

The Relationship between Mathematics Homework and Learning in Middle-School
Students: Impact on Achievement

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ABSTRACT

The relationship between mathematics homework and learning in middle-school students and the impact on achievement is the focus of this paper. A review of the literature reveals mixed results. Studies support both positive and a negative impacts of mathematics homework on student achievement or no impact at all. The purpose of this paper is two fold: 1) to review the literature on the link between mathematics homework and achievement; 2) to report the results of two surveys conducted with mathematics teachers and their opinion on the homework – achievement relationship.

The literature revealed that there are numerous variables to consider when identifying the impact of mathematics homework on achievement. Focusing on one variable to examine is extremely complex.

Two surveys were conducted. For the purposes of this paper, they are referred to as survey A and survey B. The participants of survey A were mathematics teachers currently teaching in public schools in the northern California region. In survey B, the participants were current mathematics teachers in Marin County teaching at the middle or high school level.

The main finding of the surveys indicated that between 82% and 95% of the teachers believed that mathematics homework positively impacts achievement. However, in the survey results, which is consistent with the research literature, it is impossible to separate out the main factor within the homework that contributes to achievement. Factors may include the object of the homework assignments, the time spent on homework, and the grade level which could all have an impact on student mathematics achievement.

INTRODUCTION

Homework is a heated topic in many school districts across the country. Homework trends have come and gone over the last century. At different times in American history, the idea of homework has been either supported or rejected by the culture. Today, homework is a hot topic and one at the center of much debate. With books like John Buell's Closing the Book on Homework, and Alfie Kohn's The Homework Myth: Why Our Kids Get Too Much of a Bad Thing, it appears that homework has become an unnecessary burden on American families. Is homework a necessity in contributing to student achievement, with a particular focus on mathematics? What does the research report on the relationship between mathematics homework and achievement?

History

The value of homework has tipped each side of a scale. With public opinion wavering between devaluing homework and valuing it over the last 100 years, it appears that there has been a 30-year cycle, "with public outcries for more homework or less homework occurring about 15 years apart" (Cooper, 2001, p.1).

In the early 1900s, public opinion was in favor of homework. It was believed that it helped discipline children's minds when memorization was a key component in the homework (Cooper, 2001). The memorization of multiplication tables and dates helped to exercise the mind, which had been compared to a muscle.

In the 1940s the pendulum swung in the other direction and public opinion on homework was changing. "Drill and Kill" was replaced with the idea of problem solving

as a key component of homework. Homework was also starting to be viewed as getting in the way of other student activities in the home or with the family (Cooper, 2001).

Once again American culture took a new look at education in the late 1950s. The Russians launch of Sputnik in 1957 brought up questions about the American education system and its possible lack of rigor to compete with other countries (Cooper, 1989).

Fifteen years later, in the late 1960s, “the cycle again reversed itself. Homework came to be seen as a symptom of too much pressure on students to achieve” (Cooper, 2001, p. 2). With the cycle at full throttle, the late 1980s and 1990s saw a move towards favoring homework once again. “...few issues related to schooling were as universally endorsed as homework” (Gill & Schlossman, 2003, p. 2). In the report from the National Commission on Excellence in Education (1983), homework was deemed a defense against the rising tide of mediocrity in American education (Cooper, 2001).

At the turn of the past century we saw the pendulum swing yet again. Public opinion once more adopted a negative view of homework. Researchers began again studying the current research on the impact of homework by looking more closely at the variables that make up of a homework assignment and the behaviors and views of the students themselves.

Gill and Schlossman, (2003), used a number of national surveys to study time spent on homework by students in the elementary, middle, and high school grades over the last fifty years. They found that students of today spend less than one hour studying on a typical day. This time has been mostly unchanged in the last 20 years.

One reason for the current controversy around homework may be due to the increase in assigning homework to primary-grade students. Separate from this, the only

other time in the last 50 years that students have spent more time on homework was the years following Sputnik (Gill & Schlossman 2003).

This history on the homework debate does not refer to any specific academic subject but rather all subjects that may or may not give homework. Some subjects should be debated on their own. Mathematics is one of those subjects. Mathematics is a subject that builds on itself. The success in any particular year can be contingent on the success of the previous year. Therefore, specific mathematics research needs to be reviewed and designed to show the impact of mathematics homework on achievement.

Statement of Problem

Does mathematics homework impact student achievement? The debate on homework assumes that all academic subjects are treated equally when it comes to the impact of homework on student achievement. Therefore, there is a need to focus on the role of mathematics homework separate from other academic subjects.

Purpose Statement

The purpose of this study is to examine the available research on the subject of mathematics homework and its impact on achievement. For this paper the reference to homework is defined as student independent practice of mathematics skills done outside the regular class time. This includes work completed at school or outside of school.

Research Questions

Does mathematics homework have an impact on achievement in middle school grades? What are the opinions of mathematics teachers on the relationship between mathematics homework on achievement as reported in a survey?

THEORETICAL RATIONALE

Piaget (Huitt & Hummel, 2003) believed a child goes through four stages of development. Each stage contributes to the building of cognitive structures that are used to understand the world. He called these structures schemas. He hypothesized that people are born with certain schemas that they use to adapt to their environment. It is during the intellectual progress through these stages, “the student actively constructs basic mathematical and logical concepts related to number, geometry, and higher mathematical constructs...” (Fischbein, 1999, p.48). To help a person adapt, Piaget outlined two processes: assimilation and accommodation. Huitt and Hummel explain that:

Assimilation is the process of using or transforming the environment so that it can be placed in preexisting cognitive structures. Accommodation is the process of changing cognitive structures in order to accept something from the environment. Both processes are used simultaneously and alternately throughout life. An example of assimilation would be when an infant uses a sucking schema that was developed by sucking on a small bottle when attempting to suck on a larger bottle. An example of accommodation would be when the child needs to modify a sucking schema developed by sucking on a pacifier to one that would be successful for sucking on a bottle (2003, p. 1).

This Constructivist point of view can be adapted to the acquisition of mathematic skills. The building of structures for understanding developmentally appropriate math skills is imperative to understanding math skills that have yet to be learned. An example of assimilation can be seen when repeated addition is used for

multiplication. The accommodation is when the repeated addition schema is modified to a multiplication schema. However, with Piaget's stages there is no room for the idea that one's own ability can develop through adequate instruction. His stages assume that if the skill is not present at the appropriate stage then it can't/won't be present. Therefore, Piaget's theory only addresses part of the learning through individual practice and problem solving that we are calling homework.

Along with Piaget's theory, Vygotsky's Zone of Proximal Development (ZPD) helps to fill in the missing pieces of mathematics learning. Vygotsky, a social constructivist, states the ZPD: "is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." (Vygotsky, 1978, p. 84). In other words, a student starts the learning process while being guided by the teacher. It is in this modeling by the teacher that the student becomes competent enough in the task to work independently of the teacher. This independent work is how the students acquire competence in the new skill. Homework is the independent practice.

Assumptions

It is assumed that homework is a necessary component of success in acquiring new math skills and strengthening existing math knowledge. It is assumed that engaging in the practice of mathematics homework results in improvement in student test scores compared to test scores when no homework is practiced.

Background and Need

Trautwein (2007) used three data sets to challenge the claim that time on homework positively affects achievement. This study assesses homework variables and their impact on achievement. The results of these studies show that homework assignments and completion of homework assignments have a positive impact on achievement. However, student time spent on homework as a measure does not impact achievement (Trautwein 2007).

In Trautwein's Study One he included results from the large-scale Programme for International Students Assessment (PISA) 2000 data. This was re-analyzed using a German extension study (Trautwein, 2007). The PISA data revealed a positive relationship between homework and achievement but the results may be over simplified even with the modern data analysis techniques and the carefully developed tests that were used. Factors such as “. . . prior knowledge, basic cognitive abilities, or differences in school quality . . .” may have an effect on the factors of achievement and time spent on homework; however, no control was made for these variables (Trautwein, 2007, p.375).

In the German extension study a test of cognitive abilities was given to extend the achievement measures of the PISA's reading, mathematics, and science measures. The German study used ninth graders whereas the PISA findings were based on results from 15-year-olds. This controlled any bias in the homework-achievement relationship of different grade levels. Lastly, the German extension study used a national mathematics test that ensured higher curricular validity than the PISA results which relied on mathematics and science homework to have a comparative impact on reading achievement as language homework.

The results of the German extension study challenge the findings that longer homework time is associated with increased achievement of the PISA 2000 (Trautwein, 2007). By controlling for possible influences of homework time and achievement at the student-level and school level, researchers found only a moderate relationship between homework time and achievement at the school level and a negative relationship at the individual level.

In Study Two the goal was to address some of the limitations that existed in Study One. The approach was similar to Study One in that a German extension study was implemented that using secondary students who participated in the Third International Mathematics and Science Study TIMSS (Trautwein, 2007). A longitudinal component was added to this extension study that used a data set of classes rather than schools. Students were assessed in grade 7 a year before they were assessed in the TIMSS while in grade 8. Other instruments were administered in the national extension including homework time and frequency of homework assignments.

By separating homework frequency from homework time, Study Two clearly showed that “homework frequency – but not homework time – was a significant predictor of achievement at the class level” (Trautwein, 2007, p. 381). The extension study also revealed a negative relationship between homework time and achievement and achievement gains. This finding reveals that lengthy homework times may better reflect possible motivational problems or problems understanding rather than student effort.

Homework is commonly believed to be associated with enhanced achievement, however in both Study One and Study Two, homework time, at the individual student level, was negatively related to achievement. The findings in Study Two exposed the

possibility that there is more to the belief that longer homework time is related to effort on homework. Study Three looks at this relationship in-depth.

In Study Three the effects of students' homework behavior were studied as it relates to achievement. "Homework behavior was split into two components: homework effort (i.e., conscientious execution of homework assignments) and homework time (Trautwein, 2007, p. 380).

The results of Study Three show a positive relationship between homework effort and achievement and achievement gains. Homework time was not related to achievement or gains, therefore strengthening the results from Studies One and Two. This study did not show a positive correlation between homework effort and homework time. "Hence, the present findings indicate that homework time is not a suitable indicator of the effort that students put into their homework" (Trautwein, 2007, p. 384).

Future researchers on the relationship of homework and achievement should consider this study. This study demonstrates that there is a positive relationship between homework and achievement at both the class and student level. There are many homework variables other than time on homework that need to be examined.

REVIEW OF THE LITERATURE

There have been numerous research studies and books written about homework. One side of the debate on the importance of homework is that homework is a necessary process to facilitate learning and on the other side, homework is seen as completely unnecessary and in some cases, archaic. Cooper (2001), a leading researcher on the subject of homework points out that the "... research is plentiful enough that a few studies can be found to promote whatever position is desired while the contradictory evidence is ignored" (preface xi). This makes it easy for the advocates of either side of the debate to find a study that backs up their position.

Review of the Previous Research

The review of the literature addresses the following topics: the impact homework has on learning and test scores, the multiple variables in the research on mathematics homework. For example, the time spent on homework, and the variables involved in existing research and how they may effect outcome.

Impact of Homework on Assessment

Does homework enhance learning and boost assessment scores? Homework has been shown to improve test scores and boost achievement in mathematics and other subjects. However the results are mixed. There are a number of variables, treatments, and qualifiers used in the different studies that need to be examined.

Minotti (2005) observed the effects of individualized, learning-style based homework on the achievement and attitudes of middle school students. The control group was given traditional classroom teaching and homework assignments. Both

groups displayed increased achievement in mathematics and other subjects. However, only the treatment group had a statistically significant increase in achievement. In this case it took a “non-traditional” approach to homework to demonstrate a positive impact on achievement. Cooper (2001) states that about 70% of comparisons [homework vs. no homework] indicate a positive effect on achievement when homework is practiced. Later he clarifies that high school students benefited from homework twice as much as middle school students and these students benefited twice as much as elementary students. He also addressed a number of qualifiers that had an impact on the results. For example, time spent on homework, what kind of homework, and parental involvement.

Effect of Time on Homework

How does the time students spend on homework impact study outcomes? When researchers design a study around achievement whether they are looking at the link of homework to achievement or not, many variables have to be considered. For example, Cooper (2001) found in controlled studies of influences other than homework, a presence of 1 to 16 different variables within any one analysis. Homework is just one variable that can have an effect on math achievement.

Thomas (2001) shows that several variables play a part in the relationship between greater proficiency in mathematics skills. These variables include but are not limited to, advanced math courses, grades in math courses, and amount of homework completed during the week. Thomas used eighth-grade transcripts and questionnaire data from the National Education Longitudinal Study of 1988. The results suggest that more time on task and practice on math outside of school, homework, “...helps

students to develop an understanding of the concepts necessary to achieve at the highest level of proficiency” (Thomas, 2001, p. 17).

A separate study also using eighth graders and data taken from the National Education Longitudinal Study (1988) showed similar results. Meyinsse and Tashakkori (1994) set out to show that predictors such as, but not limited to, race/ethnicity, gender, and time spent on homework would have an effect on performance on standardized mathematics tests. The researchers used a much larger student sub-sample, 9,000 students versus Thomas’s 450. Not only did this study report that “time spent on homework” had a positive relationship to performance but also the student’s love for mathematics and their perceptions of the teachers’ ability (Meyinsse & Tashakkori 1994).

In contrast, de Jong, Westerhof, and Creemers (2000), using 1,394 Dutch students from 28 schools and 56 classes, yielded results showing the only variable related to achievement was the amount of homework given. Frequency of homework and homework time were not related to achievement. In this full year study data was collected at three different levels, the school, the student and the teacher. A multi-level approach was used to study the effectiveness of homework.

The School

A Homework policy was non-existent for 27 of the schools. It was determined that if mathematics teachers who give little homework gave more homework, two tasks more per lesson, a moderate effect on achievement would be observed.

The Teacher

Data was collected through observations, questionnaires, interviews, and logs. Most of the teachers gave homework every lesson so the frequency of homework was high. However, some teachers give significantly less homework. The teachers who gave less homework were less effective. The difference in the amount of homework given was the most crucial factor of achievement at the teacher level.

Parents

“On the basis of studies in the USA it can be concluded that parents may influence the amount of homework time” (de Jong, Westerhof, Creemers, 2000, p.153). In the Netherlands, however, parents have little to say about homework. It was determined by students’ reports of parents’ contribution that their involvement in homework is not related to math achievement.

Students

Data were collected through tests, questionnaires, and logs. In this study, “time spent on homework” was not a good predictor of achievement gains. There are many factors that can influence this observation. For example, in USA studies, high ability students spend more time on homework. This could be explained by the fact that students in higher ability classes may receive more homework than students who are in lower ability classes (de Jong, Westerhof & Creemers, 2000). For this study, students were grouped in similar ability tracks.

The results showed that higher ability students needed less time to complete a homework assignment than lower ability students when the same amount of homework

was given. It appears that homework time is not a good indicator of the amount of homework completed. Therefore, it seems an unreliable measure of performed work.

The time a student spends on homework is not the variable that is closely related to achievement. The content of the homework and whether the student completed the assignment is related to increased achievement.

Researchers have speculated that the time a student spends on homework has a direct affect on achievement. de Jong, Westerhof and Creemers (2000) , as well as Trautwein (2007) concluded that homework assignments and completion of homework had an important impact on the relationship of mathematics homework and achievement.

Summary of Major Themes

In most of the studies examined, mathematics homework had a positive impact on achievement. However, there are many factors that contribute to this impact. The age and grade level of the student appears to determine the degree to which homework has a significant impact on achievement. High school students benefit from mathematics homework at a higher significance level then do middle school students. Middle school students benefit more from mathematics homework than elementary students. Time spent on homework, the frequency of assignments and the amount of homework given all were variables in different studies that had an impact on the results.

How Present Study Extends Literature

There are many variables and qualifiers in the current research on homework and achievement. In many of these studies, teacher logs were used in the data collection. However, teachers' opinions regarding the impact of homework on

achievement is under represented in the current research. The mathematics classroom teacher has a valid and tested opinion on how homework impacts achievement in their classroom. The two surveys conducted will help fill in the gaps in the current research by giving a voice to teachers in the classroom.

Implications for Future Research

There have been a number of research studies around the topic of homework and its impact on learning and achievement. A common theme is the number of variables that have to be considered when analyzing the results. Future researchers on this topic should attempt to design a study that can account for these variables.

Overall Significance of the Literature

There continues to be a growing concern regarding homework. Does it work? Are our students benefiting from homework? Is the time spent on after school homework worth the time missed doing other extracurricular activities, including spending time with family? The literature examined reveals a positive impact on homework and achievement in mathematics. A continued scholarly review of the current research and of new research in this area is required to better education the public.

METHODS OR PROCEDURES

Ethical Standards

This study adheres to Ethical Standards in Human subjects Research of the American Psychological Association (Publication Manual of the American Psychological Association, 2001). Additionally, the project was reviewed and approved by the Dominican University of California Institutional Review Board, number 6020 and 6080.

Sample and Site

The sample set for the first survey, Survey A, was picked at random during a three-day annual math conference. The population was math teachers from Central and Northern California. This population included teachers from all grade levels. The survey was handed out to conference attendees between conference sessions. Participants had the option to fill out the survey at their convenience and mail it back with the addressed stamped envelope. Three hundred surveys were handed out in this manner.

For the second survey, Survey B, an online survey was created using the website SurveyMonkey. The population was math teachers as in the first survey; however, the sample set was limited to middle school and high school teachers who were currently teaching in the Marin County public school system. Invitation to participate in Survey B was requested via email. Participants were given a log on and password to the survey website. Forty-two teachers participated in Survey B.

Access and Permissions

In Survey A, the respondents were given a survey to fill out if they chose to at a conference that I was an attendant at. In Survey B, the respondents were sent an email to

participate if desired. This email was originated by me and filtered through heads of mathematics departments at schools in Marin County.

Data Gathering Strategies Survey A

Survey A was created and a sample of math teachers were taken from a mathematics conference in California. The sample was a sample of convenience and the recipients were selected randomly. The recipients were given a copy of the introduction letter, the survey questions, and a self-addressed stamped envelope to mail back the completed surveys. Three hundred surveys were handed out and ninety were returned.

Data Gathering Strategies Survey B

Survey B was created as a follow up to Survey A. Cluster sampling was used in this survey. Invitations were sent via email, to middle school and high school mathematics teachers in Marin County to participate in the online survey. Forty-two teachers completed the survey.

Data Analysis Approach Survey A

The results were organized in an excel spreadsheet. They were divided into MS for multiple subject credential holders and SG for single subject credential holders. The few responses from non-credentialed teachers were secondary teachers of mathematics and their results were organized with the single subject holders. The following headings were used to organize the data: Grade level, total years taught, district or city, does your school have a mathematics homework policy, do you agree with the policy and is it working for your students, would you change the policy by adding, removing mathematics homework time, what is the goal of mathematics homework, is mathematics effective on achievement, can students learn mathematics with homework.

Data Analysis Approach Survey B

The data results were downloaded into an excel spreadsheet. Each completed survey was identified in a single row. The columns consisted of the survey questions and multiple choice answers. Most survey questions had a free form text box for comments. These comments were organized by column and row as well. Columns broke down into the following headings:

- What type of credential do you hold?
- How many years have you been teaching mathematics in the following grade levels?
- How often do you assign mathematics homework?
- Which is more valuable to the student to build understanding?
 - * The amount of time spent on homework?
 - * The number of problems completed
 - * Completing assignment
- What is the purpose of your homework assignments?
 - * To gain independence with topic
 - * Reinforce skills learned in class
 - * Extend learning
 - * Time management/organization
- How many teaching days do you have with your students per week?
- Is this enough time to master the skills taught in class?
- Does mathematics homework improve achievement?

For most questions the multiple choice answers were either; most important, important, neutral, or not very important; Most likely, likely, some what likely, or not likely; Strongly agree, agree, disagree, strongly disagree.

RESULTS OR FINDINGS

Description of Site, Individuals, Data

This paper was started with the intention of conducting an extensive literature review on the impact of mathematics homework on achievement. During the process of writing this paper the question was posed, what do teachers of mathematics think about this topic? The surveys that follow were created to address this question. In both Survey A and Survey B a sample of math teachers were used. In Survey A the sample was a sample of convenience and the recipients were selected randomly at an annual conference for mathematics teachers. The recipients were given a copy of the introduction letter, the survey questions, and a self-addressed stamped envelope to mail back the completed surveys. Three hundred surveys were handed out and ninety were returned. In Survey B, a cluster sample was used. The recipients were mathematics teachers in Marin County who currently teach in a middle school or high school. Emails were sent with an introduction to the survey and a link to the survey that was hosted on SurveyMonkey. All participants were anonymous.

Analysis of Themes

Survey A

The results for multiple subject and single subject credential holders showed slightly different opinions about homework; however, both sets of results were in agreement with the belief that homework does impact achievement. For the elementary, multiple subject teachers, 77% believed that homework had an impact on achievement and of the middle and secondary grades, single subject teachers. 91% believed that homework had an impact on achievement.

Survey B

The results of this survey came from mostly single subject credential holders, 79% of the participants. 100% of the participants believe that homework improves achievement in mathematics. However, within this 100% there were varying degrees of how likely. 65% of the respondents believe that homework “Most likely” improves achievement, 30% believe that homework “likely” improves achievement and 5% believe that it is “somewhat likely.”

Tables and Figures to display the data

Table A:
WHICH IS MORE VALUABLE TO THE STUDENT TO BUILD UNDERSTANDING RESULTS

	Most Important	Important	Neutral	Not very important
Time Spent on HW	5	17	11	4
Number of problems completed	10	20	8	2
Completed assignment	12	21	4	
Comments	<ul style="list-style-type: none"> • Need to master the concept using as much time as needed • Stop after one hour, speak with student to re-teach topic • Student to understand concept-time or # may not matter, completing is the closest. • Must check the answers to know if they go the problem correct • Competing assignment with accuracy is most important • Repetition breeds retention and complete well done HW solidifies understanding. 	<ul style="list-style-type: none"> • Quite time on Hw • Seek help • Concepts will not be magically absorbed in class • Completing assignment includes checking answers in back of book • Thought that is put into understanding the assignment • Learning from mistakes when assignment is reviewed. 	<ul style="list-style-type: none"> • Type of problems the most valuable. 	

DISCUSSION

Summary of Major Results

Survey A

The Multiple Subject credential holders, made up 57/90 or 63% of the total respondents. Forty percent believe that homework is not required to learn math skills. Whereas 59%, believe that mathematics homework has an affect on achievement. 46% believe that parental involvement or more class time is required for the affect to be present. 37% said either no, you can not learn math without mathematics homework or that it would be harder to get learning to stick, or only the basics can be learned or only with exceptions. Of that 37%, 81% said that mathematics homework has an affect on achievement. Sixteen percent believe that students could learn math with out homework only if they have more class time for practice. Forty-four out of the 57 multiple subject holder respondents (77%), believe that homework has an affect on achievement.

The single subject and the non-credential respondents consisted of 33/90 or 37% of the total respondents. 19% believe you can learn math without mathematics homework. However, this 19% also stated that mathematics homework had an affect on achievement. 22% of the respondents believe a student could not learn the needed math skills unless they did mathematics homework. 59% of the respondents stated that it was harder to learn math without homework or that more class time to allow for practice could take the place of mathematics homework. Of this 59%, all stated that mathematics homework has an affect on achievement. Of the total 33 respondents, 91% believe mathematics homework has an affect on achievement. For all respondents of survey A, 82% believe that homework has a positive impact on achievement.

Survey B

The respondents in this survey are all teaching mathematics in Marin County. The years of teaching experience of the respondents ranged from one year to 10 plus years. Thirty-four percent have 1-4 years of experience and 42% have more than 10 years of experience. Therefore, 66% of the responses came from teachers who have taught mathematics at least 4 years and of those, 64% have taught mathematics for over 10 years.

When posed the question of what is more valuable in building mathematics understanding; time spent on homework, the number of problems completed or completing assignment, most respondents rated completing the assignment as the most important variable. Fill in responses from respondents mentioned the importance of mastering the skills taught using as much time as needed, checking answers in the back of the book to know what was done wrong and then learning from their mistakes during homework review, and completing assignments accurately (See Table A).

When asked the question, what is the purpose of your homework assignments, and given choices of *most important*, *important*, *neutral*, and *not important*, most respondents chose that to gain independence with the topic and to reinforce skills learned in class as either *most important* or *important*. Extend learning and time management was also deemed *important*.

The respondents answered the question if the amount of time they see their students, in a week, was enough time for students to master the skills taught in class. On average teachers see their students 4 days a week. The respondents had a choice to answer the question using a four-entry scale of; *most likely*, *likely*, *somewhat likely*, or

not likely. 49% of the respondents believe that it is *unlikely* that most students can master the curriculum within the time frame of their class. Only 19% believed that it was *likely or most likely*. 62% of respondents believe, *most likely*, that students need to practice in the form of homework to master the curriculum and 32% believe it to be likely. For this question comments included that it takes practice to master anything.

Does mathematics homework improve achievement was the final question on the survey. The scale was *Most Likely, Likely, Somewhat likely, and Not likely*. Of the 40 responses, 65% believe that it is *most likely*, 30% believe that it is *likely*, and 5% believe that it is *somewhat likely*.

Some of the comments entered for this question are:

- Students need to practice skills to master them. It moves them from understanding a concept/skill to mastering it. There is not enough time in class for this practice.
- Yes, there are exceptions...
- It's the work ethic, the practice, and the questions that arise that help improve achievement.
- Reasonable amount reminds them of day's work.
- My students voice that math homework is the most helpful homework they have.
- Confirms knowledge....alerts student of problem areas.

The survey concluded with an open-ended response to this topic. Comments included the following:

- Mastery comes with time and practice. Skills need to be applied in a variety of problems.

- Students need practice on the concepts. They also need to learn to extend concepts and apply them in new ways.
- Homework is part of the process of learning. Not too much, not too little.
- Achievement, in most cases, would be enhanced and retention extended—if homework assignments are thoughtfully created and feedback is immediately available.
- Being conscientious and working to understand that homework is strongly related to achieving and succeeding in math.
- Meaningful math homework is related to achievement in math.
- Like a language course, or a sport, math requires practice. Their approach [to homework] is often as a task to complete, rather than a chance to improve skills.
- Students must practice math until they meet the standard. If they can meet the standard without homework, fine, but most need to practice more than the time available in class.
- Math is a language. Learning any language requires practice, and homework is practice. Homework is the most appropriate setting for independent practice.
- I believe that math homework and achievement levels has a strong correlation. I have the evidence to support this statement that I've gathered by way of graded assignments and test performance over the past seven years.

Comparison of Findings/Results with Existing Studies

The respondents in Survey B, found that completing assignments or the number of completed problems in an assignment to be more valuable to mastery than time spent on homework. This result backs up the results in the de Jong, Westerhof and Creemers (2000) and Trautwein (2007) studies. They found that the variable most closely related to achievement was that the homework assignment was completed. de Jong, Westerhof and Creemers (2000) identified that the teachers who gave less homework were less effective. In survey B, respondent comments included that the correct amount of homework is crucial to boosting mastery. In addressing the variable of time spent on homework, higher ability students spent less time to complete a homework assignment than lower ability students (de Jong 2000). Comments from Survey B respondents stated: it takes time to master anything; students must practice math until they meet the standards; like a language or sport, math requires practice; mastery comes with time and practice. Meynsse and Tashakkori (1994) may have shown that time spent on homework had a positive relationship to performance but in Survey A respondents reported on the need for more time in the classroom in order to make a difference in the students' mastery. Whatever the focused variable was, time spent on homework, completion of homework assignments, etcetera, The studies all stated that mathematics homework had a positive effect on achievement. In Survey A and Survey B, there was an 82% and 95% response that mathematics homework does positively effect achievement.

Limitations of the Study

Only 90 of the 300 surveys were returned. That is only 30% of the sample set.. The majority of the participants were multiple subject credential holders who teach elementary school. This study is concerned with the middle –school student and their achievement. The survey questions were not direct enough to gather the most useful data to this study.

Implications for Future Research

A larger survey including students and mathematics teachers can be very useful in understanding the relationship between mathematics homework and achievement. The direct experience of mathematics teachers cannot be underestimated. Even given the small sample size of the current study, the combined teaching experience was more than 900 years.

Overall Significance of the Study

Given the response from the teachers' survey, districts that enforce homework policies based on time spent on task should revisit the research and the back ground by which their homework policies were developed. The learning of mathematics and the effect practice has on mastery is different then other subjects. The need to question the idea that all students are served by assuming that the same time is needed to master a skill is needed to facilitate and boost achievement.

REFERENCES

- Buell, J. (2004) Closing the book on homework.: Enhancing public education and freeing family time. Philadelphia: Temple University Press.
- Cooper, H. (1989). The synthesis of research on homework. *Educational Leadership* 47 (3), 85-91. Retrieved February 19, 2007, from the ERIC database
- Cooper, H. (2001). The battle over homework: Common ground for Administrators, Teachers, and Parents (2nd ed.). Thousand Oaks, CA: Sage.
- de Jong, R.; Westerhof, K. J.; Creemers, B. P. M. (2000). Homework and Student Math Achievement in Junior High Schools. *Educational Research and Evaluation. An International Journal on Theory and Practice*, 6(2), 130-57, Retrieved February 17, 2007, from the ERIC database.
- Fischbein, Efraim (1999) Psychology and Mathematics Education. *Mathematical Thinking and Learning* 1(1), 47-58. Retrieved March 15, 2007 from the ERIC database.
- Gill, B., & Schlossman, S. (2003) "A Nation at Rest" : The American Way of Homework. *Educational Evaluation and Policy Analysis*, 25(3). 319-337. Retrieved from JSTOR on February 17, 2008
- Gutierrez, A., & Boero, P. (Eds.). Handbook of Research on the Psychology of Mathematics Education: Past, Present, and Future. Rotterdam, The Netherlands: Sense Publishers.

- Huitt, W., & Hummel, J. (2003). Piaget's theory of cognitive development. Educational Psychology Interactive. Valdosta, GA: Valdosta State University. Retrieved March 16, 2007 from <http://chiron.valdosta.edu/whuitt/col/cogsys/piaget.html>
- Kohn, A. (2006). The homework Myth: why Our Kids Get Too Much of a Bad Thing. Jackson, TN: Da Capo Press.
- Meynsse, J. and Tashakkori, A. (1994). Analysis of Eighth Graders' Performance On Standardized Mathematics Tests. Reports - Research; Speeches/Meeting Papers. 7. Retrieved Educational Research and Evaluation An International Journal on Theory and Practice 6(2) 130-57.
- Minotti, J. (2005). Effects of Learning-Style-Based Homework Prescriptions on the Achievement and Attitudes of Middle School Students. NASSP Bulletin, 89 (642) 67-89. Retrieved April 2, 2007, from Sage Journals Online.
- Swank, Anne Laney Greenwood (1999). The Effect of Weekly Math Homework on Fourth Grade Student Math Performance. Reports-Research (ED), 44, Retrieved February 13, 2007, from the Eric database
- Thomas, John p. (2001) A Model of Mathematics Achievement Using Proficiency Scores. Reports - Research (ED), 23. Retrieved February 17, 2007, from the ERIC database.
- Trautwein, U., Köller, O., Schmitz, B., and Baumert, J. (2002) Do Homework Assignments Enhance Achievement? A Multilevel Analysis in 7th-Grade Mathematics. Contemporary Educational Psychology 27(1), 26-50. Retrieved February 13, 2007, from the ArticleFirst.
- Trautwein, Ulrich (June, 2007) The homework achievement relation reconsidered:

Differentiating homework time, homework frequency, and homework effort.

Learning and Instruction, 17(3), 372-388. Retrieved October 13, 2007, from

PsycINFO database.

Vygotsky, L. (1978). *Interaction between Learning and Development* (pp. 79-91). In

Mind in Society. (Trans. M. Cole). Cambridge, MA: Harvard University Press.

Retrieved December 8, 2007 from

[http://www.comnet.ca/~pballan/Vygotsky\(1978\).htm](http://www.comnet.ca/~pballan/Vygotsky(1978).htm)