THE EFFECTS OF HOMEWORK STUDY LOGS ON CHEMISTRY STUDENTS’ ATTITUDES, STUDY HABITS, AND LEARNING

by

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ABSTRACT

This classroom research project was an investigation into the efficacy of homework logs as a means to improve students’ learning, study habits, and attitudes about homework. The study was conducted in an introductory chemistry course at St. Monica Academy high school with 20 students. Half the students maintained a homework log over the course of three units. Data collected from post exam assessments, student interviews, and surveys suggested that the logs improved students’ focus, diligence and organization but did not significantly improve students’ comprehension or understanding of the material.
INTRODUCTION AND BACKGROUND

General Purpose

A teacher’s primary goal is to help students internalize and understand what they are learning to make those concepts their own. Current education guidelines affirm the importance of this objective: “the [Common Core State Standards] ask learners to, among other things, demonstrate deep conceptual understanding of core concepts by applying them to new situations, as well as writing and speaking about their understanding” (Rillero & Padgett, 2012, p. 37). Further, many books, articles, and studies are devoted to promoting students’ deeper learning through innovative methods of classroom instruction, for example, the Blended Learning and Inquiry Based Learning models (Pappas, 2015; Blessinger & Carfora, 2015).

While advances like Blended Learning and Inquiry Based Learning can do much to promote the learning of students, their education is not limited to the classroom. Good teachers use all the tools at their disposal to ensure the best possible education for their pupils. Homework is a widely practiced technique and is generally believed to be an important supplement to in-school academic activities (Cooper, Robinson, & Patall, 2006). There are many reasons for this association. Good homework assignments allow students to practice new techniques, reinforce concepts covered in a previous class, reflect more carefully on what they heard in lecture, or synthesize ideas (2006). Advantages such as these make homework attractive as a pedagogical practice for promoting deeper learning in students.

Simply completing homework assignments, however, is not necessarily sufficient for deeper learning to occur. One study that surveyed 25,000 students argues homework
that does not transcend rote memorization will not bring a significant return on test scores (Eren & Henderson, 2011). It is possible that some students fail to reap the considerable benefits of homework because of misconceptions about what constitutes quality study (Bishop, 1989). It has been my experience that students tend to spend time outside of class focused on memorizing a list of isolated facts without much awareness of the order among the facts they are memorizing. During my six years as a high school science teacher, too often I see students pursuing rote memorization rather than truly internalizing the concepts, which indicates a need for good homework practices designed to counteract this common and mistaken idea about study.

The importance of this classroom research project is not limited to my own classroom. Deeper learning in students is a universal goal for educators (Rillero & Padgett, 2012). Since it is generally presumed that homework is a key component to education, a study that contributes to our understanding of what constitutes good homework would be very desirable. Further, although much research has already been done on homework and its effects, the relationship is still far from being thoroughly understood (Trautwein & Koller, 2003). Clearly there is a need for further research in this area that can contribute to a proper understanding of homework and the development of effective homework practices.

The general purpose of my action research study is to test implementing homework logs designed to encourage higher quality study habits in my students and determine how these techniques affect students’ learning and attitudes about learning. It is my hope that my classroom research project will provide credible evidence for the efficacy of these techniques and inform my future teaching, particularly in the homework
that I assign, and bring about better learning in my students.

School Demographics

St. Monica Academy is a private, Catholic school located just to the north of Los Angeles in the city of Montrose, CA. Founded in 2001, the school now serves 240 students ranging from first grade to twelfth grade. Students typically come from families of strong Catholic values whose parents want their children to have access to an authentic, classical education. Recent enrollment records show that 57% of the student body is White, 32% Hispanic, 8% Asian, 2% African-American, and 2% of Native American descent (St. Monica Academy Midterm Progress Report, p. 5).

Although of moderate size with a population of 19,653 (City-data.com, 2010), the city of Montrose is adjacent to the heavily populated and, in some places, affluent areas of Pasadena, Burbank, and Glendale. Generally, the families of the students are well off with the average income above $90,000 (St. Monica Academy Midterm Progress Report, p. 4). The region boasts such landmarks as downtown Pasadena, the Rose Bowl, Jet Propulsion Labs, and the Griffith Observatory. Students are fortunate to have convenient access to many centers of shopping, technology, and entertainment, numerous sports programs, and the excitement of busy, city life. According the Los Angeles Times “Mapping LA” project, 36.3% of the residents of that region have at least a four-year college degree (maps.latimes.com, 2010).

Focus Questions

The purpose of this project can be resolved into the following main question: 1) What is the effect of homework logs on students’ learning? This main question was further developed into the following sub-questions: 2) How do homework logs influence
students’ study habits? 3) What is the effect of homework logs on students attitudes about homework? 4) How do homework logs influence students’ attitudes toward learning? These questions were the guiding principles in developing the methodology, analysis and execution of this classroom research project.

CONCEPTUAL FRAMEWORK

The relationship between homework and achievement directly affects students and their families more than almost any other issue in educational research. In a meta-analysis of the homework research of the twentieth century Trautwein and Koller suggest that the connection between the two is only partially understood (2003). After careful analysis of what homework means and summarizing some of the main studies on its relationship to academic achievement, Trautwein and Koller argue that “[a] critical review of twentieth-century homework studies reveals only a weak empirical support for the assumption that larger amounts of homework enhance achievement at the class level” (2003, p 141) and that more studies about this relationship are needed.

What is Homework?

Because the term can mean different things to different instructors and students, any study about homework must begin with a clear definition. Generally, the term homework signifies ‘any task assigned by school teachers that are meant to be carried out during non-school hours’ (Cooper, 1989, p. 7). This was taken as the working definition during the course of this classroom research project.

Assigning homework is a standard educational practice. Although it has varied in its prevalence throughout the twentieth century, it is “a perennial topic of debate in education, and attitudes toward it have been cyclical” (Marzano & Pickering, 2007, p.
On its face, homework has many instructional applications and this is probably the reason for its widespread use. Various education researchers propose many applications including opportunity for the practice of newly acquired skills, preparation for new material, extension of what has been covered in class and the synthesis of multiple concepts that have already been presented (Cooper, Robinson, & Patall, 2006).

In addition to the obvious teaching applications, there has been significant research to support the position that homework improves student learning. One meta-study of research from 1987 through 2006 concluded that there was a positive relationship between homework and student achievement (Cooper, Robinson, & Patall, 2006). This study was also quick to point out that too much homework or homework used improperly could be counterproductive (2006). Marzano concludes that prior research has established homework as an effective tool to facilitate student achievement (Marzano & Pickering, 2007).

Homework and Grades

Many studies have attempted to understand or quantify the correlation between homework and academic success. Henderson and Eren (2011) investigated the efficacy of homework through a very intense statistical analysis of a large longitudinal study of eighth grade students by the National Center for Educational Statistics, the NELS:88. Approximately 25,000 students were surveyed (Henderson and Eren, 2011). The authors drew several interesting conclusions. First, only math homework seemed to have a significant effect on test scores; there was no appreciable difference in science, English or history (2011). This, they suggest, is because math homework requires solving problems and not simple memorization (2011). Second, whether or not the homework is graded
did not seem to change homework’s effect on student scores. Finally, the study concludes that in classes where there is only an emphasis on memorizing isolated facts, not on understanding the fundamental concepts, homework will not bring a significant return on test scores (Eren & Henderson, 2011). This suggests that student attitudes about memorization may be something they need to reassess. If they intend to reach academic success perhaps students ought to strive for understanding rather than mere retention.

This central contrast is articulated well by Rillero and Padgett (2012), who emphasize the need to encourage deeper learning in students and help them to go beyond rote memorization in their learning. Although their paper advocates teaching techniques different from those in the present action research study, much of the paper’s framework is similar. Rillero and Padgett distinguish between learners, people who seek deep conceptual learning, and students, those who skim the surface (2012). Practices that only help students to be better at memorizing would not meet the definition of quality learning or the goals intended by the focus question mentioned in the previous chapter.

**Methods of Studying the Effects of Homework**

The decision to use homework logs as a treatment came primarily from a study by H. Bembenutty and M. White (2012). Here they attempt to measure the relationship between homework, motivation, and grades using homework logs as an instrument. Bembenutty and White argue that “the use of homework logs to track students’ homework practice has been shown to be an effective self-monitoring tool” (p. 84). The log used in their study consisted of a spreadsheet where students recorded things like the amount of time spent on homework, where they studied, what distractions they
encountered and so on. In their discussion, Bembenutty and White (2012) conclude that “the use of homework logs serves as an important educational tool that educators can use to enhance their students’ self-regulation of learning and motivation” (p. 86). They also note that research is needed on interventions like homework logs to understand how they might improve academic success of students.

Another effective instrument in these studies is student interviews. One study of 42 students and seven English teachers relied heavily on interviews to investigate self-regulation and its beneficial effects on learning (Cooper, Horn and Strahan, 2005). Interviews were administered before, in the middle, and after the project. To analyze the data, interview questions were clustered and patterns identified, as well as interesting variations (2005). Many quotes from the interview sessions were cited throughout the discussion of the results and provided evidence to support their conclusion that efforts in the classroom to promote self-regulation would be beneficial. Like Bembenutty and White, Cooper et al. (2005) also collected student homework logs and provide samples of the logs in their appendices.

It is important to articulate the distinction between self-regulated learning and academic success, focusing on homework’s relationship to the former (Kitsantis and Zimmerman, 2008, p. 98). Self-regulated learning is associated with the skills acquired by good study habits. While students’ academic performance is important, when they leave the classroom their self-regulation with respect to learning could have even greater personal, social and academic repercussions. In their eagerness to produce academic success, teachers can sometimes overlook the immense value of self-regulated learning and ways of forming that skill in students.
The amount of prior research related to this topic is immense. This is probably because the relationship between homework and student learning is a rich area of education. A review of the studies strongly suggests, if not demonstrates, that this topic is far from exhausted and prime for further investigation. As Cooper and his fellows put it, “researchers are encouraged to find in our report any of the numerous areas where research is thin or nonexistent.” (Cooper, Robinson, and Patall, 2006, p. 53).

Most prior research seems to support the contention that there is still much to learn about the relationship between homework and academic achievement. I will consider my classroom research project a success if I can contribute in a small way to a better understanding of that relationship.

METHODOLOGY

Students often mistake rote memorization for true understanding and it is a challenge for teachers to counteract this misconception about learning. Students seem to constantly struggle with appreciating basic curriculum concepts and spend all their mental energy memorizing isolated facts to merely regurgitate during the next test. How can this be addressed? Homework is widely considered an important supplement to classroom instruction since it can give students an opportunity to practice newly acquired skills, prepare for learning new concepts, and synthesize multiple ideas (Cooper, Robinson, & Patall, 2006). The objective of the homework log in my classroom research project was to facilitate deeper learning by encouraging better quality completion of tasks assigned to students for after school hours. This general purpose was resolved into the following main research question and sub-questions: 1) What is the effect of homework logs on students’ learning? 2) How do homework logs influence students’ study habits?
3) What is the effect of homework logs on students attitudes about homework? 4) How do homework logs influence students’ attitudes toward learning?

Triangulation was a key practice in the methodology of my classroom research project. Data triangulation is “a process in which multiple forms of data are collected and analyzed” (Hendricks, 2013, p. 89). This approach yields greater credibility because a conclusion can be justified from multiple sources of evidence. In other words, if a researcher is getting the same results from several instruments, there can be a high degree of confidence that the conclusions of the study are probably true. For this reason, a variety of instruments were used to collect both quantitative and qualitative data including student interviews, Pre- and Post-Unit Assessments, Homework Quality Surveys, Homework Quality Logs, and short classroom assessment techniques. These five instruments and their relation to the focus questions are summarized below (Table 1).

| Table 1  |  
| --- | --- |
| **Research Matrix** |  
| **Focus Questions** | 1 | 2 | 3 | 4 |
| 1. What is the effect of homework logs on students’ learning? | Homework Quality Surveys | Documented problem-solving CAT | Pre- and Post-Unit Assessment scores | Interviews |
| 3. What is the effect of homework logs on students’ attitudes about homework? | Homework Quality Surveys | Documented problem-solving CAT |  | Interviews |
Study Population

The classroom research project was conducted at a private, Catholic school located just to the north of Los Angeles, CA. Most of the students come from intact families, of above average incomes, who place a great deal of emphasis on the Catholic faith. Currently the school has an enrollment of 240 students, 57% of which are White, 32% Hispanic, 8% Asian, 2% African-American, and 2% of Native American descent (St. Monica Academy Midterm Progress Report, p. 5). The classroom research project was conducted in a standard level Chemistry course with a class of 24 juniors and sophomores. Half of the participants were males and half were females.

Treatment

In order to make better use of their study time outside of class, 20 students maintained a Homework Quality Log (Appendix A) for the duration of several units during the classroom research project. Modeled after similar instruments utilized by Bembenutty and White (2013) and Cooper, Horn, and Strahan (2005), the log included a table with ten columns in which students recorded and self-evaluated different characteristics of their homework. These included amount of time spent on homework, goals and attitudes about studying and how they dealt with distractions. Completing the Homework Quality Logs delivered a motivational tool for students and encouraged regular and more serious study habits. The logs also provided artifacts that supplemented the data gathered throughout the classroom research project.

Students underwent three units with the treatment and an equal number without the treatment. These are the treatment and non-treatment groups, respectively. The classroom research project was conducted in a standard level Chemistry course and
covered topics including stoichiometry, bonding theory, aqueous systems, and solution reactions. Prior to the project, four units of equal difficulty were chosen for the classroom research project. During those four units, students alternated between keeping a study log and not, which provided two sets of data for each group. The research methodology for this project received an exemption by Montana State University’s Institutional Review Board and compliance for working with human subjects was maintained (Appendix B).

**Instruments**

Qualitative data was drawn first from the Pre- and Post-Study Interviews (Appendix C). Prior to the classroom research project, five students were randomly selected and interviewed about their views on homework. The Pre-Study Interview allowed students the freedom to respond thoughtfully and articulate more completely their views about homework. Questions focused on students’ understanding of homework, its purpose, and habits related to study. At the end of the six-unit process, the same students were interviewed again. The Post-Study Interview included all the questions of the Pre-Study Interview as well as questions about how they felt the Homework Quality Logs affected their learning and their perceptions about homework. Using the principles of emergent thematic analysis, survey responses were analyzed for common themes, which were used to support the conclusions drawn from the analysis of other instrument data.

A second source of qualitative data was short assessments at the end of each unit called Documented Problem Solving (Appendix D). In these assessments, students were given a word-problem related to the unit, and asked to distinguish and comment on the
necessary steps to solve it. This required students to explain what they had learned in their own words, making it very effective in determining the depth of learning that had taken place. For each unit, six well-documented responses were selected from among the total and analyzed for patterns in mistakes or misconceptions. Common errors in the treatment and non-treatment groups were tallied, compared and used to support claims drawn from other instruments.

Students also completed the Homework Quality Survey (Appendix E) at the beginning and end of the study. These short, Likert-type surveys focused on basic study skills, students’ attitudes about homework, and how they dealt with distractions and difficulties. Students’ responses before and after the treatment were expressed as percentages and juxtaposed in a graph to make it easier to see any significant changes before and after the study.

Pre- and Post Unit Assessments (Appendix F) were also administered as a reliable source of quantitative data. To ensure each was of equal difficulty, tests were taken from the supplementary materials provided by the publishers of the class textbook. Prior to each unit, these tests assessed students’ familiarity with the key unit concepts. After the end of a unit, students took the Unit Test again. Since the data were dependent and the sample size small \((n<30)\) the pre and post-unit scores were statistically analyzed with the Independent Samples t-test and a significance level of \(\alpha=0.05\) to determine if there was any probable difference in students’ understanding before or after the treatment.

DATA AND ANALYSIS

In order to better organize the study, focus questions (Table 1) were developed during planning stages to guide the methodology and instruments of the project. The first
of these questions was, “What is the effect of the Homework Quality Logs on students’ learning?” Documented Problem Solving assessments (Appendix D) offered some evidence of a deeper understanding of key concepts at the end of the study among the students using the Homework Quality Logs (Appendix A). During the first unit, the students using the logs were able to complete their assessments flawlessly. The students without study logs exhibited sufficient understanding of the material with some minor misconceptions. For example, several students were confused about exceptions to the Octet Rule. The second unit data showed misconceptions regarding first ionization energy in both the treatment and non-treatment groups. In the third unit, some of the non-treatment students had trouble developing correct formula units using Lewis Dot Structures. This was not a difficulty for the students maintaining homework logs, which again showed a slightly deeper understanding among the treatment group.

Students also took a Pre- and Post-Unit assessment at the beginning and end of the three units of the study, which shed some light on students’ learning. The Post-Unit Assessment score boxplots (Figure 1) show the quartiles of the students’ scores. Zeroes are the scores from students that answered every question incorrectly. Sample sizes were small (n<30) and the collected data do not appear normal. For these reasons, and because of its robustness (The Basics of Data Literacy, Bowen and Bartley, 2014), scores were analyzed using the independent samples t-test (α=5%) with the null hypothesis that there was no difference in the mean between the treatment and non-treatment groups.
The first trial was the most suggestive, with a $p$-value of 0.1816 and substantive significance of $d = 0.6402$. The second trial yielded $p = 0.7953$ and $d = 0.1177$. The final trial produced a $p$-value of 0.8002 and $d = -0.1150$. In none of the three trials was there sufficient evidence to reject the null hypothesis; it was impossible to say with any confidence that there is a difference between the mean score of the students who maintained Homework Quality Logs versus those who did not.

Post-Unit Assessment scores were also pooled to further investigate the difference between the treatment and non-treatment groups. The distributions appear nearly identical (Figure 2). The pooled test scores produced a $p$-value of 0.8520 with an effect size of $d = 0.0487$. Again there is insufficient evidence to conclude that means of these groups are different.
The second question, “How do the Homework Quality Logs influence students’ study habits?” aimed to investigate what students did while completing homework. In many ways, the students were already well disposed to good homework habits at the outset. In the pre-treatment Homework Quality Survey, 84% of the students replied agree or strongly agree to making time for homework everyday. Sixty eight percent of the students agree or strongly agree with minimizing distractions when studying. More than half of the students, 73%, expressed confidence that they have enough time to complete their homework assignments.

The pre-treatment Homework Quality Survey data also suggested some potential areas of improvement in habits related to study. Only about 50% of the students said they consistently record their homework assignments. Less than half of the students complete their homework ahead of time, with 58% completing their assignments as close to the due date as possible. About 20% of the students will refer to extracurricular
materials to supplement what they learn in class and about 63% of the students only complete what is required to finish their homework as they prepare for class.

To make it easier to see any significant changes in the students’ responses before and after the treatment, percentages were juxtaposed in a graph (Figure 3 and 4). As is evident from the bar graphs, there was little or no change in student attitudes about questions 3, 7, 8, 10, 12, 13, and 14; the distribution of student responses was nearly the same before and after the treatment.

Figure 3. Homework Quality Survey responses for questions 1-7, (N=20).

The number of students who agreed or strongly agreed that they had trouble managing their homework with their other responsibilities grew from 34% to 47% and those who complete their homework as close to the deadline as possible went from 58%
to 74%. When asked if the Homework Quality Log changed her study habits, one student responded, “it has changed it for the better. It’s like an extra planner that makes sure you do it.” Another students said, “it helped me stay more organized and it required more focus to maintain the study log.” Sixty-six percent of the students interviewed, however, said that it did not have much effect at all. As one student put it, “the study log hasn’t really changed my study habits.”

Students were also asked what they do when they get stuck while studying. Before the study, 89% said they review the book and their notes to work through their difficulty. This dropped to 79% afterward. Students who used answers from the back of the book went from 84% to 63%. Interestingly, the number of students who asked for help from a friend or parent rose from 74% to 89%. As one student put it, “sometimes in
class you don’t know if you really understand it. But when you try the problem for
yourself you can figure it out or go ask someone to explain it.” The number of students
who would stop studying rose from 37 to 42% (Figure 5).

Several students spoke of the homework log improving their organization while
completing assignments. As one student put it, “it made me stay more organized with
homework.” When asked how the Homework Quality Log changed his perception of
homework, he said, “a lot, my homework habits should be more structured and it
reminded me to plan my homework out and get a schedule that helps me to do stuff in
advance.” Another student expressed their feelings in the following way, “it keeps me
disciplined and reminds me to set aside times to do my homework.”

Figure 5. Problem solving strategies employed by students in response to challenging
questions, (N=20).
The last two focus questions had to do with the students’ attitudes about homework and learning. All the students interviewed voiced their opinion that homework delivered practice that was crucial for doing well in a class. When asked if he thought homework helped them understand the content of class better, one student responded, “I think that it does. It provides more practice and the more you practice the better you understand something.” As another student put it, “[The homework log] made me think of homework as something more than, ‘Yuck, it’s homework!’” Another student suggested that the homework log provided an effective impetus to study saying, “It motivated me to try harder at homework.”

Prior to the study, 73% of the students disagreed or strongly disagreed with the statement that completing homework was not important for learning. This grew to 90% after the study. Before the treatment, 43% of the students thought they would learn just as well without homework while only 17% thought so after the treatment. These views on homework were further expressed by the words of a student who said regarding the Homework Quality Logs, “It reinforced my belief that homework is important.”

**INTERPRETATION AND CONCLUSION**

The study led to several interesting discoveries about my students’ study habits and their views about homework. I was first struck by how students universally affirmed the importance of homework, one student saying, “it effects my learning positively; it gives me more practice so I can understand concepts better.” This kind of response was typical; ninety-two percent of the students interviewed spoke of homework as the place where they got to practice concepts they were learning and how such practice was necessary for doing well on quizzes and tests. The survey data confirmed this with the
number of students who thought homework was important increasing by 15% while those who thought they could learn just as well without it went down by 26%. By the end of the study, 84% of the students thought they learned better with homework and 90% thought that completing their homework was important for their learning.

A positive change in the students’ attitudes about homework was encouraging to see, however, there was little evidence to suggest that the logs did much to enhance their actual learning. While two of the three Documented Problem Solving (Appendix D) instruments showed the students maintaining Homework Quality Logs (Appendix A) as having a slightly better understanding of the material, this was not the case in the second unit. Further, the misconceptions of those who did not use homework logs were very minor and so this is not strong evidence of any great difference in the learning outcome between the two groups.

The Post-Unit Assessment (Appendix F) scores also suggest that the homework logs were not effective in bringing about greater subject mastery in the students; the statistical analysis of the scores does not support any significant difference between mastery of the material. The first trial weakly suggested that the logs had some effect as the t-statistic, \( t = 1.393 \), approached the critical value \( (t = 2.2621) \) and yielded a medium effect size \( (0.5 > d > 0.8) \). The other two units did not even suggest a significant effect in the treatment. Both \( t \)-statistics, \( t = 0.2633 \) and \( t = -0.2572 \) were well below the critical value \( (t = 2.2621) \) and the very small effect sizes suggested nothing but a trivial influence from the treatment. The reason for the difference in the first unit may have been due to different subject material or the “settling in” period as the students were getting used to the study log as an everyday tool and assessment for the class. In all three cases,
however, there was insufficient evidence to reject the null hypothesis and conclude that there was any real difference in the mean score of the treatment and non-treatment groups.

Seeing a difference in students’ attitudes about homework and no difference in their mastery of the material was surprising. It could be that while the logs had the aforementioned positive effects on their attitudes about homework, they did not bring about any change in study habits or techniques. While many students, when interviewed, expressed ways in which their attitudes about homework had changed, there was very little evidence that study habits or study techniques generally changed at all. This harkened back to the research of Henderson and Eren who found that homework did not significantly affect science test scores (Henderson and Eren, 2011). Several students spoke of the homework logs as a useful tool for holding themselves accountable and staying organized as they went about completing it. One student said, “it reminded me to manage my time better.” Another stated, “it helped me to get my homework done earlier in the day.” This confirms the findings of one study that concluded homework logs are “an important educational tool that educators can use to enhance their students’ self-regulation of learning and motivation” (Bembenutty and White, 2013, p. 86). However, most of the students specifically stated that the logs did not change how they went about studying much or at all. It could be for reasons like this that Cooper, Robinson, & Patall (2006) emphasized that homework is a supplement to instruction. Quality homework requires effective study practices; more is necessary than simply logs that structure and organize study time. It may be that while the logs encouraged homework regularity and accountability, any weaknesses in how students went about reviewing or studying
material went unaddressed. This would explain the similarity of the Post-Unit Assessment scores.

Based on the evidence gathered during my classroom research project, I have become convinced that homework logs can be an effective means of helping students’ focus, increase student diligence, and enhance their organization with homework and study time. These are definitely good habits that I want to form in my own students and so I will be looking for ways to implement homework logs and further develop the tool and make it better in my future classes. However, based especially on the data drawn from the Post-Unit Assessments and the Documented Problem Solving instruments, homework logs cannot replace good instruction or effective study techniques and will need to be supplemented with pedagogy that teaches not only to take the time to study but also how to study well.

VALUE

A teacher’s primary goal is to help the students internalize and understand the key ideas and concepts of any given class. This includes forming habits that will enhance their ability to learn and succeed in their professions down the road. In keeping with those goals, the specific purpose of this study was to test the implementation of Homework Quality Logs (Appendix A) and see how it affected students’ learning as well as their attitudes about learning. While performance on quantitative assessments seemed less effected, I was very happy to see that the logs probably helped students’ focus and organization in their study time outside of class. It seems very probable that a tool like the Homework Quality Log could be executed to enhance students’ focus, timeliness and organization. These are aspects of self-regulation that can have even greater personal,
social and academic effects than high marks on a test or in a class. The value of this enterprise is clear: it suggests a simple tool, available to all science educators, that can help form students who are able to carry out tasks with greater professionalism and diligence, both skills critical for success. For these reasons, I hope to use the study log as a component in my future teaching and continue examining the technique and how to make it better.

The classroom research project raises many interesting questions and avenues for further pursuit. For example, my study only implemented Homework Quality Logs over the relatively short periods of time, one to two weeks. This is not a very large portion of an academic year. Would longer use of the logs by the students have any effect on their performance on regular or cumulative assessments? Would beginning a school year with study logs affect student behavior over the entire year? Is there someway to weave direct instruction regarding specific study techniques into the logs? With the logs I used, there was little to teach the students how to study, only questions that promoted self-reflection and regular intervals of study. Is there some way to teach specific study techniques in addition to the organizational skills and time structuring benefits of a log? There are many ways this topic could be further developed and explored, and I hope to pursue some of those questions as I continue teaching.

The evidence collected in this study suggests that homework logs may have a place in aiding study and homework of a science teacher but they do not seem adequate to address all the skills necessary to ensure quality study time. Further study would need to be conducted to fully understand this relationship. Though probably effective in promoting focus and organization, the logs would need to be supplemented with training
in specific study skills and techniques in order to produce a significant change in academic performance, to say nothing of solid instruction and effective assessments. Enhancing students’ ability to self-regulate, however, is no small thing. Such habits are critically important academically, socially, and professionally and therefore I believe that the study log is a form of pedagogy worthy of use and further study.


APPENDICES
APPENDIX A

HOMEWORK QUALITY LOG
Homework Quality Log

Student Name: ___________________  Class ____________________

Week of ________________

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# How to Fill the Study Log Form

In this Study Form, you should log all of the study activities you are doing out of the classroom instruction for this class. By study activities I mean any homework assigned by the instructor and/or any studying you choose to do for this class outside of class instruction. That includes study halls.

- **Column 1:** write whether the day of the week during which you studied.
- **Column 2:** write the specific material/task that you studied (for example, reading pages 20 to 30 from the textbook). Be specific about what you will study.
- **Column 3:** write how you feel at the beginning of your homework (for example, stressed, excited, frustrated, etc.).
- **Column 4:** write the time you started studying.
- **Column 5:** write the time you finished studying.
- **Column 6:** write where you studied (for example, your bedroom, in the library, on the train).
- **Column 7:** write with whom you studied (indicate whether you studied alone, with a classmate, with a tutor, with a friend, a parent).
- **Column 8:** rate how focused you were during your study time on a scale of “1” to “10”; a “1” will indicate, “There were so many distractions around that I might as well not have spent that time studying” while a “10” will indicate, “I was really in the zone. I remember exactly what I did and barely noticed anything else while I was working.” If applicable, note the presence of any distractions during the study time (for example, the television was on in the room you were studying).
- **Column 9:** write how you feel at the end of spending time working on your homework (for example, confident, exhausted, relieved, stressed, etc.)
- **Column 10:** rate how well you have completed your assignment on a scale of “1” and “10”; a “1” will indicate that you completed the assignment very badly and “10” will indicate that you completed the assignment very well.

**Please turn in on Friday.** Legible writing is 5 points. At least 3 study sessions is 5 points. Total points for assignment: 10 points
APPENDIX B

IRB APPROVAL
The above research, described in your submission of November 29, 2016, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

- **X** (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

- **X** (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

- **X** (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

- **X** (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

- **X** (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

- **X** (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.
APPENDIX C

PRE- AND POST- STUDY INTERVIEW
PRE- AND POST-STUDY INTERVIEW QUESTIONS

Pre Treatment Interview Questions

1. What do you think homework is?
2. Do you think homework helps you understand the content of the class better?
3. How do you think homework relates to grades?
4. Tell me about your homework habits.
5. Is there anything else you’d like me to know?

Post Treatment Interview Questions

1. How do you think homework affects your learning?
2. How has keeping a homework log changed your homework habits, if at all?
3. How has keeping a homework log changed your perception of homework, if at all?
4. How have homework surveys changed how you approach homework, if at all?
5. How have homework surveys changed your perception about homework, if at all?
6. Do you think homework helps you understand the content of the class better?
7. How do you think homework relates to grades?
8. Is there anything else you’d like me to know?
APPENDIX D

DOCUMENTED PROBLEM SOLVING
Name:
Date:

CAT Unit 1: Chapter 10

Solve the following problems, carefully documenting your steps as you go. This is not a test or quiz. It is more important for you to explain how you are trying to solve the problem than to get the right answer. Clearly number and label the steps of your solving process.

1. How does the average kinetic energy of the helium molecules in a balloon change as the helium gas is heated from -100.0 °C to 73 °C?

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<th>Work</th>
<th>Steps and Explanation</th>
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APPENDIX E

HOMEWORK QUALITY SURVEY
Name:  
Date:  

Homework Quality Survey

Please answer the following questions with a 1 through 4, 1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree.

1. I always record my assignments in my planner or notebook.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

2. I have trouble managing my homework with all my other responsibilities
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

3. I make time for homework everyday.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

4. I have enough time to complete my homework.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

5. Completing my homework is not important for my learning.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

6. I complete my homework as close to the deadline as I possibly can.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

7. I usually study in the same place.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

8. I try to minimize distractions when I study.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

9. I would learn just as well without homework.
   
   (1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree
10. I review outside-classroom resources (books/articles related to the class, online videos/tutorials, etc.) to supplement what I learn in class.

(1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

11. Too little homework is assigned in class.

(1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

12. I need to be reminded to do my homework; otherwise I just forget to work on it.

(1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

13. I never do more study than is required to complete my homework assignments.

(1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

14. Homework helps.

(1) Strongly Agree   (2) Agree   (3) Disagree   (4) Strongly Disagree

15. When I get stuck I: (circle all that apply)

a. review the textbook and my notes until I figure out the answer.

b. use the answer in the back of the book and figure out where I went wrong.

c. ask a friend or parent for help.

d. copy the answers from the back of the book or a classmate and then do something else.

e. skip the problem or question.

f. Other: ______________________________
APPENDIX F

PRE- AND POST-UNIT ASSESSMENTS
12. Which one of the following compounds is not covalent?
   a. SCl₃  
   b. KCl  
   c. HCl  
   d. S₂Cl₂

13. How many valence electrons does an atom of any halogen have?
   a. 1  
   b. 2  
   c. 4  
   d. 7

14. A diatomic molecule with a triple covalent bond is:
   a. N₂  
   b. Br₂  
   c. H₂  
   d. O₂

15. A molecule of nitrous oxide, N₂O, contains all of the following except:
   a. a coordinate covalent bond  
   b. a triple bond  
   c. a double bond  
   d. nonbonding pairs of electrons

16. If a bonding pair of electrons is unequally shared between two atoms, the bond is:
   a. ionic  
   b. coordinate covalent  
   c. nonpolar covalent  
   d. polar covalent

17. The electron dot structure for water is:
   a. H : O : : H  
   b. H : O : : H  
   c. H : O : : H  
   d. H : O : : H

18. Which of the following compounds is not ionic?
   a. NaI  
   b. CaCl₂  
   c. CO₂  
   d. Na₂O

19. A covalent bond forms:
   a. when an element becomes a noble gas.
   b. when atoms share electrons.
   c. between metals and nonmetals.
   d. when electrons are transferred from one atom to another.

20. The electron dot structure for the polyatomic ion OH⁻ is:
   a. [O⁻ : H]⁻  
   b. [H⁺ : O]⁻  
   c. [H⁺ : O]⁻  
   d. [O⁻ : H]⁻

21. Which of these compounds would not have covalent bonds?
   a. NO₂  
   b. K₂O  
   c. N₂O₃  
   d. H₂O₂

22. A molecule with a single covalent bond is:
   a. CO₂  
   b. F₂  
   c. NO  
   d. N₂