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# Homework Presentations: Are They Worth the Time?

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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
July 2008

**Homework Presentations: Are They Worth the Time?**

## Abstract

In this action research study of my eighth grade mathematics classroom, I investigated the use of daily homework presentations and how they impacted students' written and oral reasoning, students' attitudes towards mathematics homework and students' grades and completion of mathematics homework. I discovered that implementing daily homework presentations had no influence on students' grades or attitudes towards mathematics homework, however students did find homework presentations useful in helping them to better understand the mathematics they were learning. Students' written and oral reasoning were increased through daily homework presentations as well. By requiring students to not only present daily homework problems, but also be active listeners during other's presentations, students were more aware of their reasoning and thinking while completing mathematics homework. As a result of my research, I plan to continue using daily homework presentations in my classroom as a tool for students to communicate their thinking.

## Introduction

Throughout my career as a mathematics teacher, I have always struggled with homework. More specifically, I have struggled with getting students to complete their own homework, understand the homework, and be able to explain their work. Providing immediate and helpful feedback to students has always been difficult for me.

Currently, I am teaching eighth grade mathematics. I have three groups of eighth graders and each group is a heterogeneous mix of abilities. We do not “track” students at our school, so the material taught and covered is the same for each group. Every day I spend the beginning of each class period reviewing and answering questions from the previous day’s homework. I have tried to have students answer the questions by presenting the work that they have done, but the students are either not willing or are not confident enough in their own work to share. Students seem to care more about simply getting the right answers, either by doing the work or copying someone else’s answers, than they do about the process of learning mathematics. The homework that I assign daily usually consists of about 10-15 computation and skills practice problems with 5-8 written explanation type problems. Consistently, students do fine on the computation and practice problems but seem to struggle on the written explanation problems. They are searching for the “correct” way to write their answer instead of simply explaining their thinking and reasoning processes.

After we have gone over any questions from the previous homework, students hand in their assignments and we move on to the new material for the day. I used to collect every assignment daily and grade every problem. Doing this made getting all the assignments graded and handed back the next day very difficult. Consequently my students got their graded homework back one or two times a week. I know that the turnaround on homework was too long,

and the feedback that students did get on their assignments seemed irrelevant. The students did not pay attention to my feedback because it had been almost a week since the homework was submitted. Overall, I was extremely unsatisfied with my grading procedure of homework and with the way students approached their homework assignments.

In my “perfect” or ideal classroom, these issues would be solved. I would have time for five to eight student presentations daily. Through these presentations, the students would be able to communicate their learning not only to me but also to their peers. The students who are not presenting would be able to ask the presenter clarifying questions to assist in their understanding as well. All students would present at least twice a week (with pleasure), and they would do their own work (not copy). I would grade the presentations immediately to give the presenters feedback, and I would only grade the presented problems on other students’ homework. This would reduce the problems that are being graded. Turnaround on the assignments would be shorter, so that all students receive meaningful feedback in an appropriate amount of time.

I have realized throughout my own education and my career as an educator that effective communication is a key to learning. If I do not truly know what my students are learning or understanding, I cannot continue to build on that knowledge. My quest for solutions to the constant battle with mathematics homework has led me to research homework presentations. My overall goal is to research daily homework presentations and their impact in my mathematics classroom. I would like to see if daily homework presentations change student attitudes towards mathematics, as well as improve their written and oral reasoning skills. Along the way I am also interested if immediate and helpful feedback will increase completion of students’ daily homework.

## Problem Statement

Homework has long been a struggle for all educators. As a teacher, I give homework because as a student, I was given homework. Similarly, I tend to grade homework how my own homework was assessed. By investigating homework presentations, I will help myself and my students because I will gain more insight into how they are learning, and they will better understand the material being taught. Students will be able to build their mathematical knowledge base not just because they have learned new skills but through the communication of their learning as well.

Students being able to communicate their knowledge is relevant and important not only to me, but to all educators because it demonstrates a deeper understanding of concepts or material. I believe other teachers in my building, especially the other mathematics teachers, will be interested in this research because we have been discussing our frustrations and difficulties for years. We all have struggled with these homework issues in our classrooms. Many teachers assess homework on a daily basis and I believe other teachers would find my research interesting and informative.

As a society of educators in the world of No Child Left Behind, communication is extremely important for our students. My students' assessment scores are evaluated and criticized by the public eye. I believe that increasing communication will increase our students' achievement. My research relates to the National Council of Teachers of Mathematics' principles and standards that deal with equity, learning, teaching, and communication. The equity principle maintains that teachers should require high expectations and strong support for all students. I believe that I currently have high expectations for all my students. Implementing homework presentations in class may possibly provide the support outlined in NCTM's equity principle. For

students who may not be able to write what they are thinking, but can verbalize their thought process homework presentations are a possible support in the students' mathematical learning process. Students who can explain their mathematical thinking in words will have the opportunity to work on their verbal communication through homework presentations.

I see the connection in both teaching and learning because I need to understand what students know and students need to be able to learn with understanding. Again, I think the homework presentations will better assess what students know, and hopefully will encourage students to actively build their knowledge. Although it may seem obvious, there is also a connection with the communication process standard. The students must be able to communicate their thinking not only to me with words on paper, but also to their peers through their presentations and discussions.

## Literature Review

Daily homework and the problems associated with it in my classroom have continually perplexed me. Because of this issue, I decided to conduct an action research project based on homework presentations and their effect (if any) on student grades, attitudes and oral reasoning. My research of the available literature revealed four main themes. The first theme is that teachers must be aware of student attitudes and beliefs towards mathematics and mathematics homework in order to provide meaningful lessons and assignments for all students. Teacher-to-student written feedback is the second theme I identified. Written feedback is what helps to guide students when they are learning concepts in mathematics. Teachers need to be aware of the types of written feedback that they are providing their students, if any.

A third theme is students' oral reasoning and discourse in mathematics classrooms. I was unable to find any research that had been done on using daily homework presentations in

mathematics classes, so I focused on discourse and oral reasoning. Classroom discussions and student discourse are beneficial ways for teachers to allow the students to talk about their thoughts on the content and their thought processes while working. Teachers also need to be able to build instructional decisions around their students' understanding. Teachers can gain this knowledge by listening to their students' oral reasoning and class discussions. The final theme that I identified is students' homework completion. Getting students to complete homework on time has long been an issue for many educators and I believe that it is important for teachers to be aware of the reasons behind this issue, as well as possible ways to prevent this problem. The following sections will examine each of these themes in more detail and also explain the ways in which my project differs from the published literature in these areas.

## Student Attitudes & Beliefs

"Will we have homework today?" is a daily question from many mathematics students. The teacher's answer is typically "yes" and the students' response is generally negative. Many students today do not see the benefit or purpose of homework to their learning. Student attitudes toward homework and mathematics in general, are often considered unenthusiastic. Mengel, Holcroft and Zahn (1966) studied twenty-two hundred students ranging from kindergarten through eighth grade and the students' eighty-four teachers to see if the way homework was presented to students would change their perceptions of homework. The authors found that when students were given more information and input into their assignments, the more interested students became in the assignment and completed the assignment on time. Homework has long been a vital part of the educational system. While Mengel, Holcroft and Zahn believe that teachers may play a more important role in student attitudes toward homework than initially thought, others disagree.

Evertson, Emmer and Brophy (1980) did a study of seventh- and eighth-grade mathematics teachers to try to compare behaviors and characteristics of effective and less effective teachers. They found that the time that teachers devoted to student understanding within the class and the frequency with which homework was assigned had a positive correlation with higher achievement and academic encouragement. Although this study looks on the surface to distinguish between “good” and “bad” teachers, with so many variables, “we cannot say which variable, or class of variables, is most important in producing achievement or positive student attitudes” (Evertson et al., 1980, p. 176). Due to the findings I would conclude that there needs to be further study done on positive student attitude with more focus on the students and less on the teachers.

In my teaching tenure, I have always thought that students judge their self-worth in a classroom based on their ability to do the work. A study done in Italy (Mason, 2004) with fifth grade students who were given two different types of instruction--innovative and traditional--was focused on students’ mathematical beliefs. The instruction was innovative because the learning environment was changed to a more activity based, discovery learning environment. The study found that those students who had received innovative instruction had higher beliefs not only in themselves as learners, but also in their beliefs of mathematics and learning mathematics through problem solving.

While Evertson, Emmer and Brophy (1980) studied student achievement and student attitude linked to teacher characteristics and instructional practices, I will study student attitude linked to homework, and more specifically daily homework presentations. By changing the type of assignment and in essence the classroom environment, my study is similar to Mason (2004) who studied students’ mathematical beliefs through the changing of the learning environment.

Unlike Mengel, Holcroft and Zahn (1966) who studied students' attitudes toward homework based on changing instructions to an assignment, the entire structure of assignments changed in my study.

## Written Feedback

"Assessment should support the learning of important mathematics and furnish useful information to both teachers and students" (NCTM, 2000, p. 22). When I read that in the NCTM's *Principles and Standards for School Mathematics*, I really begin to think about the type and frequency of feedback that is given to students in their classes. Schoen and Kreye (1974) did a study on 147 prospective elementary teachers. They split the teachers into five different groups and varied the written feedback they were to give students. The feedback ranged from simply marking an incorrect answer with an X to specifically using the student's first name with an explanation as to why the given answer was incorrect, followed by the correct answer. The authors found that although the variation in types of written feedback to students did not appear to make a difference in student achievement or attitude, there was a significant difference in retention for those students who received feedback specific to their error.

The use of rubrics in assessing students has brought about another variation in written feedback to students. Stutzman and Race (2004) are both mathematics teachers in Colorado who wrote an article on the Excellent, Meets Expectations, Revisions Required and Fragmentary (EMRF) rubric assessment system they developed for their classrooms. The authors found that after initially implementing their new grading and feedback system, students felt uneasy and uncomfortable. However, after time students began to see the positive side of knowing what is expected of them. Stutzman and Race believe that providing students the expectations prior to assessment, and then giving the students feedback and opportunities to revise their work helps to

promote an “ongoing learning process” within the mathematics classroom (2004, p. 39). This is an important piece of information for my research because I will be using rubrics to grade students’ daily homework presentations.

Evens and Houssart (2004) conducted a study of over 400 written responses provided by 11-year-old students on a mathematics test. While most of the students were unable to provide a complete and clear explanation, the authors found that with some assistance from their teachers and classmates, students’ responses could be developed into correct and complete responses. Unlike Schoen and Kreye (1974), the authors also found that when giving feedback to students’ responses, teachers should not provide a correct solution for students. Instead, teachers should encourage students to improve their initial answers by asking clarifying questions.

A main component in my study was giving students written feedback to not only their daily presentations but also to the homework assignments being handed in and graded. Similar to Stutzman and Race (2004), I used a rubric during my study to grade students’ presentations and give them feedback. I did not, however, write a new rubric for each problem that was presented or assessed. My study also involved me giving feedback to student presentations through questioning similar to Evens and Houssart (2004), but differed in that I focused on oral responses instead of written responses. While Schoen and Kreye (1974) focused on different types of written feedback, my study focuses on simply making sure each student receives written feedback on their presentation and their graded problems. The type of feedback I focused on was correct or incorrect with some clarifying questions.

## Oral Reasoning

“Communication is an essential part of mathematics and mathematics education” (NCTM, 2000, p. 60). In a mathematics classroom, both teachers and students need to be able to

communicate their thoughts and ideas to each other both in writing and orally. Kotsopoulas (2007) did a study of a ninth-grade mathematics classroom to find the gaps in students' oral communication. During the study, the author found that the variety "of representations of words in everyday language and within the mathematical register can create significant interference as students struggle" (p. 302) to apply meaning to words in contexts they do not understand. The language of mathematics is complex and many words are borrowed from everyday language. Students struggle with the ability to attach a new and different meaning to words they may use everyday. Kotsopoulas believes that "students need to participate in mathematical discussions and conversations in classrooms" (p. 305) to become skilled at mathematical discourse. In order for students to be involved in mathematical discussions, the focus of the classroom needs to be switched from teacher lecture to student-centered discussions.

Manouchehri (2007), a professor of mathematics education at Ohio State University conducted a study during a two-week time period at the beginning of the academic year. The focus was on problem solving and students' ability to discuss their findings and support their results. Although the age of the students was not mentioned in the article, Manouchehri found that teachers need to be flexible in their approach to curriculum and that providing students opportunities to informally discuss their thoughts and findings may lead to a change in course of instruction. Providing students the opportunity for discussion may lead the lesson in an unintended yet educational direction.

Both Manouchehri (2007) and Kotsopoulas (2007) discussed results that favored discourse and teacher questioning in strengthening students' mathematical knowledge. However, House (2004) conducted a study on the link between instructional practices and achievement in mathematics using data from the TIMSS 1999 assessment. The students involved in this study

were 13-year-old students from Japan. House found that the use of cooperative learning and student-to-student discourse during a new concept had a negative correlation to student achievement. Although House cited other studies that showed positive correlations between cooperative learning and mathematics achievement, he suggests that “cooperative learning activities must be carefully considered when developing instructional programs for mathematics learning” (p. 205). He also suggests that the use of cooperative learning may not be linked with higher mathematics achievement when introducing a new mathematics concept. This says to me that cooperative learning can be both helpful and harmful to mathematics achievement depending on how it is used within the classroom.

Pape, Bell and Yetkin (2003) conducted a study on the collaboration of a seventh-grade mathematics teacher and a university researcher. Their study focused on developing students as self-regulated learners. One topic in their study focused on classroom discussions and students’ abilities to think mathematically. The seventh-grade teacher required her students to explain and support their reasoning. Papa, Bell and Yetkin found that in order for a teacher to expect that of students, the teacher needs to build a larger base for the subject matter that is being presented to the students. Having strong content knowledge will give the teacher the confidence to guide their students through discussions and assist teachers in being prepared for questions or comments that may arise during discussions.

My research focused on students’ oral reasoning during daily presentations, more specifically, both the presenter and the listeners. This is in contrast to House’s (2004) study which mainly talked about student discourse in a small group setting. Like Manouchehri (2007), students presented their ideas to the class, but they did so on an individual basis and not in groups. As mentioned before, both Manouchehri and Kotsopoulas (2007) discussed results that

favored discourse and teacher questioning in strengthening students' mathematical knowledge. My study, however, focused more on discourse and questioning between students with less focus on the teacher.

## Homework Completion

On-time completion of daily homework has long been an issue in my teaching tenure. "Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well" (NCTM, 2000, p. 16). In order for me as a teacher to meet this principle of mathematics teaching, students need to complete and turn in their work, providing me the opportunity to give them feedback. Mengel, Holcroft and Zahn (1966) found during their study that when teachers were more responsive to student input and feedback, students were more likely to not only see the value of the homework, but take more responsibility for their homework and their learning.

Corno (2000) researched how homework has changed and the dynamics surrounding the assigning of homework. The article discussed good and bad issues associated with homework from the perspective of inside school and outside school. Within this article, Corno discussed a variety of case studies designed to identify third-grade students' responsibility in completing different types of homework. These case studies showed that there were many factors that influenced whether or not homework was completed. Included in those factors was not only understanding of the material, but the environment in which the homework was being completed. Teachers need to be aware of not only the cognitive development of their students but also of the environment in which those students do work outside of school.

Corno (2000) focused on the environment that may hamper a student's ability to complete homework. This is helpful information for my research, but neither Mengel, Holcroft

and Zahn (1966) nor Corno studied the types of homework assignments that were given. My research will compare what I do in my classroom now—traditional assignments—to daily homework presentations with selective grading on handed in assignments.

I believe my research on daily homework presentations adds to the existing literature. In my review of the literature, I was not able to find any specific research on homework presentations in mathematics classrooms. Since the focus of my study was on any effects daily presentations may have on student attitudes and beliefs, students' oral reasoning skills and homework completion, I believe my research can provide new information to future researchers. Many teachers are looking for a different way to assess student understanding through homework. I hoped that my research on homework presentations would be able to provide the educational community with a new approach to homework.

## Purpose Statement

The purpose of my study is to investigate the effects of daily homework presentations in my classroom. I examined the variables of students' written and oral reasoning, student questions, homework completion rate, and student attitude regarding homework in seeking to answer the following research questions:

- What will happen to students' grades after implementing daily homework presentations?
- In what ways (if at all) will written feedback (teacher to student) on daily presentations and graded problems influence students' of homework?
- What will happen to the level of student reasoning, both oral and written, after implementing daily homework presentations?
- In what ways (if at all) will implementing daily homework presentations influence students' attitude about mathematics homework?

- What will happen to my teaching when I institute daily homework presentations?

## Method

This action research took place during the second semester of the 2007-2008 school year, from January 8, 2008, through April 15, 2008. Data was collected from many sources throughout the research time period and was used to support my findings for my research questions. I collected and analyzed three types of data for each research question to support my findings. To describe what happened to students' grades after implementing daily homework presentations, I conducted individual student interviews (see Appendix A for interview questions), kept copies of my grade book, and kept a personal journal to record my observations of how students responded to the daily homework presentations. I interviewed eight students throughout the months of March and April. The individual interviews focused on the student's perception of themselves as learners in a mathematics classroom and their beliefs or attitudes towards mathematics and daily homework presentations. During the interviews, students were asked about their thoughts on homework presentations and whether or not they had noticed changes in their daily grades since beginning homework presentations. I also kept copies of my grade book to measure any changes in students' grades.

The last source of data for my first research question was my personal teacher journal. At the end of each week, I completed a journal entry by answering the reflection questions I had previously prepared (see Appendix B). I really struggled with the process of journaling consistently and having enough information. The journals allowed me to keep notes on observations I made during the week and were a beneficial source of information for each of my research questions.

To analyze how written feedback on daily presentations and graded homework influenced students' completion of homework, I kept copies of students' graded problems and presentations graded using a rubric (see Appendix C), interviewed a focus group of six students, and recorded observations in my personal teacher journal. The copies of students' graded problems allowed me to look for comments or suggestions I had made to students and whether or not the students followed through with those comments by doing "corrections" or "fix-ups" for a better grade. The three focus group interviews (see Appendix D) were conducted once a month in February, March and April. The group interviews focused on mathematics in general, the students' beliefs on learning mathematics, and how to achieve to their highest potential. Again, I used my personal teacher journal to record observations that I made during presentations on students' preparedness to present problems and hand-in their daily homework.

To analyze the impact of daily presentations on the level of students' oral and written reasoning, I used student journals, copies of students graded problems, and my personal teacher journal. Student journals were completed throughout this study (see Appendix E). The students were asked to journal on one or two questions every other week throughout this research. The journals focused on students' individual beliefs and feelings related to mathematics homework, and whether or not they had seen any changes in their thoughts towards daily homework presentations over time. Another focus of the journals was on teacher-to-student feedback and whether or not students felt it was helpful to them. Copies of student work were kept to observe any changes in the way students reasoned on their written work. The teacher journal was again a source of data for this part of the research. I recorded any noticeable changes or observations regarding students' oral communication in my journal that I saw during class and during presentations.

To describe any changes in students' attitude about mathematics homework after implementing homework presentations, I gave a survey, had the students journal, conducted group interviews and recorded observations in my personal teacher journal. I gave the students a pre-, mid- and post- attitude survey (see Appendix F) to assess their attitudes and beliefs towards mathematics homework. Again, I used focus group interviews to assess their perceptions of mathematics homework and to see if any changes in their attitudes had occurred throughout the time of the research. The students were asked to journal about their attitude towards mathematics in the beginning of the research. At the end of the research period, the students were asked to journal about any changes they had noticed in their attitude towards mathematics homework. Finally, at the end of each day, I recorded in my personal teacher journal observations I had made of students attitudes during the time that they were working on their homework assignments during class.

It seemed that I ran into many challenges along my data collection journey. The amount of time that we were not in school became a major issue for me. It seemed that once the research began, the weather did not cooperate and we missed school nearly one day a week. I also have a lot of responsibilities within my building and school district, so I was pulled out of class a lot to go to meetings, portfolio reviews or school improvement workshops. Throughout the research period, I lost approximately 10% of my teaching time. I even had to ask my principal to please not take me out of class anymore unless it was an extreme emergency because I began to feel I was not going to be able to collect enough data for my research. Fortunately, when all was said and done, everything did work out and I collected a lot of valuable information.

## Findings

I taught eighth grade mathematics during the 2007-2008 school year at Gordon-Rushville Middle School. The school districts of Gordon and Rushville consolidated three years ago and we merged our sixth through eighth grades into a middle school. I had three groups of eighth graders and each group was a heterogeneous mix of abilities. We did not “track” students at our school, so the material that I taught was the same for each group of students. I have each of the groups for seventy-five minute periods three days a week (Monday, Tuesday and Thursday), and I have them for forty-five minutes on Friday. On Wednesday, I am the “floater” teacher for the eighth grade. On that day, I help the other eighth grade teachers with anything they may need such as taking a small group of students, assisting with administering a test, or even substituting for an absent teacher. If I am not needed in any of these areas, I work with the other mathematics teachers in my building developing curriculum for our middle school program, or I may work on our school improvement plan. If nothing else, I simply keep my head above water in my own planning.

My classroom is set up with trapezoid tables that are put together to form hexagons for the students to work around. I have groups of three to four students who sit at each set of tables. I have small whiteboards that each student can use when we are working on problems together or playing a review game. I also have two couches and a recliner that are in the back corner of my classroom that students use to sit at when working on homework or for cooperative group work.

I meet the students at the door and shake their hands as they enter the room. This helps me get a read on how the students are feeling, and it also helps with attendance; I know who is either absent or tardy right away. Once class has begun, while I am taking attendance, the students are either signing up for presentations or milling around the room asking for help or

helping others. Before I began my research, I would spend the beginning of each class answering questions students may have had on the previous homework. Since I have begun presentations, I expect the students to help each other. I try not to help them too much, especially if they are giving a presentation.

I give the students about five minutes to ask and answer any questions they may have, then I begin class with a few minutes of good news. Any student who has good news to share has the opportunity to do so before we actually begin presentations. After good news, I ask students who are not presenting to turn in their papers (to avoid them copying off the board during presentations), and those who are presenting to put any work they would like to on the board. Each of the six presenters then presents his or her problem and answers any questions that anyone may have. The presentations typically take approximately thirty minutes of class. After the presentations, we have a class discussion of anything the students found interesting or new during the presentations, and then we begin the new lesson for the day. My students do not have textbooks, so I type up notes for them and typically assignments that we go through together. During the notes, we do activities and problems together where the students either do them with their table group, or they sometimes come to the board and show their work and explain to the class what they have done.

After we have completed the notes and the students seem to understand the new concept, I give them their assignment and they begin working. The assignments that I type up for the students usually consist of ten to fifteen calculation-type problems with six to eight real-world application and explanation problems. During this time, I am free to roam around the room and answer any questions or clarify any directions for the class. I encourage the students to seek help

from those students at their table if possible. If they are all unsure, the students can ask me for help.

Throughout my ten-year teaching career, I have always found it important for my students to work together. Yet I have had a hard time trusting in the fact that they were all doing their own work. Since I have been teaching eighth grade, I have really begun to understand how important it is for my students to learn to cooperate and collaborate together. However, I have had a hard time getting them to see the benefits of working together and not copying. This is one of the main reasons for my action research on daily homework presentations.

Through my research, I have found that students are empowered when given the opportunity to express their knowledge and learning through homework presentations. Many of my students were truly excited to be able to explain their work and understanding to the class during homework presentations. Although their attitude about mathematics homework was not really affected, they were excited about what they were learning through both giving presentations and listening to presentations. The data also suggests that students' written reasoning skills were increased through homework presentations. Evidence to support my findings for each of the research questions follows.

## Student Grades

Implementing daily homework presentations did not improve students' average daily grades. Throughout this study, I wrote journals each week illustrating my observations on student responses to daily homework presentations. I noticed that students were excited about homework presentations from the beginning largely due to a change in the classroom structure. Unfortunately the students' excitement was not because they were getting to communicate their learning to others. In the beginning of the research period, students who signed up for a

presentation were not graded on that daily assignment, only the presentation they gave. Grading only the presentation created a lot of miscommunication. Some students were only completing one or two problems and hoping to be able to sign up for a presentation and receive credit. The students who were not presenting were graded only on the six problems that were presented that day. Having only those six problems graded also caused problems in the beginning because the problems that were chosen for presentations were usually six of the more difficult problems on the assignment, and students were not getting them correct or completed.

An excerpt from my personal journal supports this finding. In my one of my journals from early on in the research period I wrote:

> *I have noticed that some students will jump to give presentations because the rest of their assignment may not be completely finished... This was a tough change in class for some students. When presentations began at the beginning of this semester, I also told the students that of those that don't present only the presented problems will be graded. I have noticed a lot of "grumbling" over that issue… I sense some real frustration with only the grading part of the students' assignments and I am wondering if it is necessary. After being in class and talking with Ruth, I have decided to continue with everything as planned, except I will be grading everyone's assignment, everyday. Students that give a presentation will get two grades for the day. (Personal Journal, February 1, 2008)*

After deciding to grade everyone's assignment every day, I noticed that the students began to really get into giving presentations and the issues with how I was grading were gone. I also interviewed students individually on their perceptions towards mathematics and daily homework presentations. Some students were noticing small changes in their daily grades, but they were not sure of the reason. However, most students did not seem to feel there had been any changes in their daily grades. During individual interviews, students were asked "Have you noticed any changes in your daily grades since beginning presentations? Why or Why not?" Here are the responses to those questions:

Walter: *"My grades are kind of dropping and I don't really know why."*

John: *"… a little worse because I don't hand in my papers on time."*

Jason: *"At first my grades were going down, but when I noticed that I just stepped it up and got it back up."*

Brian: *"No, not really because I usually do pretty good on both presentations and homework."*

From these students' quotations, I noticed that the students were not noticing any changes in their daily homework grades.

I also kept copies of my grade book and looked at students' daily grades during three different periods of this research. I looked at daily grades in the beginning, the middle and the end of the research. I was looking for any changes in daily grades. I made a graph to show the average grade on the homework assignments in the beginning, middle and end of the research period (see Figure 1).

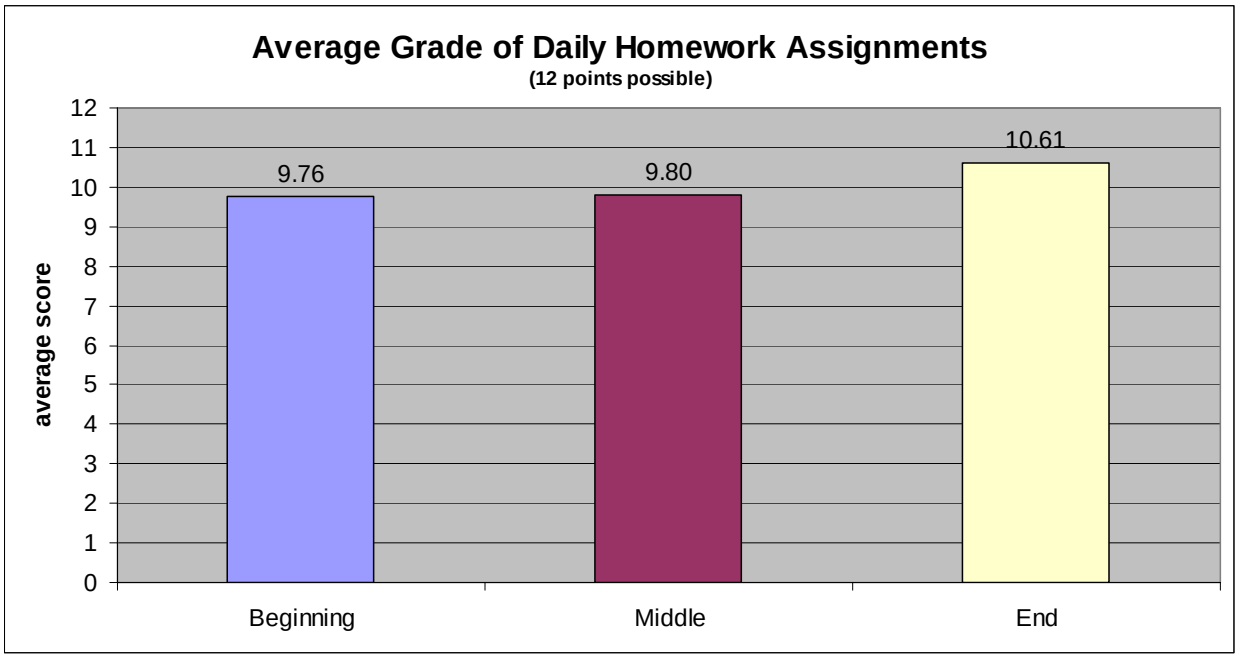



**Figure 1. Average Grade of Daily Homework Assignments.**

From looking at the graph, one can see that the average daily grades were almost the same for the beginning, end and middle of my research. Although there is a slight increase in average daily grades from the beginning to the end, I attribute that mostly to the fact that in the beginning I was only grading the six problems that had been presented and students were not doing well on just those six problems.

Throughout the course of my research, I found that homework presentations are a valuable tool in gaining insight of whether or not a student understands a concept. However, there is not enough evidence to say that homework presentations have made any impact on students' daily homework grades. There was a small increase in student daily grades from the beginning to the end of the research. Yet, the change was not a significant enough to be able to conclude that homework presentations had an influence on daily grades.

## Homework Completion

When given descriptive feedback, students are more likely to correct their mistakes either for a higher grade or to learn for future assignments. For example when given following problem: "Describe and correct the error that was made in writing 0.001 as a percent: $0.001 = \frac{1}{100} = 1\%$." Here is Amy's original response, and correction:

Original Response:

> *"You should only move the decimal point two places when moving from a decimal to a percent = 0.1%"*

I had written a comment on the original paper that she needed to describe and correct the error not just part of the error. I also asked, "So what does the new problem look like and what should the answer be?"

Student Correction:

> *"The error is that you should only move the decimal over two places to the right and that the one should be over 1000 not 100. The problem should look like this:*
> $0.001 = \frac{1}{1000} = 0.1\%$ .

Amy took my descriptive comments and re-did the problem to receive a better grade. The second time she did this problem she showed a better understanding of the problem.

In my classroom, I have a policy that students can go back and re-do any previous work and receive credit for it. On daily work, they can get full credit back and for tests or quizzes they will receive half credit. During the course of this research, I had 40 of the 48 students, or about 83%, turn in corrections of one kind or another. Although I have nothing to compare that to, I believe it is a significant amount. I credit this to the fact that I was more conscious of the feedback I was giving students.

While conducting the first focus group interview, I asked students, "How much do you actually go back through your graded problems to see what you may have missed and the comments I have made?" All of the students interviewed responded that they did go back and look at their graded homework for mistakes and comments.

Gary: *"like every paper, it helps to see what you have written because then you can fix it next time you do a problem like that."*

Kim: *"it helps that it tells what you did wrong so you can fix it."*

I realized through this interview that it does make a difference what I comment on in students' papers and students are actually reading them and using them to improve their homework and their grade.

Students had also done a journal that asked the question "When you receive graded homework back, do you look to see if I have written any suggestions or feedback on how to fix your mistakes? Please explain why or why not." The majority, 79%, of the students responded

that they did look at each paper for comments to either assist them with corrections or for future assignments.

I also wrote in my journal regarding student corrections and the feedback I was giving them. From a journal in the beginning of my research I had written:

> *I am trying to be more conscious of the feedback and comments I am making on students presentations and homework assignments. I have noticed an increase in students that are doing corrections to improve their grade. It seems that I have students turning in corrections that wouldn't normally turn them in and they must be reading the comments because their second attempt at the problems shows a better understanding of the concept and represents a more complete solution. (Personal Journal, February 14, 2008)*

From this journal I realized that giving descriptive feedback to students on their homework was encouraging more of them to turn in corrected solutions.

The evidence has shown that providing immediate and helpful feedback on homework was valuable not only to my students but to me. When given descriptive feedback on their homework, students were better able to correct their solutions and turn them back in to improve their grade. Besides improving their daily grade, students were able to gain a better understanding through the corrections. As a teacher, I was able to see that my students did have a better understanding of the concepts after they had done corrections.

## Student Reasoning

After looking at all the evidence, I am confident that implementing daily homework presentations increases students' oral and written reasoning. Throughout this study, students were given journal prompts to complete every other week. One of the journal prompts was, "Describe your thoughts on daily presentations and how you think they have changed (if at all) your thought process while completing mathematics homework." Here are some of the responses:

Amy: *"I like them very much. I think they help the class and the person presenting understand better."*

Alice: *"I understand it more and figure out how to do it better."*

Stephanie: *"It has helped me learn to write all of my steps and be more complete with my work."*

Conner: *"It has changed my thought process on how I would explain how to do it. I don't mind doing them or hearing them."*

Julia: *"I like doing presentations because they get me thinking about the problems that I may have missed on my assignment."*

The majority of students responded to this journal question in the same manner. 89% of students that felt that homework presentations helped them understand the mathematics better and improved their ability to explain their thought process.

Another journal prompt was, "Do you feel you are better able to understand mathematics homework and explain the mathematics since we have begun presentations? Please explain." Students shared these responses.

Conner: *"Yes, a lot better for I have realized how much explaining things even to myself has increased my understanding."*

Misty: *"Kind of, because I just naturally write a book every time I give an explanation, but presentations kinda made me look at my explanation to double check that it was right."*

Stephanie: *"Yes I do, when I do not fully understand how to do a problem it is usually well explained so I comprehend and can do it the next time."*

All but one student responded to this journal in the same manner. The responses from the students made me realize that students were taking homework presentations seriously and understood the value of presentations in their learning process. Looking back through my personal journal entries even early on in presentations, I had written how impressed I was with the quality of the presentations and the language the students were using. The questions and

discussion from the students listening to the presentations were very interesting, and I was excited about the quality of the discussion and questions. I was especially impressed with the way students were asking questions and not just trying to point out others' possible mistakes. I had written about my observations regarding homework presentations in a few of my journals throughout the research process. Here are some excerpts from my personal journals:

> *I did notice that this week even though we only had one presentation, the students that signed up for them wouldn't normally sign up for a presentation. They seem to be getting the hang of presentations and actually enjoy being in front of the class explaining their work. I have also overheard a lot of comments from students about how much they like actually explaining their work or ideas in words rather than in writing (Personal Journal, February 15, 2008)*
>
> *I have also noticed that the students are doing a great job of helping each other and asking questions. (Personal Journal, February 1, 2008)*
>
> *In the beginning, I had to continue to stress how important it was to be respectful of the presenter and to listen to be able to understand the problem or ask questions. This week, it went a lot better. (Personal Journal, February 8, 2008)*
>
> *I have one student that asks questions during presentations like I would ask…it is like she is trying to be a mini-teacher. During presentations over the lesson on the sum of the angles of a polygon, she asked why use the formula 180(n – 2) and when the presenter couldn't answer she then directed her next question to the whole class: "Does everyone know where that formula comes from? Do you remember the activity we did drawing triangles inside the polygons?" And she continued to explain it like she was the teacher. (Personal Journal, March 21, 2008)*

After looking back over my journal entries, I realized there was one theme that became evident. My students were beginning to take a more active role in their learning through the use of homework presentations. Students were beginning to rely on each other for help and to understand that even if their answer was incorrect, during a presentation, the rest of the class would help them through it.

In looking over the copies of student work, I noticed a slight increase in students' written reasoning. For example, after reviewing papers from Jessica, early assignments that required

explanations were simply calculated and the reasoning was either not completed or not correct. In later assignments Jessica not only did the calculations or diagrams necessary, but explained her reasoning or process as well. Here is an example of a question from an early assignment and the response from Jessica:

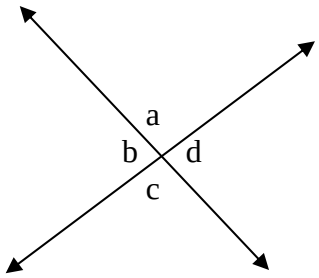
Question: How many decimal places does $1.3^1$ have? $1.3^2$ ? $1.3^3$? $1.3^7$? Explain your reasoning.

Jessica: *Whatever the exponent is that is how many decimal points you will have.*

And here is a question from an assignment near the end of the research period:

Question: How many pairs of vertical angles do two intersecting lines form? Draw a diagram **<u>and</u>** explain your reasoning.

Jessica: *There are two pairs of vertical angles because a and c are the same measure and b and d are the same measure because they are across from each other and that is the definition of vertical angles:*




This not only showed me that this student understood the concept, but was able to explain their understanding by representing their solution in a diagram and in writing. Conner would usually leave questions blank that asked for explanations or diagrams in the beginning of the research. However, by the end of the research this student was completing these problems and giving great explanations. Here is a question and Conner's response from an assignment towards the end of the research period.

Question: Can two angles of a triangle be supplementary? Explain why or why not.

Conner: *No, because supplementary angles are two angles whose sum is 180 degrees and that is the sum of all three angles of a triangle. Therefore, you cannot have just two angles in a triangle be supplementary angles.*

This answer was not only complete, but demonstrated that the student understood the concept of supplementary angles and the sum of the angles of a triangle. The biggest discovery for me on student reasoning was that if students are given different methods of communicating their learning to others, they become more confident learners. In the beginning of this research period, students were apprehensive about giving presentations because they did not want to be wrong. By the end of the research period, students were giving presentations even if they knew their answer was wrong in order for their peers to help them find their mistakes. The communication in my classroom blossomed more than I had expected, and I was truly impressed with the growth in my students.

## Student Attitudes

Students felt that daily homework presentations helped them gain a better understanding of the mathematics they were learning, however, it did not change their attitude towards mathematics. Standing in front of a group of your peers to discuss one's method of solving a mathematics problem was a daunting task for some students. However, all the students have expressed the joy in showing their classmates a new or simpler approach to a mathematics problem.

The students were asked to complete a mathematics attitude survey three different times during the semester. One question on the attitude survey read, "Communicating with other students helps me have a better attitude towards mathematics." The first time students completed the survey, 77% of students either agreed or strongly agreed with that statement. The results of

the same question on the third survey showed that 73% either agreed or strongly agreed with that statement. There was not a significant difference in these percentages showing me that their attitudes did not change from the beginning to the end of the research. The fact that there were three people unavailable to take the third survey could also account for the difference.

Students were also asked to journal about their thoughts on daily homework presentations. There were a variety of responses from students. Responses ranged from how helpful presentations were to that student specifically, to how helpful presentations were to the class and the students listening. Here are some journal responses from students regarding homework presentations:

David: *"Presentations have helped me understand math better and I think it (attitude) has changed a little."*

Emily: *"No, I don't think presentations have changed my attitude towards math because, I don't think about giving presentations when I'm working on my assignment. But, I do like how if I make a mistake, the other classmates' presentations can help me understand usually."*

Austin: *"I think presentations make you think, if someone else read your work would they figure out how you got it? And they also prepare you for real life when you have to give a presentation for a job."*

Julia: *"Doing presentations has helped me a lot so I can see how other students are doing that problem and I can try that method too. They do not change my attitude towards math, just help me understand."*

Misty: *"I feel that presentations have helped me because after I get my homework done, I go back over the ones I had trouble with so I know how to present them. I enjoy the presentations that we do and knowing that we are going to do a presentation in front of the whole class over what we are learning makes me pay better attention and try harder."*

Stephanie: *"Not specifically has it changed my attitude completely, but it does help me understand."*

The journal responses from students revealed that although attitudes towards homework were not affected through homework presentations, mathematical understanding was deepened.

At the end of each of the group interviews, students were asked if they had anything to add that had not been previously asked. Here is what the students had to say:

Amy: *"I like the whole presentation thing because they are usually harder problems and if someone is up there that knows what they are doing, or even if they don't know, you get a chance to understand the problem better."*

Gary: *"and it can help other kids in class if they don't get the problem and it's shown to them on the board then they can figure out how to do it next time."*

Kim: (after being asked if students find it difficult to describe their process while completing a problem) *"it is actually kind of easier I think."*

These responses only strengthened my assertion that homework presentations were viewed as valuable from the students' point of view.

I had written in my journal in the middle of the research period regarding my observations of student confidence in presentations.

> *I did notice that this week, even though we only had presentations once, the students that signed up for them wouldn't normally sign up for a presentation. They seem to be getting the hang of presentations and actually enjoy being in front of the class explaining their work. I also have overheard a lot of comments from students about how much they like actually explaining in words their work or ideas rather than in writing. (Personal Journal, February 14, 2008)*

From this evidence, one can see that students did find homework presentations to be a valuable tool in their learning.

Throughout the research period, student homework presentations were an important tool for learning within my mathematics classroom. Through the use of homework presentations, students felt they were better able to understand mathematics and they liked being able to see

others' solutions and show their solutions. Although presentations did not have any influence on student attitudes towards mathematics they provided a valuable learning experience in my classroom.

## Teaching Insights

I realized that I have a tendency to always want to jump in and "save" my students instead of allowing them to struggle with their thought for a while. In each journal entry, I have described the changes in my teaching and my struggles with letting go of control in the classroom. In the beginning of presentations, the students were really excited, and the students who were not presenting were asking great questions. Everyone responded well to this change, except for me. I had a difficult time letting the students struggle at the board and trying to take a less prominent role in the classroom. The students started out by directing their questions to me, instead of the presenter. It also seemed that for a while they were only trying to find any possible mistakes instead of looking at the process the presenter had described. I really tried hard to let the students direct the discussions, but I seemed to always speak up and help someone.

I have always had a hard time with students doing work on the board or coming to the board to show an idea or process. My reservations are not because I want to have all the control, but I have always worried that if their idea or process was not exactly correct, the other students would simply make fun of them and it would hamper their confidence. I have worked hard to change this. I had written a journal regarding this:

> *In beginning a new unit on Geometry and Measurement, I started the class by simply asking students what they already knew. For the most part, the students answered the questions and were somewhat excited about moving on to this unit, but one group in particular was really excited. When I was asking them what they knew about angles, they just started rattling off all kind of information and one student was so excited she asked to come to the board and show something. It was great how they got into the lesson and we hadn't even started yet. The student*

> *came to the board and drew a protractor and then discussed how to use it to measure all kinds of angles (even those larger than 180 degrees). This was really enlightening to me to watch this exchange and we hadn't even really begun the lesson yet. (Personal Journal, March 7, 2008)*

This was a valuable experience for me because although I was apprehensive, the student was not and I really learned that it is okay for the students to share their ideas, even if there is a chance they aren't completely correct. For me, this is a huge change in my teaching because before I would have probably asked the student to describe it to me, then if the student was correct I would either put it on the board or allow them to come to the board. I wrote about his internal struggle of mine in a couple of different personal journals:

> *Again, I am struggling with not jumping in and saving the students when they are struggling. Since the science teacher and I are working together on this project, he tells me that I help the students too much and I should let them struggle a little before jumping in. When he notices it, I know it is a problem. (Personal Journal, February 22, 2008)*
>
> *Before when a student would ask to come to the board to share an idea or thought, I probably would not let them because I wouldn't want them to be wrong and have the rest of the class laugh at them. I am beginning to allow the students to give all of their ideas and we build on them even if they are wrong. I was really inspired on Tuesday when one group was so excited and students were sharing things on the board. (Personal Journal, March 7, 2008)*

Both of these journals really show how difficult it has been for me to allow my students to struggle. The teacher in me has always thought that I had to protect my students from struggling with concepts. Throughout this entire research experience, I have worked hard to better understand myself as a teacher. I do understand that watching students struggle is not always the easiest thing to do, but I have learned through this research that it is almost necessary in order for students to really understand what they are learning. Although I have changed this a little in my own classroom, it will be an issue that I deal with every day of every school year. I will have to continue to remind myself that it is okay for students to struggle, and that my students are

actually capable of helping themselves and learning without my guidance all of the time. I have always encouraged my students to take ownership in their learning. I have learned through this research process that in order for my students to have ownership in their learning, I need to become more of a facilitator in my classroom and less of “the leader” of the classroom.

## Conclusions

I believe that homework presentations have played an extremely important role in my classroom this semester. Although I was not able to see much change in student grades or attitudes, I did gain some great insight as to how students were learning and becoming more independent learners. I believe that homework presentations help students to better understanding the mathematics they are learning and are a powerful tool for student-to-student teaching. Students realized that homework presentations were important, not only for learning mathematics, but also because the presentations helped them feel more comfortable in their ability to speak in front of a group and present their ideas. Students were able to see, through presentations, that there are many ways to do a problem in mathematics and even though one method is different from another, it does not mean it is wrong.

My findings regarding student attitudes paralleled those of Mason (2004). In his study of fifth grade students, Mason found that with more innovative instruction, students had a higher confidence level in themselves as learners, specifically learners of mathematics. I noticed that although homework presentations are not necessarily innovative, the presentations did completely change the learning environment in the classroom, and my students definitely became more confident in their abilities as learners.

Similar to Stutzman and Race (2004), who implemented a grading rubric into their classrooms, my students were also apprehensive to begin presentations after reviewing the rubric

I would use to grade them. Throughout the course of this study, I tried to give a variety of types of feedback to my students. Like Schoen and Kreye (1974), when my students were given more specific feedback according to their mistake or asked clarifying questions, they were able to improve or correct their response when turning in their corrections. Evens and Houssart (2004), found that with assistance from teachers and classmates, a student would be able to improve their response I also used questioning during homework presentations to assist the students in providing a clear explanation of the problem. During the course of this research, I realized that I no longer had to ask the clarifying questions because the students in the class were doing it, and the responses were clear and concise.

The discussions that occurred during daily homework presentations were enlightening to hear. Like Manouchehri (2007) and Kotsopoulas (2007), who found that discourse and teacher questioning strengthened students' mathematical knowledge, I found in my study that using questioning and discussion allowed my students to make their explanations and reasoning more clear to others. Although my research did not deal with cooperative learning specifically, I believe that there is a connection between cooperative learning and homework presentations. Students did not necessarily work in groups or teams on presentations, but as a class, they worked as a group to help each other through presentations. Unlike House (2004), who found that cooperative learning during a new mathematics concept had a negative correlation to student achievement, I noticed that when students were discussing concepts using correct terminology, they were better able to understand the topic or concept.

Throughout this research project, I found that my students benefited from giving and listening to daily homework presentations. Although grades, homework completion, and student attitudes may not have been affected, my students did value the deeper understanding provided

through the presentations. I also found that the more specific and meaningful my feedback on homework is to students, the more likely they are to try to correct or fix their error. There was a deeper understanding of mathematics in my classroom as a result of the homework presentations and the discussions that followed. Although presentations take a lot of time, not only giving, but preparing and grading, I do believe they enhance the learning environment of the classroom and are definitely worth the time.

## Implications

As a result of this study, I plan to continue to use homework presentations in my mathematics classroom. Some students suggested that I continue with homework presentations next year the same as this year and do them for only one semester, but I plan to use them all year. I believe that my students and I will benefit from both hearing and giving presentations over mathematics problems. I also want to do more informal research into different ways to grade homework assignments because this issue continues to plague my classroom.

The research I conducted has given new meaning to change and learning in my classroom. Peter Block, a business philosopher said, “Too many decisions about changes are made by people untouched by the change process.” In my educational experience, it has been a top-down approach to change where I implemented or changed what I was told to change. Throughout this research, I believe that I have been able to make positive changes in my classroom for the benefit of my students. I have a better idea of what I want my classroom to look like, and I know that I am the driving force behind the changes necessary to get it there. I have been touched by the positive changes in my classroom.

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## Appendix A

### Individual Student Interview Questions

- How would you describe yourself as a mathematics student?
- How would you describe yourself as a student in other school subjects?
- Tell me about your feelings and opinions toward giving presentations on daily mathematics homework problems.
- Do you think most other people in the class feel the same way?
- What do you like about presentations?
- What don't you like about presentations?
- How easy or hard is it to understand students' explanations during their homework presentations?
- Think about how it used to be in class before we did homework presentations, when I explained homework problems that students found difficult:
    - Do you think you understood homework better then or now?
    - Do you think you tried more to get your homework completed then or now?
- Have you noticed any changes in your daily grades since beginning presentations? Why or why not?
- What do you think might be the consequences if I changed my grading procedures so that homework grades were only based on your presentations and not on your daily written assignment?
    - How fair would that be?
    - Do you think that how well you do on the homework presentations reflects how much you understand?
- Have presentations helped you understand more math this semester? Please explain why or why not.
- What advice would you give me about whether I should have my classes next year do homework presentations or not? Please explain.
- Is there anything you want to tell me about the homework presentations that I may not already have asked?

## Appendix B

### Personal Teacher Journal/Reflection

1. What are two or three observations you made this week regarding students' attitude and responses toward daily presentations?
2. What are two or three observations you made this week regarding students' preparedness in presentations and graded daily problems?
3. What are two or three observations you made this week regarding students' attitudes while working in class?
4. How have this week's presentations and graded problems influence your lesson plans (if at all)?
5. What is one question you have after this week?
6. What has changed in your teaching this week (if anything)?

**Appendix C**

**Homework Presentation Rubric**

| | Explanation | Mathematics | Readiness |
|---|---|---|---|
| **Advanced** Superior **4** | Accurate response that is communicated clearly. Answers questions correctly | Student uses correct mathematical language and symbols | Student is ready to present |
| **Proficient** Satisfactory, with Minor Flaws **3** | Main ideas are accurate, with some minor inaccuracies. Answers most questions correctly | Student uses correct mathematical language and symbols with minor errors | Student is ready to present |
| **Progressing** Nearly Satisfactory, with Serious Flaws **2** | Response has minimal accuracy and explanation is minimal and/or unclear. Answers few questions correctly | Student attempt, but does not use mathematical language and/or symbols correctly | Student is not entirely ready to present |
| **Beginning** Unsatisfactory **1** | Response is inaccurate and explanation doesn't cover problem. No questions answered | No use of mathematical language and/or symbols | Student is not ready to present |

## Appendix D

## Group Interview Questions

Interview #1

- Why do you think teachers assign homework?
- How much do you think doing math homework helps students learn math? Please explain.
- What kind of feedback on homework is helpful to your learning?
- What would homework assignments look like if you were in charge?
- What kind of grading would be done on homework if you were in charge?
- What would you tell students who were going to have me as their math teacher next year what it takes to get good grades on their homework assignments?
- Is there anything you would like to ask me about math homework?

Interview #2

- Why do you think I have started having students do homework presentations?
- How easy or difficult is it to understand other students' explanations during homework presentations?
- How do you see homework presentations compared to what we used to do with checking homework in class?
- As I consider if I will use homework presentations in my math class next year, what advice would you give me? What do you see as the pros and cons?
- As I consider how to grade homework next year, what advice would you give me? What do you see as the pros and cons of how I am now grading homework?
- Is there anything you would like to ask me about homework and/or presentations?

Interview #3

- What advice would you give to next year's eighth graders if I were to continue to use homework presentations I class?
- What advice would you give me if I were to continue to use homework presentations next year?
- What can I do as a teacher to make homework more meaningful to students?
- Think back to when we first began doing homework presentations:
    - How have the presentations changed throughout the semester?
    - Describe the pros and cons of doing homework presentations and hearing homework presentations.
    - Is there anything you would like to ask me about homework and/or presentations?

## Appendix E

## Student Journal Questions

Journal 1

- Please describe your thoughts on daily presentations and how you think they have changed (if at all) your thought process while completing math homework.
- Do you feel that daily presentations have affected your thoughts about math? Please explain why or why not.

Journal 2

- How do you feel about mathematics homework?
- Has your attitude towards mathematics changed since the beginning of the semester? Please explain why or why not.

Journal 3

- Do you feel you are better able to understand mathematics homework and explain the mathematics since we have begun presentations? Please explain.
- Have daily presentations influenced how much work or explanation you show on your daily work? Why or why not.

Journal 4

- What is your attitude toward mathematics and mathematics homework? Has it changed at all since beginning presentations? Explain why or why not.
- Do you feel that homework presentations specifically have changed your attitude about mathematics? Why or why not.

Journal 5

- When you receive graded homework back, do you look to see if I have written any suggestions or feedback on how to fix your mistakes? Please explain why or why not.
- Do you feel you are doing a better job of getting your homework completed on time this semester? Please explain why or why not.

## Appendix F

### Student Mathematical Attitude Survey

Please respond to the following items by drawing a circle around the response that most closely represents your opinions right now: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), or Strongly Disagree (SD).

1. Mathematics is enjoyable and stimulating to me.
   SA A U D SD

2. Communicating with other students helps me have a better attitude towards mathematics.
   SA A U D SD

3. I am interested and willing to acquire further knowledge of mathematics.
   SA A U D SD

4. The skills I learn in this class will help me in other classes.
   SA A U D SD

5. I learn mathematics well from lectures.
   SA A U D SD

6. I am sure I can learn mathematics.
   SA A U D SD

7. Knowing mathematics will help me earn a living.
   SA A U D SD

8. Math is a worthwhile, necessary subject.
   SA A U D SD

9. Math is a fun subject.
   SA A U D SD

10. My teachers give me examples of how math is important in life.
    SA A U D SD

11. I believe math homework is helpful.
    SA A U D SD

12. I believe teachers assign math homework to help us learn better.
    SA A U D SD

13. I am good at completing my math homework assignments.
    SA A U D SD

14. I would be better at math if I understood how math relates to my life.
    SA A U D SD