

The Effect of Number Talks  
on Student Number Sense

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A Special Project

Presented to

Dr. Audrian Huff

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FACULTY APPROVAL

The Effect of Number Talks  
on Student Number Sense

Approved for the Faculty

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## ABSTRACT

The purpose of this study was to find the effects of Number Talks on student number sense. With the push for mathematical reform and the debate over traditional algorithms versus non-traditional programs, teachers would see an increase in mathematical performance in students when given more opportunities to solve mathematical problems mentally through activities such as Number Talks.

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## CHAPTER 1

### Introduction

#### Background for the Project

Students taking high stakes tests such as the Washington Assessment of Student Learning have been struggling in the area of number sense. Over a seven year trend, students tested in the fourth and seventh grades in elementary school have scored below the fifty third percentile in the area of number sense (Office of Superintendent of Public Instruction Washington State Report Card, 2008).

The problem trickled down to the first grade where students had been struggling with number sense and simple computation. Many students relied on finger counting solely to perform simple computation which indicated that the students lacked mental strategies to solve the problem. The students often counted each finger individually, which indicated that the students did not have an understanding of numbers. Students often did not trust the count nor did the students understand the cardinality of a number or the last number said after a person counted. Students also lacked the skill of subitizing which meant that students could not easily have looked at a set of objects at a glance without having to have had to count the set of objects. The ability to subitize strongly indicated readiness in a student's ability to compute numbers. (Willis, Devlin, Jacob, Powell, Tomazos and Treacy, 2007) When given a set of objects to count, many students counted the objects, but could not answer the question, "how many are there?" without recounting the objects. Not being able to trust the

count adversely affected the student's ability to perform simple computational problems.

### Statement of the Problem

Recently, teachers were given a district wide presentation at an area high school in Eastern Washington on the use of Number Talks in the Classroom by Doctor Ruth Parker, Chief Executive Officer and Co-Founder of the Mathematics Education Collaborative. To what extent could daily Number Talks have improved number sense and simple computation in the first grade? Could Number Talks also have increased student participation in mathematics lessons?

### Purpose of the Project

As a result of this project the author had the intentions of determining whether the use of Number Talks in the classroom would increase number fluency thereby increasing number sense and therefore increase basic computational skills amongst first graders. At the end of the study, the students who participated in Number Talks on a daily basis would have been able to more quickly and correctly solve basic computational problems using numbers one to twelve. Students would also have been able to feel more confident in the ability to perform mathematical problems and therefore would have become more willing participants in mathematical discussions and or lessons.

### Delimitations

The project was conducted in an elementary school in suburban Eastern Washington. The elementary school was housed within a city that had a diverse population made up of 56.3% Hispanic origin, 37.0% White Non-Hispanic

origin, 3.2% Black, and 1.4% American Indian found on the website [www.city-data.com](http://www.city-data.com).

The local industry was made up of mostly agriculture, viticulture, food and construction. The median household income in 2005 was \$34,100 ([www.city-data.com](http://www.city-data.com)).

The elementary school taught a large group of minority students. Students who attended the elementary school were 91.4% Hispanic, 4.9% White, 2.1% Black, 0.7% Asian, and 0.5% American Indian/Alaskan Native. The school had a free or reduced price meal rate of 89.7%. The migrant percentage at the elementary school was 12.5% and 61.9% of the students that attended the elementary school were enrolled in a bilingual classroom (Washington State Report Card, 2007).

The students who participated in the research were from 4 first grade classrooms. Two of the classrooms were bilingual classes taught in the native language of the students, Spanish. Each bilingual classroom housed 25 Hispanic students. The two bilingual teachers were named Ms. S and Mrs. C.

One English classroom was taught by two teachers. The two teachers split the day in half. Half way through the school year the two teachers switched the half of the day taught. During the other half of the teacher's day, the teacher tutored students in Reading Recovery. The two English classroom teachers were named Mrs. H. and Ms. W. During the first trimester and first half of the second trimester, Ms. W taught the portion of the day when mathematics was taught. During the first half of the second trimester and all of the third trimester Mrs. H taught the portion of the day that mathematics was taught. The final

English classroom teacher was named Mrs. S. Each English classroom housed 22 students of various ethnicities.

### Assumptions

The assumption was made that the teachers of the four classrooms were highly qualified and capable of teaching. The assumption was also made that students did not have any undiagnosed disabilities that prevented the students from being able to perform at a normal pace for that of a first grader. A final assumption was that the students were correctly placed at the first grade level and that the classroom placement was random. During the testing, the assumption was made that students with strong number sense and computational strategies were able to solve the problems more quickly and therefore would have completed a higher number of problems correctly.

### Research Question

Will the use of Number Talks on a daily basis increase number sense among first grade students? Will student participation increase during mathematics instruction with the use of number talks in the first grade classroom?

### Significance of the Project

The author believed the study would find Number Talks did indeed increase number sense among students. If Number Talks did increase number sense, the school would benefit from an implementation of Number Talks in all classrooms and the district would benefit in the training of teachers on Number Talks and the use of Number Talks in the classrooms. Student scores would increase on high stakes tests such as the Washington Assessment of Student Learning. If the

results did not show an increase in number sense then teachers would have an extra ten minutes in the instructional day to use a different intervention to increase number sense.

The author also believed that student participation would increase during mathematical instruction because of the use of daily Number Talks in the classroom. The author believed that the Number Talks would give the student more confidence and therefore allow the student to feel more capable in front of the peers of the student.

### Procedure

During this investigation, the researcher compared four classes of first grade students taught mathematics with *Investigations in Mathematics*. Two classes were made up of 25 bilingual Spanish speaking students per classroom and two classes were made up of 22 English speaking students per classroom. Each class was given an identical quiz on the student's computational skills created by the author.

To create the pre and post test, the author selected 25 simple computational problems that used the numbers 1 to 12. The research teacher wrote the problems in number sentence form.

The students were given the quiz with no time limit for the first assessment. The classroom teacher noted the amount of time the students used to complete the test. The second assessment was given a time limit determined by the author after reviewing the average amount of time used for the first attempt. The tests were then scored with a total of 25 points possible, 1 point per

problem. The assumption of the test was that students with stronger computational skills and number sense would be able to answer more problems correctly during the testing period.

During the investigation all four teachers taught mathematics according to the pacing chart created by the school district that housed the particular elementary school. In addition the teachers taught a 10 minute mini-lesson on Number Talks each day. The mini lesson progressed as the school year progressed. The mini-lesson started with a picture of any number of objects less than 10 that were shown to the students. The students were asked to then tell the teacher how many objects the students saw and how the students were able to quickly see that number of objects. As students became familiar with the concept of the question asked of the students (“How many in all?”) the teacher gradually removed the picture from the sight of the students as the students answered the question. Eventually students were given the image for a total of 5 seconds, after which the students were to recall the image without having been able to look at the image to answer the question of “How many in all?”. As students were able to quickly recall how many in all for objects up to 10, the teachers began to use simple number sentences during the mini lesson. The number sentence consisted of either an addition or subtraction problem. Students were instructed to solve the problem quietly in the students’ heads without paper and pencil or the use of manipulatives. Students would show the teacher readiness to answer by raising a finger in front of the chest so as not to intimidate slower thinkers into rushing into an answer. The teacher would ask for

and write all of the answers the students came up with on the board. Once all of the answers were given, the teacher then gave the students time to explain the answer (in other words to solve the problem) given. Through this process students were given the chance to eliminate wrong answers and better understand why the correct answer was indeed correct. During this time students were building mental strategies to solving basic computational problems and encouraged to share the strategies with the class. At the end of each trimester, students were tested on computational skills.

### Definition of Terms

cardinality. The term cardinality referred to the last number word said when objects were counted.

intervention(s). The term intervention referred to strategies and/or tools used to assist students when the students struggled with a concept.

Number fluency. Number fluency was described as the ability to use numbers flexibly, quickly and accurately.

Number sense. Number sense was an intuitive understanding of numbers, the magnitude of numbers, relationships, and how numbers were affected by operations.

Number sentence. A number sentence was an equation or inequality expressed using numbers and common symbols. A number sentence could have looked like  $2+2=4$ .

Number Talks. Number Talks were a daily activity that lasted for about ten minutes at a time.



subitize. Subitizing was the ability to see how many at a glance. trust the count. Students trusted the count when a set of objects was counted and the set was always called five without recounting the objects.

### Acronyms

AYP. Annual Yearly Progress.

ELL. English Language Learner.

MEC. Mathematics Education Collaborative.

NCTM National Council of Teachers of Mathematics.

OSPI. Office of the Superintendent of Public Instruction.

TERC. Technical Education Resource Centers

## CHAPTER 2

### Review of Selected Literature

#### Introduction

A steady growth in the concern for mathematics education has led to a push for mathematical reform. Within this reform a number of agencies have developed to help educators, parents and communities develop mathematically competent students. One such group was the Mathematics Education Collaborative (MEC) founded by Dr. Ruth Parker and her partner, Patty Lofgren. Together the two women have created a series of workshops and community forums to strengthen the mathematical knowledge of educators and parents respectively. Dr. Parker and Ms. Lofgren advocated the use of number talks on a daily basis in an effort to promote a better understanding in number sense among students during the many presentations given to parents and community members alike.

The goal of mathematics education was to produce mathematically competent and confident students (Parker, 1993). Number Talks was bridge to creating mathematically confident students. Number Talks allowed students to engage in discussions about numbers. Number Talks also allowed students to have flexibility with numbers, which was to take apart and put back together numbers efficiently and accurately. Students were more easily able to make sense of a problem because students had practice using mental strategies to make sense of numbers.

A review of literature was done on the subject of Number Talks. During the review the researcher had a difficult time finding research that spoke specifically about the effects of Number Talks on student performance. The researcher did however find numerous references to Number Talks and how Number Talks would have helped build number sense in students. Mathematics educators have said often that number talks would strengthen number sense. The researcher therefore thought the discussion of the importance of number sense and how number sense affected a student's ability to perform mathematical problems would be beneficial (Gurganus, 2004; Degaene, 2002; Jordan & Locuniak, 2008; Van de Walle & Lovin 2006). Research on the various methods of interventions available to increase number sense was also important to understand how a student developed number sense. Since number talks did not follow the traditional paper and pencil method to solving a mathematical problem the researcher felt the discussion about the push in the reform of mathematics and the shift from traditional algorithms to reform-based mathematics instruction and the debate that instilled from the push for a change would be important. Finally, the researcher included a subset on the mathematics curriculum used during the study, Investigations in Number, Data and Space also referenced as TERC. The name TERC formerly was used as an acronym for Technical Education Research Centers, TERC later became the name of Technical Education Research Centers in the 1980's when the company had outgrown the longer version of the name and was understood to be an educational research and development organization (TERC, 2006).

## Number Sense

Number sense has been defined by the NCTM as an intuition about numbers drawn from all varied meanings of number (Gurganus, 2004). Number sense was also defined as a short-hand for a person's ability to quickly understand, approximate, and manipulate numerical quantities (Degaene 2002). Another definition of number sense found in *Teaching Student Centered Mathematics* said that number sense was 'flexible intuitive thinking with numbers' (Van de Walle & Lovin, 2006, p. 42).

Many studies have linked a student's number sense with the ability to do computational problems. One study used the number sense of kindergarten students to predict the calculation fluency in the second grade (Jordan & Locuniak, 2008). Many other studies have used number sense to predict test scores in computational assessments for the following years. A number of recent studies found evidence that a sense of approximate numerical sense developed in infancy. The findings were considered to be intuitive (Jordan, 2007; Jordan & Locuniak, 2008).

The NCTM made curricular focus recommendations in the area of number sense and computational fluency or number fluency in 1989 (Griffin, 2003). Although often thought of as separate, number sense and computational fluency have been proven over and over to go hand in hand; a person could not have computational fluency without number sense (Griffin, 2003). Often what

happened was teachers would begin to develop number sense but then too quickly shifted to computation without leaving students with a strong foundation in number sense (Van de Walle & Lovin, 2006). Teachers were also mistaking the basis of the problem as difficulty memorizing facts and as a result intervention often focused on drilling the facts (Jordan October, 2007).

There has been a surge in the push for developing number sense in younger students since the 1980's as teachers and researchers began to see the importance of number sense in a student's mathematical performance. The importance of number sense could be seen when students began to rely on counting by ones to solve simple story problems and had difficulty mastering basic facts (Van de Walle & Lovin, 2006 2). One researcher stated, "Imagine how hard it would be to memorize arithmetic combinations without understanding how numbers related to one another" (Jordan October, 2007, p. 64).

#### Interventions to Enhancing Number Sense among Children

Many studies have been performed to create interventions in enhancing a student's number sense. Number sense had been recognized as essential to a young student's development of mathematics and the performance of the student in mathematics throughout the education of the student for decades. Recent studies have shown interventions that were often provided to students who struggled in mathematics were misguided by misdiagnosis to the base of the problem. Students were being pushed too early into computation and were not given more time to build number sense. When a problem was diagnosed in a student, the student's problem was often treated with special instruction focused

on drill of number facts as opposed to building number sense (Jordan, October 2007).

Many interventions and strategies have been proven to help students build number sense. The authors of *Minilessons for Early Addition and Subtraction* stated that children must have a generalized model of quantity, and must have understood how a whole number was made up of parts (Fosnot & Uittenbogaard, 2007). “By composing and decomposing parts of a whole, children became able to understand and represent the operations of addition and Subtraction” (Fosnot & Uittenbogaard, 2007, p. 6). Fosnot and Uittenbogaard (2007) said strategies children used to represent addition and subtraction in the beginning stages of learning, such as counting one by one, could not be left with limited methods to solving number problems.

Research suggested that the teacher paired numbers with meaningful objects and used language that gradually matched numbers with objects and symbols. Research also suggested that teachers counted forward and backwards at the beginning of each lesson (Gurganus, 2004). The creators of Steps and authors of *First Steps in Mathematics* created a series of interventions and assessments to enhance a student’s number sense. Among the interventions the authors suggested that the teacher flash small groups of objects, also known as quick images, to students. The teacher would have asked the student to say how many at a glance without one-to-one counting (Willis, et. all). Number Talks were also suggested as an intervention by one group because Number Talks gave students practice with number concepts. Students had

opportunities to solve a variety of problems and were exposed to many different ways of solving the problems. Over time students were able to develop competence in problem solving skills and computational fluency (Postlewait, Adam, Shih, 2003).

### Traditional Mathematics versus Reform-Based Mathematics

Over the last 25 years, mathematics instruction had been a large debate amongst educational professionals. Discussions on the instruction of mathematics in schools began when society felt schools had been failing the students. The reaction was to radically change the way society looked at mathematics. In the 1980's the crisis went national with publications like *An Agenda for Action* (NCTM, 1980), *A Nation at Risk* (National Commission for Excellence in Education, 1983), and *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (National Research Council, 1989) By the end of the decade, the NCTM released the *Curriculum and Evaluation Standards for School Mathematics* (1989). The NCTM released set of standards was meant to help resolve the problems articulated throughout the 1980's. From the set of standards, new curriculum came out along with much controversy.

Traditional mathematics was generally referred to as paper and pencil math. Students taught in the traditional form of mathematics were taught to memorize basic facts and algorithms. Instruction generally included paper and a pencil and drill activities. Problem solving usually appeared out of an outgrowth of computation with word problem applications that followed the teaching and practice of each arithmetic skill (Burns, 1992). Opponents of sticking to the

traditional form articulated the traditional method was not always practical in real-world situations and teaching mathematics with paper and pencil as the sole tool did not prepare the student for situations when paper and pencil would not be readily available. Opponents of traditional mathematics did not oppose altogether the teaching of traditional algorithms, instead the opponents hoped for a curriculum that allowed students to explore mental strategies and efficiently and appropriately use estimation to solve problems (Burns 1992; Colvin, 1999; Covino, 2001).

Reform mathematics, also referred to as New Mathematics or Constructivist Mathematics, generally involved the teaching of mental strategies, the use of manipulatives and a push to build a better sense of how numbers functioned together. One author defined reform teaching as "...activities related to the implementation of high-demand tasks that foster the development of mathematics concepts and understanding" (Franco, C. Sztajn, P., Ortigão, M.I.R., 2007, Context sect. para. 1). Proponents for reform mathematics also added group work and discussion to the instruction.

In reform mathematics students were encouraged to construct meaning through more hands-on approaches, sometimes seen as watered down and confusing. Opponents were thought to be confused and misguided as to the purpose for the form of instruction suggested by reform mathematics. Jennifer Covino recently quoted Diane Briars, a mathematics coordinator in Pittsburg Pennsylvania, after responding to opponents who expressed concern that reform mathematics turned students loose into the mathematics without having taught



the students the basics first, as saying the opponents to reform mathematics have missed the point. Briars said [while those in favor of reform mathematics] “talked in the standards about what needed to be different...skills are still valued and still important” (Covino, 2001, The New-New Math section, para. 6). Covino also wrote how the former NCTM President Lee V. Stiff argued that traditional mathematics instruction left students unenthused and in the dark. Stiff became frustrated when the quest for sound mathematics was clouded by misunderstanding (Covino, October, 2001).

Research has shown that students were able to perform arithmetic computations adequately, yet students weren't able to use learned skills to solve problems. Reports showed students were lacking in the cognitive skills and understanding to have solved problems beyond step-by-step situations. A study in Brazil found reform teaching to have been beneficial to 90 percent of Brazilian students studied, whether of low or high socio-economic status. The study found reform mathematics instruction reduced the achievement gap between schools for students of low socioeconomic status and students of high socioeconomic status (Franco, Sztajin, and Ortigão). A study created out of Michigan State University by Jon R. Star and Amanda J. Hoffman showed how reform mathematics impacted students' conceptions of mathematics. The study found that students taught in the reform mathematics classrooms gave responses aligned with the beliefs of the reform oriented ideas of reform mathematics. Students who were taught in the traditional classrooms did not. The study also

found students in the reform classrooms developed conceptions of mathematics aligned with NCTM reform documents (Franco, Stztajin, & Ortigão, 2007).

### Investigations in Number, Data and Space

Investigations in Number, Data and Space (Investigations) was created out of Cambridge Massachusetts by TERC in the 1990's. Investigations was funded by the National Science Foundation and was created out of a series of programs aimed at improving mathematics education. Investigations was a result of 20 years of extensive research and study as well as influenced by national publications from NCTM, the National Research Council, and the Conference Board of the Mathematical Sciences. Investigations had undergone an upgrade to include recent publications and studies in the year 2000 known as Investigations Second Edition. Both Investigations and the second edition were tested in elementary schools with the help of over 50 classroom teachers for several years before the actual publication became public. The first edition, Investigations, was tested and tried for over eight years before Investigations became finalized as what was known as Investigations. The second edition was developed over a period of five years which stemmed from the ten years of research and classroom use from the previous edition.

During the study of the author, the classroom program practiced was Investigations. The goals of Investigations were to:

1. Support students to make sense of mathematics and learn that students can be mathematical thinkers.

2. Focus on computational fluency with whole numbers as a major goal of the elementary grades.
  3. Provide substantive work in important areas of mathematics—rational numbers, geometry, measurement, data, and early algebra—and connections among them.
  4. Emphasize reasoning about mathematical ideas.
  5. Communicate mathematics content and pedagogy to teachers.
  6. Engage the range of learners in understanding mathematics
- (TERC, 2007, Goals and Guiding Principles section, para. 1).

There were also three guiding principles in the creation of Investigations; students have mathematical ideas, teachers are engaged in ongoing learning about mathematics, and teachers collaborate with the students and curriculum materials (TERC, 2007).

Validity and reliability was tested by Pearson publishing. School districts across the United States were given the program for use in the classroom. Schools then reported students' scores on state assessments to TERC. Amongst the school districts chosen, seven came from Washington State. All seven schools in Washington State and across the United States showed growth in student mathematical achievement (Simpson, 2007). Scores from Washington State were especially important to note because all students took the

Washington State Assessment of Learning, used to measure student achievement in the school where the field study of Number Talks was tested.

Investigations was recently reviewed as an instructional tool to adopt in the state of Washington. Although Investigations was not selected as a top three choice, Investigations did outscore one of the instructional tools selected as a recommendation (OSPI, 2008).

### Summary

In summary, number sense was the foundation for student achievement in computational problems. Researchers and educators have concluded students needed a strong foundation in number sense to have strong computational skills. There were a number of interventions proven successful to the assistance for building number sense; among the intervention strategies were number talks and quick images. Research had found that by building students' number fluency with Number Talks and quick images students were more able to flexibly use numbers when solving a problem.

Supporters of traditional mathematics (Traditionalists) were often thought to be confused by the purpose of reform mathematics. Proponents for reform mathematics (Constructivists) believed that the students needed the opportunity to approach number problems with the use of hands-on materials and needed to be able to construct an individual understanding of how numbers worked without always reverting to the traditional rote memorization and drill of facts and algorithms. Studies have found that the use of manipulatives and free exploration of numbers had increased students' ability to solve complex problems and also

helped students to have a better appreciation of mathematics and the applications of mathematics in the real world.

## CHAPTER 3

### Methodology and Treatment of Data

#### Introduction

Mathematics scores and trends of students in Washington State have been poor. There has been a recent push for educators and policy makers to improve the instruction of mathematics. Many mathematics consultants have been involved in the attempt to change current curriculum and methodologies used in the teaching of mathematics. In one school district, former educator turned consultant Doctor Ruth E. Parker was hired to present the findings of MEC and the use of Number Talks in the Classroom. In the school district teachers were encouraged to implement Number Talks into the daily lessons of the classroom. A qualitative study was done to determine if the use of Number Talks in the classroom truly improved the mathematical performance students.

#### Methodology

The qualitative study examined the effects of Number Talks on student performance in basic computational facts. Students of four 1<sup>st</sup> grade classrooms were presented with the Number Talks and assessed on basic computational facts. Scores were compared and examined to determine if a difference occurred in the student's ability to solve basic computational facts. The author also surveyed the classroom teachers on the use of Number Talks in the classroom and the effects Number Talks had on students.

## Participants

Four 1<sup>st</sup> grade classrooms in an adjacent hallway of an elementary school began the study. Two classrooms were taught in English and two classrooms were taught in the native language of the students, Spanish. Each English classroom contained 22 students and each Spanish classroom contained 25 students. Of the 94 students taught 5 were labeled as migrant and 2 received special services in mathematics. There were a total of 48 girls in the study and 46 boys. The teachers of the English classrooms reported a total of six severely behaviorally disruptive students and the Spanish teachers reported one. The importance of the amount of behavioral students in a classroom was found when said students refused to participate in assessments given and/or interrupted the process of the Number Talks. Of the 94 student participants, only 36 students could be assessed due to student withdraws, new student entries and the removal of classroom data from the study due to inconsistencies.

Within the four classrooms there were five classroom teachers, and a student teacher who entered during the winter quarter. One English classroom had classroom teachers in a job share position, called classroom one. The classroom teachers of classroom one rotated the subjects taught mid-way through the year. The same classroom also received the student teacher. The student teacher did not perform Number Talks until two weeks prior to the final assessment due to miscommunication by the master teachers. The master teacher revealed that Number Talks were performed on a non-consistent basis before the student teacher entered the classroom. When the student teacher

arrived, the students received limited practice with actual number problems during the Number Talks. Instead, the Number Talks consisted of quick images, which were consistent with the mathematics lessons that were taught out of the Investigations curriculum during the period of time the student teacher entered the classroom. Due to the long absence of Number Talks, classroom one was removed from the study. The second English classroom, called classroom two, lost the classroom teacher due to Maternity Leave In March. The substitute teacher did not perform Number Talks for the last two weeks of the study this room was also removed from the study.

Of the five original classroom teachers, three teachers had completed a Master's program and two teachers were in the process of completing a Master's program. Two teachers had recently become National Board Certified Teachers and one teacher had recently become Professionally Certified in the state of Washington. The remaining two teachers had yet to attempt the Professional Certification or National Board Certification processes. All five teachers had strong backgrounds in the subject area of reading and literacy. The author had been trained in the use of Number Talks through a professional development class presented by MEC trained teachers.

### Instruments

The author created a survey for the classroom teachers (Figure 3, Appendixes) to help further explain the results of the study. The survey consisted of eight multiple choice questions. To determine the effect of Number Talks on student performance, the author created a 25 question basic computational quiz



(Figure 1, Appendixes) that was given at the beginning of the school year and again at the end of the study. The author also kept record of the number of times a student participated in the Number Talks (Figure 2, Appendixes) within the author's classroom.

### Design

The author attended a training on Number Talks through MEC. The author presented the Number Talks to the team of teachers that participated in the study. The author gave a pretest for all of the participating teachers to assess the students. The pretest also gave a baseline to show the students' preexisting mathematical abilities. Number Talks became a part of the daily routine in the classrooms as a ten minute mini-lesson. At the end of the study the author gave a posttest to determine if growth was made in the students' mathematical abilities.

### Procedure

The author created a simple computational test (Figure 1 Appendixes) to assess the students' knowledge of basic computational facts. To create the pre and post test, the author selected 25 simple computational problems that used the numbers 1 to 12. The research teacher wrote the problems in number sentence form. The students were given the quiz with no time limit for the first attempt at the beginning of the school year. The classroom teacher noted the amount of time the students used to complete the test. The second attempt was given a time limit of five minutes determined by the author after reviewing the average amount of time used for the first attempt. The second attempt occurred

in the middle of the third trimester. The tests were then scored with a total of 25 points possible, 1 point per problem. The author presented a teacher survey to the classroom teachers near the end of the study.

### Treatment of the Data

The author scored each pre and posttest. Scores were converted into percentages and placed into a table (tables 1,2, and 3) for the author to compare. The author determined there was improvement if the score increased from the pretest to the posttest. Raw scores were also inserted as a discussion point.

### Summary

In an effort to determine the effectiveness of Number Talks on first grade number sense, the author began an inquiry within 4 first grade classrooms in an Eastern Washington elementary school. During the study, fidelity in one classroom was lost due to miscommunication between a master teacher and a student teacher. The data from the above mentioned classroom was removed from the study. A second classroom was removed from the study due to maternity leave.

Data was gathered by the author through a series of two tests, a pre-test and a posttest, given at the beginning of the study and again at the end of the study. The tests consisted of 25 basic addition problems ranging from numbers 1 to 12. Students were given an average of fifteen minutes to complete the pre-test. Students were given seven minutes to complete the posttests. The author compiled the results into three tables to compare the data. Improvement was determined if the score increased from the pretest to the posttest.

## CHAPTER 4

### Analysis of the Data

#### Introduction

The author created a study on the effectiveness of Number Talks on first grade student performance in number sense after reviewing statewide test scores in number sense amongst students. During the study, Number Talks were given on a daily basis. A 25 question pre and posttest was given to assess student performance in three first grade classrooms. Between the classrooms, a total of 44 students were assessed. The author also created an eight question rubric to determine the feelings towards Number Talks in the classroom and whether or not teachers felt Number Talks were helping the students.

#### Description of the Environment

The project was conducted in an elementary school in suburban Eastern Washington. The elementary school was housed within a city that had a diverse population made up of 56.3% Hispanic origin, 37.0% White Non-Hispanic origin, 3.2% Black, and 1.4% American Indian. The local industry was made up of mostly agriculture, viticulture, food and construction. The median household income in 2005 was \$34,100 ([www.city-data.com](http://www.city-data.com)).

The elementary school taught a large group of minority students. Students who attended the elementary school were 91.4% Hispanic, 4.9% White, 2.1% Black, 0.7% Asian, and 0.5% American Indian/Alaskan Native. The school had a free or reduced price meal rate of 89.7%. The migrant percentage at the elementary school was 12.5% and 61.9% of the students that attended the

elementary school were enrolled in a bilingual classroom (Washington State Report Card, 2007).

The students who participated in the research were from 4 first grade classrooms. Two of the classrooms were bilingual classes taught in the native language of the students, Spanish. Each bilingual classroom housed 25 Hispanic students. The two bilingual teachers were named Ms. S and Mrs. C.

One English classroom was taught by two teachers. The two teachers split the day in half. Half way through the school year the two teachers switched the half of the day taught. During the other half of the teacher's day, the teacher tutored students in Reading Recovery. The two English classroom teachers were named Mrs. H. and Ms. W. During the first trimester and first half of the second trimester, Ms. W taught the portion of the day when mathematics was taught. During the first half of the second trimester and all of the third trimester Mrs. H taught the portion of the day that mathematics was taught. The final English classroom teacher was named Mrs. S. Each English classroom housed 22 students of various ethnicities. The classroom of Mrs. H. and Mrs. W was removed from the study due to an early exit from the study.

### Research Question

Will the use of Number Talks on a daily basis increase number sense among first grade students? Will student participation increase during mathematics instruction with the use of number talks in the first grade classroom?

### Results of the Study

Of the two remaining classrooms, results of the study were discussed. Classroom 1 noticed an increase in 10 students' scores. Classroom 1 also noticed no change or a decrease in score from 10 of the students. Classroom 2 noticed an increase in 15 students' scores. Classroom 2 also noticed no change or a decrease in score from 3 of the students.

### Findings

The research question was answered. According to the findings, student number sense did increase with the use of Number Talks. Of the 36 students tested, 25 students experienced an increase in score from 1 to 21 points. According to the records kept regarding student participation, the author did see a slight increase in student participation. Of the 18 students tracked, 16 had an increase in recorded accounts of participation during mathematics.

### Discussion

During the collection of data, the author noted some interesting facts. While there was overall growth amongst the students, the amount of growth for each individual student varied. Some students only improved by a point and others made improvements by as much as 21 points. When the author looked at the scores in both tables, the author noticed that students M and 1 stayed the same, therefore did not show growth. The reader would also notice that students D, E, H, I, and scored higher on the pre-test but much lower on the posttest with a difference of 6 or more points. The author assumed the drop in scores of the students was due to the amount of time given to the students. Perhaps had the

students had more time to complete the test, the scores would have improved or stayed the same. The author made the assumption that Number Talks may not have increased the students' ability to answer more quickly. However, when the author looked at students O, R, 2, 3, 4, 6, 7, 8, 9, 11, 14, 15, 16, and 17, the author noticed an improvement within the range of 6 to 21 points. The author made the assumption that Number Talks did increase the ability to answer more quickly in students O, R, 2, 3, 4, 6, 7, 8, 9, 11, 14, 15, 16, and 17. The pattern of a large drop in points or a large gain in points was found throughout the two classrooms. Overall, more students were able to answer more questions correctly in the shorter amount of time during the posttest.

The author noted some disappointments in the teacher surveys. While all teachers found Number Talks valuable, Number Talks were not a part of the daily routine as consistently as assumed. One teacher answered as implementing Number Talks only two times a week. Another teacher answered as "whenever I get around to it". Interestingly, both classrooms still showed growth even though the amount of time spent using Number Talks varied. In table 2, the author noted more students saw an increase than no increase. When paired with the survey, the author could assume the classroom teacher used Number Talks more consistently. In Table 1, the author noted more students had a posttest score of 25, or 100%, than the other two classrooms. Again, the author assumed classroom two also experienced a more consistent use of Number Talks.

When the author looked at the data from the classroom participation, the author noticed that by the end of the study, almost every student had participated

at least one time. When the author compared the first two months of the study to the last two months, the author also noted students who participated the most during the beginning continued to do so. Students with little or no participation in the beginning only experienced a small gain in participation from 1 to 7 participation marks. The author made the assumption that students began to feel more inclined to share strategies and work done during mathematics class because the Number Talks celebrated students when students were willing to share whether or not the answered shared was correct. The author also believed students felt more comfortable with wrong answers because the classroom had created a safe-haven for wrong answers and constructively worked together to correct the wrong answers.

### Summary

In a sub-urban city, the study of Number Talks and the effects Number Talks had on student number sense were tested. Two 1<sup>st</sup> grade classrooms participated in the study. During the study, Number Talks were given on a daily basis. Students were tested on number sense using a 25 question test created by the author. The test was given during the first trimester of the school year and again mid-way through the second trimester. The tests were scored by the author. The author placed the scores of each classroom into a table and looked for students who experienced an increase in score. The number of students who experienced an increase in test score was higher than the number of students who did not. Of the 36 students tested, 25 students experienced an increase in

score. Students in one classroom also experienced more participation during mathematics class from more students as the study progressed.



## CHAPTER 5

### Summary, Conclusions and Recommendations

#### Introduction

The use of Number Talks was proven to increase student performance in number sense. The author experienced higher participation in students during mathematics class.

#### Summary

The author conducted a short study on the use of Number Talks in three first grade classrooms. Number Talks were a part of the daily routine in the classroom, lasting ten minutes at a time. Students were given a 25 question pre and posttest to determine if there was improvement in number sense. The author did find an increase in number sense amongst the students in the classrooms. The author also looked for an increase in student participation. The author found an increase in student participation.

#### Conclusions

Based on the findings, Number Talks did increase student number sense with daily use. The author concluded that the two classrooms with only a fifty percent increase would benefit from further training in Number Talks. The teacher survey led the author to believe Number Talks may not have been a priority in all classrooms, but a lack of understanding may have hindered the process. The author also concluded Number Talks did not increase the overall fluency of students in solving number problems. This conclusion came out of the

observation of test scores on the pre and posttest when students with high scores in the pretest scored considerably lower in the posttest.

In the classroom of the author, the conclusion was made that students were more willing to participate in mathematics discussions and or share mathematics work done in class because of a positive attitude created during Number Talks. Students were willing to share any answer, even if it was wrong because there was no shame in doing so. Wrong answers that were shared by students were constructively corrected to help every student understand how to attain the correct answer. The author believed the celebration of students willing to participate during Number Talks gave students a sense of security when sharing other mathematics work.

### Recommendations

Based on the conclusions, the author recommends classroom teachers further continue the use of Number Talks in the classroom on a more consistent basis. The author believes with consistent use, students will begin to develop more efficient strategies to solving basic number facts and in turn increase number sense. After review of the teacher surveys, the author was disappointed to see that Number Talks were not being implemented as consistently as planned and suggests with daily use, Number Talks is a great tool to helping students build number sense. The author also recommends more teachers be trained in Number Talks and the MEC philosophies of mathematics education. The author believes training in the MEC philosophies make the teacher more effective during Number Talks.

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## Appendixes

Figure One

Twenty-five question pre and posttest

Name/Nombre:	Date/Fecha:
1.) $5+2=$	5.) $7+2=$
2.) $2+6=$	4.) $8+3=$
3.) $1+1=$	6.) $4+3=$
7.) $9+1=$	8.) $9+2=$
8.) $9+2=$	9.) $10+1=$
10.) $8+1=$	11.) $6+7=$
12.) $6+5=$	13.) $7+8=$
14.) $3+7=$	15.) $1+0=$
16.) $8+4=$	17.) $5+6=$
18.) $5+7=$	19.) $2+4=$
20.) $7+4=$	21.) $4+2=$
22.) $8+1=$	23.) $1+10=$
24.) $9+4=$	25.) $6+1=$

Figure Two

Pre and Posttest Scores

Table 1			
Results of Pretest and Posttest Classroom 1			
Student	Pre	Post	Increase
A	17	18	Yes
B	20	23	Yes
C	17	19	Yes
D	22	8	No
E	25	18	No
F	25	20	No
G	25	24	No
H	24	17	No
I	25	10	No
J	24	25	Yes
K	23	25	Yes
L	23	25	Yes
M	23	23	No
N	25	18	No
O	18	24	Yes
P	23	25	Yes
Q	24	25	Yes
R	8	20	Yes

Table 2			
Results of Pretest and Posttest Classroom 2			
Student	Pre	Post	Improvement
1	25	25	no
2	6	15	yes
3	2	11	yes
4	3	21	yes
5	0	3	no
6	8	18	yes
7	9	21	yes
8	6	23	yes
9	15	23	yes
10	20	25	yes
11	1	22	yes
12	23	25	yes
13	22	24	yes
14	4	23	yes
15	2	23	yes



16	1	10	yes
17	3	15	yes
18	3	0	no

Figure Three

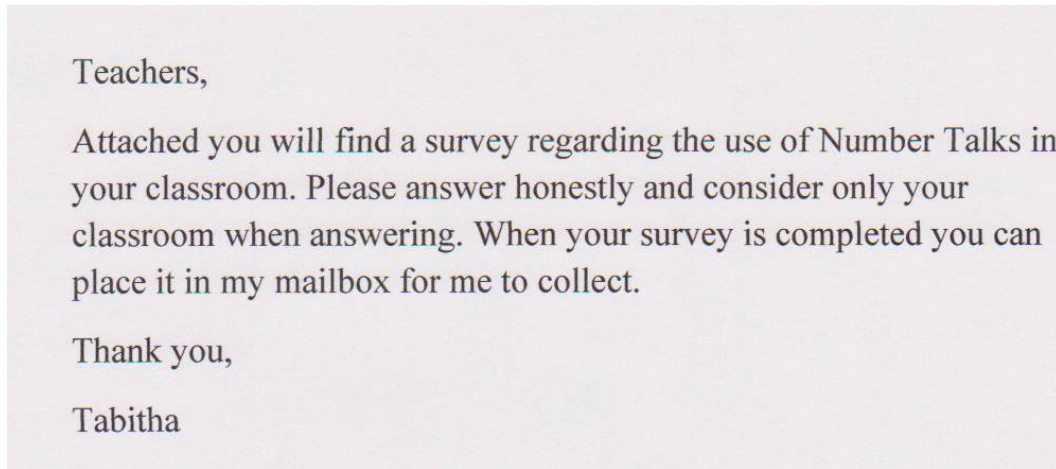
Tally of Student Participation in Mathematics

Child	December	January	February	March	April
1	xxxxxxx 7	xxxxx 5	xx 2	xxxxxxxx 8	xxxxxxx 7
2	xxxxxxxxx 9	xxx 3	xxxxxxxxx 9	xxxxxxxxxxx 11	xxxxxxx 7
3	xx 2	xxx 3	xxxx 4	xxxxx 5	xx 2
4	xx	x	xxxxxx 6	xx	xxxxxxx 7
5	xxx 3	xxx 3	0	xxx 3	0
6	xxxxxxx 7	xxxx 4	0	xxxxxx 6	Student moved
7	xxxxxxxxxxxxxxxxx 15	xxxxxxxxx 8	0	xxxxx 5	xxx 3
8	x 1	x 1	0	xxxxxxxxx 8	xx 2
9	No student assigned	No student assigned	No student assigned	New student xxx 3	xx 2
10	xxx 3	xx 2	0	xxxxx 5	xxx 3
11	x 1	x 1	0	xxxxx 5	xx 2
12	x 1	xxx 3	xx 2	xxxxxx 6	xxxxx 5
13	xxxx 4	x 1	x 1	xxxx 4	xx 2
14	xxxxxxxxxxx 10	xxxxxxxxxxxxxxxx 12	xxxxxxxxxxxxxxxx 12	xxxxxxx 7	xxxxx 5
15	xxxxxxxxxxx 11	xxxxxxxxxxxxxxxx 13	xxxxxxx 7	xxxxxxxxxxxxxxxx 12	xxxx 4
16	xxxxxxx 8	xxxxxxxxxxxxxxxx 13	xx 2	xxxxxxxxxxx 9	xx 2
17	0	xx 2	xxxxx 5	xxx 3	xxxxx 5
18	xxxxxxx 7	xxxxxxxxxxx 9	xxx 3	xxxxxx 6	0
19	xxxxxx 6	xxxxxxxxxxx 9	0	xx 2	0
20	0	0	0	xxx 3	x 1
21	0	x 1	0	Student moved	Student moved
22	0	x 1	0	xxx 3	x 1
23	xxxxxxxxxxxxxxxx 14	xxxxxxxxxxxxxxxx 15	xxxxxxxxxxx 11	xxxxxxx 9	xxxxx 5

24	0	x 1	x 1	x 1	x 1
25	xx 2	xxx 3	0	xxx 3	x 1

Figure 4

Teacher Survey



1. How often have you implemented Number Talks in your classroom?
  - a. Daily
  - b. Three times a week
  - c. Two times a week
  - d. Once a week
  - e. Whenever I get around to it
  - f. Never/I gave up

In question 1, one response was to a, one response was to c and one response was to e.

2. If you have been implementing Number Talks on a regular basis, would you say that:  
(answer all that apply)
  - a. My students have been more willing to participate in mathematics activities
  - b. My students have stronger number sense skills
  - c. My students are performing better in simple computational problems
  - d. I have seen no change in my students

There was 1 response to a, 2 responses to b, and 2 responses to c for question two.

3. If you have been unable to regularly implement Number Talks, would you say that:

(answer all that apply)

- a. My students do not enjoy Number Talks therefore we don't do them as often
- b. I'm not comfortable with Number Talks therefore I don't do them often
- c. I don't have time for Number Talks
- d. I have not seen a change in my students' mathematical abilities therefore I stopped doing them.

There was 1 response to answer b for question three.

4. I think Number Talks are time well spent in class.

- a. Yes
- b. No

There were 3 responses to answer a for question four.

5. More training on Number Talks would prompt me to use them more.

- a. Yes
- b. No

There were 3 responses to answer a for question five.