se reunió en la colecta?

A. $ 11 110
B. $ 13 410
C. $ 13 500
D. $ 13 510

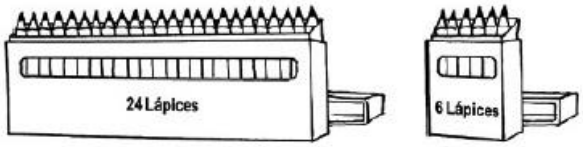
27 Don José tenía 100 kilos de manzanas para vender en la feria. Un día vendió 26 kilos y otro día vendió 58 kilos. ¿Cuántos kilos de manzanas le quedan por vender?

A. 16 kilos.
B. 32 kilos.
C. 42 kilos.
D. 84 kilos.

28 Un avión se encuentra a 9 793 metros sobre el nivel del mar al pasar sobre la cumbre de un volcán. La altura del volcán es de 6 893 metros sobre el nivel del mar, ¿a qué distancia pasa el avión de la cumbre del volcán?

A. 2 900 metros.
B. 3 900 metros.
C. 9 793 metros.
D. 16 686 metros.

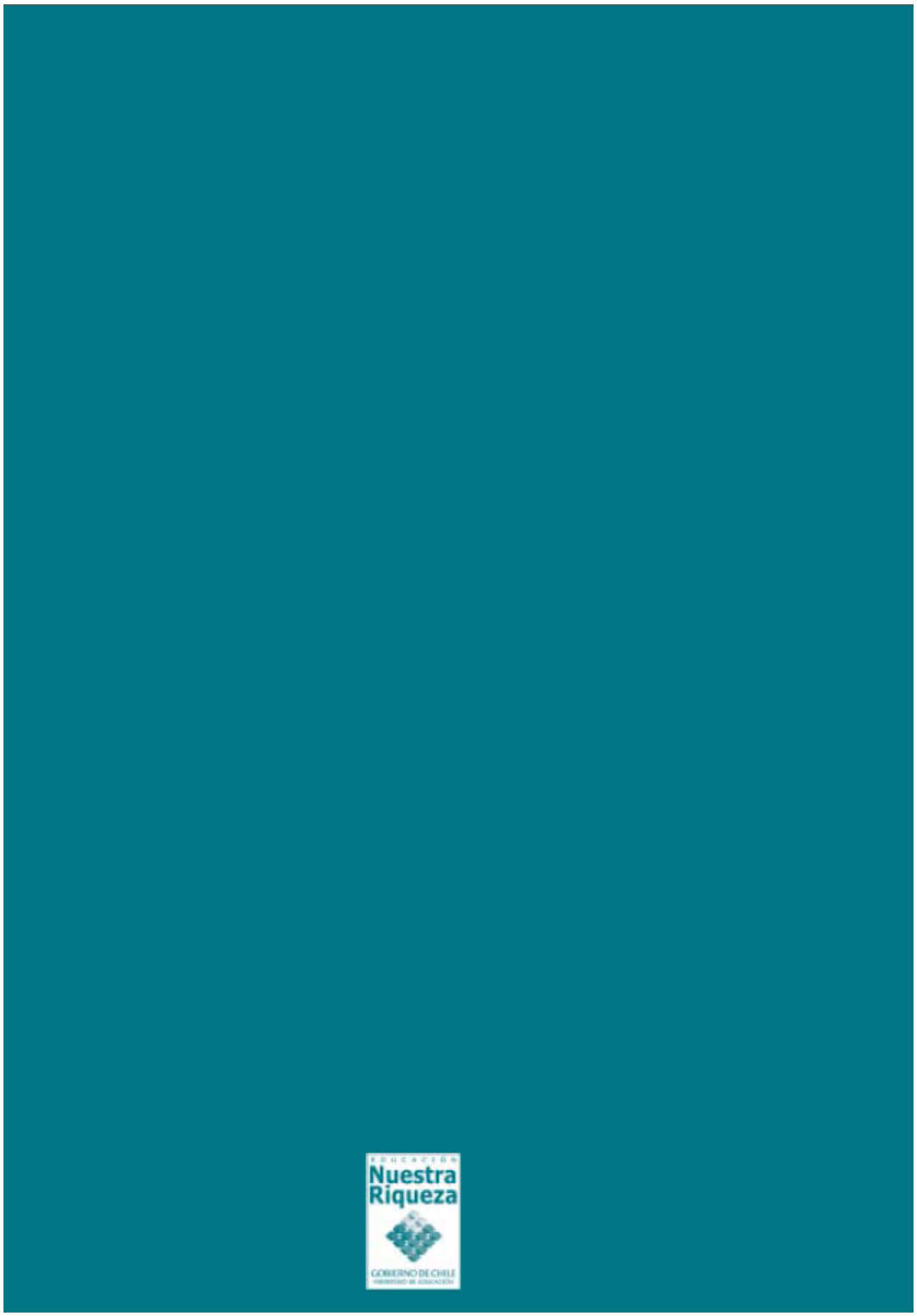
29 ¿Cuántos lápices hay en total, en estas dos cajas?



A. 24 : 6
B. 24 – 6
C. 24 • 6
D. 24 + 6

30 Claudia y su hermano van a comprar un chocolate que cuesta $980 para regalárselo a su mamá y tienen la siguiente conversación:

Escribe cómo Claudia puede pagar el chocolate, usando la menor cantidad posible de monedas.


Nuestra
Riqueza
GOBIERNO DE CHILE

Appendix W: Model of SIMCE Mathematics Examination 2007 English Translation

Read the instructions before opening the test.

INSTRUCTIONS

- The test has 30 questions
- Most questions are multiple choice and the last one is short-answer
- All the multiple choice questions must be answer on the respond page 1 and the short-answer question on the respond page 2
- Use pencil to answer and eraser
- Do not use calculator
- Time to answer 60 minutes

QUESTIONS

1. Which of the following objects can be represented by a cylinder?
2. In a piece of folded paper, half of a letter was drawn. When cutting the folded piece of paper the complete letter is shown, as the following figures show.
   Which letter can be drawn and cut using the same procedure?
3. Looking at the bold sides of the following figure, which the following statements is true?
   A. Both are parallel and same length
   B. Both are parallel and different length
   C. They are perpendicular and different length
   D. They are perpendicular and same length
4. What is the solution of: 234 + 826 + 48
5. To calculate how many festoon to buy, some children measured the width of the classroom, but they registered different numbers.
   A. 5 centimeters
   B. 50 centimeters
   C. 5 meters
   D. 50 meters
   Which result could be the correct one?
6. In a promotion of drinks, with 3 marked caps you can get an action figure. Ramón has 6 marked caps, how many figures can he get?

7. Francisca lost 14 stamps from her collection. To know how much stamps she has now, what she need to know?

    A. How many stamps she has repeated

    B. How many stamps she wants to get

    C. How many stamps she had before losing them

    D. How many stamps she lost

8. Which of the following figures has right angles?
9. The following box is closed. How many vertex has?
10. A figure in the following position. How it will if the figure is turn to the right, the same direction as the arrow?
11. A family use five tea bags in one day. Before buying a box of 100 tea bags, Mom made the following calculation:

    100: 5 = 20

    Which of the following questions can you answer with the previous calculation?

    A. How much money cost each teabag?

    B. How many cups of tea Mom can prepared with a bag?

    C. How many tea bags there are in the box?

    D. How many days will last the box of tea?

12. Marcela has a collection of 184 stamps, 52 are from American, 65 are from Europe and the rest are from Africa. How many stamps of Marcela's collection are from Africa?
13. If 4 cokes cost $3800, what is the closed price of 8 cokes?
14. A group of children was asked what about their favorite sport. The following graph shows the result of the survey. How many children did answer the survey?

Look at the following graphs and answer questions 15 and 16.

The following graph shows the amount of pants sold by a store en 5 days of the week

15. What days the store sold exactly 40 pants?
16. How many pants were sold in 5 days?
17. Which of the following problems, Ricardo could solve multiplying 6 times 12?

    A. I have 6 plates with 12 cookies each. How many cookies have altogether?

    B. I have 6 red little cars and 12 blue. How many cars have altogether?

C. I have 12 crayons in my case and lend 6. How many left?

D. I have 12 balls and sharing among of my 6 friends. How many balls are for everyone?

18. Look at Don Titos' market poster. Mrs. Elena makes the following calculations: I divide 540 by 2 then I got 270, after that I add 380 and I got 650. Then she calculated how much money she has to pay for different items such as:
19. The figure shows the route of a train across small towns of equal distance. If Jorge lives in Surina and goes to Turán, what part of the total travel has he completed when the train stops in Caupolicán?
20. Indicate which is the result of 42-20:2
21. If you have a rectangle like this one. Which one of the following cut you can get a square?
22. In the following multiplication, what is the number shaded by the grey-square?
23. Eduardo has more red toy cars than yellow toy cars, and less red than green toy cars. Which the following options shows the toys cars ordered correctly from greater to smaller.

    A. red - yellow - green

    B. green - red - yellow

    C. red - green - yellow

    D. green - yellow - red
24. Multiplying any number by 0 the answer is:
25. The following drawing represent the half of the figure. Which one of the following drawing represent the whole figure?
26. In a raise money activity there are the following coins and bills.

    1 bill of $10000

    3 bills of $1000

    4 coins of $100

    10 coins of $1

    How much money was raised?
27. Don José had 100 kilos of apples to sell in the market. One day he sold 26 kilos and another day he sold 58 kilos. How many kilos of apples were left?

28. A plane is flying 9,793 meters above sea level when pass over a volcano. The height of the volcano is 6,893 meters above sea level, what is the distance between the plane and the volcano?
29. How many crayons there are in both boxes?
30. Claudia and her brother go to buy a chocolate bar that costs $980 to give it their Mom and they have the following conversation:

    Brother: *do you have money to pay for the chocolate bar?*

    Claudia: *yes, I have just enough money*

    To write how Claudia can pay for the chocolate bar using the least amount of coins.