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Checking Middle School Mathematics Assignments for Completion

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Checking Middle School Mathematics Assignments for Completion
Versus Collecting and Giving Individual Feedback

by

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Abstract

“Checking Middle School Mathematics Assignments for Completion versus Collecting and giving Individual Feedback” is a thesis paper about the effectiveness of two different teacher methods of checking and assessing their student’s homework. The first method of checking is looking for completion of the assignment and the second method included collecting homework and writing individual feedback on the assignment and returning it to the students the following day. This research involved a suburban seventh grade mathematics classroom. It was determined, for this environment, that collecting and commenting on homework significantly increased student quiz performance scores.

Chapter One

Problem Statement

Homework is a critical part of education today. At the secondary mathematics level, almost every teacher assigns homework to students in some format or another. Usually for mathematics, the homework is in the form of problems intended to practice the skills learned in class. Cooper, Lindsey, Nye, & Greathouse (1998) stated “the reason most often cited for giving homework is that it can improve students' retention and understanding of the covered material” (p.71). The amount of problems given for homework vary, as well as how teachers check and assess homework assignments. The goal of this research is to determine if there was a significant difference in student performances on quizzes because of different approaches used to monitor and assess homework. Specifically, two approaches for homework management were investigated:

- a. Checked Homework, defined as reading and going over the answers the same day the assignment is due
- b. Collected and Commented Homework, defined as collecting the homework; and then giving students individual feedback, which they receive the following class day.

For this research, the homework assignment is from a worksheet given in a seventh grade mathematics class. The worksheet consisted of an average of ten mathematics problems.

Significance of the Problem

During the past ten years, the mathematics curriculum has changed three times in New York State. Additionally, there have been federal changes to “No Child Left Behind.” Such changes have demanded more from teachers concerning curriculum planning, and instruction. Thus the effective use of time in the classroom is more critical than ever. The approximate three hours and forty minutes that teachers typically see their students a week must be meticulously designed for maximum use of time. Class time spent going over homework offers an opportunity to correct errors or misconceptions but it reduces the amount of time used for direct instruction of new content. When teachers collect the homework and comment on the individual assignments it takes less time during class, but more outside of class, and offers teachers clearer idea of what students are struggling with. However, it does not give students immediate feedback before they complete the next lesson since they will not get their assignments back until the following day. It is important to determine which method of assessing homework has a more positive impact for students. This impact can be measured by student performance scores.

Purpose

One objective of homework is for students to have an opportunity to practice a learned skill and for teachers to be able to measure the level of skill obtained through analysis of performance scores. This allows teachers to more effectively plan their future lessons and possible remediation. Thus, the purpose of this study was to determine which method, either the “checked homework” or the “collected and

commented homework”, had a larger effect size on assessment scores in a seventh grade mathematics classroom. More specifically, this study focused on determining if checking their homework for completion and then going over the answers with the students contributes to the student’s academic performance score more or less than collecting homework and providing individual feedback on their papers. The class included in this research and analysis was designed using the national and New York State Mathematics Seven standards, and the specific unit of focus was on decimals. This age level was chosen because independent practice is an essential life skill to learn. For example, if a swimmer only practices during the season assigned practices then the swimmer’s performance may not be very successful. At the seventh grade level students need to learn and experience the reward that can come from hard work. It is common for teachers to notice that it is challenging for seventh grade students since they often have a difficult time balancing their social lives with their education.

Rationale:

To practice skills and/or extend one’s learning in the mathematics classroom makes homework an essential part. However, it does not seem to be as simple as assigning the homework. The entire process from assigning, to monitoring, and to assessing, will determine how beneficial it is (Yanping, 2010). Teachers at the middle school level have noted that it is a struggle to get the students at this age to appropriately respond to homework assignments. Most teachers’ goals are to use homework as formative assessment as well as a learning opportunity for students (Christopher, 2007). It is seen as a formative assessment because the teacher can

adapt to what students need based on their work. It is also a learning opportunity for students because they can monitor their own progress between assignments and they can hear questions and comments from their peers as it is gone over in class. One of the most valuable formative assessments a teacher can use is homework (Christopher, 2007). Therefore, this research project was conducted with a focus on effective methods of viewing and responding to homework. Professional research has been studied and data from a seventh grade classroom has been included in these results.

In the past, checking homework for completion and giving students points based on effort for homework assignments has been a common procedure for secondary mathematics teachers. This is because most mathematics teachers use homework most frequently to practice the concepts and skills that students have already learned. Please note that this is not the only role that homework can play but it currently is the most common amongst mathematics teachers (The Center for Public Education, 2009). However, using the method of “same day review” teachers experienced that students would occasionally try to “cheat the system”. Often times a teacher will walk around the room with say a clipboard and record sheet, to view student’s assignments that they had placed on their desks. Teachers have found that occasionally students will display a random page maybe even another night’s homework assignment or they would just write down a jumble of numbers and operations in order to fill their papers. Some teachers complain that they are not getting a strong gauge for how each individual understood the concepts on a daily basis. For the sake of having good classroom management and the most effective use

of time, teachers felt that they could not spend a lot of class time viewing each individual's assignment. This is an obvious concern because teachers want to know if they need to make any immediate changing in their instruction or possible individual remediation in order to alleviate misconceptions and help with confusing concepts. For this reason, it was important to study the research that surrounded this topic of assessing homework.

Definitions:

To be sure to be consistent and familiar with the terminology used in this thesis, the following terms have been defined/explained.

Homework: an assignment given to students to be completed outside of the classroom. It is intended to strengthen and extend the concepts learned in class. Some questions could include content covered previously during the school year (Hung, Wan, & Peng, 2011).

Formative assessment: formal or informal assessments given to the students throughout the learning process to help the students and teacher determine how to best focus their time and improve instructional methods (Chirstopher, 2007).

The following are all policies that have been put into place within the classroom involved in the study:

Individual feedback on homework: this will be written on the student's homework assignment. It could be as simple as stating there is a rounding error or as detailed as giving the student a written explanation of their misconception and possibly another example worked out for them.

Weekly reviews: ten random questions on material previously covered in any of the math classes, these are assigned each week and must be completed within seven days, these are not included in “homework”. These weekly reviews are a department policy in the school in which the study was completed.

Checked homework: On the day an assignment is due, the teacher will quickly walk around the room and look at each students homework to make sure that they have tried (with work) every problem. The answers are posted on the board for them to self correct. The teacher will go over any questions that the students cannot figure out.

Collected and commented on homework: This homework is collected the day it is due, and then the teacher will give the students individual feedback on their sheets. The sheets will be returned to students on the next class day.

Chapter Two

Literature Review

For the past 85 years, U.S. educational researchers have been actively investigating homework (Cooper & Valentine, 2001). Homework is defined as a task(s) being completed by the students in a non-school setting (Cooper & Valentine, 2001) and the purpose of assigning these task(s) is to extend learning outside of the classroom, reinforce what was learned in the classroom, and to practice skills to increase retention and understanding. These are generally universal goals

Educational researchers have long tried to determine what homework policy is most effective in increasing student achievement. Unfortunately there are no “clear-cut” answers. This is because of the complexities of research with so many factors involved. For example, student differences, community or family support and the varying methods used by teachers to structure and monitor homework all influence homework outcomes. This is why there have not been any conclusive findings even though there have been many formal studies concerning the use of homework (Hung, Wan, & Peng, 2011). However, the general consensus is that it is beneficial for students but to what degree depends on the grade level (Yanping, 2010).

Harris Cooper and Jeffrey Valentine (2001) spent an incredible amount of time and effort to look further into the previous research and they came out with the following findings. Elementary aged students seem to produce a very low correlation between homework and achievement scores. However, as the students increase in age the correlation is positive and increasing in strength (Cooper & Valentine, 2001).

There are many possible reasons for the low correlation within the early years of education. To name a few, the students would have underdeveloped study skills at this age and their attention span and ability to not become distracted are much lower (Cooper & Valentine, 2001).

This current study is specifically looking at the methods of monitoring student homework with some restrictions because it is a better option to look at more specific factors. Therefore, the study is limited to a specific population by age, ability, location, and content. However it is important to note that due to these restrictions the conclusions cannot be generalized to homework practices in a broader context. While reviewing the associated literature, similar concerns were identified as the previously mentioned teacher complaints. Buffy Sallee and Neil Rigler (2008) mentioned comparable experiences of “borrowing” worksheets and showing a random page in their article in the *English Journal*. They said that they are finding it difficult to watch the students try to find a balance between their extracurricular activities and their school work. They also mentioned they found that when the outside school work or homework is not treated or viewed as meaningful, the effort and completion rate drops significantly. This article makes one recognize that the practice of just “checking in” on student homework assignments and giving a grade based on completion, might communicate the message that the assignments are relatively meaningless. “Do we want students simply to have completed a set of assignments or do we want them to master a set of skills and a method of listening, speaking, writing, and thinking?” (Sallee & Rigler, 2008, p. 51).

For homework to be viewed as useful, teachers first need to determine student's current perceptions. Dr. Jan Wilson and Dr. John Rhodes (2010) took this deeper by looking into what the student's perspective actually was on homework. They reported that there were two reasons that students did not do their homework or put the effort into completing it well. The first was that they did not understand the material and the second was that they felt it was meaningless. They reported it as meaningless because they did not receive immediate or any feedback from their teachers. "If a teacher does not grade the homework and return it to the students the next day or quickly thereafter, the students report feeling like they have wasted their time on that activity." (Wilson & Rhodes, 2010, p. 352)

The common practice of giving credit, which goes towards their grade, for completing homework has revealed two potential flaws in our school system. "First, both students and teachers tend to view homework grades as rewards for working rather than as feedback about learning. Secondly, students fail to connect homework to assessments, not realizing that homework is "practice for the game." (Vatterott, 2011) Giving the students credit for completing the assignment sends an unclear message and confusion between a grade and the most important purpose of homework which is to help the students reach their learning goals. Cathy Vatterott (2011) suggests that the completion and accuracy of a homework assignment should be documented but not included into their course grade. She determined that individual feedback on the assignments as opposed to simply checking to make sure it has been done, has shown to further the student's learning much more.

The research shows that homework assignments bear a significant and positive relationship to achievement if it is carefully monitored (Marzano, Pickering & Pollock, 2004). Marzano, Pickering, and Pollock (2004) suggest that homework should be checked, commented on, and returned quickly to be the most beneficial. They noted that homework in which the teacher has included instructive comments will have the greatest effect on learning. There is a significant difference in the effect size of cumulative assessments between collecting, grading, and commenting (Marzano, Pickering & Pollock, 2004). For reference, an effect size of 0.20 is small, an effect size of 0.50 is medium, and 0.80 would be considered large. Compared to just assigning homework, assigning and checking to see if it has been completed has an effect size of 0.28. When the homework is graded the effect size increases to 0.78. However, as reported the homework that receives written comments has an effect size of 0.83 or a 30 percentile gain. (Marzano, Pickering & Pollock, 2004). These findings were not specifically researched within a seventh grade mathematics classroom but they definitely continue to intrigue teachers to discover if the same results would occur in a mathematics classroom of seventh graders.

Chapter Three

Application and Evaluation

The school which was chosen for this study was a suburban school in upstate New York. The district has about 2,600 students, 11% of which are included in the free or reduced lunch program. The student racial makeup is 96.6% white, 1.2 % Asian, 0.9% Hispanic, 0.6% American Indian, 0.4% African American, and 0.3% other. The specific class used consisted of twenty-two students, nine females and thirteen males. The students have a range in abilities and past experiences but there are no students with documented disabilities. All of the students are in the regular mathematics track as they plan to take Integrated Algebra as a ninth grader. The class meets five days a week for thirty-nine minutes each day. The classroom activities usually included a warm-up, homework correction, notes and/or an activity and some sort of closure. The research was preformed while the students were focused on a unit of decimals. The unit began with comparing, converting, and naming decimals and then moved into the operations with decimals. The students are used to having assignments nightly. Three to four times a week the students will have a homework assignment which consists of current material. The other nights a week is dedicated to the students working on their weekly reviews. Weekly reviews are ten problems that are slightly higher level questions. They have one every week and they must submit them twice a week, once on Tuesday as a draft and then again on Friday as a final submission. The weekly review assignments were not included in the data for this research however all other assignments were included.

In order to determine the effectiveness of checking assignments for completion versus collecting and commenting on homework, a three week study with twenty-two seventh graders was conducted. The three weeks began by giving the students a pre-quiz on the upcoming unit. The pre-quiz covered conversion, comparisons, and naming decimals. Student then received one and a half weeks of instruction with regular assignments. During this time, homework was not collected. At the beginning of each class the students would pull out their assignments and compare their solutions with correct answers on the board. While the students were checking their answers the teacher walked around the room and quickly checked to make sure that the students had completed the assignment. If the student tried all of the problems a two out of two points were recorded. If they had done at least half of the problems but did not complete it they were awarded one point. Finally, if the student had done less than half or not at, they received a zero. It might be important to note that if the student came in during lunch and makes up the assignment they got half of their points back. This is because it is still important for students to do the homework but it has lost some value because it was not completed in time for the class discussion. Once the students had gone through the answers the teacher would go over any questions that they had. At the end of the week and a half, the students had a quiz on the material covered during that time. The pre-quiz and then quiz percentages were compared and by looking at the percent increases from the pre-quiz to the post-quiz.

The second half of the three week period was carried out in a very similar fashion. It also started with a pre-quiz. This pre-quiz covered the four operations, adding, subtracting, multiplying, and dividing decimals. The homework during this time period was assigned in the same manner as previously. The only variable that was intentionally changed was that in the beginning of each class, the homework assignments were collected. The lesson then continued on in the same format as the previous weeks. It is important to keep in mind that due to the circumstances and class availability the change in lesson content was not able to be controlled. The lessons were all centered about the decimal system but they varied from day to day. In the afternoon, the teacher looked at each individual's homework and made comments on their work. The comments were specific and constructive. Comments were made on little details. If a student responded incorrectly to numerous questions it was usually a result of one specific error that they were making repeatedly. This would be pointed out to them, sometimes even with an example problem on the side for them to see the correct approach. Comments were also often positive. This was supposed to be a good experience for the students and the teacher wanted them to be encouraged to read the comments and then learn from their mistakes. At the end of the three weeks, the students were given another quiz to assess their growth over the past week and a half. Each individual's percent increase was then recorded for the second method. In the end, the percent increases in different subcategories were compared and then evaluated for differences.

During the evaluation period and due to the research collected the teacher decided to also give the students an anonymous survey which contained a few questions on homework. The teacher wanted to know what they thought about homework and its importance. The last question also asked the students which method, checking or collecting and commenting, they preferred. The survey was chosen to be given to the students at the end because they needed to experience the commented homework assignments even if it was for only a week and a half. The survey is included as appendix A. Following the completion of the survey, all of the data was combined; some of which will be discussed and others are organized into charts and tables for the ease of interpretation and reference.

Chapter Four

Data Collected

The following is the initial data collected with all twenty-two students included. It shows the students pre-quizzes and their respective post-quizzes. The percent increase is the percent improvement from the pre-quiz to the post-quiz.

Table 1

All student data for method one and two

Method 1: Checking Homework for Completion

Students	Pre-Quiz Score	Post-Quiz Score	Percent Increase
Student A	52.8	94.4	41.6
Student B	58.3	91.7	33.4
Student C	87.5	98.6	11.1
Student D	77.8	98.6	20.8
Student E	86.1	98.6	12.5
Student F	83.3	97.2	13.9
Student G	81.9	95.8	13.9
Student H	50.0	94.4	44.4
Student I	81.9	100.0	18.1
Student J	76.4	97.2	20.8
Student K	76.4	97.2	20.8
Student L	75.0	100.0	25.0
Student M	65.3	94.4	29.1
Student N	33.3	56.9	23.6
Student O	37.5	86.1	48.6
Student P	54.2	87.5	33.3
Student Q	41.7	62.5	20.8
Student R	72.2	95.8	23.6
Student S	70.8	94.4	23.6
Student T	76.4	91.7	15.3
Student U	65.3	97.2	31.9
Student V	50.0	97.2	47.2
% Averages	66.1	92.2	26.1

Table 1 continued

Method 2: Collecting and Commenting on homework

Students	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Larger % Increase in Method 2
Student A	70	93.6	23.6	No
Student B	50	95.0	45.0	Yes
Student C	40	97.1	57.1	Yes
Student D	80	101.4	21.4	Yes
Student E	80	95.0	15.0	Yes
Student F	90	94.3	4.3	No
Student G	50	92.9	42.9	Yes
Student H	80	100.0	20.0	No
Student I	50	91.4	41.4	Yes
Student J	70	86.4	16.4	No
Student K	80	94.3	14.3	No
Student L	60	102.9	42.9	Yes
Student M	60	90.0	30.0	Yes
Student N	50	82.9	32.9	Yes
Student O	60	95.0	35.0	No
Student P	60	104.3	44.3	Yes
Student Q	50	86.4	36.4	Yes
Student R	70	91.4	21.4	No
Student S	60	100.0	40.0	Yes
Student T	60	95.0	35.0	Yes
Student U	60	92.1	32.1	Yes
Student V	70	94.3	24.3	No
% Averages	63.6	94.4	30.7	

Notice that the percent increase from the pre-quiz to the post-quiz was on average 4.6% higher with the second method as compared to the first method. Also note that 14 out of the 22 students had a higher percent increase with the second method as opposed to the first.

The next table, Table 2, looks at the data that only includes the students that completed every homework assignment for the entire three weeks. Unfortunately, this takes the sample down to only twelve students but it was important data to consider

since homework completion is critical to the study. This is also an example of the complexities of this type of research.

Table 2

Excludes student who did not do 100% of their homework during the three weeks

Method 1: Checking Homework for Completion

Students	Pre-Quiz Score	Post-Quiz Score	Percent Increase
Student C	87.5	98.6	11.1
Student F	83.3	97.2	13.9
Student I	81.9	100.0	18.1
Student J	76.4	97.2	20.8
Student K	76.4	97.2	20.8
Student M	65.3	94.4	29.1
Student P	54.2	87.5	33.3
Student Q	41.7	62.5	20.8
Student R	72.2	95.8	23.6
Student T	76.4	91.7	15.3
Student U	65.3	97.2	31.9
Student V	50.0	97.2	47.2
<i>% Averages</i>	69.2	93.1	23.8

Table 2 continued

Method 2: Collecting and Commenting on Homework

Students	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Larger % Increase in Method 2
Student C	40	97.1	57.1	Yes
Student F	90	94.3	4.3	No
Student I	50	91.4	41.4	Yes
Student J	70	86.4	16.4	No
Student K	80	94.3	14.3	No
Student M	60	90.0	30.0	Yes
Student P	60	104.3	44.3	Yes
Student Q	50	86.4	36.4	Yes
Student R	70	91.4	21.4	No
Student T	60	95.0	35.0	Yes
Student U	60	92.1	32.1	Yes
Student V	70	94.3	24.3	No
<i>% Averages</i>	65.2	93.1	29.9	

Table 2 only includes students that completed all of their homework and demonstrates a higher difference of 6.1% in the average percent increase between the two methods.

The last way that the data was organized was by similar pre-quiz scores. The pre-quiz scores are grouped by increments of 10% and then compared by the percent increases. This means that there is no relation to individual students in this table.

Table 3

Grouped by pre-quiz scores for all students

Quiz Intervals	<i>Method 1: Checking Homework for Completion</i>				<i>Method 2: Collecting and Commenting on Homework</i>			
	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Average Percent Increase	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Average Percent Increase
[25, 35)	33.3	56.9	23.6	23.6				
[35, 45)	37.5	86.1	48.6	34.7	40	97.1	57.1	57.1
	41.7	62.5	20.8					
[45, 55)	50.0	94.4	44.4	41.7	50	95.0	45.0	39.7
	50.0	97.2	47.2		50	92.9	42.9	
	52.8	94.4	41.7		50	91.4	41.4	
	54.2	87.5	33.3		50	82.9	32.9	
					50	86.4	36.4	
[55, 65)	58.3	91.7	33.3	33.3	60	102.9	42.9	37.0
					60	90.0	30.0	
					60	95.0	35.0	
					60	104.3	44.3	
					60	100.0	40.0	
					60	95.0	35.0	
					60	92.1	32.1	
[65, 75)	65.3	94.4	29.1	27.1	70	93.6	23.6	21.4
	65.3	97.2	31.9		70	86.4	16.4	
	70.8	94.4	23.6		70	91.4	21.4	
	72.2	95.8	23.6		70	94.3	24.3	
[75, 85)	75.0	100.0	25.0	18.6	80	101.4	21.4	17.7
	76.4	97.2	20.8		80	95.0	15.0	
	76.4	97.2	20.8		80	100.0	20.0	
	76.4	91.7	15.3		80	94.3	14.3	
	77.8	98.6	20.8					
	81.9	95.8	13.9					
	81.9	100.0	18.1					
	83.3	97.2	13.9					
[85, 95)	86.1	98.6	12.5	11.8	90	94.3	4.3	4.3
	87.5	98.6	11.1					
	Average of the percent increases			27.2	Average of the percent increases			29.5

It is interesting to note that the students who struggled the most on their pre-quiz, benefited, in terms of their percent increase, the greatest from the implementation of the second method.

The next table is similar to the last except that the students that did not complete their homework have been removed. There was no way for the student to be given feedback which defeats the purpose of trying to determine if there was any improvement.

Table 4

Grouped by pre-quiz scores; only includes the students that always completed homework

<i>Method 1: Checking Homework for Completion</i>					<i>Method 2: Collecting and Commenting on Homework</i>			
Quiz Interval	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Average Percent Increase	Pre-Quiz Score	Post-Quiz Score	Percent Increase	Average Percent Increase
[35, 45)	41.7	62.5	20.8	20.8	40	97.1	57.1	57.1
[45, 55)	54.2	87.5	33.3	40.3	50	86.4	36.4	38.9
[55, 65)					50	91.4	41.4	
					60	92.1	32.1	35.4
					60	90.0	30.0	
					60	95.0	35.0	
[65, 75)					60	104.3	44.3	
	65.3	94.4	29.2	28.2	70	93.6	23.6	20.5
	65.3	97.2	31.9		70	86.4	16.4	
	72.2	95.8	23.6		70	91.4	21.4	
[75, 85)	76.4	97.2	20.8	17.8	80	94.3	14.3	14.3
	76.4	97.2	20.8					
	76.4	91.7	15.3					
	81.9	100.0	18.1					
	83.3	97.2	13.9					
[85, 95)	87.5	98.6	11.1	11.1	90	94.3	4.3	4.3
	Average of the percent increases			23.6	Average of the percent increases			28.4

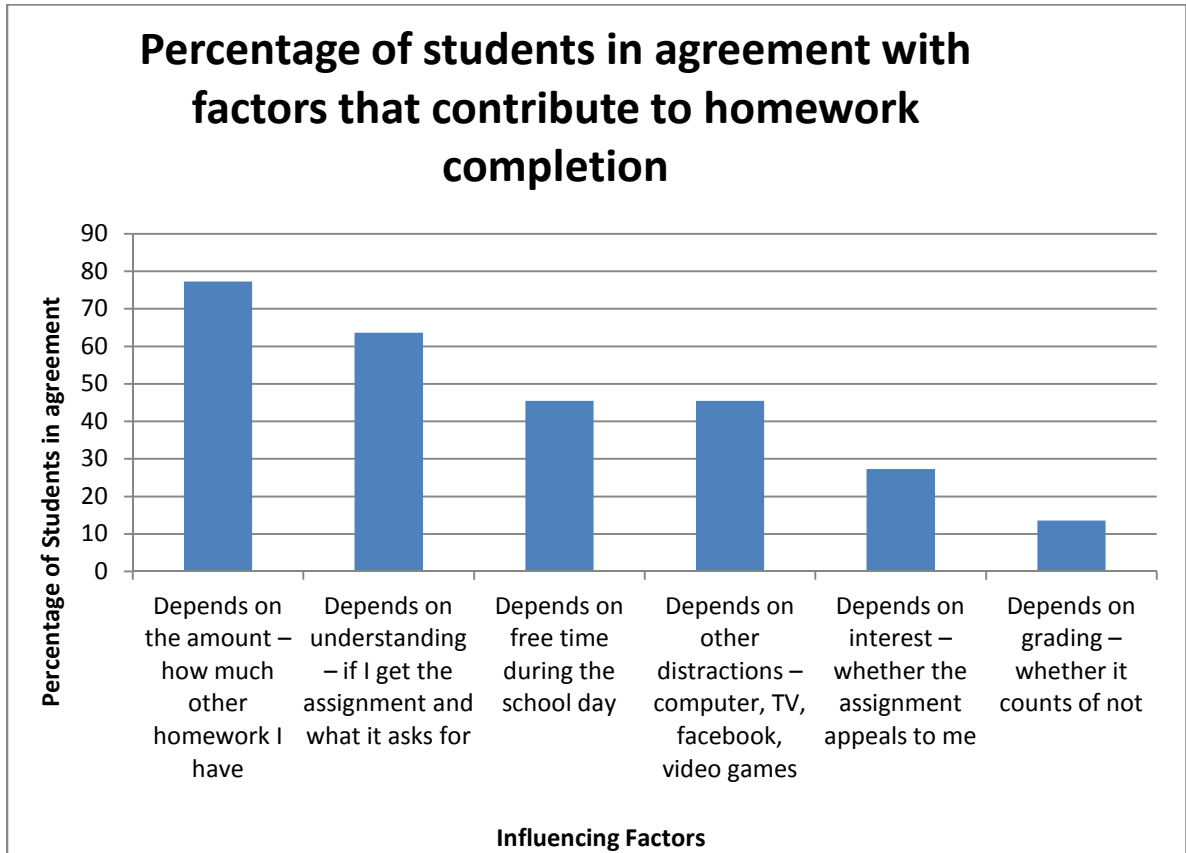
The data here is similar to the results as the previous table. Again, the students that struggled the most had a much larger increase in their post-quiz scores with the

implementation of the second method.

The next two figures are the data that was collected from the survey.

Graph 1

Responses to Question 1 regarding homework

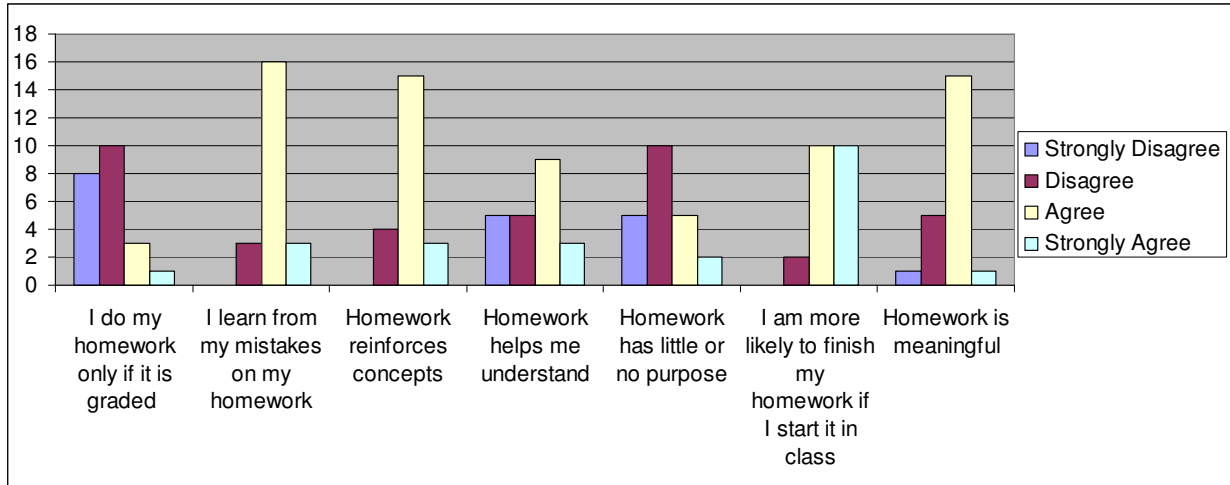


Apparently, students place more emphasis on the amount of homework, their level of understanding, and their availability when determining if they complete their homework and much less emphasis on whether or not it is graded.

This next graph represents the responses to question #2 regarding homework

Graph 2

Student responses to specific homework questions



This graph breaks down the students responses more specifically. Notice that the students responded with an overwhelming majority that graded homework does not determine whether or not they do the assignment. Teachers are also pleased to see that the majority of the students said that homework reinforces concepts, is meaningful and that they learn from their mistakes,

Lastly, the third question regarding homework, asking students which is more beneficial having homework checked or having it collected and commented had an 8 to 14 vote respectfully. This means that about 36% of the people chose having homework checked and about 64% picked having their homework collected and commented on.

Chapter Five

Data Analysis

The data analysis process began by putting all of the data into an excel sheet. Since the focus is on how the two homework methods affect student's achievement on a summative assessment, each of the students percent increase from the two methods (see Table 1) was identified. Then the average percent increase for the two methods was examined; method 1 had about a 26% average increase and method 2 had about a 31% increase. In the far right column it is noted with a "yes" or "no" if the student performed better with the second method. Just under 64% of the students did in fact perform better on the post-quiz after their homework had been checked and commented on. These results seem very consistent with the reviewed literature; specifically the data illustrated in *Classroom instruction that works*.

Considering the inferences made from the data collected from the seventh graders was very dependent on whether or not the students completed their homework, Table 2 was created which documents the data for only the students who completed every single homework assignment over the three week study. It is important to note that the number of participants gets quite low so it might not be significant evidence but it is still important to look at. Focusing mainly on the average percent increases, take notice that again, the collected and graded homework had a higher average percent increase, this time by just under a 6% increase.

The data can also be illustrated by two box and whisker plots directly next to each other. This approach allows for easier viewing of the distribution of the data.

Note that method 1 is checking homework and method 2 is the collected/commented homework.

Graph 3: Box-and-Whisker Plot of Percent Increases

Percent Increases for the two different methods

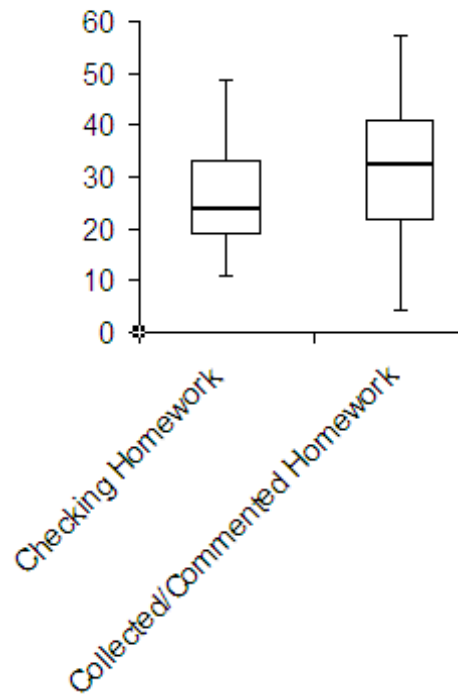


Table 5

Data associated with preceding box and whisker plot

Labels	Method 1	Method 2
Min	11.1	4.3
Q ₁	18.775	21.4
Median	23.6	32.5
Q ₃	32.95	41.05
Max	48.6	57.1
IQR	14.175	19.65
Upper Outliers	0	0
Lower Outliers	0	0

These box and whisker plots illustrate a definite shift in the data. A shift that seems to support the theories that collecting and commenting on homework is more beneficial for the students. The one data value that sticks out from the rest would be the decrease in the minimum value for method 2. Looking back at the data from Table 1, it can be noticed that this value came from a student who received a 90% on the pre-quiz and then only had a 4% increase. This student could have only improved by a total of 10% as they would have then had a 100%. Realistically, there are going to be other students that are in the same situation, the better they did on the pre-quiz the less percentage points they would have been able to improve by.

For the above reason, it is then necessary to look at the percent increases for scores that had similar (within 10%) pre-quiz scores. This means that the personal percent increase in scores is no longer being compared but instead just the similar pre-quizzes and how much they improved. This is illustrated in Tables 3 and 4. The only difference in these two tables is that in Table 4, any of the students that did not

complete their homework every night during the study have been removed. What one might find interesting about both of these tables is that they seem to have the same pattern in that the commented homework really helped the students that had a weaker pre-quiz grade. The pre-quizzes that were higher seemed to increase more when the homework was just checked for completion. This is evident in the column labeled “average percent increase”. Notice however, that overall the percent increase was still greater for the commented homework as opposed to the checked for completion homework.

There are obvious improvements in the average percent increase when students receive feedback on their homework but is it significant? To determine if these differences in the means of the percent increases were significant or not, a *t-test* statistic was used. Based on the collected data and the literature reviewed, the null hypothesis was chosen to state that checking homework for completion is greater than or equal to the effectiveness of collecting and commenting on the homework. The alternate hypothesis states that collecting and commenting is more effective than simply checking for completion. At a 0.05 level of significance, and using the subsequent data values, the following were found:

Table 6

<i>Matched pair t-test data</i>
$\bar{X}_1 = 26.073232$
$\bar{X}_2 = 30.714286$
$\sum D = 331.8272$
$D^2 = 7548.308$
$N = 22$
$\alpha = 0.05$
$d.f. = 22 - 1 = 21$
$t = 1.97804$

Based on a t distribution table, the critical value at the 0.05 level at 21 degrees of freedom is 1.721. Since the calculated t -value is larger than the critical t -value, one can reject the null hypothesis and conclude that the two sets of data are significantly different. This means that the data states that there is a significant improvement in the quiz scores of students when their homework is collected, commented on, and returned to students as compared to simply being checked for completion.

The other data that was collected were student's responses on the survey. Graph 1 represents the cumulative responses for six factors that might affect the amount of homework students complete. It is not surprising to find that 77% percent of the students indicated that it depended on how much other homework they had and about 64% said that it depended if they understood the assignment and what was is asking for. The other two largest factors with agreement from about 45% of the students is that it depends on the amount of free time during the school day and other distractions such as facebook. These questions were asked because teachers are

finding that they are seeing less and less homework from students as the school year progresses. This was evident in Table 1 and 2 where the sample went from twenty-two students down to twelve because only that many had completed every assignment.

Graph 2 represents the student's perception on homework and its meaning. It is really interesting that the overwhelming majority disagreed with the comment that they only complete homework if it is graded. This supports the theories shared by Cathy Vatterott in *Making Homework Central to Learning* and Kathleen Cushman in her article *Show Us What's Homework is for*. This tells teachers that students have a better understanding of the true purpose of homework instead of just being focused on getting more points. Teachers would also be pleased to find that after the study the majority of the students agreed or strongly agreed that homework reinforces concepts, helps with understanding, is meaningful, and is an opportunity to learn from ones mistakes. This again indicated that we are headed in the correct direction. The only data value that really stuck out was that 20 out of 22 students said that they were more likely to finish their homework if they started it in class. One can hypothesize that this is because they can get a feel for the assignment and ask clarifying questions before they leave. This would support the response to question 1 about being more likely to complete the assignment if they understood what was going on.

The final question asked the students which method they preferred. The data showed that 14 out of 22 students preferred to have their homework collected and commented on. It is important to note here that all of the students were included in

the survey and since it was anonymous the students that did not complete their homework were not able to be removed. Therefore, there are students who responded that might not have experienced having their homework commented on. One might also wonder if the responses would have varied a little more had there been a longer trial period in which the two methods were tested. Regardless, all of these responses were very similar to what Dr. Jan Wilson and Dr. John Rhodes found in their study on students perspectives. The students want to know the purpose and how to complete the assignment and then receive feedback on their efforts.

Conclusion

This research was found to be very rewarding in terms of professional development. Teachers that were previously very set in checking homework for completion and then immediately going over it now have research that might support other options. The literature review really encourages one to look at it from a different perspective. Looking at each individual's solutions offers the students differentiated and personal feedback. It sends the message that each of their work is important and they should be held accountable. The results were not found to be extremely significant, however throughout a study such as this one, teachers become aware of possible confounding variables such as, the difference in content covered, the short period of time the trial took place, and the low number of participants. There are probably many other lurking variables as well.

Teachers have personally experienced the rewards of collecting and commenting on their students homework. These teachers claim to have a much better,

and current, idea of what each student has mastered throughout the week. It may take more of a teacher's time outside of class to view the assignments but it is saving time in class. The day an assignment is given back, the teacher will point out common or repeated errors that were noted but it seems that the students are taking more of an initiative to find their own mistakes instead of the teacher going over every problem. Following this study, the teachers involved have continued to collect and comment on the majority of their assignments. Many look forward to using this method for the remainder of the quarter and then reassess the differences in the two methods.

While reflecting on the goals for trying out this method, it is encouraging that commenting on their homework might also have other benefits not previously thought of. For example, teachers have been working hard to encourage students to think for themselves before they ask for help. Specific to homework would be when the students are given the answer and they realize that they get one wrong, they just want the teacher to tell them why they got it wrong instead of going back and trying to find their own mistake. The comments on the homework may tell them what their mistake was but it does not give them the answer and the justification is written out in words, it is not fixing their work. The hope is that it might help students to use their resources a little better. For instance, the students sometimes choose not to read the textbook or even use their notes to help think through a question. The comments and hints are similar to the comments in the book and their notes. Hopefully, the students will become more familiar with the terminology and recognize that it is more efficient

to initially look it up in their resources than to do the homework incorrectly and then have to go back and make corrections.

Future Work

Throughout the remainder of this school year and years to follow, researchers are going to continue to specifically look for these changes and continue to collect evidence regarding the different homework methods. This study has also intrigued teachers to research further into the literature associated with grading homework. Does grading homework either for completion or accuracy measure what is valued most? The student responses indicate that a grade does not affect whether they do their homework or not so is a homework grade simply inflating their average instead of their level of mastery? All of these questions and more, are what teachers and researchers are looking forward to researching in the future.

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Appendix

Homework Questions

Please answer the following questions honestly.

1. What factors affect the amount of homework you complete? **CIRCLE AS MANY AS APPLY**

- a. Depends on the amount – how much other homework I have
- b. Depends on free time during the school day
- c. Depends on interest – whether the assignment appeals to me
- d. Depends on understanding – if I get the assignment and what it asks for
- e. Depends on grading – whether it counts or not
- f. Depends on other distractions – computer, TV, Facebook, video games

2. Answer the following questions by checking off, strongly disagree, disagree, agree or strongly agree

	Strongly Disagree	Disagree	Agree	Strongly Agree
I do my homework only if it is graded				
I learn from my mistakes on my homework				
Homework reinforces concepts				
Homework helps me understand				
Homework has little or no purpose				
I am more likely to finish my homework if I start it in class				
Homework is boring				
Points should be taken off if it is turned in late				
I don't do homework because I don't like it				
Homework is meaningful				

3. Which would help you the most as a math student? PLEASE PICK ONE.

- a) Have my homework checked for completion and then I check my answers and correct my own paper as we go over it
- b) Have my homework collected and have the teacher make comments/point out mistakes on my homework.