A STUDY OF MATHEMATICS HOMEWORK

by

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After spending the day learning in elementary school, most children across the United States are given *homework*, assignments to be completed outside of the regular school day. Most research on homework conducted in elementary schools focuses on the relationship between achievement and time spent on homework. Little, if any, research has investigated the types of mathematics homework assigned to elementary students and its relationship to achievement. Given the continued practice of assigning homework and the gap in literature regarding research that investigates type of homework, as well as the paucity of homework research at the elementary level, there is a need for further research. Thus, the focus of this dissertation was to investigate the type of mathematics homework assigned to fifth-grade students, their interaction with the assigned homework and the relationship to achievement on a statewide test.

This exploratory descriptive study used a convenience sample of fifth-grade students from a school district in the Pacific Northwest to examine the type of mathematics homework assigned to fifth-grade students, their interaction with the assigned homework, and the relationship between the homework students completed and their achievement on the statewide standardized test in mathematics.

The majority of homework collected was correctly completed Direct Contact Practice homework. Furthermore, the mathematical strand of Calculations and Estimations was the most frequently assigned strand. Correlational analysis indicated that weak correlations with student total RIT scores on the statewide standardized test in mathematics existed in several areas. There was a correlation of .29 between the number of correct homework interactions and state test score, a correlation of .36 between the number of *Direct Contact Practice* homework and the RIT score, a -.28 correlation between the number of *Other* homework items completed and the RIT score, and a .26 correlation between the total number of homework interactions and RIT score. When the relationship between homework categorized by math strand and the state stranded math score was examined, there was a .36 correlation between the number of *Algebra* homework interactions and score on the algebra strand of the statewide mathematics assessment.

Limitations of the study are discussed and recommendations for future research are presented.

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CHAPTER I

INTRODUCTION

Few issues in education affect students and their families as frequently as homework. After spending the day working and learning in elementary school, most children across the United States are given *homework,* "work assigned by the classroom teacher to be completed outside of the regular school day" (Cooper, 1989, p. 7). According to the National Assessment of Educational Progress (Campbell, Reese, O'Sullivan & Dorsey, 1996), over two-thirds of all nine-year olds and three-quarters of all 13- and 17-year olds reported doing nightly homework. Although Gill and Schlossman (2003) reported recent declines in time spent on homework, other researchers have reported an increase in homework among our youngest students six to eight years old (Kohn, 2006).

The completion of a homework assignment, more than any other instructional endeavor, involves a complex interaction of school, home, peer and community influences. Teachers convey homework expectations and monitor their completion in a variety of ways. Parents also set homework expectations and create a home environment that contributes to their child's experience with homework. Students take cues on the importance of homework from their teachers, parents and peers. Finally, the greater community plays a role by offering sports and leisure activities that may compete with time needed to complete homework assignments. All these influences interact and can lead to conflict for students, parents, and teachers and thus can be a source of stress within the family (Cooper & Valentine, 2001; Grolnick, 2003; Kohn 2006). The majority of parents do not turn to research journals to inform their opinions and decisions about homework for their children. Instead, many of them get their information from less empirical sources.

Mainstream magazines and popular press commonly espouse the dangers of homework, especially for elementary school age children (Coutts, 2004; Kohn, 2006; Kralovec & Buell, 2000; Loveless, 2003; Ratnesar, 1999). Parents complain that there is too much or too little homework, that it is too hard or too easy, or that homework is too ambiguous (Kralovec & Buell, 2000; Loveless, 2003; Warton, 1998). Teachers complain about the lack of parental support to complete homework assignments, a lack of training in how to prepare effective homework assignments, and a lack of time in which to prepare them (Farkas, Johnson & Duffet, 1999). Students complain about the amount of leisure time taken away by homework (Coutts, 2004; Kralovec & Buell, 2000). In fact, many students consider homework to be the main source of stress in their lives (Kralovec & Buell, 2000). In addition to these complaints, reviews of empirical studies of homework intended to synthesize discrepant findings often bring educators no closer to a firm understanding of the impact of homework on student achievement. This lack of substantiated evidence has contributed to educators questioning the value of assigning homework, especially in elementary school.

Homework assignments rarely reflect a single purpose and are often a combination of instructional and non-instructional objectives (Epstein, 2001; Epstein &

Van Voorhis, 2001). The most common instructional type of homework is referred to as *practice homework* (Gagne, 1970, p. 376-77) and is given to provide students with an opportunity to practice skills and concepts learned in the classroom (Becker & Epstein, 1982). Other types include *preparation homework,* designed to introduce students to ideas and concepts that will be covered more deeply through classroom instruction (Muhlenbruck, Cooper, Nye, & Lindsay, 1999); *extension homework,* designed to involve the transfer of previously learned skills and concepts to new situations (Lee & Pruitt, 1979); and finally, *integrative homework,* assigned to challenge students to integrate separately-learned skills and concepts into tasks such as book reports and science investigative or experimental projects (Lee & Pruitt, 1979).

Homework is thought to have other purposes in addition to enhancing instruction. Some of the non instructional purposes of assigning homework are: to establish communication between parent, child, and school (Corno, 1996; Van Voorhis, 2003); to fulfill district or school policies (Hoover-Dempsey, Bassler, & Burrow, 1995); and in some cases, to punish students (Epstein & Van Voorhis 2001; Xu & Corno, 1998).

The reason most often cited for assigning homework is that it can improve students' academic achievement (Cooper, 1989; Cooper, Robinson & Patall, 2006). However, the results of research on homework involving elementary school children consistently show little correlation between homework and academic achievement in elementary school (Cooper, 1989; Cooper, Jackson, Nye & Lindsay 2001; Cooper et al., 2006). Even with the recent negative press and current research findings indicating little empirical support for the practice, elementary school educators continue to assign homework to their students.

Purpose and Rationale for this Study

Given the continued practice of assigning homework to elementary students, and the gap in literature regarding research that investigates type of homework and its relationship to achievement, as well as the paucity of research at the elementary level, there is a need for further study. Thus, the focus of this dissertation was to investigate the types of mathematics homework assigned to fifth-grade students, their interaction with the assigned homework and the relationship to achievement on standardized tests. Specifically, I looked at the types of mathematics homework assigned, which stranded area it was assigned in and whether it was correctly, incorrectly or not completed by fifth-grade elementary students and its relationship to their overall and stranded mathematics scores on the statewide mathematics assessment.

It is my experience as an educator that homework is usually assigned with the best of intentions; however, it is frequently a source of conflict between home and school. Teachers receive conflicting expectations from parents ranging from those who expect certain frequency, amounts and types of homework to parents who would prefer that no homework be assigned for their children at all. Along with parent expectations, teachers also contend with administrative expectations about homework. In some cases, teachers may be better informed than administrators about the current research and debate on homework and feel that their philosophy and practice towards homework are unsupported by administrators, or vice versa. The varying perspectives of teachers, parents, and administrators make it difficult at best for educators to establish clear homework guidelines and useful assignments for all students. Furthermore, I suspect that the variability in the types of assigned homework and our lack of understanding as to which types of homework, if any, enhance students' academic achievement contribute greatly to our confusion about homework. Although research has not yet substantiated a strong correlation between homework and achievement in elementary students, it does not appear that the practice of assigning homework is going to vanish from our educational practices.

The debate over homework has been ongoing since at least the beginning of the twentieth century, and researchers have conducted studies to try to understand the value of homework. However, we have not come any closer to making well-informed decisions that guide educators in the practice of assigning homework. Although research on homework and achievement at the elementary level is inconclusive, proponents of homework often contend that research supports assigning homework to elementary students. It is understandable that educators and the general public would think that homework goes hand in hand with achievement. Logically, if students spend more time engaged in academic efforts, then this should be reflected in higher achievement. Many feel that homework adds value to instructional time in the classroom. It is hard to accept the fact that at this time, the findings of research defy logic and do not support the added value argument, especially at the elementary school level.

Most of the research involving homework has looked at amount of homework related to students' achievement. The accepted definition of homework is rather broad;

"work assigned by the classroom teacher to be completed outside of the regular school day" (Cooper, 1989, p. 7). However, many types of homework exist, and in most cases the research that has been conducted on homework has only looked at the relationship between the amount of time spent on completed homework and achievement through the lens of the broad definition of homework. Research investigating and documenting *type* of homework and academic achievement is sparse. Therefore, there is a need to better understand the type of homework assigned, how students interact with it, and the relationship to mathematics achievement. If educators are investing time and effort into homework and asking parents and students to do the same, then it behooves them to be aware of which, if any, types of homework are most likely to enhance academic achievement. This, then, formed the impetus for my study: a better understanding of student interaction with homework and the relationship between different types of homework and student academic achievement.

CHAPTER II

LITERATURE SYNTHESIS

Homework has been common practice in public education for many years. It has also been a point of conflict between parents, educators, and policy makers. So that education stakeholders can make sound decisions about homework, it is important to understand the historical significance of homework, the relationship between homework and achievement, prevailing attitudes about homework, and how information and beliefs about homework influence homework policies in schools.

Historical View of Homework

Over the course of the twentieth century, the topic of homework often provoked heated debate between educators, researchers, parents and policymakers. Proponents argue that homework increases time on academic tasks and encourages self-discipline and good study habits. Opponents argue that homework results in over exposure to academics and limits time for leisure and community activities. Often radically different viewpoints have been argued, and the tendency to portray homework as either all good or all bad is at the center of those arguments (Bryan & Nelson, 1994; Gill & Schlossman, 2000).

Early in the twentieth century, homework was viewed as being an important means to disciplining children's minds. At that time, it was thought that memorization led to knowledge acquisition and because memorization could be easily accomplished at home, homework was encouraged as a strong schooling strategy (Cooper, Lindsay, Nye, & Greathouse, 1998; Gill & Schlossman, 2000). However, by the mid 1920's, scholars reacted against the memorization focus of homework, and greater emphasis was placed on developing problem solving as opposed to learning through drill. Opposing views about homework led many educators to wage a crusade to abolish the practice entirely. Others took a more progressive view and began seeking ways to reform homework so it mirrored the educational focus of developing student initiative and interest in learning (Cooper, Lindsay, Nye, & Greathouse 1998; Gill & Schlossman, 2000).

Two philosophical camps, the homework abolitionists and the homework reformers, emerged and began debating the pros and cons of assigning homework. Initially, the homework reformers constituted a small and largely powerless minority, and the homework abolitionists seemed to prevail. In the 1930's and 1940's, many school districts abolished homework in grades K-6. However, in the early post World War II years, issues raised by the homework reformers gained popularity and began to shape educational discourse on homework. The major task of those working to reform homework was to define a new pedagogical purpose for it (Gill & Schlossman, 1996, 2000). The central mission of the reformers was to move homework beyond textbooks and memorization, making homework tasks more activity based. In addition, they worked to develop policies on the quantity of homework to be assigned so as to not over burden students and their families. Rather than suggest that homework should not be assigned, the reformers worked to clarify the type of homework tasks that should be assigned. The reformists' ideas were a direct application of the ideas of progressive educators: phrases such as "learning by doing," "educating the whole child" and "child-centered, learner-driven education" are peppered throughout their writings (Gill & Schlossman, 1996, 2000).

In the late 1950's, after the Russians launched the Sputnik satellite, the trend toward assigning less homework was reversed. Americans became concerned that a lack of rigor in the educational system was leaving U.S. children unprepared to face a quickly growing technological future and to compete with other countries (Cooper & Valentine, 2001). The proposals made by the reformists of the post war era were widely accepted by the educational community, with a resulting increase in homework.

By the mid 1960's, however, the practice of assigning homework was once again reversed. During that time, homework was viewed as putting too much pressure on students. Some educators even thought of homework as detrimental to students' mental health, especially if it took time away from social, recreational and creative activities (Wildman, 1968). This attitude continued throughout the 1970's. But in the early 1980's, the cycle was once again reversed after *A Nation at Risk* (National Commission on Excellence in Education, 1983) identified insufficient homework as a major source of our educational problems. This new focus on achievement led to a "tougher standards" movement. Many schools began to require more and more homework at earlier and earlier grades. School district policies requiring homework in early grades, sometimes even as young as kindergarten, became common practice for the first time in United States history (Gill & Schlossman, 2000; Kohn, 2006).

This trend continued into the 21st century and was further encouraged by the *No Child Left Behind Act* which, with its emphasis on mandatory annual testing and punitive consequences for struggling schools, prompted many schools to respond by increasing homework requirements (Bennett & Kalish, 2006; Kohn, 2006). However, once again, the practice of assigning homework is being challenged by parents and educators concerned about the stress that homework may put on children (Cooper et al., 2006; Kohn, 2006; Kralovec & Buell, 2001; Winerip, 1999)

This brief history of homework clearly illustrates the cyclical nature of public acceptance of homework and how it has been influenced by the prevailing broader social, political, and economic environment. It is clear that homework is still a topic of debate among educators and parents. Therefore, it is essential that stakeholders have a clear understanding of the effects that homework has on student achievement. This understanding will enable stakeholders to make sound decisions about the practice of homework rather than merely reacting to the next swing in public perception about its place in American schools.

Research on the Relationship between Homework and Achievement

Despite the long history of homework and homework research, the role that it plays in student achievement is, at best, only partly understood. Researchers have been far from agreement in their assessments of the benefits and limitations of homework except when it comes to elementary school children. For elementary students, researchers consistently suggest that the relationship between time spent on homework and achievement is little to near zero (Cooper, 1989; Cooper, 2001, Cooper et al., 2001; Cooper et al., 2006; Cooper & Valentine, 2001).

The most extensive studies conducted on homework to date are those of Harris Cooper (Cooper, 1989; Cooper et al., 2006). In his 1989 study, Cooper conducted a meta-analysis of 120 empirical studies on the effects of homework that took place in the years between 1960 and 1987. He divided the analyzed studies into 3 categories. The first type of study compared the achievement level of students who were assigned homework to that of students who were not assigned homework. Out of the 20 studies of this type, Cooper found that 14 favored the homework-assigned group and 6 favored the no homework group, with an overall effect size of d = .21. In addition to a general positive outcome for homework, these studies also suggested a strong relationship between the grade level of the student and the effect that homework had on achievement. High school students in classes with homework scored about two thirds of a standard deviation higher on standardized test scores than their same-grade peers in no-homework classes (d = .64). In junior high school, the effect was less than half the magnitude found at the high school level (d = .31). And at the elementary school level, the effect size was less than one fourth that of the high school level (d = .15). Thus, for the first type of study (no homework to homework condition), Cooper's analysis indicated significant grade level differences on the relationship between homework and achievement on standardized tests.

The next type of study that Cooper (1989) analyzed compared homework to in-class supervised study. As in the first type of study, Cooper found that homework positively correlated with achievement; however, in-class supervised study had a stronger positive correlation than homework alone. The overall effect size of homework compared to in-class supervised study (d = .09) was nearly half of what it was when homework was compared to no homework (d =.21). The most important finding in these studies, relative to my proposed study, was that once again, grade level played an important role on the effect of homework. When homework and in-class supervised study were compared at the elementary level, in-class study proved superior.

The third type of study correlated the amount of time students spent on homework with their achievement scores (Cooper, 1989). These studies used statewide and national data sets and again showed the relationship between homework and achievement to be influenced by grade level. For high school students, there was a weak relationship (r = .25); for students in grades 6 through 9, the relationship was negligible (r = .07); and for students in grades 3 through 5, the correlation between time spent on homework and achievement was near zero.

In their more recent meta-analysis, Cooper, Robinson and Patall (2006) analyzed research studies about homework and academic achievement conducted between 1987 and 2003. Both published and unpublished studies were included in the analysis. Again, these studies were categorized by 3 basic design types. First, researchers could manipulate the presence or absence of homework expressly for the purposes of the study. In this design type, researchers introduced the manipulation at the student or classroom level by either randomly or non-randomly assigning students to homework or no homework conditions (Finstad, 1987, Foyle, 1990, McGrath, 1992, Meloy, 1987, Townsend, 1995). Out of these 5 unpublished studies, 4 were conducted at the elementary level with students in second through fifth grade (Finstad, 1987; Foyle, 1990; Meloy, 1987, Townsend, 1995). Each revealed a positive effect of homework on math or language arts unit tests, with greater gains on post-test scores for students in the homework group. Only one of these studies (Meloy, 1987), looked at the effect of homework on standardized achievement. That study found a negative effect for students in the homework condition when measured on a standardized test for third graders.

The findings from this first group of studies are somewhat obvious. As one might expect, if one uses classroom unit tests to study the effects on homework specifically assigned to help students prepare for those unit tests, the students who have completed the homework are better prepared for the tests and achieve higher scores. However, when measured by standardized assessment, positive effects of homework on long-term achievement are not seen. The power of these studies is that they used random assignment. However, the small number of studies and the variety of methods and contexts preclude their use in any formal analyses investigating possible influences on the effects of homework (Cooper et al., 2006). Furthermore, the same researchers determined that all of these studies were flawed such that the flaws compromised researchers' ability to draw strong causal inference (Cooper et al., 2006).

A second group of studies analyzed by Cooper et al. (2006) used multivariate analyses of data to attempt to statistically equate students on other variables that might be confounded with homework. These studies used data from the National Education Longitudinal Study of 1988 (NELS) or a NELS follow-up on the same students in 1990, 1992, 1994 or 2000, and specifically related the amount of time spent on homework to its effect on achievement-related measures. Unlike the first type of studies, those in the second type did not include "exogenous manipulation" on the part of the researchers (Davis & Jordan, 1994; Hill, 2003; Peng & Wright, 1994; Thomas 2001; Thomas, 2002). Examined as a group, these studies revealed that every regression coefficient associated with homework was positive, and all but one researcher (Hill, 2003) reported results statistically different from zero, with beta weights ranging from .05 to .28. However, this body of research was conducted on middle and high school students only, and the application of these findings to elementary students can not be assumed.

Several additional studies analyzed by Cooper et al. (2006) also used multivariate analysis, with other variables controlled, to examine the relationship between homework and achievement (Brookhart, 1997; Cool & Keith, 1991; Cooper, Lindsay, Nye & Greathouse, 1998; Fehrmann, Keith & Reimers, 1987; Foyle, 1990; Hendrix, Sederberg & Miller, 1990; Olson, 1988; Portes & MacLeod, 1996; Smith, 1990; Smith, 1992; Wynn, 1996). Out of these studies, only three included elementary age students. These three studies revealed a positive but non-significant relationship between the homework and achievement measures (Cooper et al., 1998; Olson, 1988; Wynn, 1996).

Cooper et al. (2006) also analyzed nine studies that tested a structural equation model. Four of these investigations used data from the NELS database or from the *High School and Beyond* database, and all but one study excluded elementary students. Only one of the nine studies, Cooper, Jackson, Nye, and Lindsay (2001), used original data and was conducted with elementary students. Not surprisingly, that study revealed a positive correlation between time on homework and grades assigned by the classroom teacher. The path coefficient was .20, $p < .01$.

A third type of study involved a simple bivariate correlation between time spent on homework and score on an achievement measure. Unlike the second group of studies, no attempt was made to equate students on other variables that might be confounded with time spent on homework. Cooper et al. (2006) found 32 such studies, and from those studies a total of 69 correlations were reported. The researchers found that the correlation between time spent on homework and achievement was significantly higher for secondary students (r = .25) than for elementary students (r =.04), and the association with homework was stronger for grades than for standardized tests. Consistent with Cooper's 1989 study, Cooper et al. (2006) found that the mean correlation between time spent on homework and achievement for elementary students was not significantly different from zero.

Prevailing Attitudes for or against Homework

Although researchers have not found strong positive correlations between homework and achievement, proponents of homework still argue that homework has academic benefits and suggest that there are nonacademic benefits for students as well. Along with that argument, many proponents contend that homework serves as a communication tool between school and home by allowing parents to be involved in the work their children do while at school. They posit that homework encourages self-discipline and good study habits (Cooper, 1989; Cooper et al., 2006; Corno & Xu, 2004; Coutts, 2004; Warton, 2001).

The research on nonacademic benefits of homework does not appear to substantiate the claims of those who support homework. Over the years, research has found that high levels of family involvement in homework are not significantly associated with high levels of academic achievement. (Balli, Wedman, & Demo, 1997; Center for Public Education, 2008; Cooper et al., 2000; Epstein, 1988). In fact, one study (Epstein, 1988), found that students whose parents were more involved in their homework had lower achievement scores. Cooper, Lindsay, and Nye, (2000), found that this was especially true for elementary students. However, one study suggested that at the elementary level, parent involvement in homework might have behavioral benefits, such as increased family time and increased parent awareness of their children's academic life (Balli et al., 1997).

Another argument put forth by proponents of homework suggests that without significant amounts of homework, American students will not be able to compete academically in the international economy. This argument, as well, falls short of being conclusive. Research conducted using information from international assessments shows little relationship between the amount of homework students do and tests scores. For example, research from the Organization of Economic Cooperation and Development (2004), found that students in Finland and Japan are assigned less homework but still outperform U.S. students on standardized assessments. In addition, when the relationship between homework and math achievement was examined in 46 countries, it was found that student achievement was lower in countries where homework counted towards grades, was used as the basis for classroom discussion, and where students corrected homework in class (Mikk, 2006).

Opponents of homework argue that parental involvement in homework can be negative and cause conflict between parent and child, especially if parents put too much pressure on children or are confused about how to help their children. In some cases, they argue, homework is done without adult supervision and can impede the learning process by reinforcing work done incorrectly (Kralovec & Buell, 2001). Opponents contend that homework can lead to over-exposure to academics and can limit time for leisure and community activities. Many feel that schools should not dictate what goes on in the home, including homework related to school study. Some even suggest that homework, due to its sedentary nature, is a source of blame for the rise in obesity in American children (Bennett & Kalish, 2006; Kohn, 2006; Kralovec & Buell, 2000).

It is clear that there are varying perspectives about the value of homework. These perspectives make it difficult for educators to decide how to proceed with homework. Differences in perspective also contribute to differences in how homework practices are carried out across the United States, throughout school districts, and even within the same school. In an attempt to make homework practices more consistent, many school districts formalize policies suggesting the amount of homework teachers should assign to students in different grade levels. Ideally, these policies would be informed by empirical research; however, this is not always the case.

Homework Policies

Solid, evidence-based research in homework and strongly supported evidence as to the positive effects of homework on student achievement remain unseen (Viadero, 1999) for a variety of reasons. First, educational research is typically carried out in real-world contexts. The complexities of educational settings introduce factors that influence whether or not a practice will produce a desired result. The varying factors within each educational setting are sometimes difficult to recognize and even more difficult to represent or control within the confines of a single study. Thus, often studies that appear quite similar produce different results for subtle reasons (Cooper & Valentine, 2001).

Second, for practical and ethical reasons, educational research is often carried out using designs that do not permit strong causal inferences. The use of random assignment to groups of treatment and no-treatment in educational settings is difficult because students are usually assigned to classrooms before research begins. At best, researchers might assign class groups in some stratified random process. Due to these complexities, the outcome of any single study is probabilistic in nature. Therefore, when many studies on homework are conducted, variation in their outcomes in the direction as well as the magnitude of their effects is not surprising. This variation makes it difficult for policy makers to make sound decisions based on research (Cooper & Valentine, 2001).

Although my literature search did not reveal strong evidence for continuing the practice of assigning homework, especially at the elementary level, it does provide a clear description of the conflicting findings in this field. With so little consistency in the empirical literature, it is no wonder that school districts grasp simple guidelines such as the arbitrary ten minute rule suggested by Cooper (1989). An internet search of schools in the state in which I conducted my research revealed that most have a homework policy and many base their decision to continue assigning homework on the erroneous claim that research shows homework to be beneficial to student achievement. In addition, most of these schools also suggest that homework has long-term nonacademic benefits for children, another claim that has not been substantiated by research. The district in which I conducted my research was in the process of developing a clearer understanding of the reasons elementary educators might assign homework and what type, if any is beneficial to student learning and achievement. The culmination of this work is intended to be a revised homework policy for the district (see Appendix A).

Summary of Research

Historically, public acceptance of homework has been cyclical in nature and influenced by the prevailing political, economic and social environment of each time period. Two philosophical camps, the homework abolitionists and the homework reformers, developed in the early twentieth century, and changes in the social, economic and political environment across the country dictated which philosophical camp prevailed at a given point in history. Currently, homework's place in elementary schools is still an unresolved issue among education stakeholders. It appears that the homework abolitionists and reformists are debating their positions once again using achievement claims not yet substantiated by research.

Findings of non-significant or even negative relationships between achievement and homework at the elementary level prevail. Not surprisingly, the link between homework and achievement is stronger when achievement is based on teacher-determined grades rather than standardized assessment scores. Findings at the middle and high school levels show a stronger relationship between homework and achievement, yet there are conflicting studies at each of these grade levels. Although researchers have not found positive relationships between achievement and homework at the elementary level, proponents of homework argue that homework benefits student achievement. Opponents of homework argue that homework places too much stress on students and interferes with leisure and community activities.

In this study, I add to our understanding of homework by researching the type of homework assigned, student interaction with the assigned homework and its relationship to achievement on the statewide mathematics assessment. An understanding of student interaction with homework and the relationship between type of homework and achievement will help elementary educators determine how best to structure homework for their students—or give them reason to advocate for abandoning the practice.

CHAPTER III

METHODOLOGY

In this chapter, I describe the research design, setting, participants, and measures I used to describe the situation of homework in fifth grade classrooms in one district and to examine the type of homework assigned, student interaction with the assigned homework, and its correlation to mathematics achievement.

Research Design

This research was an exploratory descriptive study of the situation of homework in 5th grade classrooms in one school district. I examined and described themes that emerged from the collection of homework assigned to 5th grade students and gathered information from their teachers about their homework policies and students' statewide assessment performance.

Setting

This study took place in a school district located in the south metropolitan area of a large city in the Pacific Northwest. The district encompassed two cities and a small rural area and had approximately 8000 students in kindergarten through 12th grade. The district had a long history of high academic performance. Their SAT scores were among the highest in the state, and the state consistently ranked first or second nationwide for states in which 50% or more of graduating seniors take the SAT. Typically, approximately 90% of high school graduates in the district matriculate to 2-year or 4-year colleges the fall after high school graduation. The district was also one of the highest scoring districts in the state on the statewide, large-scale assessment. The elementary schools consistently score overall ratings in the *exceptional* or *strong* categories of Adequate Yearly Progress based on the *No Child Left Behind* reporting areas.

In terms of demographics, the school district is 87% white and 13% minority. The district's free and reduced-price meal rate is 13%, and the population of students identified as English Language Learners is 5%.

According to district elementary school principals, the student population in each classroom was designed with balance in mind. In other words, there was an attempt by each elementary school to ensure that classes were equivalent in gender; numbers of high-, medium-, and low-performing students; and numbers of children identified as Talented and Gifted as well as children on Individualized Education Plans and children identified as English Language Learners.

Participants

Six of the seven elementary schools in the district participated in this study. One elementary school was excluded to avoid bias because I was the principal of that school. I used a convenience sample of twelve fifth-grade classrooms, two from each participating elementary school. Fifth-grade teachers with at least five years of teaching experience were recruited to participate in this study. There were 5 male teachers and 7 female teachers who participated in this study. Twelve students were nominated by each participating teacher based on their fourth-grade statewide mathematics assessment. Only students who scored in either the *nearly meets* or *meets* categories of the fourth-grade state assessment were chosen for this study. For fourth-grade, the *nearly meets* scores range from 208-211 and for the *meets* category from 212-224 (Oregon Department of Education, 2006). Choosing student participants from these ranges helped to control selection bias as might occur had I included students who showed very low mathematics ability or very high mathematics ability as determined by their past state mathematics benchmark scores. Logically, students who might benefit from the value-added effect of homework would tend to be those students in the middle of the scoring range. Students whose scores are below the *nearly meets* range may correctly complete the assigned homework, however, because of low mathematics ability, may not be able to score beyond a *nearly meets*. Students whose scores are higher than the *meets* category may—because of high mathematics ability—be able to achieve at or beyond that level without doing any homework, or, may, because of high motivation and ability, correctly complete all of the homework and score high on the assessment, making it look, in comparison to others, that the homework had a positive effect on their achievement score.

Power analysis indicated that "to detect a moderate correlation (r = .30), a sample of 64 analyzable subjects will provide 80% power" (http://www.researchconsultation .com). I sent out 148 parent permission slips and received permission from 29 parents for their students to participate in this study.

Procedures

I met with the district's Deputy Superintendent to obtain permission to conduct this research in the district (see Appendix B). Then, I held a meeting with all of the principals from the six participating elementary schools to ask for permission for this study to be carried out in each of their buildings. At the meeting, I explained the nature and background of the study. Once I received permission to include the schools, I recruited two fifth-grade teachers from each participating elementary school. Students were given the opportunity to decline to participate in the research. Written student assent and teacher and parent permission were obtained before the study began (see Appendix B). One student, student J2, was removed from the study by request after the study had begun, therefore, their data was not included in this study.

To reduce the potential for researcher bias and to protect confidentiality, each of the participating teachers and students were assigned a code number by a neutral third party. An Instructional Coordinator from each school who signed a confidentiality agreement (see Appendix B), coded each homework assignment with each teacher and student participant's code (Appendix C), made copies of participating students' completed homework, and delivered the homework to me through the district courier. Once the students completed the state mathematics assessment, the Instructional Coordinators also coded individual test score reporting sheets for each student and delivered them to me for analysis.

Data Sources

I included several data sources in this study: totals of type of homework, totals in each mathematical strand, and totals of correctly and incorrectly completed homework. Students' stranded and overall scores on the state mathematics assessment, and a teacher survey were also collected and analyzed. The survey gathered information about years of teaching experience and teacher attitudes about homework and the state assessment. This information was collected to provide a classroom context for the study as well as to help explain the findings (see Appendix F).

For this study, I further developed the definition of *practice homework* by defining two different types: *Access Skills Practice* and *Direct Contact Practice*. I defined *Access Skills Practice* as math homework that only addresses computation practice and rote memorization. I defined *Direct Contact Practice* as math homework that addresses practice with mathematical skills, concepts and mathematics strand vocabulary aligned with the state standards. Assignments classified as *Direct Contact Practice* closely resemble questions and/or address concepts that may appear on the state assessment. A third category, *Other Homework,* included homework assignments that did not fall into either the *Access Skills Practice*or *Direct Contact Practice* categories and was also tabulated.

I used the state's Mathematics Test Specifications and Blueprints for test development document to develop sample questions for the typology of Direct Contact Practice and Access Skills Practice homework used in this study. This document, used to guide the writing of questions for the statewide assessment, explains the state's statewide assessment program and the specifications used when the state's assessments are designed. The content of these specifications reflects the skills and expectations outlined by the Content Standards adopted by the state's State Board of Education. These content standards directly align with the National Council of Teachers of Mathematics' Principles and Standards for School Mathematics (2000). This document also includes common curriculum goals for each strand of mathematics, the state standards for grade 5, and an explanation and sample questions for each standard. In the fall of 2008, six administrators from the district and I assessed consistency in categorizing homework using the adapted typology and the Blueprints (see Appendix D) to categorize by strand and type the sample math homework from the non-participating elementary school. I calculated the percentage of agreement between individual participating administrators' categorizations and my categorizations to evaluate the consistency of agreement with the adapted typology and the categorization of type and strand of mathematics homework. We categorized 121 fifth grade mathematics questions. Initially, there was a 79% agreement on the typology categorization. After discussion and clarification of the definitions of the three typology categories, we re-categorized the mathematics questions and reached 91% agreement. The mathematical strand categorization agreement was 93%.

Copies of completed mathematics homework assignments were collected from each of the participating students from January 2009, through March of 2009, for a collection period of nine weeks. I coded and categorized each assigned mathematics homework question for each student into either Access Skills Practice questions or Direct Contact Practice questions. I also categorized those questions by mathematics strand (see Appendix E). Homework that did not fall into either of the access or direct practice categories was sorted and tallied into a category labeled as Other Homework. Each individual item assigned as homework was included in these tallies. Homework items assigned to students were tallied and categorized by *student interaction; correctly completed*, *incorrectly completed* or *not completed*.

Data Analysis

I calculated descriptive statistics to examine student interaction with each type of homework.divided into three categories: (a) Access Skills Practice, (b) Direct Contact Practice, and (c) Other Homework. I also calculated and examined descriptive statistics for each mathematics strand area tested on the state assessment. I used correlational analysis to determine the strength of the relationship between homework and student mathematics overall RIT scores and stranded scores on the state assessment.

Hypotheses

I hypothesized that the null hypothesis would be supported in the relationship between fifth grade students' interaction with homework in each homework type category and their overall and stranded scores on the statewide assessment. I further hypothesized that there would be great variability in the type and amount of homework assigned between classrooms and in the way students interacted with the assigned homework.

CHAPTER IV

RESULTS

Before explaining the relationship between type and amount of homework and student achievement, I provide frequency counts from teacher responses to the survey. I then provide descriptive statistics for homework interactions, types of homework and homework by mathematical strand. Finally, I present the results of my correlation analyses, examining the relationship between homework interactions, types of homework, and state mathematics test scores, both for the individual mathematics strands and for the overall RIT score.

Teacher Survey

In all, ten teachers completed the paper-pencil survey. This represents 83% of my sample of teachers. One teacher omitted a response for one question, but all teachers responded to the remaining questions (see Table 1). Although the total number of teachers who completed the surveys was small, those who did complete the surveys presented a good range of years of experience, with the least experienced teacher having taught for five years and the most-experienced teacher having taught for 28 years. Six of the teachers had taught for fewer than ten years, while the remaining four had taught ten or more years.

The survey asked teachers to report on their familiarity with the state Mathematics Test Specifications and Blueprints as well as on their attitude toward the importance of homework. All ten teachers reported their main reason for assigning math homework was to provide students with the opportunity to practice the concepts being covered in class. Two teachers indicated they thought homework was important because it taught students time management skills. One teacher [mistakenly] identified homework as a district requirement. Only one teacher explicitly mentioned the mathematics strands in answering this question. Additional questions provided me with insights into how teachers differentiate homework, but those are not reported here, as they served only to provide context to allow me to better understand homework in the district.

Table 1

Frequency Counts from Teacher Survey

How familiar are you with the Mathematics Test Specifications and Blueprints on the state education website?			
I'm not at all familiar	I know they are on the ODE Website	I have read them	I use them along with other resources to create math homework and classroom activities
3	2	2	2
On a scale of l (low) to 4 (high), how important do you think homework is for students' overall achievement in your grade level?			
Not at all important	Somewhat Important	Important	Very Important
0	3	2	5

Homework Interaction

I analyzed homework items for each individual student and categorized the interactions as correct, incorrect or not attempted (see Table 2). Fully 82% of the collected homework was correctly completed, 13% was incorrectly completed and 4% was not attempted. The mean for correct interactions was substantially higher (M = 184.76, SD = 119.32) than the mean for incorrect interactions (M = 29.72, SD = 20.09). All interactions categorized as not attempted were removed from all subsequent analyses.

Table 2

Descriptive Statistics for Homework Interactions, Counts of Homework Problems

Interaction	Total	M	SD	Minimum	Maximum	Percentage
Correct	5358	184.76	119.32	22	498	82
Incorrect	862	29.72	20.09	0	85	13
Not Attempted	276	9.52	13.88	0	43	4
Total	6496	224.0	136.97	46	571	

Homework Type

I categorized each homework interaction by type. In all, 73% of the homework collected during this study was Direct Contact Practice homework, 25% was Access Skills Practice and 2% was categorized as Other Homework. The mean for Direct Contact Practice was substantially higher (M = 161.54, SD = 99.74) than either Access Skills (M = 55.04, SD = 58.98) or Other homework (M= 4.00, SD = 5.33). Table 3 contains descriptive statistics for homework type. Data include mean and standard deviation for each homework type category as well as the range and percentage of each type.

Table 3

Descriptive Statistics for Homework Type, Counts of Homework Problems Completed

Type	Total	M	SD	Minimum	Maximum	Percentage
Direct	4523	161.54	99.74	35	443	73
Access	1541	55.04	58.98	0	244	25
Other	112	4.00	5.33	0	20	2

Homework by Mathematical Strand

Each homework question was categorized into one of five mathematical strands. Over 39% of the collected homework was in the mathematical strand of Calculations and Estimations (M = 85.79, SD = 85.22). The next most frequent strand was Geometry at 29% (M = 65.04, SD = 55.03). The other stranded areas were: Measurement at 18% (M = 40.68, SD = 66.54), Algebra at 9% (M = 20.07, SD = 34.15) and Probability and Statistics at 4% (M= 9.00, SD = 15.00). Table 4 contains descriptive statistics for mathematical strands. Data include mean and standard deviation as well as range and percentage of each strand collected.

Table 4

Descriptive Statistics for Homework Strand, Counts of Homework Problems Collected

Strand	Total	M	SD	Minimum	Maximum	Percentage
Calc/Est	2402	85.79	85.22	0	303	39
Geometry	1821	65.04	55.03	0	180	29
Measurement	1139	40.68	66.54	0	211	18
Algebra	562	20.07	34.15	0	115	9
Prob/Statistics	252	9.00	15.00	0	62	4.03

State Test Score by Mathematical Strand

The state test in mathematics is reported by five mathematical strands as well as an overall RIT score. On the state test, students in my sample scored highest in Algebra (M = 226.61, SD = 12.51). The next highest scores were in the Measurement strand (M = 225.96, SD = 10.79). The third highest scores were in the Probability and Statistics strand (M = 225.79, SD = 11.37). Students scored lowest on the Geometry (M = 225.57, SD = 11.34) and Calculations and Estimations strands (M= 223.71, SD = 7.04). Table 5 contains descriptive statistics for the state test by mathematical strands as well as total RIT score. Data include mean and standard deviation as well as range and percentage of each strand collected.

Table 5

Descriptive Statistics for State Mathematics Test Scores, by Strand

Strand	M	SD	Minimum	Maximum
Geometry	225.57	11.34	204	258
Algebra	226.61	12.51	193	248
Measurement	225.96	10.79	211	259
Calculations and Estimations	223.71	7.04	201	231
Probability and Statistics	225.79	11.37	207	250
Total RIT Score	225.25	6.67	211	236

Correlations

I examined the relationship between student performance on the state mathematics test and the number of homework problems with which each student interacted (r = .26). I further examined the relationship between student performance on the state mathematics test and three specific aspects of homework: interaction, type, and mathematical strand. For the relationship between student performance on the state mathematics test and interaction with homework, I correlated RIT score from the state mathematics test to the number of correct, incorrect, and non-attempted interactions with homework (see Table 6).

Table 6

Correlation between State Test Score and Interaction

	Correct	Incorrect	Not Attempted
RIT Score	.29	.01	-.22

For the relationship between student performance on the state mathematics test and type of homework, I correlated RIT score from the state mathematics test to the number of interactions with *direct*, *access*, and *other* homework problems (see Table 7).

Table 7

Correlation between State Test Score and Type

	Direct	Access	Other
RIT Score	.36	.01	-.28

For the relationship between student performance on the state mathematics test and the number of homework problems they had completed in the different strands, I correlated stranded score from the state mathematics test to the number of math homework problems within each strand. For Geometry, Measurement, Calculations and Estimations, and Probability and Statistics, the relationship was negligible (r = -.07, -.02, -.01, -.14, respectively). I found a weak relationship between Algebra homework and the state Algebra stranded score (r = .36). The number of Algebra homework problems students interacted with predicted about 13% of the variance in state Algebra stranded score. It is also worth noting that 100% of the Algebra homework problems were *Direct Contact*

Practice, while 95% of the Calculations and Estimations homework problems were *Access Skills Practice*.

Summary of Results

My findings did not support my hypotheses related to the relationship between homework and performance on the statewide assessment. I found weak relationships between fifth grade students' interaction correct and incorrect interactions with homework and their scores on the statewide mathematics test. I also found a weak relationship between both the number of *Direct Contact Practice* and *Other* homework type homework problems students completed and their scores on the statewide mathematics test. In addition, I found a weak relationship between the number of algebra interactions and fifth grade students' algebra strand score on the statewide mathematics test. All other relationships that I examined were statistically non-significant.

However, my findings did support my hypothesis that there would be great variability in the type and amount of homework assigned between classrooms and in the way students interacted with the assigned homework. I found that, indeed, the number of interactions with homework varied tremendously from student to student.

CHAPTER V

DISCUSSION

In this section, I discuss the results of my study with respect to the research questions asking (a) how students interacted with assigned homework, (b) what type of homework was assigned, (c) what strand of homework was assigned, and (d) the relationship between achievement on the state mathematics assessment and student homework interaction, homework type, and strand. I begin by discussing the limitations to my study, then discuss the implications of the findings, ending with suggestions for future research.

Limitations

This study had several limitations, including: (a) sample size, (b) research setting, (c) duration of the study, (d) dependability of data collection, and (e) lack of demographic information for student participants.

Sample size. There were 28 student participants in my study. This represents only 4% of the 5th graders in the district. Furthermore, power analysis indicated that a total of 64 subjects were needed to provide 80% power (http://www.researchconsultation .com). Originally, I had planned to over-sample. I sent out 148 parent consent forms, but only 29 parents returned the signed forms, despite my attempts to encourage wider participation (I re-sent the consent forms to all parents who had not responded after the initial form went out). As mentioned earlier, one of the students dropped out of the study, leaving me with only 28. Thus, although the results of this study can inform the district as to the situation of homework for some 5th grade students, the results of this study cannot be generalized across the district or to the larger population of fifth-grade students in general.

Research setting. I conducted this study in six 5th grade classrooms in a high performing school district in the Pacific Northwest. Typically, over 90% of the 5th grade students in the district meet or exceed the standards for the state mathematics assessment. Comparatively, across the state only about 77% of 5th graders meet or exceed the standards (Oregon Department of Education, 2009). Furthermore, 86% of the students in this study met or exceeded the state standards assessed on the 5th grade statewide assessment. Clearly, the district in which I conducted my study is well above the state in 5th grade mathematics achievement and, therefore, the results from this study may not generalize to other 5th grade populations.

Study Duration. This study was conducted over a period of 9 weeks. Although this timeframe provides a window into trends that might be occurring in homework in the school district, this period of time only represents about 26% of the school year. The state mathematics assessment is meant to be a comprehensive assessment of student learning in one school year. If researchers want to get a clearer picture of the relationship of homework to achievement, then homework should be collected and analyzed over a much longer period of time.

Data Collection. Homework for this study was collected by internal district employees who had jobs that required a substantial time commitment. Their other work responsibilities may have impeded consistent data collection. The process for collection of data was clearly outlined; however, because it was carried out by people other than myself, I cannot assure that all homework interactions were indeed collected, resulting in possible missing data. Therefore, the results of this study may have been impacted by missing data, but it is impossible to determine if this was, in fact, the case.

Sample demographics. Because I conducted this study in the district where I am employed, I did not collect demographic data from student participants. This decision, which helped protect confidentiality, also resulted in the inability to analyze what differences exist—if any—in the relationship between homework and state test performance in mathematics for different sub-groups of students. The work of all students, regardless of sex, ethnicity, language of origin, or special/general education placement, was grouped together throughout the study.

Findings Related to the Teacher Survey Information

Teachers in my study echoed the suggestions made in *A Nation at Risk* (1983) with their feeling that the main purpose of homework is to provide students with the chance to practice the skills being taught in class. Their survey responses seem to indicate that they are focusing more on this aspect of homework than on the potential for homework to establish self-discipline and good study habits, as suggested by Cooper et al. (2006), Corno and Xu (2004) and Coutts (2004), although one teacher did include reference to homework being a reinforcement of good study behavior.

That only one teacher made reference to the state content standards in response to the question about what he/she considers when designing or selecting math questions to assign for homework is not surprising, given that only two teachers indicated that they use these standards to create math homework and classroom activities. Three of the teachers indicated that they were not at all familiar with the state content standards in mathematics, two reported that they knew they were on the state department of education's website, but indicated they had not read them and did not use them to create math homework and classroom activities. This lack of attention to the state content standards may help explain the weak relationship between homework and performance on the statewide mathematics assessment. Given that the statewide assessment is designed to assess student knowledge and skill in these standards, one might expect a stronger relationship if the standards were being used as a guide to design homework.

Responses to the question about the importance of homework are more consistent. In all, seven of the teachers indicate that they think homework is *important* or *very important* for students' overall achievement in their grade level, while only three indicate they think it is only *somewhat important* and none of the teachers indicated they think it is *not at all important*. These findings contrast with findings from the Organization of Economic Cooperation and Development (2004), which found that students in Finland and Japan are assigned less homework but still out-perform United States students on standardized assessments. In addition, Mikk (2006) found that student achievement was lower when homework counted toward grades. Like many United States teachers, those included in my sample appear to support homework even though the literature related to its use, especially in elementary school, suggests it might not have much value.

Findings Related to the Proportion of Homework by Interaction

The proportion of homework that students correctly completed indicates that most of the student participants had the skills to interact with the assigned homework in a positive manner or that they had support at home to enable them to do so. However, the ranges in correctly completed homework and total amount of homework indicate that for some students this may not be true. For example, student B1 only had 46 interactions of homework, and only 22 of those interactions were correct. Furthermore, student B1's teacher expressed concern that the student participating from her class "was challenged by work production both in class and at home" and although the amount and interaction of homework collected for this study was "typical for student B1," she indicated that "the student was not representative of the work that most students do in [her] class." Perhaps this finding confirms the fear of some opponents of homework; that some students do not have the skills or supports in place to complete homework correctly, therefore reinforcing incorrect concepts and skills and establishing negative work habits (Kravolec & Buell, 2001). However, for this particular study, the majority of students had mostly positive interactions, in that most of their homework was completed correctly.

The average amount of homework interactions collected for each student over this 9-week study was 220 total interactions. In other words, on average, each participating student had about six math problems a night. However, data collected during this study indicate that there is great variation in the total number of interactions by individual students, ranging from students who interact on average with only one problem each night, to students who interact on average with 15 math problems each night. This finding has implications for teachers.

Bennett and Kalish (2006), Kohn (2006), and Kralovec and Buell (2000) suggest that students are given too much homework. In my study, the average student completed only six math problems per day, with the student who had the most math homework completing only 16, on average, per day over the course of the nine weeks during which I collected data. This amount of homework does not appear to be too much; however, teachers must take into consideration students' ability and homework they have assigned in the other content areas that would add to the total amount of time each student must devote to homework completion. For students who struggle academically, six problems may be a large burden to them and their families. Likewise, when students have a large amount of other content area homework in addition to mathematics, being assigned six problems in math may, indeed, be too much.

Findings Related to the Proportion of Homework by Type and Mathematics Strand

In regards to homework type, the greatest proportion of homework collected for this study was Direct Contact Practice homework. In other words, most of the homework collected and completed by the participating students was directly related to the state mathematics standards. This finding indicates that the majority of homework with which participating students interacted allowed students practice with math skills and concepts similar to those set forth in the state standards and assessed on the state mathematics assessment. A much smaller proportion of the collected homework was Access Skills

Practice. This finding contradicts claims by Bennett and Kalish (2006) and Kohn (2006) that homework tends to be rote practice of basic facts and algorithms.

My findings suggest that deeper conceptual understanding, and not rote memorization or the practice of traditional algorithmic processes, is the main focus of homework for these participating students. Especially in the area of Algebra, where I found the highest correlation between homework and state tests score (r = .36), students in my sample appear to be working with more complex, direct practice mathematics problems in this strand.

However, to add another layer of confusion to the already baffling question about homework for elementary students, this pattern of assigning more complex homework problems does not hold true for some of the individual strands. For example, nearly 60% of the homework collected in the strand area of Calculations and Estimations is categorized as Access Skills Practice. This finding appears to support the claim that homework is mostly rote and a waste of time made by critics of assigning homework, especially at the elementary school level (Bennett & Kalish, 2006; Kohn, 2006).

If 60% of the homework in the Calculations and Estimations strand, which was also the strand area in which most homework was collected, was rote and algorithmic and not directly related to questions on the state assessment, then one would expect to see little relationship to student achievement in that mathematics strand. Indeed, the data indicate that this is the case (r = -.01). This finding seems logical. If students are expected to be prepared to answer questions in calculations and estimations that require 3-step problem solving strategies and conceptual understanding at deeper levels, then practicing rote and algorithmic Access Skills Practice questions for homework seems to defeat the purpose of homework practice.

An explanation for having assigned this type of homework was given by two teacher participants on the teacher survey. One of them explained that she assigns homework that is "recognizable and understandable to parents; mostly memorization of basic facts and practice of traditional algorithms," while the other provided a similar response. Perhaps these teachers spend valuable class time on the deeper skills and concepts and leave the practice of more basic skills for homework.

These findings—that the homework strand with the strongest relationship to the state mathematics stranded score (Algebra) is also the strand with the highest proportion of Direct Contact Practice homework (100%) and the homework strand with one of the weakest relationships to the state mathematics stranded score (Calculations and Estimations) has the highest proportion of Access Skills Practice homework (95%)—offer insight into the study of homework. This approach to studying homework's impact (categorizing it further into type of homework and its relation to the state achievement test) may offer improvements to the way homework is more typically studied, as a single phenomenon, where such differences would not emerge. Although my findings with such a small sample should not be generalized, the methodology I used in this study may be worthy of further replications with larger samples.

Findings Related to Homework Interactions and Achievement

In regards to the relationship between homework interaction and achievement, I found a weak positive correlation between the number of correct interactions and the students' overall RIT score on the statewide mathematics assessment (r =.29). This correlation is higher than what was found in prior meta analysis of homework research that looked at time spent on homework (rather than number of interactions), where the average correlation for elementary students in grades three to five was close to zero (r = .02) (Cooper, 2001).

Because I was more interested in studying homework interactions, I did not collect data about the amount of time students spent on homework. Thus, it is impossible to know how much time students spent doing their math homework. Logically, those students who only completed one problem a night would likely spend less time on their homework than those who completed 16 problems a night. However, the amount of time a student spends on homework is not only determined by the number of problems assigned, but also by many other variables, including the ability of the student and the support available in the home environment. Thus, I believe the use of *time* as an independent variable is difficult to defend.

Findings Related to Homework Type and Achievement

I found that the strongest positive relationship between homework type and achievement existed between Direct Contact Practice homework and students' RIT score on the statewide assessment (r = .36), a negligible relationship between Access Skills homework (r = .01), and a weak negative correlation between "Other" type of homework and students' RIT score on the same statewide assessment (r = -.28). Although the two significant correlations in my study are small, they are comparatively much higher than what prior researchers have reported, using other independent variables related to homework. Most of those studies (Cooper, 1989; Cooper, 2001; Cooper et al., 2006) have reported correlations near zero when examining the relationship between homework and achievement. In this case, and I suspect in most cases, the *type* of homework students interact with is more relevant to the relationship of homework to student achievement than the *time* that it takes for students to complete homework or whether they had homework or not. If students are spending large amounts of time on homework and researchers are not paying attention to the type of homework they are doing, then that might be why so many past studies analyzing the relationship between the time elementary students spend on homework and achievement have found that relationship to be nearly nonexistent. In other words, students in these prior studies could be spending large amounts of time doing less helpful types of homework, resulting in little impact on achievement.

Findings Related to Homework Strand and Achievement

Regarding the relationship between the number of interactions in each strand category and individual strand scores on the statewide mathematics assessment, the relationship with achievement in each of those strands was negligible, with the exception of the strand area of Algebra. In this area, I found a weak positive relationship between the number of Algebra interactions and students' Algebra score on the statewide assessment (r = .36). Given that the relationship between number of homework items completed in Algebra and score on the statewide assessment in this strand area is the strongest in my study, additional research to explore this relationship further seems warranted.

Future Research

Previous researchers have looked at homework in terms of the amount of time students spent completing homework and its relationship to achievement, or compared homework to no homework groups, or in-class supervised study (Cooper, 1989; Cooper et al., 2006). However, to my knowledge, previous researchers have not examined the students' *interactions* with homework or the *type* and *strand* of homework students are completing.

Based upon my findings and the findings of prior research, I would suggest several follow-up studies to further examine this topic. For instance, I would suggest a similar study, but with more participants to provide additional power for analysis. A larger sample would increase the likelihood of the sample being more representative of fifth grade students in the population. In addition, I would suggest a quasi-experimental study in which one could control number and type of homework problems assigned to treatment and comparison groups as a way of examining causal relationships. More complex statistical analysis also might provide more insight into this topic.

My findings—that when one looks at homework through a more specific lens, classifying it by how closely it is aligned to the state content standards / state assessment items, one may find a clearer relationship between homework completion and achievement—have implications for future research in this area.

APPENDIX A

THE DISTRICT'S HOMEWORK GUIDELINES DRAFT

The District's Homework Guidelines Draft

Primary School

Homework is a valuable strategy for developing students' lifelong learning habits. Being responsible and accountable for completing a task, building routines, and learning how to ask for help are important skills to practice. In addition, homework is a way to reinforce classroom instruction, promote home/school communication, and involve parents in the learning process. With consistent homework assignments, children gain fluency, speed and accuracy using skills that lead to competence and confidence.

Individual students learn and process learning at different rates and in different ways. Therefore, the amount of time spent on homework will vary by child; what takes one child 10 minutes to complete can take another child much longer, (and vice versa). General guidelines for daily homework and typical assignments are:

- Kindergarten and First Grade 10-20 minutes
  Reading with parents, printing practice, beginning math facts
- Second and Third Grades 20-30 minutes
  Reading, writing, spelling, math
- Fourth and Fifth Grades 30-50 minutes
  Reading, writing, spelling, math, vocabulary, information searches, projects

If a child consistently struggles with homework or constantly spends more than the recommended time on homework, please contact the teacher so assistance can be provided or adjustments can be made. Don't hesitate to contact your child's teacher with any questions regarding homework.

APPENDIX B

RECRUITMENT LETTERS

Dear Deputy Superintendent,

As you know, I am a doctoral candidate from the University of Oregon Department of Educational Leadership. I would like to conduct my research in the Name of School District. I hope to learn about fifth grade mathematics homework; the type that is sent home with students, how they interact with it and the relationship between homework and achievement. The results of my study will contribute to my doctoral dissertation and hopefully, contribute to our understanding of homework in our school district.

My research is designed to be a descriptive analysis of the situation of homework in 5th grade classrooms in one school district. I will examine and describe themes that emerge from the collection of homework assigned to 5th grade students. Furthermore, **I will use descriptive analysis to explain student interaction with homework. Specifically I will look at: the amount and type of correctly completed, incorrectly completed or not completed homework. Then I will collect participating student's Oregon Mathematics Benchmark Assessment scores to examine indicators that may be suggestive of the relationship between homework and achievement on the state mathematics assessment.**

To provide a classroom context for the study as well as to help explain the findings, a survey will be given to teacher participants. The survey will gather information about years of teaching experience and teacher attitudes about homework and the state assessment.

As you know, confidentiality of student and teacher information is highly important. In my study, participating children and teachers will first be given a code number that will protect confidentiality. **Beginning January 20, 2009 and ending March 20, 2009, each child's completed mathematics homework assignments will be collected on a weekly basis by an Instructional Coordinator at each participating school who has agreed to confidentiality and coding.** The assigned mathematics homework will provide data about the type of homework fifth grade children are assigned and how they interact with it. Once each child has completed the State Benchmark Assessment, I will collect participating students' mathematics scores, which have been coded for confidentiality, to use in my data analysis.

If you agree to allow me to conduct my research in the school district as described above, please sign the bottom of this letter and return it to me. I have included a copy for your records. If you have any questions, I can be reached at 503-673-7070. I have attached my dissertation proposal for your review.

Sincerely,
Holly Omlin-Ruback

I_______________________________agree to allow Holly Omlin-Ruback to conduct her dissertation research; A Study of Mathematics Homework in the Name of School District.

Signed ____ Date___________

Deputy Superintendent

Dear Fifth Grade Students,

You are invited to participate in a research study conducted by Holly Omlin-Ruback, a doctoral candidate from the University of Oregon Department of Educational Leadership. I hope to learn about the type of mathematics homework assigned to fifth grade students. You are invited to be a possible participant because you are a fifth grade student in the West Linn-Wilsonville School District.

If you participate you will be assigned a code number that will protect your identity. Then I will collect copies of your homework beginning January 12, 2009 and continue through March 13, 2009. Your homework will provide information about the type of homework you are assigned and how you interact with it. I will also collect your state assessment score once you have completed it. I hope to use the information I collect to better understand homework and how it might be related to student achievement. However, I can not guarantee that you will personally receive any benefit from this research.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with your teacher, principal or the school district. If you decide to participate, you are free to stop participating at anytime without penalty.

If you have questions, please feel free to contact me, Holly Omlin-Ruback at 503-673-7070. **If you do not give your assent to participate in this study, please sign the bottom portion of this form and return it to your classroom teacher by January 15, 2009.**

Sincerely,
Holly Omlin-Ruback
Principal, Bolton Primary School

I ________________________________ **DO NOT** want to participate in this study.

Student signature____Date___________

Dear Parents or Guardians

Your child is invited to participate in a research study conducted by Holly Omlin-Ruback, a doctoral candidate from the University of Oregon Department of Educational Leadership. I hope to learn about the type of mathematics homework assigned to your fifth grade student and how it may be related to achievement. The results from my study will contribute to the findings for my doctoral dissertation. Your child was selected as a possible participant in this study because they are a fifth grade student in the West Linn Wilsonville School District and their classroom teacher nominated them based on their fourth grade Oregon Mathematics Benchmark Assessment scores in which they scored in either the "nearly meets or "meets category.

If your child participates, they will first be given a code number that will protect confidentiality. Then, your child's completed mathematics homework assignments, coded for confidentiality, will be collected on a weekly basis beginning January 12, 2009 and ending March 20, 2009. Your child's mathematics homework will provide data about the type of homework your child is completing. Once your child has completed the Mathematics Benchmark Assessment, given to all fifth grade students in the state of Oregon, I will collect your child's score, which has been coded for confidentiality, to use in my data analysis. I hope to use this information to help parents, educators, and students better understand the type of homework assigned to fifth grade students and the relationship between homework and achievement. However, I cannot guarantee that you or your child will personally receive any benefits from this research.

Your child's participation is voluntary. Your decision whether or not to let your child participate will not affect your relationship with the West Linn Wilsonville School District or your child's grades in his/her class. If you decide to allow your child to participate, you are free to withdraw your consent and discontinue your child's participation at any time without penalty.

If you have questions, please feel free to contact me, Holly Omlin-Ruback at (503)-673-7070 or Dr. Jane Stickney at (503)-673-7000, or my advisor, Dr. Gerald Tindal at (541) 346-3535. You may also contact your child's school principal or teacher. If you have questions regarding your child's rights as a research subject, contact the Office for Protection of Human Subjects, University of Oregon, Eugene, OR 97403, (541) 346-2510. This office oversees the review of the research to protect your rights and is not involved in this study.
If you give your consent for your child's participation in this study, please sign the bottom portion of this form and return it to your school principal by January 12, 2009.

Sincerely,
Holly Omlin-Ruback
Principal, Bolton Primary School

I give my consent for my child (name)____________________to participate in this study. I understand that my child's weekly homework will be collected for the time period specified in the permission letter and that my child's Oregon Benchmark Assessment scores for mathematics will be collected in the spring. I understand that to protect anonymity and confidentiality, all student information, test scores and homework will be coded.

Print Parent/Legal Guardian name:____________________________
Parent/Legal Guardian Signature:________________________ Date________________

Dear Teacher Name,

You are invited to participate in a research study conducted by Holly Omlin-Ruback, a doctoral candidate from the University of Oregon Department of Educational Leadership. I hope to learn about the type of mathematics homework assigned to fifth grade students and its relationship to student achievement. The results from my study will contribute to the findings for my doctoral dissertation. I hope to use this information to help parents, educators, and students better understand homework and its relationship to achievement. However, I cannot guarantee that you will personally receive any benefits from this research.

You were selected as a possible participant in this study because you are a fifth grade teacher in the West Linn - Wilsonville School District. If you decide to participate, you will be asked to provide me with copies of selected students' completed mathematics homework. **Your school's Instructional Coordinator has been recruited to make the copies and deliver them to me.** I will also ask that you fill out a short teacher survey that should take you less than 20 minutes to complete.

The information from the survey will be used to provide a classroom context for this study as well as to help explain the findings of this study. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. To safeguard all of the data obtained in this study, and to protect confidentiality, each student and teacher participant will be assigned a code number by an outside third party. This code number will be used on all data obtained and the identity of the participant will be kept confidential.

Your participation in this study is voluntary. Your decision whether or not to participate will not affect your relationship with the West Linn - Wilsonville School District. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have questions, please feel free to contact Holly Omlin-Ruback at (503)-673-7070, or my advisor, Dr. Gerald Tindal at (541) 346-3535. If you have questions regarding your rights as a research subject, contact the Office for Protection of Human Subjects, University of Oregon, Eugene, OR 97403, (541) 346-2510. This office oversees the review of the research to protect your rights and is not involved in this study.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Print Name____________________Signature ____________________ Date_______

Principal Investigator: Holly Omlin-Ruback
Department: Educational Leadership, University of Oregon
Doctoral Candidate
Project Title: A Study of Mathematics Homework

I understand that as a data copier working for Holly Omlin-Ruback with the research related data that I copy, I am required to maintain and protect the confidentiality of the information divulged by all participants. I agree not to disclose the information gathered to anyone other than the principal investigator. I agree also to not disclose the identities and information about the identities of the individuals who participate in this study. My signature confirms that I will abide to this agreement and that I will preserve the confidentiality of all proceedings, data gathered and copied, as well as the identities of participants in this study.

Full name (please print):______________________________________

Signature:______________________________Date:________________

The West Linn Wilsonville School District understands that this research is being conducted in the district and that Instructional Coordinators at each participating school will work as data copiers for the principal investigator, Holly Omlin-Ruback. All district employees and Oregon certified teachers are expected to comply with FERPA guidelines.

Date______________

District official signature______________________________________

Title____

APPENDIX C

ACCESS SKILLS PRACTICE AND DIRECT CONTACT PRACTICE EXPLANATION SHEET

Access Skills Practice: Math homework that addresses computation practice and rote memorization.

For example:

1. Multiplication table worksheets: facts to 12s
2. Multiplication games: facts to 12s
3. Computation practice worksheets: 34 x 8, etc....using addition, multiplication, subtraction, division, fractions, etc.
4. Simple one-step word problems: Sally has 4 bags of apples. Each bag holds 23 apples. How many apples does she have?

Direct Contact Practice: math homework that addresses practice with mathematical concepts and mathematics strand vocabulary aligned with the state standards and that closely resemble questions that may appear on the State Benchmark Assessment.

For example:

Calculations and Estimation problems designed to:

1. Understand numbers, ways of representing numbers, relationships among numbers and number systems.
2. Compute fluently and apply order of operations to multiple step (2 or more) word problems and make reasonable estimates using whole numbers, decimals and common fractions.
3. Understand meaning of operations and how they relate to one another.

Measurement problems designed to:

1. Understand measurable attribute of objects and the units, systems and processes of measurement.
2. Apply appropriate techniques, tools and formulas to determine measurement.

Statistics and Probability problems designed to:

1. Select and use appropriate statistical methods to analyze data using measures of central tendency, mean, median, mode and range.
2. Formulate question that can be addressed with data and collect, organize and display relevant data to answer them and read and iterpret various types of graphs.
3. Develop and evaluate inferences and predictions that are based on data.

Algebraic Relationships problems designed to:

1. Understand patterns, relations and functions and the difference between expressions and equations.
2. Evaluate one variable expressions.
3. Analyze patterns, find rules using words, tables and graphs and represent numbers using variables and algebraic symbols
4. Use mathematical models to represent and understand quantitative relationship and interpret situations modeled by graphs

Geometry problems designed to:

1. Analyze characteristics and properties of 2-D and 3-D geometric shapes and develop mathematical arguments about geometric relationships and determine

specific attributes of shapes showing an understanding of geometry vocabulary and classification.

2. Use visualization, spatial reasoning and geometric modeling to solve problems.
3. Analyze 2-D representation and visualize the 3-D model.
4. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
5. Apply transformations and use symmetry to analyze mathematical situations.
6. Identify and work with reflective and rotational symmetry.

(Oregon Department of Education, 2006.)

APPENDIX D

STATE CONTENT STANDARDS

CALCULATIONS & ESTIMATION

Score Reporting Category 1

NUMBERS

Common Curriculum Goal: Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Grade 5 Standards	Explanation	Sample Question
Order, model, and compare common fractions, decimals and percentages. 1.1.51 Locate decimals and percentages on a number line. 1.1.59 Model, recognize, **and generate** equivalent forms of commonly used fractions, decimals, and percents. 1.1.510 Identify classes of numbers (e.g., primes, composites, even, odd, multiples) in a 1-to-100 number chart **and describe numeric patterns related to them.** 1.1.513 Recognize characteristics of odd, even, prime, and composite numbers. 1.1.514	Students are expected to recognize and work with classes of numbers and a variety of representations of numbers. They are also expected to model, compare, and generate such numbers.	Which is a prime number? A. 9 B. 21 C. 33 D. 37 What are the decimal & percent forms of one fourth? A. 0.4 and 40% B. 0.25 and 25% C. 0.75 and 75% D. 0.14 and 14%

*Bolded Text is NOT eligible to be tested.

CALCULATIONS & ESTIMATION

COMPUTATION AND ESTIMATION

Score Reporting Category 1

Common Curriculum Goal: Compute fluently and make reasonable estimates.

Grade 5 Standards	Explanation	Sample Questions
Divide by two digit numbers. 1.2.58 Add and subtract fractions and mixed numbers with common fractions found on a ruler (2, 4, 8, 16). 1.2.510 Add, subtract, multiply, and divide decimals, including money amounts. 1.2.511 Determine the order of operations for multiple-step calculations involving addition, subtraction, multiplication, and division. 1.2.515 Select and use an appropriate estimation strategy (overestimate, underestimate, range of estimates) based on the problem situation when computing with decimals. 1.2.516	Students are expected to apply the order of operations for multiple-step problems. They are also expected to estimate and compute fluently with larger whole numbers, decimals, and common fractions.	There are 300 grapes. 18 grapes are rotten. The remaining grapes are placed evenly into 6 piles. How many grapes are in each pile? A. 3 B. 30 C. 47 D. 50 Jane wants to buy 5 apples. Each apple costs 89¢. ABOUT how much money does she need? A. $3.50 B. $4.00 C. $4.50 D. $5.00

*Bolded Text is NOT eligible to be tested.

CALCULATIONS & ESTIMATION

Score Reporting Category 1

OPERATIONS AND PROPERTIES

Common Curriculum Goal: Understand meaning of operations and how they relate to one another.

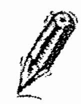
Grade 5 Standards	Explanation	Sample Questions
Use inverse operations (addition and subtraction, multiplication and division) to solve problems **and check solutions** involving calculations with decimals. 1.3.52 Apply the commutative, associative and identity properties of addition and multiplication and the distributive property to simplify calculations with decimals. 1.3.53	Students are expected to understand the meaning of the operations and how they are related, applying inverse operations as appropriate. They are also expected to apply number properties to simplify calculations.	Which is the same as $(0.25 \times 400) + (0.5 \times 400)$? A. 0.75×800 B. 0.75×400 C. 100.5×400 D. $4.25 + 4.5$

Bolded Text is NOT eligible to be tested.

MEASUREMENT
UNITS AND TOOLS

Score Reporting Category 2

Common Curriculum Goal: Understand measurable attributes of objects and the units, systems and processes of measurement.

Grade 5 Standards	Explanation	Sample Question
Using estimation, convert from a measurement expressed using one unit within a system to one using a comparable unit within the other system (e.g., inches to centimeters). 2.1.52	Students are expected to understand measurable attributes of objects. They are also expected to convert between and within systems of measurement, with actual and estimated measures of length and perimeter.	 The pencil is 6 inches long. About how many centimeters is the pencil if 1 inch is approximately 2.5 centimeters? A. 6 cm B. 8.5 cm C. 12.5 cm D. 15 cm

Bolded Text is NOT eligible to be tested.

MEASUREMENT

Score Reporting Category 2

DIRECT AND INDIRECT MEASUREMENT

Common Curriculum Goal: Apply appropriate techniques, tools, and formulas to determine measurement.

Grade 5 Standards

Determine measurements of length and perimeter to the nearest tenth centimeter (millimeter) and nearest tenth meter. 2.2.54

Estimate the measure of acute, right and obtuse angles in degrees using referent angles of 45 and 90 degrees & determine the measurement of angles between 0 & 180 degrees to the nearest degree. 2.2.510

Develop and use formulas for determining the perimeter and area of rectangles, and related triangles and parallelograms. 2.2.511

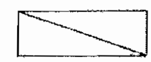
Use referents for metric measurements to make estimates of length, weight, and volume **and evaluate the reasonableness of the estimate (e.g., height of teacher estimated in height of students lengths)**. 2.2.520

Explanation

Students are expected to apply appropriate techniques and tools to measure and they should use referents to make estimates of length, weight, volume, and angle. They are also expected to develop and apply formulas for finding the area and perimeter

Sample Questions

The rectangle measures 5 inches by 10 inches. What is the area of the shaded triangle?



A. 100 square inches

B. 50 square inches

C. 25 square inches

D. 15 square inches

Which would be the best estimate of the weight of a candy bar?

A. 40 kilograms

B. 40 grams

C. 4 kilograms

D. 4 grams

*Bolded Text is NOT eligible to be tested.

STATISTICS AND PROBABLITY

Score Reporting Category 3

STATISTICS

Common Curriculum Goal: Select and use appropriate statistical methods to analyze data.

Grade 5 Standards	Explanation	Sample Question
Compare two related sets of data using measures of center (mean, median, and mode) and spread (range) 3.1.5I	Students are expected to determine and interpret data using measures of center (mean, median, mode) and spread (range).	Set A – 4, 5, 6, 5, 7, 8, 5 Set B – 3, 5, 6, 6, 2, 4, 6 Which is the median of all the numbers in both sets combined? A. 3 B. 4 C. 5 D. 6

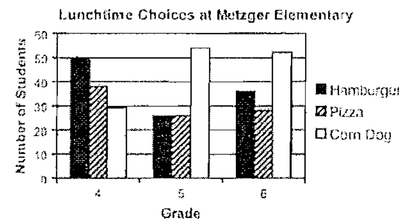
*Bolded Text is NOT eligible to be tested.

STATISTICS AND PROBABLITY

Score Reporting Category 3

COLLECT AND DISPLAY DATA

Common Curriculum Goal: Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Grade 5 Standards	Explanation	Sample Question
Represent and interpret data using tables, circle graphs, bar graphs, and line graphs or plots (first quadrant). 3.3.55	Students are expected to formulate questions that can be addressed with data and collect, organize, and display relevant data using various types of graphs.	 About how many students in fifth grade chose corn dogs for lunch? A. 54 B. 29 C. 27 D. 22

*Bolded Text is NOT eligible to be tested.

STATISTICS AND PROBABLITY

DATA ANALYSIS AND PREDICTIONS

Score Reporting Category 3

Common Curriculum Goal: Develop and evaluate inferences and predictions that are based on data.

Grade 5 Standards	Explanation	Sample Question
Analyze data from tables and bar graphs using mean, median, mode, and range, and draw conclusions 3.4.51	Students are expected to understand and interpret data using various types of graphs.	(see below)

Sample Question:

Price of Shoes				
$15	$35	$25	$20	$15

What is the average (mean) price of shoes?

A. $22

B. $15

C. $20

D. $25

*Bolded Text is NOT eligible to be tested.

ALGEBRAIC RELATIONSHIPS

PATTERNS AND FUNCTIONS

Score Reporting Category 4

Common Curriculum Goal: Understand patterns, relations, and functions.

Grade 5 Standards

REPRESENT and analyze patterns and functions using words, table, graphs or simple algebraic expressions. 4.1.51

Supply a missing element in or determine a rule that extends number patterns involving multiplication/division. 4.1.53

Explanation

Students need to understand the difference between expressions and equations. They will evaluate expressions and equations using one variable expressions. Students will analyze patterns, find rules using words, tables and graphs, and represent numbers using variables.

Sample Question

WEEK	FLOWERS
1	1
2	3
3	6
4	10
5	15

Mary has a garden. Every week more flowers grow. One flower grows during week 1. Three flowers grow during week 2. The pattern continues, as shown in the table. How many flowers grow during week 9?

A. 37

B. 40

C. 45

D. 56

*Bolded Text is NOT eligible to be tested.

ALGEBRAIC RELATIONSHIPS

Score Reporting Category 4

ALGEBRAIC RELATIONSHIPS

Common Curriculum Goal: Represent and analyze mathematical situations and structures using algebraic symbols.

Grade 5 Standards	Explanation	Sample Question
Use letters, boxes, or other symbols to stand for an unknown quantity in expressions or equations. 4.2.51 Represent the idea of a variable as an unknown quantity using a letter or symbol 4.2.52 Represent and evaluate algebraic expressions involving a single variable (e.g., 4s, .05n). 4.2.56 **Identify and represent** whole number data on a coordinate graph (first quadrant). 4.2.57	Students need to understand the difference between expressions and equations. They will evaluate expressions and solve equations using one variable. Students will analyze patterns, find rules using words, tables and graphs, and represent numbers using variables	Solve for C: 14 + 7 = 6 + C C = __?__. A. 0 B. 14 C. 15 D. 27

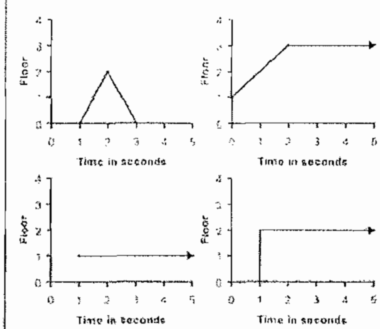
*Bolded Text is NOT eligible to be tested.

ALGEBRAIC RELATIONSHIPS

MODELING

Score Reporting Category 4

Common Curriculum Goal: Use mathematical models to represent and understand quantitative relationships.

Grade 5 Standards	Explanation	Sample Question
Identify or **describe** a situation which may be modeled by a given graph. 4.3.53	Students need to understand and interpret situations modeled by graphs.	Which graph shows an elevator starting on the first floor, going up two floors, and then staying there? 

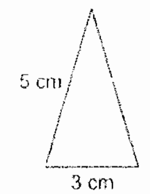
*Bolded Text is NOT eligible to be tested.

GEOMETRY

Score Reporting Category 5

PROPERTIES AND RELATIONSHIPS

Common Curriculum Goal: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Grade 5 Standards	Explanation	Sample Question
Identify, **describe**, compare and classify triangles by their sides and angles. 5.1.51 Use properties of triangles to determine the lengths of their sides and perimeters. 5.1.54 **Develop, understand**, and apply the property of the sum of the angle measures in a triangle is 180 degrees. 5.1.55	Students will apply their understanding of characteristics of 2-D and 3-D shapes as they classify triangles and determine specific attributes (angle measures, length of sides, etc.) of various triangles.	What is the perimeter of this isosceles triangle?  A. 5 cm B. 8 cm C. 13 cm D. 15 cm

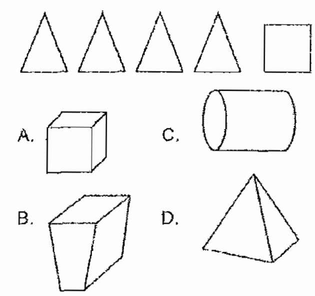
*Bolded Text is NOT eligible to be tested.

GEOMETRY

MODELING

Score Reporting Category 5

Common Curriculum Goal: Use visualization, spatial reasoning, and geometric modeling to solve problems.

Grade 5 Standards	Explanation	Sample Question
Identify **and build** three-dimensional objects from two-dimensional representations. 5.2.53	Students will be able to analyze a 2-D representation and visualize the related 3-D model.	If you cut paper into the shapes below, which 3-dimensional figure could you create using all 5 pieces as they are? 

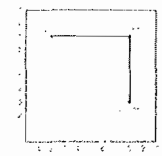
*Bolded Text is NOT eligible to be tested.

GEOMETRY

COORDINATE GEOMETRY

Score Reporting Category 5

Common Curriculum Goal: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Grade 5 Standards	Explanation	Sample Question
Make and use coordinate systems to specify location and describe paths 5.3.51 Find the distance between points along the horizontal and vertical lines of a coordinate system. 5.3.52	Students work with properties of quadrilaterals/polygons: finding the perimeter/area of polygons on coordinate graphs: determining measures of complimentary/supplementary, interior, and exterior angles. Circle vocabulary includes radius, chord, diameter, circumference, center, pi. Students will also use fractions when finding the area/perimeter of polygons or circles. Students should be able to identify and work with line and rotational symmetry.	Using the graph, which of these coordinates would make a rectangle?  A. (2, 2) C. (3, 2) B. (2, 3) D. (3, 8)

*Bolded Text is NOT eligible to be tested.

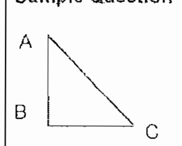
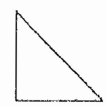
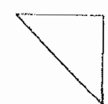
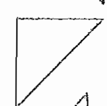
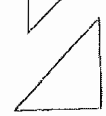
Appendix D16

GEOMETRY

TRANSFORMATIONS AND SYMMETRY

Score Reporting Category 5

Common Curriculum Goal: Apply transformations and use symmetry to analyze mathematical situations

Grade 5 Standards	Explanation	Sample Question
Identify **and describe** line and rotational symmetry in two-dimensional shapes and designs. 5.4.51 Identify **and describe** a motion or series of motions that will show two triangles are congruent. 5.4.54	Students are expected to identify and work with reflective and rotation symmetry.	 If triangle ABC is reflected over the dashed line, the result will look like: A.  B.  C.  D. 

*Bolded Text is NOT eligible to be tested.

APPENDIX E

HOMEWORK CODING SHEET

Homework Coding Sheet

Teacher #: ___________ Student #: ___________

Date: _______________

Assignment: ____

____

Item #	Interaction			Type			Strand				
	C	IC	NA	Othr (O)	Acc (A)	Dir (D)	Geo (G)	Alg (A)	Meas (M)	Calc & Est (CE)	Prob & Stats (PS)

Key:
Othr = Other
Acc = Access
Dir = Direct

Geo = Geometry
Alg = Algebra
Meas = Measurement
Calc & Est = Calculations and Estimations
Prob & Stats = Probability and Statistics

APPENDIX F

TEACHER SURVEY

Teacher Survey

Teacher Code__________

1. How many years have you been teaching?

2. How many years have you been teaching 5th grade?

3. On a scale of 1 (low) to 4 (high), how important do you think homework is for students overall achievement in your grade level?

1	2	3	4
Not at all important	Somewhat important	Important	Very Important

4. What is/are the main reason(s) you assign homework?

5. What do you consider when you are designing or selecting math questions to assign for homework?

6. What do you consider when you are designing or selecting math activities for classroom instruction and practice?

7. How familiar are you with the Mathematics Test Specifications and Blueprints on the state education website?

1	2	3	4
I'm not at all familiar.	I know they are on the ODE website.	I have read them.	I use them along with other resources to create math homework and classroom activities.

8. Do you differentiate homework? Yes No

9. If yes, how often? Every assignment Occasionally

10. If yes, how? I differentiate by amount only

I differentiate by content and or difficulty which may affect the amount

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