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**Perceptions of Math Homework: Exploring the Connections between Written Explanations
and Oral Presentations and the Influence on Students' Understanding of Math Homework**

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Math in the Middle Institute Partnership
Action Research Project Report

In partial fulfillment of the MAT Degree
Department of Mathematics
University of Nebraska – Lincoln
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Perceptions of Math Homework: Exploring the Connections between Written Explanations and Oral Presentations and the Influence on Students' Understanding of Math Homework

Abstract

In this action research study of my fifth grade mathematics classroom, I investigated how homework presentations combined with written explanations of math homework influenced students' understanding of math concepts and perceptions of math homework. I discovered that my students really do not like homework but they do believe that homework has a purpose. I also found that my students' test scores were slightly higher when they had written about and presented a particular math concept. Finally, as a teacher I learned that my students can interact in a positive way and teach each other math, so I do not always have to be the one teaching for my students to learn. As a result of this research I plan to implement homework presentations and written explanations for the entire school year to see if students' understanding of math concepts continues to increase.

Introduction

In my classroom I am currently using homework presentations to serve a few main purposes. First of all, I use homework presentations as a way to gauge what students know and understand about a particular concept. The second main purpose I have in using presentations is to engage students in discussing mathematics. Lastly, I want students to see the value in both doing and discussing their homework so that they understand that the purpose of homework is to solidify their understanding of mathematics. With that, I do not believe that homework presentations in my classroom fulfill all of the above objectives.

Based on many discussions about homework with my students, I believe most of them feel that homework is horrible and pointless. Students do not see the value in doing homework because they do not believe that it contributes to their understanding of mathematics.

The reason that I am so interested in the topic of homework is because homework is something that is a constant struggle for me in my classroom. The way that homework is done has never really changed throughout history, like so many other classroom practices have. Giving homework seems to be a tradition everyone accepts as a part of school, yet homework is a topic of contention for students, teachers, parents and administrators. From my own experience as both a student and a teacher I can sympathize with my students and say that I too do not love homework. However, I know that I understand math much better when I do a homework assignment where I am required to actually discuss math through a written explanation than when I do not write. As a teacher I understand the value in homework and I want my students to see this value too!

With all of that said, the current situation in my classroom with regards to homework is one of frustration. I give my students homework because I think that it is important from both a

student's and a teacher's perspective. Students do not like doing homework and therefore often do not do their assignments. I do not know how to help them see that homework is a valuable tool that contributes to a deeper understanding of fundamental mathematics. Therefore, in an effort to remedy this situation, I have implemented two things: written explanations of homework problems and homework presentations.

Problem Statement

I believe that the problem concerning homework routines and procedures is worth knowing more about because almost every day in my classroom I give a homework assignment to my students and every morning I wonder if it is making any difference in the knowledge and understanding that my students have of mathematics. I constantly have and overhear conversations in the teacher's lounge about problems with homework so I know that this is part of a larger problem of practice and not just something that I struggle with as a teacher. Additionally, I have parents calling and complaining about fighting with their students about homework. I have students who hate their work but do it because they have to. Then I have some students who do not do homework at all.

In previous years I have tried different methods of doing/grading homework. For example, I have graded every problem on each assignment that students do and have handed it back. Usually students looked at the score and tossed it in the trashcan. I knew what concepts my students knew and understood but I do not think that they even looked at what they missed. Clearly this method did not teach kids that homework is of value because they did not take a second glance at their work to evaluate their understanding of the math concepts. I have had students grade each other's work but then all they focus on is getting more correct than the person next to them even if they cheat to do it. This past year I have had a couple of problems on

the board when students enter that I see as representative of the concept taught. Students enter the room and sign up for a problem if they want to. Students then write their problem on the board and prepare to share their solution with the class. Although I think this method of doing homework can be effective, I do not feel that it is currently sparking the mathematical discussion and learning that I hope to see. I want to know how I can get students to see homework as a valuable tool that helps them to develop a deep understanding of mathematics.

Literature Review

The purpose of my research is to explore the connection between written explanations and homework presentations, and to see how writing and orally communicating mathematics will influence students' understanding of math concepts and perceptions of homework. My search through related literature has led me in two directions, homework and communication. First I will be discussing homework, where three distinct themes emerged. The homework themes include perceptions of homework, the purpose of homework, and homework strategies. The second part of my search was focused on both oral and written communication, where two themes emerged. The communication themes include: students' struggles in connection with understanding and teacher's strategies.

Homework

The topic of homework has been an area of contention between students, teachers and parents for decades; so naturally, this would be a great conflict to solve. Cooper, Robinson and Patall (2006) from Duke University, have put together a synthesis report summarizing the findings of research about homework from 1987 to 2003. One of the areas that they focus on is the struggle over homework between home and school, and this has become a hot topic with the media where many differing opinions exist. Cooper states that many students do not like doing

homework and many teachers struggle to get students to complete homework. Parents are often times caught in the middle of this ongoing battle between students, who feel that homework is often a punishment, and teachers, who want students to practice concepts taught in the classroom. Again, Cooper states that there is clearly not a simple solution to the problem or it would be solved already. However, any understanding and insight that can be brought to the situation may help to alleviate tensions between parents and teachers allowing them to work together for the good of the students.

Xu (2005) conducted a study that discusses the purposes for doing homework from three perspectives, the students, the teachers and the parents. Interestingly, Xu states there is not a lot of research about students' perceptions of homework. Xu collected information about the perceptions of homework from 920 students in grades 5 – 12. He discovered ten purposes for doing homework with the main one being the practice of concepts taught in the classroom with the expectation of increased student achievement. All ten of the purposes can be divided into two groups, intrinsic reasons and extrinsic reasons. The main intrinsic reason that students do homework is to better themselves, while the most common extrinsic reason for completing homework is to please the teacher or parents. Xu found that the students who only did homework for intrinsic reasons had a lower rate of incomplete homework.

Additionally, Trautwein (2007) conducted three studies including 26,972 seventh through ninth grade German students where he looked at the factors that contributed to student achievement. These factors are differentiating homework time, homework frequency and homework effort. He “tested the popular claim that homework time is positively related to achievement and achievement gains” (p. 385). The fact that time spent doing homework helps students to score better academically is a very popular assumption that is believed by teachers

and parents alike. However, his results indicated that the time students spend on homework is not necessarily what increases student achievement, but rather increased effort on homework and more frequent assignments does increase achievement.

The general knowledge that homework increases student achievement is wonderful, but this does not change the fact that teachers still have to come up with ways to get students to actually complete their homework. Bryan and Sullivan-Burstein (1998) conducted a study assessing homework completion with 11 elementary teachers and 123 students where they found significant increases in homework completion based on three different strategies. These strategies included giving assignments that pertained to real-life situations, using homework agendas and graphing homework completion.

Xu's research is particularly important to my study because I am using intrinsic purposes for homework, in that, I am trying to see if students have a better understanding of their homework if they write and talk about it, and therefore see value in actually doing it. Trautwein's findings are critical to my own study because I am reducing the number of problems that students complete in a night. Instead I am requiring that students write about a problem in detail and present it to the class knowing that writing an explanation of understanding requires more effort than simply completing a page of problems. In my classroom homework completion is not a major issue and will therefore not be a huge focus, but it is a major theme in homework research. With that, it is important to keep in mind that homework is such a complex topic and therefore research has not had a lot of success in informing instruction in the past (Cooper, et al., 2006). Since this research takes place in my classroom I will be able to use the results to inform my instruction and to inform parents about my homework policies and the purposes for them.

Communication

Until recently, the topic of oral and written communication in mathematics has not been a popular topic for research. The basic difference between the two forms of communication is that oral communication is done in collaboration with others, while written communication is typically an individual task. O'Shea (2004) conducted a study at NUI-Maynooth in Ireland where he introduced writing into the mathematics department because he believed that "students should be able to communicate mathematics both verbally and in written form" (p. 101). These two forms of communication are particularly important because they are the two most common types of communication. His study focuses on first and second year mathematics courses and suggests that students do not like to communicate in math because it is difficult. The difficulty in communicating mathematics is largely due to the fact that students are never formally taught the "language of mathematics" (p. 101). Finally, O'Shea believes that once educators see value in written communication in mathematics, then students will be able to see the importance as well.

In discussing oral communication in the classroom, McCrone (2005) completed a study where she explored the communication in a fifth grade classroom over a period of six months. She wanted to see how students' discussions developed over the course of the school year, and how the teacher's teaching changed to meet the different classroom climate. One of the implications from her study suggested that in order to develop rich mathematical discussions, all of the students and the teacher must work together because communication is such a complex process. Students do not necessarily know how to talk to each other. The teacher needs to teach students how to communicate effectively.

Morris (2007) studied mathematics in the writing center, where students gathered to work problems together, and found that students who were taking a high school physics class and presented problems to each other had a better understanding of the subject overall. Amos (2007)

observed discussions of 21 third grade students in an inner city math class and noticed that being comfortable with the language of the subject contributed to the students' overall understanding. Both of these studies discuss the importance of teaching students how to talk to each other, even though students do not like the idea initially, so that students can learn from these discussions.

Like oral communication, written communication must be taught to students because it is not something that they just know how to do. In an action research project conducted by Aspinwall and Miller (1997) students were expected to write about math as part of their first semester of calculus, and of course, not all students were excited about this. The teacher-researchers made three changes in their teaching which were implementing cooperative learning groups, homework writing tasks and testing writing tasks. Then students were asked to respond to two surveys at the beginning and middle of the class and an interview at the end. The authors found that there was an increase in the understanding of the mathematics taught, and that some students relied so heavily on the written explanations that they continued to write about math in other classes to help them understand other subjects as well. Finally, O'Shea (2004) notes at the end of his study that teachers need to value written explanations in mathematics and then students will begin to appreciate the importance of the understanding that is gained.

All of the studies above that deal with communication, both oral and written, have shown a positive effect on students' understanding of mathematics. I am going to create situations similar to that of Aspinwall and Miller (1997) where I have students write about mathematics for homework and McCrone (2005) where I have students discuss mathematics during homework presentations. Then I will use this information to see if communication effects students' perceptions of homework.

Finally, I am going to explore the connection between written explanations and homework presentations (oral communication), and to see how this will influence students' understanding of math concepts and perceptions of homework. This is especially significant because, according to Xu (2005), there is not a lot of research about students' perceptions of homework. Additionally, in the studies above, both oral and written communication have positively contributed to students' understanding of mathematics, so I will use the same methods as McCrone (2005) to teach students how to communicate. Finally, research in the area of homework has not really driven instruction in the classroom (Cooper, et al., 2006). Since I am completing the study in my own classroom, I can definitely use the results to inform my own instruction.

Purpose Statement

The purpose of my action research project was to explore the connection between written explanations and homework presentations and to see how writing and presenting influenced students' understanding of math concepts and perceptions of homework. In order to better understand this I examined the following variables:

1. The quality of student reasoning (written) to explain math concepts.
2. The quality of student reasoning (oral) to present homework solutions on the board.
3. The quality of student to student interactions during homework presentations.

This study attempted to answer the following research questions:

1. How does a written explanation for homework contribute to the overall quality of a homework presentation?
2. In what ways does a written explanation combined with an oral presentation influence students' understanding of math concepts?

3. In what ways does a written explanation combined with an oral presentation influence students' views about the purpose of homework?
4. What happens to my teaching when I institute written explanations combined with student homework presentations?

Method

I began my research in my classroom January 28, 2008 and finished April 18, 2008. My class was made up of 26 high ability students between the ages of 10 and 11. During this time I implemented weekly written paragraph explanations for homework and presentations over the written paragraphs. I had previously done both writing for homework and presentations in my classroom, but when I began my research I created a rubric to assess both paragraphs and presentations (see Appendix A). I gave a copy of the rubrics to each of my students and we discussed my new expectations.

Throughout my research I collected and graded students' homework paragraphs according to the rubric that I created and handed out to my students. I evaluated the presenter and the audience during homework presentations also according to the rubric. I graded paragraphs and homework presentations using rubrics so that I could later evaluate the effectiveness of these two methods of homework. Students took a survey at the beginning and end of the research period (see Appendix B), and I conducted interviews with six students at both the beginning and the end of the research period as well (see Appendix C). The surveys and interviews allowed me to get a snapshot of students' perceptions about this new method of doing homework. After each test I gave to students, I collected and assessed the results so that I could make comparisons between sections that were written about and presented and sections that had a sheet of problems.

Finally, at the end of each week I took all of the notes that I had collected and turned them into a journal so that I could see changes in my teaching and my students.

I divided my research period into 10 weeks and collected and organized my data around these weeks. I kept a notebook with me during math class and each day I noted what I taught and any other useful information. I also kept a file for each week and put all data that I collected for the week in that file. At the end of the week when I wrote in my journal, I graded students' paragraphs and tests and enter this data onto a spreadsheet along with data that I had collected from presentations. After each month of collecting data I sat down and analyzed all of that data that I had collected up to that point. I read through all of my qualitative data and I found the means and standard deviations of my quantitative data. I also looked for themes in my research for the purpose of making assertions.

Findings

In order to make assertions about my research, I looked at all of my data and lumped it into groups according to my research questions. By organizing my information I was able to make sense of what the data was saying. I will begin by describing a typical day in my classroom and then move into my assertions for each research question.

During my research study a typical day followed this basic format. Students came into the classroom and either signed up for a homework presentation problem, usually two or three, that I had written on the board or began work on their warm up. Once homework presenters were ready and the warm up was complete students presented and discussed homework problems. I expected my students to take an active role by working with each other, asking questions and trying to make connections in order to understand the math that they were learning. After presentations were complete I took questions on any other problems that

students did not understand. Once a week students wrote a written paragraph for homework instead of doing a sheet of problems and these paragraphs were presented just like the homework problems by a few students. At this point I considered the homework portion of class complete and I began introducing the lesson for the day. Here is what I found from my research.

Research Question 1 – How does a written explanation for homework contribute to the overall quality of a homework presentation? I found that when students write a paragraph for homework, the quality of their presentation is better than presentations for which students did not write paragraphs. However audience participation is not as good with paragraphs as is it without them because students were not asking many questions or having deep mathematical discussions.

Throughout my research I paid particular attention to homework presentations that were over written paragraphs. During one such presentation I noted in my teacher journal that, “I was a little bit disappointed about Student 25¹ not having any interaction with the audience. Maybe since he did such a good job explaining his problem there was nothing left to ask? However, my hope in doing these presentations is for students to learn from each other by interacting together” (Personal Journal, April 4, 2008). This scenario was representative of many homework presentations over written paragraphs.

After grading students’ paragraphs, I made the following note in my eighth journal. “I continue to see that students that present over a problem that they have written about have a better presentation overall but they have less audience participation. As written explanations get better, audience participation seems to decrease” (Personal Journal, April 4, 2008). I wondered if

¹ All names are pseudonyms.

this decrease in student participation was because students felt that they have a good understanding of the topic writing and therefore did not have any questions to ask each other?

After evaluating the data from homework presentations I found that the mean score for students who did homework presentations in combination with a written explanation was 3.61 with a standard deviation of 0.49. This is higher than the mean score of 3.31 with a standard deviation of 0.43 for presentations without written explanations. However the audience scored an average of 2.96 with a standard deviation of 0.70 for participation with presenters over paragraphs and a mean of 3.19 with a standard deviation of 0.85 for participation with presenters over regular homework problems. This showed that although presentations were better for students who did a written explanation, the audience participated less.

Overall, my research shows that the quality of a homework presentation is better when a student has formally written about the problem for homework the previous night. A possible explanation for the increase in presentation quality is the fact that students have had to really understand the math problem in order to write about the process they used to solve the problem. Naturally student presentations would be better because the students understand the problem on a deeper level than when they simply have to solve and provide an answer. The fact that students understand the problem better may also lead to the decrease in audience participation. This decrease in participation may be due to the fact that the presenter articulated their thinking better and because the audience may also have a better understanding of the problem from the start since they too had previously written about the problem for homework. Therefore the audience did not feel they needed to ask questions because they already understood the math.

Research Question 2 – In what ways does a written explanation combined with an oral presentation influence students' understanding of math concepts? Students have a higher average score on test sections covering topics about which they have written and presented.

In my eighth journal I noted that after I graded a test, my district requires that I reteach any child who did not achieve proficiency. I found that “I have noticed that I am doing less reteaching over sections that students have written about and presented” (Personal Journal, April 4, 2008). So my students are scoring better on sections of the test that they have previously written about for homework and discussed with their classmates through presentations.

On student tests, sections where students had written and presented concepts, they scored an average of 3.56 out of 4 with a standard deviation of 0.20. I have compared this information to test sections where students have done homework, but not done a written explanation or presentation and students scored an average of 3.43 with a standard deviation of 0.35. Students performed better on test objectives that they had previously written about and discussed through homework presentations.

In my interviews with students I asked if writing and presenting in math helps them to understand math better. Student 23 said, “It helps me understand better,” and “You have to have a good understanding to write what it’s about.” This student also said, “I get less problems wrong after writing about it” (Student Interview, April 18, 2008). Additionally, on the student survey, questions 5, 6 and 7 all asked if students felt that they understood math better after writing and presenting their homework (see Appendix B). The survey results showed that students' views about the value of writing and presenting homework increased from the first survey to the final survey (see Appendix D), which tells me that after the 10 week research period, students thought that writing and presenting homework was more helpful than they did before the research began.

Research Question 3 – In what ways does a written explanation combined with an oral presentation influence students' views about the purpose of homework? After completing a written explanation combined with a homework presentation students appeared to believe that the purpose of homework is to help them understand math concepts. During interviews I asked students if their attitude about homework had changed during their fifth grade year and Student 26 said,

“Mine has because before like when I was in fourth grade I thought that ok, I did my math homework, I turned it in to the teacher, she graded it, I got it back, done. and I didn't know what it was really supposed to be for. Well now I know it's for me, so I can really understand it better and it's not just to get a grade on it” (Student Interview, April 18, 2008).

During the interview when Student 26 made this statement, the other five students quickly agreed. The fact that students all agreed shows me that throughout the research process many students began to see that homework was to help them understand math better. Students were no longer completing the assignment just to get a grade, but rather to understand math.

On the student survey, question 8 asked if math homework had a purpose. The average score was a 4.30, with a 4 being agree and a 5 being strongly agree. On the other hand, questions 1 and 2 on the survey ask about how much students like homework and writing for homework. With 3 being a neutral opinion, the mean response was a 2.77 and a 2.46. This shows that students really do think that homework has a purpose, however, they do not really like homework.

Throughout the school year, and especially during my research period, I held a lot of classroom discussions because I got good information from my students. My students know that I am taking math classes in order to be a better teacher. I recorded a lot of snippets from class

discussions in my teacher journal. During one classroom discussion that occurred after homework presentations, I asked students what they thought about doing homework this new way. One of the responses that I got was from Student 22 who said, “Paragraphs make me understand why” (Personal Journal, March 27, 2008). Many other students nodded their heads in agreement with this statement.

By the end of the research period students were verbalizing their thoughts about homework being a tool to help the understand math. Although students still did not like doing homework, students knew that doing their homework was beneficial to their understanding.

Research Question 4 – What happens to my teaching when I institute written explanations combined with homework presentations? I believe that during the implementation of writing and presentations in math, I take on the role of facilitator in my classroom. Exploring this research question was exciting for me because I was able to see how my teaching was changing throughout the research process. All of my evidence for this question comes from my teacher journal.

Early on in my research I was able to see that my teaching style was changing along with my role in the classroom. I was moving toward becoming a teacher that lead students to discover meaning in their work rather than simply telling my students the answers.

One thing that I have noticed about my teaching this week is that I tend to ask more questions than I ever have before. I don’t feel the need to always give students the answer to a question right away, and tend to ask them a series of careful questions to lead them to figure out their own answer. It seems that often times my students really do know the answer to the question they are asking, but they just need someone to pull it out of them (Personal Journal, February 8, 2008).

I am leading students toward discovering answers to math problems themselves by asking careful questions. I do not want to give away too much information with my questioning, but I want to give them enough information to be successful in their discovery. I am also noticing that students are starting to interact with each other more than ever before during homework presentations. I am not the only person in the room asking the presenters questions. My students are starting to have good mathematical dialogue without me having to be at the center of the conversation.

This week I could tell that my teaching is starting to look a little bit different than it has in the past. I have been doing homework presentations and paragraph writing with my kids all year, but now that I have formally created rubrics to evaluate both processes, my students are beginning to perform like I hoped they would. What I mean is that homework presentations are beginning to take shape and hopefully become effective.

With that said, I can see that I am starting to back off of teaching at the beginning of each class period, and my students are really starting to take over. They are leading and carrying on conversations with me playing a minor role. . . That is really exciting that they can learn from each other without me always having to direct the conversation.

Backing off is not so hard for me now that I know that my students can handle the situation and are still thinking and learning. I am still jumping in and asking questions during presentations, but my kids do this too! The questions that they ask are not always directed at me and instead they direct them at the presenters. This is a good feeling.

(Personal Journal, February 15, 2008)

I am excited to see that my students are working well together and that they feel comfortable asking and answering each other's questions instead of coming directly to me. I can see that students are learning from each other through homework presentations. Throughout the

course of my research I could see that as I gave up some of my control, my students were becoming more accountable for their own learning. They took the initiative to ask questions to further their own learning. This is supported by the following entry from my personal journal.

I am still in front of the class teaching, but I am not in control and directing a step by step process all day every day. Instead, I expect my students to take an active role by working with each other, asking questions and trying to make connections in order to understand the math that they are learning. I focus much more on having students understand the math rather than simply teaching them how to do it. I am more of a guide, and still definitely a teacher, but I have given up some of my control so that my students have to be accountable for their own learning. (Personal Journal, February 29, 2008)

As I moved away from simply telling students how to solve a problem to teaching students to understand the math behind basic algorithms, I could see my students shift their focus from wanting the answer right away to trying to understand why answers were correct. This was very exciting because it showed me that students really cared about their work and were taking responsibility for their own learning.

These journal entries help me to see that my teaching really has changed during throughout the whole research process. I am more purposeful about the questions that I ask and how I answer questions from my students. I also have always encouraged students to ask and answer each other's questions, and I have finally seen this take shape during homework presentations. Students really are learning from each other and I get to take a back seat and watch.

Conclusions

As a teacher conducting research in my own classroom, I believe that I have learned a lot about my own teaching and about my students. First of all, I know that most of my students really do not like homework, but, I also know that they do now realize that homework has a purpose and that it helps them. The fact that students know their homework is to help them understand math is an intrinsic motivating reason. This is consistent with Xu's (2005) findings that intrinsic motivation produces greater achievement gains than extrinsic reasons. Secondly, the results show that there was a slight increase in student scores when they wrote and presented about the topic before testing. In talking with students and looking at the survey data, students feel that writing and presenting helped them to understand math concepts better. This increase in achievement is consistent with Trautwein's (2007) findings that time spent on homework is positively related to achievement. Finally, as a teacher, I found that my students really can interact and teach each other math. They can pose and answer each other's questions and I can take a step back and give some control over to my students so that they understand that they are somewhat responsible for their own learning.

Implications

Knowing all of this information, next year I will start earlier in the year with having students write and present their homework. I am interested to learn if students become more comfortable with the process and therefore become better writers if they practice all year, rather than just 10 weeks. One thing that I will be interested to know is if there is an even larger increase in student understanding with this longer period of time. Additionally, I will be interested to see if students get better at interacting with their peers during homework presentations if I carry them out over a whole year instead of just a few months. Another area that I wonder about is if communication during homework presentations, once they really

understand the process, will help students to understand the math better. Finally, I plan to give control over to my students earlier in the year with the hope that students will take responsibility and ownership for their own learning.

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Appendix A

Homework Presentations Rubric				
Presenter	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
	-Writes problem on the board and explains process used to solve problem in <u>great</u> detail.	-Writes problem on the board and explains process used to solve problem in <u>some</u> detail.	-Writes problem on the board and explains process used to solve problem in <u>little</u> detail.	-Writes problem on the board, but doesn't explain process used to solve the problem.
	-Demonstrates thought process in <u>much</u> detail.	-Demonstrates thought process in <u>some</u> detail.	-Demonstrates thought process in <u>little</u> detail.	-Does not demonstrate thought process.
	-Interacts with audience by asking and answering questions.	-Interacts with audience by answering questions.	-Interacts with audience minimally.	-Does not interact with audience.
Audience	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
	Is engaged in hw presentations by: -having hw out -listening attentively -asking questions -checking own work -presenting alternate solutions to hw -asking for clarification	Is engaged in hw presentations by: -having hw out -listening attentively -asking questions -checking own work	Is engaged in hw presentations by: -having hw out -listening attentively -checking own work	Is engaged in hw presentations by: -having hw out

Homework Paragraphs Rubric			
<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
-does the problem and shows work in <u>great</u> detail	- does the problem and shows work in <u>good</u> detail	-does the problem and shows work in <u>some</u> detail	-does the problem and shows work in <u>little</u> detail
-explains how and why a procedure works	-explains either how or why a procedure works	-explains very little of the procedure	-does not explain the procedure
-if possible shows and explains more than one way to solve and understand the problem	-explains only one way to solve and understand the problem		

Appendix B

Math Survey

Please give your honest response to each statement: 1: strongly disagree 2: disagree 3: neither agree nor disagree 4: agree 5: strongly agree.

- | | |
|--|-------------------|
| 1. I like math homework. | 1 2 3 4 5 |
| 2. I like writing explanations in math. | 1 2 3 4 5 |
| 3. I like presenting homework problems in math. | 1 2 3 4 5 |
| 4. I like listening to homework presentations in math. | 1 2 3 4 5 |
| 5. Writing explanations for homework in math helps me to understand math better. | 1 2 3 4 5 |
| 6. Participating in math presentations by presenting helps me to understand math better. | 1 2 3 4 5 |
| 7. Participating in math presentations by listening to presentations helps me to understand math better. | 1 2 3 4 5 |
| 8. Math homework has a purpose. | 1 2 3 4 5 |

Answer the following questions.

9. Does writing for homework help you during homework presentations as the presenter and/or an audience member? Why or why not?
10. Has your attitude about homework and writing in math changed during your 5th grade year? If so, how?

Appendix C

Interview Questions

1. How much time on average do you spend on homework assignments?
2. Why do you think that teachers assign math homework?
3. Do you like doing homework presentations/ writing in math? Why or why not?
4. Do you think that homework presentations/ writing in math helps you understand math better? Why or why not?
5. What does it look like when you justify your answers on a homework assignment?
6. Why do you think I have been asking students to write a paragraph about answers on homework assignments?
7. What do you like best about math? What do you like least about math?
8. What makes math easy or difficult for you?
9. Has your attitude about homework and writing in math changed during your 5th grade year? If so, how?
10. Does writing for homework help you during homework presentations as the presenter and/or an audience member? Why or why not?
11. As I plan my math class for next year, what advice would you give me about homework presentations? About writing paragraphs about homework answers?
12. If you found out that your math teacher next year was not going to include homework presentations or writing in math class, how would you react?
13. Is there anything else I should ask you to know more about how you feel about homework presentations and writing in math?
14. Is there anything you would like to ask me about homework presentations or writing in math?

Appendix D

Question	Difference (Post Survey - Pre Survey)							
	1	2	3	4	5	6	7	8
	-2	-1	0	0	0	2	0	-4
	0	-2	0	-3	-1	-1	-1	-1
	0	-1	-1	1	-1	-2	2	1
	1	0	1	0	0	0	1	0
	0	0	0	-2	0	1	-1	1
	2	-2	0	-1	-2	0	2	-1
	-1	0	2	0	-1	2	0	0
	1	1	1	-1	2	0	3	0
	-1	-1	0	0	1	-1	-1	0
	0	1	1	-1	0	-1	-1	0
	0	1	0	0	0	0	-1	-1
	-1	0	1	-2	-1	1	1	1
	0	-2	2	-2	0	1	0	0
	0	2	1	1	2	1	1	0
	2	2	0	0	1	0	0	0
	0	1	0	-1	1	0	0	0
	2	1	1	1	2	0	0	0
	0	1	0	0	1	1	1	0
	-1	0	-1	0	-1	-1	2	-1
	1	0	-1	0	-1	-1	0	0
	-1	-1	0	0	0	0	-1	0
	1	2	0	0	1	1	1	1
	1	1	-2	-1	0	1	0	0
	-1	-2	-1	0	-1	0	1	0
	0	-1	2	2	0	2	1	-1
	1	0	2	0	1	0	0	-1
Mean	0.15	0.00	0.31	-0.35	0.12	0.23	0.38	-0.23
Stand. Dev.	1.05	1.26	1.05	1.09	1.07	1.03	1.10	0.99