INCREASING STUDENT EFFORT IN COMPLEX PROBLEM SOLVING THROUGH
COOPERATIVE LEARNING AND SELF-RECORDING STRATEGIES

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ABSTRACT

In recent years, teachers have noticed a drop in student effort on complex problems in math and science. The purpose of this study was to determine if incorporating cooperative learning and self-recording strategies had an impact upon student effort on complex problems. A total of 38 $9^{th}$ through $11^{th}$ grade math and science students at two different sites were a part of the study. All students were placed in cooperative learning groups and each kept a Strategy Journal. This journal was a self-recording tool which helped students organize their errors and keep track of strategies that were helpful in solving complex problems. Data was collected through three tools: a Pre- and Post- Intervention Survey, weekly Homework Checks, and weekly Bell-ringer Questions. The surveys asked students to indicate how they approached complex problems. The surveys were then analyzed to see what changes in behavior occurred during the Pre-Intervention and Post-Intervention periods. The Homework Check was conducted once a week to determine the level of effort that students put forth on work completed at home. The weekly Bell-ringer Question was conducted to determine the level of effort students put forth on work completed in class. After compiling data during the Pre-Intervention, Intervention, and Post-Intervention periods, effort scores were averaged week by week. Then, the teacher researchers were able to analyze whether student effort had increased since the Pre-Intervention period. Results indicated that student effort on complex problems increased over the Intervention and Post-Intervention periods from the original Pre-Intervention effort scores. The average effort score on the Homework Check went from a maximum score of 1.4 during the Pre-Intervention period to a maximum score of 1.8 during the Intervention period. During the Post-Intervention period scores remained constant at 1.7. The average effort score on the Bell-ringer Question went from a maximum score of 1.8 during the Pre-Intervention period to a maximum score of 2.0 during the Intervention period. The maximum score during the Post-Intervention period was a 1.9. The teacher researchers concluded that cooperative learning and self-recording strategies did make an impact on student effort on complex problems in the math and science classrooms. The teacher researchers recommend continuing this research for a longer period of time to fully determine the effects of cooperative learning and self-recording strategies on student effort.

TABLE OF CONTENTS

CHAPTER 1
PROBLEM STATEMENT AND CONTEXT

General Statement of the Problem

This action research project targeted 20 $9^{th}$-$10^{th}$ grade math students at Site A and 18 $11^{th}$ grade science students at Site B. The teacher researchers observed that students in their classes do not put forth effort on complex problems given as homework or in other classroom activities. The teacher researchers assessed the lack of effort to be a problem through various methods, including student surveys, weekly Homework Checks, and weekly Bell-ringer Questions.

Immediate Problem Context

The two school research sites are quite similar, both in student and faculty make-up. The populations of both schools are primarily White, with a smaller subgroup of Hispanic and Black students. The schools are well-cared for and offer many activities for students to take part in. Both schools also exhibit the same problem: students do not complete complex problems.

Site A

Site A is located in a northwestern suburb of a large midwestern city. Site A is a $9^{th}$ through $10^{th}$ grade building that is a part of a larger high school. There is another campus with an $11^{th}$ through $12^{th}$ grade building, but as research was not done at this school, it will not be discussed in detail. The total enrollment of the school is 3,919 students, with approximately 2,124 students at Site A. Please note that the total enrollment is from the 2007 School Report Card, whereas the Site A population is a count of 2007/2008 population. Therefore, there is a slight discrepancy. This population is primarily White, with considerable Hispanic, Black, and Asian populations. Table 1 shows the racial and ethnic percentages of students at Site A versus the entire school. Again, information about Site A is from a personal communication with the School Relations Director, and the entire population figure is from the 2007 School Report Card.

*Table 1.* Percentage of Racial/Ethnic Backgrounds of Site A vs. Entire School

| Racial/Ethnic Background | Percentage of Population in Site A | Percentage of Population in Entire School |
|---|---|---|
| White | 57.8% | 63.5% |
| Black | 9.46% | 9.6% |
| Hispanic | 16.8% | 14.5% |
| Asian/Pacific Islander | 10.4% | 10.7% |
| Native American/Alaskan | 1.78% | 0.6% |
| Multiracial | 3.76% | 1.1% |

According to the School Relations Director at this school, approximately 14% of the students at Site A are considered low-income, while 11% of students at the entire school fit this classification. These are students who "come from families receiving public aid; live in institutions for neglected or delinquent children; are supported in foster homes with public funds; or are eligible to receive free or reduced-price lunches" (2007 School Report Card 1). However, this number changes on a month-to-month basis, dependant upon need. Also, approximately 3.5% students in the entire school have limited-English proficiency. At Site A, an accurate count from the 2007/2008 school year showed 93 ELL students, which comprises 4.4% of Site A's population (Personal communication with School Community Relations Director). Student attendance at this school is approximately 92%, with 12% of students considered truant (2007 School Report Card 1).

The following information also comes from the 2007 School Report Card. There are 229 total teachers within the entire school, with 44.5% being male and the remaining 55.5% being female. Compared to the varied student body at this school, the faculty seems quite monoracial. See Table 2 for a racial/ethnic breakdown of faculty.

*Table 2.*  <u>Percentage of Racial/Ethnic Backgrounds of Site A for Faculty of Entire School</u>

| Racial/Ethnic Background | Percentage of Population |
|---|---|
| White | 93.4% |
| Black | 0.9% |
| Hispanic | 3.9% |
| Asian/Pacific Islander | 1.7% |

Over 93% percent of faculty are White, with 3.9% of faculty being Hispanic, 1.7% considered Asian, and only 0.9% considered Black. The average experience of teachers at this school is 10.7 years, with 50.7% of faculty having either a master's degree or higher. The average salary for teachers at this school is $63,556, which is approximately $5,000 above the state average. The average salary for administrators is $127, 223, which is nearly $25,000 above the state average. The average class size at this school is 20.3 students. The teacher-student ratio is approximately 19.2 students per every one teacher.

Academic subjects at Site A are quite competitive, and include general courses in math, science, English, and history, as well as German, Spanish, and French. Physical education is required for most students, as well as a health course, an economics course, and a government course. Students can also choose to take part in a variety of music, art, and industrial technology courses. The graduation rate at the entire school, according to the school website, is 96.4%. Even so, Site A, as well as its 11th through 12th grade counterpart, is currently in danger of undergoing restructuring, due to failure of Adequate Yearly Progress (AYP) through the No Child Left Behind Act. In the 2006-2007 school year this school failed to make AYP in reading and math with Black students, and math with special education students. In the 2006-2007 school year 61.8% of students met or exceeded standards on the Prairie State Achievement Exam (PSAE).

This was actually a drop from the 2005-2006 school year, where 64.6% of students met or exceeded standards (2007 School Report Card 4). This is a serious concern for Site A, with Work Key training and remediation being set up for students who are identified as struggling. Work Key training helps students become more adept at working with real-life application math problems. This school also had an ACT composite score of 21.8, a SAT math score of 679 and a writing score of 641 (School Site A Website).

Site A has several catch phrases that are used to invigorate students and staff. The first of these is "We're 1st class." This phrase is meant to inspire student success and appropriate behaviors. Another quote that is frequently used around the school is "Expect Success. Exceed Expectations." This quote is especially unique because it evokes different ideas for students and faculty. For a teacher, it reminds one to expect success out of every student. For a student, one is reminded to always try his hardest and in time he will succeed. Site A also takes part in the program "Project Lead the Way" (PLTW), which works to boost the quantity, but more importantly, quality, of engineers coming out of public schools. This is a program that offers courses in engineering, and support from qualified faculty. At Site A, PLTW is headed by several industrial technology teachers.

Site A was originally built in 1915. In 1984 the building was destroyed in a fire, and did not reopen until 1987. There are three floors, with two wings to a floor. The math classrooms that are being researched are on the north wing of the third floor. The building is brick with gardens visible through hallway windows. New carpet has recently been placed and hallways have been recently painted. At Site A, student leaders are celebrated by the "1st class leaders" portrait board in the office. One of the main hallways of the school cuts through the office, which allows students more frequent contact with administrators. This also allows students to more

frequently see the artwork on the walls, all of which come from art classes at Site A. Flags of all the different countries represented at Site A also cover the walls, intended to help diverse students to feel welcome.

Site B

Site B is also located in a northwestern suburb of a large midwestern city. Site B is a 9th through 12th grade building that is located in a district that contains one other 9th through 12th grade high school. Research was not done at this second school, however, so it will not be discussed in detail. The total enrollment of the district is 2,604 students, with approximately 1,407 students from Site B. Please note that the total enrollment of the district is from the 2007 School Report Card, whereas the Site B population is a count of this year's 2007/2008 population. Therefore, there is a slight discrepancy. This population is primarily White, with a small Black, Asian/Pacific Islander and Multiracial population. The Hispanic population makes up the largest subgroup. Table 3 shows the racial and ethnic percentages of students at Site B versus the whole district. Information found in the following table about Site B is from a personal communication with the School Attendance Secretary, and the entire population information is from the 2007 School Report Card.

Although Site B is slightly more diverse than the district, as a whole, it is still a primarily White population. The following information comes from the 2007 School Report Card. Approximately 8.5% of students at Site B are considered low-income students, however there are no students cited as having limited-English proficiency. Student attendance at this school is 94.6%, with 1.8% of students considered truant.

*Table 3.*  Percentage of Racial/Ethnic Backgrounds of Site B vs. Entire District

| Racial/Ethnic Background | Percentage of Population in Site B | Percentage of Population in Entire District |
|---|---|---|
| White | 72.2% | 74.4% |
| Black | 4.2% | 3.3% |
| Hispanic | 14.4% | 13.5% |
| Asian/Pacific Islander | 5.1% | 6.7% |
| Native American/Alaskan | 0.4% | 0.2% |
| Multiracial | 3.6% | 1.8% |

There are 165 total teachers within the entire school district, with 47.0% being male and the remaining 53.0% being female. Unlike the school population, the faculty's population is quite uniform. See Table 4 for a racial/ethnic breakdown of faculty at the district level (2007 School Report Card 1).

*Table 4.*  Percentage of Racial/Ethnic Backgrounds of Site B for Faculty of Entire District

| Racial/Ethnic Background | Percentage of Population |
|---|---|
| White | 97.4% |
| Black | 1.8% |
| Hispanic | 0.6% |
| Asian/Pacific Islander | 0.2% |

The following statistics were all obtained the 2007 School Report Card. Over 97.4% percent of faculty in the entire district are White, with 1.8% of faculty being Black, 0.6% considered Hispanic, and 0.2% considered Asian/Pacific Islander. The average experience of teachers in the district is 10.2 years, with 65.6% of faculty having either a master's degree or higher. The average salary for teachers in this district is $62,335, which is approximately $4,000

above the state average. The average salary for administrators in the district is $120,202, which

is about $18,000 above the state average. The average class size at Site B 19.8 students. The

teacher-student ratio for the district is 17.8 students per teacher.

Site B offers general courses in math, science, English, and social studies, as well as

Spanish and French. Additionally, students must complete the following: consumer

education/economics, health course, driver's education course, one applied arts class, one fine

arts class, and several elective credits. Students can choose to take part in a variety of music, art,

and industrial technology courses for their electives. The dropout rate for the entire district,

according the 2007 School Report Card, is 1.5%.  Site B has also struggled to reach Adequate

Yearly Progress and could be in danger of restructuring in the future. In the 2006-2007 school

year this school failed to make AYP in reading and math with Hispanic students.  In this same

school year 61.1% of students in the district met or exceeded standards on the Prairie State

Achievement Exam (PSAE). This was actually a drop from the 2005-2006 school year where

62.4% of students met or exceeded standards (2006 School Report Card 4). This is a concern for

both district schools, with Work Key training for all students and goal setting documentation

being set up for students who are identified as struggling. According to Site B's assistant

principal, the school had a Spring 2007 ACT composite score of 21.0.

Site B also has catchphrases that are used to motivate the population. The first of these is

"Every Student, Every Day." This phrase is meant to inspire student success by incorporating

teaching and learning strategies that address the needs of every student.  Another quote that is

frequently used is "Weeding the Garden." This quote reminds teachers to focus on the important

content and skills that all students should walk away with by the time they graduate from high

school. Teachers are encouraged to eliminate unnecessary content in order to cover key topics in

detail. Site B takes part in the local community college's technology program, which prepares students for numerous jobs (nursing, cosmetology, firefighting, etc.).

Site B was originally opened in 2004. There are three academic floors. A second wing houses the life fitness and art departments. The third and final wing consists of administration offices. The science classrooms that are being researched are on the first floor of the academic wing. The building is brick with an open courtyard visible from the window. The building is relatively new, therefore all of the tile floors are in good condition and the paint in the classrooms is fresh. At Site B, pictures from major celebrations such as the National Honor Society Induction Ceremony or the recent pep assembly are posted on the main office's windows. One of the main hallways leads to the administration wing, which allows students frequent contact with administrators. The large hallway that leads past the cafeteria and toward the athletic field house has display cases, showing off the recent works of art and technology students. This hallway also contains the flags from the eight towns whose students attend the school, thereby trying to make everyone feel welcome.

<center>Local Problem Context</center>

Site A and Site B are both located in a northwestern suburb of a major midwestern city. Site A, which is located in Town A, is slightly more north than Site B, which is located in Town B. Both towns are a short distance from the large midwestern city, and are also very close to their northern-border's neighbor state.

According to the 2000 Census, in 2000 Town A had 28,834 people. This is in contrast to the significantly smaller population of Town B, which in 2000 only had 18,506 people (State website, para. 4). The estimated growth in the last five years for Town A is 1,938 people, which translates to a 6.7% increase. In Town B, the estimated growth in the past five years is 2,593

people, which is an increase of 14% (http://www.citytowninfo.com). Even though the sizes of these two towns are quite different, the age distribution within these two towns is surprisingly similar. Table 5, below, shows the age distribution between Towns A and B.  Information to make this table was taken from paragraphs 6 and 7 of the state website.

*Table 5.*  Age Distribution of Towns A and B

| Age Distribution | Town A Percentage | Town B Percentage |
|---|---|---|
| Under the Age of 18 | 30.3% | 33.1% |
| Age 18 to 24 | 5.5% | 5.6% |
| Age 25 to 44 | 37.2% | 40.4% |
| Age 45 to 64 | 19.9% | 16.3% |
| Over the age of 65 | 7.2% | 4.5% |

As one can see, the age distribution is remarkably similar between these two towns. The only notable difference is that Town B has slightly more people from the age of 25 to 44; while Town A has a slightly older population, with more inhabitants from age 45 on.  Even so, one could say that these demographics are nearly identical. The racial demographics of Town A and Town B are also very similar. Just as in Site A and Site B, the clear majority of inhabitants in Town A and Town B are White. Table 6 explores these similarities in detail. Information for this table was taken from paragraphs 4 and 5 of the state website.

*Table 6.*  Percentage of Racial/Ethnic Backgrounds of Town A and Town B

| Racial/Ethnic Background | Town A Percentage | Town B Percentage |
|---|---|---|
| White | 82.12% | 91.00% |
| Black | 5.06% | 1.58% |
| Hispanic | 6.03% | 4.97% |
| Asian/Pacific Islander | 8.25% | 4.26% |
| Native American | 0.18% | 0.19% |
| Multiracial | 2.23% | 1.27% |
| Other Races | 2.15% | 1.70% |

Town A shows a more diverse population than Town B. This is not surprising as the same characteristics were evident in Site A and Site B. One interesting note is that both towns' second highest population have Hispanic backgrounds. This was also true in Sites A and B.

Though specific information could not be attained on religious affiliations in Towns A and B, these teacher researchers can hypothesize that the majority of the community considers themselves of Christian or secular descent.  This hypothesis is based on the fact that no schools in the area receive Jewish or other religions' holidays off.

In the year 2000, Town A and Town B also had similar educational attainments. Education varied from below a ninth grade level to graduate and professional degrees. Table 7 shows the similarities in educational attainment in Town A and Town B.  Information for this table was taken from the 2000 Census Bureau FactFinder, Section DP-2.

*Table 7.* Educational Attainment in Town A and Town B

| Highest Educational Attainment | Town A Percentage | Town B Percentage |
|---|---|---|
| Less than 9th grade | 1.8% | 1.6% |
| 9th to 12th grade with no diploma | 4.0% | 3.8% |
| High school graduate | 18.6% | 15.4% |
| Some college, no degree | 21.3% | 22.0% |
| Associate degree | 6.5% | 6.5% |
| Bachelor's degree | 30.8% | 33.3% |
| Graduate or Professional degree | 17.0% | 17.5% |

In 2000, both towns had approximately half of their population with at least a bachelor's degree. There was also a relatively small population who had not received a high school diploma as of the year 2000.

The following information comes from paragraph 5 and 6 of the state website. As of the 2000 census, Town A had 10,629 households, with 7,716 families. The population density was about 2,151.6 people per square mile. Of the 10,629 households, nearly 42.3% had children below the age of 18 living with them. Married couples living together made up approximately 62.6% of the population, with 7.8% as single-mother households. "Non-families," which the researchers are assuming means non-relatives living together, were 27.4% of the population. Nearly 22.7% of households were of individuals, and 6.4% were of an elderly person living alone. All in all, the average household size of Town A was 2.71 people, with the average family size as 3.25 people.

The following information also comes from paragraphs 5 and 6 of the state website. As of the 2000 census, Town B had 6,503 households, with 4,948 families. The population density was

approximately 1,969.2 people per square mile. Of the 6,503 households, 48.6% had children under the age of 18 living with them. Married couples living together made up approximately 66.3% of the population, with 7.4% as single-mother households. "Non-families," which the researcher is assuming are non-relatives living together, were 23.9% of the population. Nearly 18.7% of households were of individuals, and 4.0% were of an elderly person living alone. All in all, the average household size of Town A was 2.84 people, with the average family size as 3.31 people.

Town A and Town B also had very similar median incomes in the year 2000. This information comes from the 2000 Census Bureau FactFinder, Section DP-3. In 2000, Town A had a household median income of $75,742 and Town B had a household median income of $73,143. On the other hand, when comparing family median incomes, Town A showed a higher income of $88,932 versus Town B's family median income of $81,503. However, the largest disparity of incomes was between the incomes of males and females. This disparity appeared in both Town A and Town B. In Town A the average median income for males was $60,274 versus a female median income of $38,714. Likewise, in Town B, the same trend occurred. Males had a median income of $60,857 in comparison to the female median income of $37,839. In Town A, 3.0% of the population and 2.0% of families lived below the poverty line in 2000. Similarly, Town B had comparable rates of 3.0% of the population and 2.4% of families living below the poverty line.

Employment within these two towns was also very similar in the year 2000. This information also comes from the 2000 Census Bureau FactFinder, Section DP-3. Of inhabitants in Town A, age 16 and over, approximately 75.4% were in the work force, with 0.2% of this population in the armed forces. That left 24.6% of the population who were not in the work

force. This was most likely the younger population who chose not to work. Approximately 1.7% of the population considered themselves a part of the workforce, but currently unemployed. The most popular occupations for workers were management or professional positions, at 50.4% of workers, and within these occupations, the most popular industry was manufacturing, of which 25.4% of workers were a part.

Information on Town B's employment was also found in the 2000 Census Bureau FactFinder, Section DP-3. In 2000 approximately 78.5% of inhabitants aged 16 and over were in the work force, with 0.3% of this population in the armed forces. That left 21.5% not in the work force. This was most likely the younger population who did not work. Only 1.8% of the population considered themselves a part of the work force, but unemployed. Again, occupations for this population were varied, with 52% of workers in a management or professional occupation. Another notable occupation was sales and office occupations at 26.9% of workers. A large portion of Town B worked in manufacturing.

Town A was originally erected by settlers from New York State in 1835. They settled next to a large river in the area which has been known to have serious flooding, as recently as 2000 (state website para. 1, 8). Town B, on the other hand, became a village in 1895 after settlers from New York State and Ohio arrived. Town B also had difficulties with flooding, as in 1935 a notable flood had residents using rowboats in the street (city website history timeline)! Both Towns are consistently improving roads and facilities to accommodate their populations. The most notable recreation opportunity for both towns is a large amusement park in Town A. This amusement park provides recreation and employment opportunities for many of the town's population.

There are three main elementary districts that feed into Site A. This school comprises its own district, with only one superintendent (School website, 2007). In 2007 a referendum for increased funding failed for Site A and its 11th through 12th grade counterpart. In response to this failure, both campuses needed to make changes to school bus and security personnel.  According to the 2007 School Report Card, 81% of the entire school's funds come from property taxes, totaling over 36 million dollars in 2005-2006. Even so, that year the school had approximately a seven million dollar deficit. There are four regular use computer labs at Site A as well as two computer labs for industrial tech and digital photography classes. Each classroom has at least 30 computers for student use. The library also has 30 computers for students to use, and laptops can be rented, as well. Similar accommodations are available at the 11th-12th grade campus.

There are five elementary districts that feed into Site B, consisting of students from a total of eight different towns (*Daily Herald,* Jan. 21, 2004). Approximately 71% of property taxes of Town B go to Site B's school district. This translates to about $2090.67 per resident per year (town website Property Taxes)**.** Site B is part of a two high school district-a central campus and a north campus. One superintendent serves both of the schools. The campus in which this research focuses on has a total of four regular use computer labs, not including the computer labs for industrial technology. Each computer lab has 30 computers for student use. The library also contains multiple computers students can use; the main room has 30 laptops for general student use and a private room containing 30 computers can be rented out by classroom teachers. Lastly, the science department also has a set of 24 laptops that can be signed out within the science department.

National Context of the Problem

Based on the number of documents relating to homework on the National Education Association (NEA) website, the teacher researchers concluded that homework-related issues are important to parents and educators nationwide. Common problems include students avoiding their homework or not putting in the effort to complete complex problems. Nevertheless, research has shown that students do better in school when they spend more time on homework and that they experience further academic benefits as they progress into the upper grade levels (National Education Website, 2007). Thus, parents and teachers are becoming increasingly concerned that students are not completing their homework.

Generally speaking, teachers are finding it challenging to generate assignments that are both meaningful and appropriate while still actually getting students to successfully complete the homework (National Education Website, 2007). The previous article also identifies several causes, including "troubled or unstable home lives, lack of positive adult role models, and a high rate of mobility found among families who move their children from school to school" (National Education Website, para. 5). There are also many things that students may devote their time to after school as opposed to homework. These include working, babysitting their siblings, participating in extra-curricular sports and activities, and watching television (Education World, 2007). By visiting the NEA website, teachers can find practical solutions offered by other practicing teachers. For instance, one teacher from Colorado posted an article in which she describes how she reduces the number of zeroes in her grade book by allowing students to drop the lowest homework grade if they turned in all of their assignments for a given three week period (National Education Website, 2007).

Countless documents on NEA's website are intended for parents, offering insightful tips and solutions for the time old issue of homework completion (National Education Website, 2007). One of NEA's documents suggest that there are four major things parents can do to increase students' motivation for learning: show your children that you are still a learner and value learning, show an interest in what your children are learning in a non-threatening manner, express that you believe your children can learn in a sincere manner, and become involved at your children's school (National Education Website, 2007). A second website from NEA is geared towards parents of middle school students; however, many of the solutions it offers are applicable to high school parents as well. For instance, it states that parents should be prepared to have their children do homework every night, parents should ensure that the teacher's homework policy is understood, parents should be available while their children work on their homework, parents should be comfortable using other resources such as the guidance counselor or other students their children can study with, parents should stay in touch with their children's teachers, and that parents should encourage their children's interests both inside and outside of school (National Education Website, 2007).

There are several immediate, local, and national reasons that could influence the behaviors the students exhibit in the two classroom sites. This is a serious problem that not only affects these classrooms, but classrooms across the world. This is evident by the wide number of resources already available for teachers interested in overcoming this problem. It is the goal of these teacher researchers to determine how to best work around these reasons and inspire their students to self-motivate and put more effort into complex problems.

Reflections

Teacher Researcher A's Perspective

It is my personal belief that there are several characteristics of Site A that lend themselves to a lack of effort of complex problems. First, the immense size of Site A may be enough for some students to feel lost in the crowd, unimportant, and therefore they may be unwilling to put effort into anything. Also, failure to pass AYP for several years in a row shows that there are several low-achieving students at Site A. I would hypothesize that low-achieving students are less likely to put effort into complex problems. Next, a high truancy rate would also affect effort. Being truant would clearly increase gaps in student education, which would likely lead to a decrease in student effort.

Teacher Researcher B's Perspective

I feel that there are two characteristics of Site B that lend themselves to a lack of effort in solving complex problems. First, the Hispanic population may feel isolated from the rest of the students at Site B because they hold different educational and social values. Also, as in Site A, failure to pass AYP in the 2006-2007 school year shows that there are many low-achieving students at Site B. This could also lead to lowered effort on difficult problems.

CHAPTER 2
PROBLEM DOCUMENTATION

Problem Evidence

After conducting action research at Site A and Site B, the two teacher researchers have determined that there are several factors that influence how much effort their students put into complex problems. These factors are varied, including poor self-regulation and self-efficacy skills; environmental problems, whether in the classroom or at home; inadequate tasks given by instructors; and not finding the subject meaningful or interesting. Although there are many variables that affect our students' motivation and effort, several cannot be influenced by the teacher. Such variables include students' family life, socioeconomic background, parent involvement, or students' commitments outside of school. Therefore, the purpose of this research project is to identify and implement strategies, within our control, that help influence students' motivation and effort. Done correctly, these strategies will be transferred into new situations and will help students maintain high levels of effort and motivation even outside of our classrooms. One might ask, why is this research topic important? Increased effort and motivation have been found to correlate to increased academic achievement (Bembenutty, 2005). It is our hope that by increasing student motivation and effort on complex tasks, we will indirectly affect student achievement as well.

Two teacher researchers took part in this research project. Teacher Researcher A is a high school math teacher. Teacher Researcher B is a high school science teacher. Both teachers used a variety of methods to gather evidence, including a Pre-Intervention and Post-Intervention Student Survey, weekly Homework Checks, and weekly individual Bell-ringer Questions.

Pre-Intervention Survey

The purpose of the Pre-Intervention Survey was to gain insight into students' effort and motivation to complete complex problems. The survey was given to one math class at Site A and one science class at Site B. The surveys were distributed between the dates of September 11-12, 2008 and were collected the same day in class, ensuring a return rate of 100%. Students did not put their names on the survey. The survey contained four multiple choice questions and a space for any student comments. See Appendix A.

The survey started with asking students what strategies they use when working on homework. This was to gauge how much effort students put forth into assignments at home. The next question asked students to best describe how they reacted to a complex problem on their homework. Students were asked to give the best answer so that teacher researchers could analyze the pre-intervention effort that students put into complex problems at home. The third question asked students what they would do if they were confronted with a complex problem in a group. This was to see how students responded to the idea of effort within a group setting, prior to intervention. The last question asked students to consider what they would do when their teacher was going over a complex problem in class. This question was used to determine if students were using self-regulation skills before intervention.

Pre-Intervention Survey Results

A total of 38 students from Sites A and B took the Pre-Intervention Survey, which consisted of four questions. Students were first asked to indicate which strategies they currently use in order to finish their homework. The most popular response was to look at their notes or example problems done in class.  This represented 44% of the total responses for this question.

Relatively few students reported that they rely on an adult, like a parent or guardian to help them with homework. This represented only 13% of the total responses for this question.

Responses from Question 2 supported findings from Question 1, reasserting that students' primary strategy for attempting difficult problems was to look back at problems done in class. This represented 49% of the total responses for this question. However, the second most frequent response was that the student would simply skip the problem. This represented 21% of the total responses for this question.

Responses from Question 3 indicated that when students are asked to solve a difficult problem when in a group setting, the vast majority will work with the group to solve the problem, and not on his/her own. This represented 84% of the total responses for the question. The least frequent response was that the student would not include his or herself in the group and would skip the problem. No students chose this response.

Responses from Question 4 showed that when students cannot solve a complex problem that they will write down the strategy that the teacher gives them. This represented 48% of the total responses for this question. The second most common response was that students write down the errors they make on the problem and then use that strategy to solve the problem. This represented 29% of the total responses for this question. The third most common response was that students listen to what the teacher is saying and assumes they will remember it. This represented 21% of the total responses for this question.

Some items of note: on Question 1, one student chose not to answer the question. Also, on Question 2, five students gave more than one response, even though the directions asked them not to. Also, on Question 4, four students gave more than one response, even though the directions asked them not to.

Homework Check

The purpose of the Homework Check was to monitor student effort on complex problems attempted at home. Each week, one homework assignment was collected by the teacher researchers to collect data on student effort. Before each assignment was collected, teacher researches determined which complex problem they would check on the assignment. Apparent effort was checked on these problems. Data was recorded only on the appropriate Tally Sheet (see Appendix B), and was not placed on the students' papers. Students could receive a score of 0, 1, or 2 for effort. A score of "0" showed no effort on the problem. A score of "1" showed some effort on the problem, and a score of "2" showed multiple strategies used on the problem or one strategy used to completion. However, a score of "2+" was given to show the teacher researchers when students had also received the correct answer. By using the Homework Check teachers were able to see how much effort students put on work completed at home.

Pre-Intervention Homework Check Results

The Pre-Intervention period took place over the first four weeks of Site A and Bs' school year. After compiling both Site A and Site Bs' data, the total number of students whose homework was checked each week was recorded and an average homework effort score for the week was computed. The table below shows the number of students who received an effort score of 0, 1, 2, and 2+ for each week, as well as the average effort score for each week. The total number of students per week varied, as students were either absent or withdrew from the class.

*Table 8*. Average Homework Effort Scores During Pre-Intervention

| | Homework Effort Scores | | | | | |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
|---|---|---|---|---|---|---|
| Week 1 | 10 | 10 | 6 | 11 | 37 | 1.2 |
| Week 2 | 16 | 8 | 5 | 9 | 40 | 0.9 |
| Week 3 | 10 | 3 | 7 | 19 | 39 | 1.4 |
| Week 4 | 12 | 8 | 7 | 6 | 33 | 1.0 |

During the Pre-Intervention period students' effort on homework ranged between average scores of 0.9 and 1.4, all of which are classified as students putting forth "some effort" on the problems. The graph below shows the trend of average homework effort during the Pre-Intervention period.

*Graph 1*. Average Homework Effort Scores During Pre-Intervention
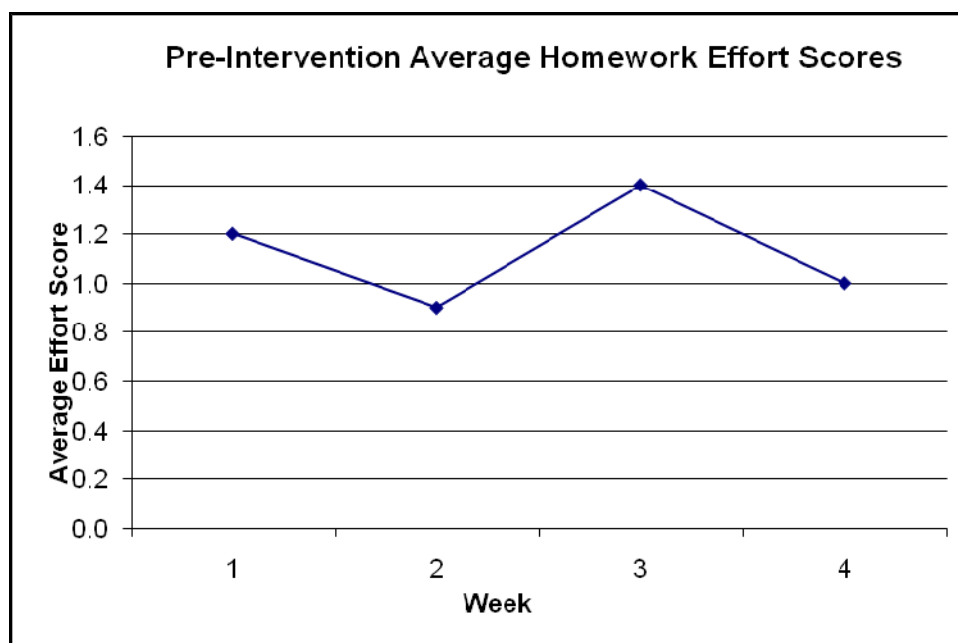


This graph shows that effort fluctuated each week. Effort was at its lowest during Week 2 and then peaked during Week 3.

Pre-Intervention Individual Bell-ringer Question

       A Bell-ringer Question is a short task that students are given either right after class begins or right before class ends. The purpose of the Bell-ringer Question was to monitor student effort on complex problems attempted in class. Each week, one Bell-ringer Question was collected by the teacher researchers to collect data on student effort. Apparent effort was checked on these problems. Data was recorded on the appropriate Tally Sheet (see Appendix C), and was not placed on the students' papers. Students could receive a score of 0, 1, or 2 for effort. A score of "0" showed no effort on the problem. A score of "1" showed some effort on the problem, and a score of "2" showed multiple strategies used on the problem or one strategy used to completion. However, a score of "2+" was given to show the teacher researchers when students had also received the correct answer. By using the individual Bell-ringer Question teacher researchers were able to see how much effort students put on work completed in class.

Pre-Intervention Individual Bell-ringer Question Results

       After compiling both Site A and Site B's data, the total number of students whose Bell-ringer Question was checked each week was recorded and an average Bell-ringer Question effort score for the week was computed. The table below shows the number of students who received an effort score of 0, 1, 2, and 2+ for each week, as well as the average effort score for each week. The total number of students per week varied, as students were either absent or withdrew from the class.

*Table 9*. <u>Average Bell-ringer Question Effort Scores During Pre-Intervention</u>

| | Bell-ringer Question Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 1 | 1 | 6 | 13 | 14 | 34 | 1.8 |
| Week 2 | 11 | 9 | 14 | 2 | 36 | 1.1 |
| Week 3 | 2 | 4 | 5 | 24 | 35 | 1.8 |
| Week 4 | 3 | 4 | 5 | 25 | 37 | 1.7 |

 Three of the four scores were comparable to an effort score of "2", which denotes high amount

of effort put forth on the problem. The graph below shows the trend of average Bell-ringer

Question effort during the Pre-Intervention period

*Graph 2*. <u>Average Bell-ringer Question Effort Scores During Pre-Intervention</u>
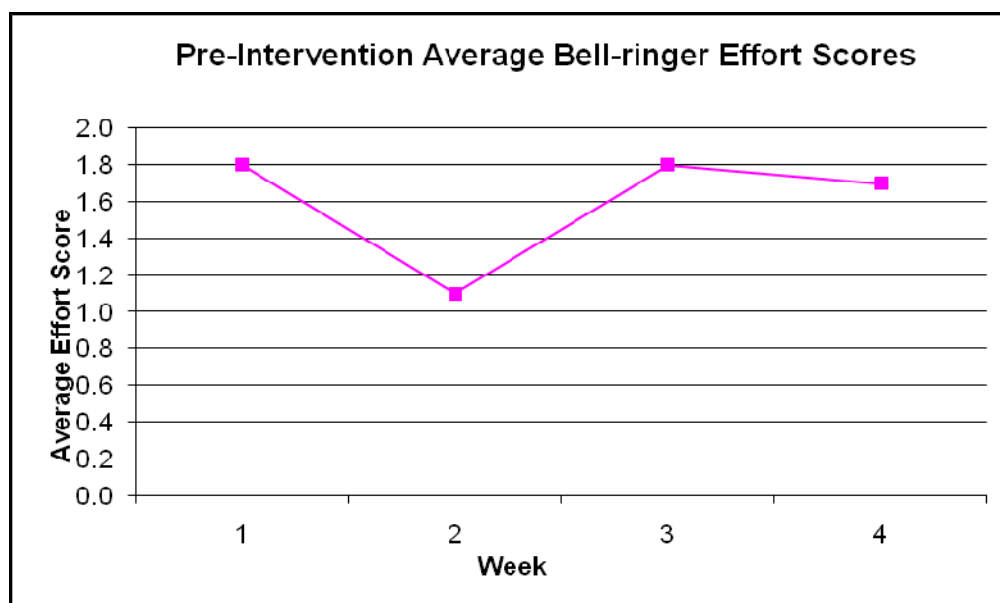


This graph shows that effort fluctuated each week but remained fairly consistent during Week 3

and Week 4. Effort was at its lowest during Week 2, which was also true of the Homework

Check effort scores.

Probable Causes

Before determining what solutions will help increase our students' effort, we first must understand the causes and context of the problem, as researched by professionals. To begin our research we began looking for causes of motivation decline, since motivation is so closely linked with effort. Each section will discuss a possible cause and research that backs this cause.

Value of Subject Matter

The value component of homework can be defined as the students' feelings on the importance of doing well in the subject, the student's intrinsic motivation for a particular subject, and the students' opinions on the overall benefits of the subject (Trautwein & Ludke, 433). After investigation, Trautwein and Ludke discovered that students put more effort into homework of subjects that they valued (p. 438). Coughlan-Mainard also examined motivation of students to complete classwork and homework. Two reasons students gave for completing these tasks was to make their parents happy and to be prepared for a job, showing that these subjects were of value in some way to students (Coughlan-Mainard, 2002). Another study found information concerning parents' values influencing student motivation. Tuckman (1998) found a positive relationship between motivation in college classrooms and parents' value of the subject. This study also found a positive relationship between students' value of the subject and motivation to do well (Tuckman, 1998).

Poor Environmental Fit

Poor environmental fit can have a significant influence on student effort on complex problems both in and outside of the classroom. When examining the changes from elementary students to secondary students, Athanasiou and Philippou (2006) found that the older students felt their teachers were less friendlier and promoted less cooperation and participation in

comparison to your students. Similarly, their studies showed that the younger students were given more effort and task motivational goals (as opposed to performance goals), and had more motivation for valuing mastery of a topic (Athanasiou and Philippou, 2006). Such changes in teacher behavior, classroom environment, and overall goal focus leads many students to a "poor person-environment fit," which helps explain the motivation decline as students enter the secondary grades (Athanasiou and Philippou, 2006, p. 87).

Poor environmental fit at home can also affect students' effort on complex problems. Hong, Milgram, and Rowell (2004) examined the different environments students could complete their homework in, including brightness of light, at a desk versus a less structured environment, type of music or no music, and by ones self or with a group. The researchers discovered that students prefer to work on homework in many different ways in many different environments. However, the overwhelming conclusion was that the surroundings that students work in "influence the degree to which the learner sustains the effort to successfully complete the homework tasks" (Hong, Milgram, & Rowell, 2004, p. 199). Specifically, the larger the difference between the environments students did homework in and their actual preferred environments, the less they were motivated to work, and the worse they did in actual achievement (Hong, Milgram, & Rowell, 2004). This suggests that manipulating students' homework environments could increase homework attitudes and make homework more meaningful for students (Hong, Milgram, & Rowell, 2004).

Clearly, environmental fit, both in and outside of the classroom can influence student effort on complex problems. Because an inadequate environment can so severely affect a student's motivation to complete homework or class work, effort can be severely damaged.

<u>Low Self-Efficacy</u>

Self-efficacy can be defined as the personal beliefs someone has about how well he or she is able to do a particular task (Bembenutty, 2005). Researchers have shown that students who identify themselves with academics are more motivated to succeed because their self-esteem is strongly impacted by their academic performance (Osborne & Rausch, 2001). Students with high self-efficacy tend to "choose difficult tasks, expend greater effort, persist longer, [and] use more complex learning strategies" compared to low-efficacy students (Jakubowski, 2004, p. 8). Therefore, self-efficacy has major implications on the amount of effort students put forth on complex tasks. Additionally, researchers have found a connection among several of the causes of student effort. Research has shown that students who are motivated to succeed have high self-efficacy skills, use self-regulatory strategies, and value of the subject, and success (Tuckman, 1998).

<u>Poor Self-Regulation Skills</u>

Self-regulation is defined as "a process that require[s] students to get proactively involved in their personal, behavioral, motivational, and cognitive learning endeavors in order to accomplish important and valuable academic goals" (Bembenutty, 2005, p. 3). In other words, self-regulation skills are the skills that students rely on to motivate them to put effort into their school work. Self-regulation involves phases before, during, and after learning has taken place. Skills such as goal setting, planning, determining strategies to be used, and reflection on their efforts are all part of how to self-regulate one's learning (Bembenutty, 2003). Zimmerman explains through his self-regulation cycle that the reflection takes place at the end of the cycle, and thus helps influence student goal-setting the next time they begin to self-regulate (as cited in Bembenutty, 2003). Bembenutty has also studied self-regulation in comparison to academic

delay of gratification. Students who have higher self-regulatory skills are able to delay gratification and continue to work harder and longer without an immediate result. His study confirmed that there is a positive relationship between academic delay of gratification and academic performance (Bembenutty, 2007). In another study, Bembenutty (2005) found that effort regulation, which is the intent to put in maximum effort on an assignment, self-efficacy beliefs; and intrinsic-motivation were predictors of academic success. Another aspect of self-regulation is task interpretation. Task interpretation is the skill of being able to determine what the goal of a task is. Task interpretation is one of the first steps of self-regulation, and without it, students can not successfully complete a task (Butler & Cartier, 2004). Students can not possibly know if they are motivated to put in effort on a problem or task if they do not understand the task. This is why it is such an important part of the self-regulation process, and has such serious implications to student motivation and effort (Butler & Cartier, 2004).

Procrastination

Another possible cause for lack of effort and achievement on complex problems is due to procrastination. Procrastination is defined as "purposely delaying the start or completion of a task to the point of experiencing discomfort" (Reasinger & Brownlow, 1996, p. 3). Procrastination is related to self-regulation because procrastinators tend to have trouble setting goals, which is one of the key first steps of self-regulation (Reasinger & Brownlow, 1996). Students tend to procrastinate because they are afraid of doing poorly on an assignment or because they are simply not motivated by a task, according to Reasinger & Brownlow, 1996. These researchers found that one predictor of procrastination is having an external attributional style, meaning that students who attribute failure or success to ability or luck, rather than effort are more likely to procrastinate (Reasinger & Brownlow, 1996). Procrastination is related to

personality of a student, but also his motivation for a particular topic. Thus, "what motivates students to perform and accomplish academic work in the first place is paramount to understanding whether they will procrastinate, why they will do so, and the types of reasons they will use to justify their procrastinatory behavior" (Reasinger & Brownlow, 1996, p. 5). Because procrastination is linked with motivation, it clearly impacts student effort and achievement on complex tasks.

Low Reading Skills

Students who struggle with reading may also exhibit low levels of effort on complex problems. Low reading skills may be fostered in middle school students because "instruction focuses on acquisition and proficiency of subject matter rather than acquisition and proficiency in reading" (Kozen, Murray, & Windell, 2006, p. 196). Thus, students may lack important skills needed for learning how to read when they reach high school. According to Margolis & McCabe (2004), the negative experiences that students with low reading skills have with homework also promote the belief that they cannot succeed on the homework. Margolis and McCabe (2004) also point out that struggling readers will only begin to believe in the possibility of success if they learn to connect their successes to their effort. This implies that even if a student has low reading skills, low effort levels may still be the cause of a student's inability to work on complex problems.

Conclusion

In light of the many possible causes of lack of effort, the teacher researchers believe they have the most influence over self-regulation skills of the students in their classrooms. It is not possible to attempt to fix all of the probable causes in this research project. Instead, the teacher

researchers will now examine possible solutions to best implement a positive change in student effort.

CHAPTER 3
THE SOLUTION STRATEGY

Literature Review

The two teacher researchers teach 9th-10th grade math and 11th grade science at high

school sites A and B. Their research problem is to determine how to increase student effort on

complex problems. After examining the many causes that lead to poor student effort, it was time

to investigate the possible solutions. Among the many ideas suggested in the research literature,

there were four clear solutions that professionals recommended: incorporating cooperative

learning groups, increasing student self-regulation, increasing student self-efficacy, and

improving students' reading skills.

The first strategy was to use cooperative learning groups in order to teach modeling and

increase motivation among students. DiPerna (2006) states that interpersonal skills, like those

developed in cooperative learning can be an academic enabler that can enhance classroom

instruction and therefore the development students' academic skills. The second solution which

the teacher researchers found applicable was to increase self-regulation in students by teaching

specific self-regulation strategies. Cleary and Zimmerman (2004) developed the Self-Regulation

Empowerment Program. This program motivates students to become self-regulated learners who

track their own progress and evaluate the effectiveness of the strategies they use. Students who

took part in the SREP increased their self-regulation and self-efficacy skills, as well as

motivation to learn.

Another possible solution was to increase self-efficacy skills in students. Bembenutty's

(2005) research suggests that self-regulation and self-efficacy strategies strongly impact

academic achievement. This suggests that these solutions not only increase motivation and effort,

but also have the side effect of increasing student achievement. In research conducted by

Chapman (2006), it was found that students who make connections between the content and their own life experiences are able to construct their own meaning in math word problems. Thus these students are more motivated to complete them.

Margolis and McCabe suggest "stack[ing] the deck for success" by giving assignments that are shortened and simplified, then advancing to work that is moderately challenging, but can be completed with effort (Margolis & McCabe, July 2004, p. 243). This solution seemed applicable because the more confidence a student has in his/her abilities, the more likely s/he is to put effort into the assigned task.

A last solution the teacher researchers found was to increase student effort and motivation by improving reading skills. Schunk and Zimmerman (2007) mention in their research that modeling can help increase student attitudes about reading. Changing student attitudes about reading is important if they are going to increase their effort on complex problems. Liang and Dole (2006) commented on "The Scaffolded Reading Experience" (SRE) in their research. In the SRE, students took part in pre-reading activities, during-reading, and post-reading activities, which helped students approach reading in several different ways (Liang & Dole, 2006). Students used art, reading to others, silent reading, discussion, and reteaching, which allowed the student to revisit the text several times (Liang & Dole, 2006). This engagement allowed students to comprehend the reading better. This was another applicable solution because it focused on students who struggle with completing complex problems due to their reading ability. If students become better readers, then they would be more confident in trying complex reading problems.

Although all of these solutions are applicable to the research topic, the two teacher researchers chose to focus on two different ideas. Using cooperative learning groups and

strategies and teaching self-regulation skills were solutions that many professionals suggested, and which the teacher researchers felt were lacking in their classrooms. Thus, the two solutions that were implemented in their classrooms were cooperative learning techniques and teaching self-regulation strategies.

<u>Cooperative Learning</u>

Cooperative learning can be defined as "an instructional model for teaching students how to learn together. It uses heterogeneous groups as a tool for creating a more cooperative classroom in which students' achievement, self-esteem, responsibility, high-level thinking, and favorable attitudes toward school increase dramatically" (Bellanca & Fogarty, 2003, p. 43). The teacher researchers have therefore chosen to use cooperative learning as a strategy because of its ability to improve higher-order thinking that is needed for solving complex problems. Moreover, "of all the classroom grouping strategies, cooperative learning may be the most flexible and powerful" (Marzano, Pickering, & Pollock, 2001, p.91).

Before cooperative learning can occur however, the teacher must carefully determine how to group his or her students, and must teach social skills to ensure that the strategy will work effectively. According to Bellanca and Fogarty, most cooperative groups consist of two to five students who differ on one or more of the following characteristics: gender, race, ability or skill level, and motivation (p. 43). After the teacher has divided the students into groups, the teacher should formally teach social skills to ensure that cooperative learning with be successful. The teacher researchers decided to use a T-chart with their students to discuss what cooperative learning should look and sound like.

Self-Regulation

Because research shows that students who lack motivation and do not put effort into homework are lacking in self-regulation skills, one possible solution to the problem is to teach self-regulation skills. The research points out that there are many aspects of self-regulation. One of the first steps to successful self-regulation for a student is task-interpretation. If students do not decipher a task correctly, then they may not choose the correct strategies that will help them to accomplish the task (Butler & Cartier, 2004). "[S]tudents' interpretation of tasks drives their planning…the strategies they select and implement, and the criteria against which they judge their performance during monitoring and self-evaluation. Therefore, if task interpretation is absent or faulty, learning is derailed" (Butler & Cartier, 2004, p. 1735).

Another aspect of self-regulation is goal-setting. Students should set specific goals that correspond to performance standards and create long term goals that are broken down into short-term attainable goals. These goals should be moderately difficult and should be set by the student as opposed to the teacher (Schunk, 2001).

Although task-interpretation and goal-setting are very important, the teacher researchers decided to focus specifically on the self-regulation strategy of self-recording, which is a specific type of reflection. One way students can self-record is by using a Strategy Journal. Strategy Journals are used to write down problems that give students trouble and then strategies that the students found useful to solving that specific problem (Butler, Beckingham, & Lauscher, 2005). Strategy Journals can be used over time to compile specific strategies that help the students solve complex problems. They also help students transfer ideas to similar types of problems, as found by Butler, Beckingham, and Lauscher (2005) in their research. Paris suggests that by modeling these self-regulation strategies, students will be encouraged to become more aware of their

thinking and use strategies for learning, studying, controlling emotions, attaining goals, and ultimately sustaining motivation (2003). These researchers also found that by using the journal, students' strategies became more sophisticated over time and "connected better to task demands," showing a clear improvement in self-regulation skills (Butler, Beckingham, & Lauscher, 2005, p. 165). Self-recording techniques are useful to students because they help students keep track of what they are learning and what strategies work well for them. As students become aware of these ideas they are becoming more self-regulated learners, and thus, have the skills to put forth effort into complex problems.

<center>Project Objectives</center>

As a result of using cooperative learning strategies and teaching self-recording skills, during the period of August 2008 through November 2008, the students of Teacher Researchers A and B were to be exposed to different teaching methods and strategies that would motivate them to increase their effort on complex tasks. While several solutions to increase student effort and motivation were suggested in the research, Teacher Researchers A and B chose to focus specifically on cooperative learning strategies and self-recording techniques. Through these techniques, students were to be exposed to a variety of different strategies which would help to motivate them, teach them ways to self-regulate, and improve their own learning. Although the teacher researchers cannot control how students do homework, they felt that the skills taught in class would transfer to activities outside of the classroom and increase homework effort as well. Through these strategies, students would learn to become more independent and effective self-regulated learners.

Processing Statements

The teacher researchers developed a Pre-Intervention Student Survey for students to complete. This Student Survey asked students to consider their effort on difficult problems at home versus in a group. Teacher researchers also prepared weekly Homework Checks and Bell-ringer activities for students to complete. Each of these items contained at least one complex problem that teacher researchers graded for effort. Effort was graded using an Effort Rubric that teacher researchers created. Teacher researchers collected data by using their effort Tally Sheets.

During intervention, teacher researchers had to carefully select heterogeneous cooperative learning groups for students. To help students increase self-recording strategies, teacher researchers created a template that students could use for their Strategy Journal.

In preparing for the Post-Intervention period, teacher researchers prepared a Post-Intervention Survey (see Appendix A) that was identical to the previously administered Pre-Intervention Survey.

Project Action Plan

1. Prior Documentation (August 13-15, 2008).
   - Each teacher researcher will copy and assemble their parent consent forms.
   - Each teacher researcher will copy and assemble their student assent forms.
   - Each teacher researcher will copy and assemble their Student Survey.
   - Each teacher researcher will distribute parent consent forms on August 13, 2008 for students to take home for parent signature and completion.
   - Each teacher researcher will hand out and collect student assent forms from August 14-15, 2008 after the student has brought in the signed parent consent form.
   - Each teacher researcher will keep their signed parent consent forms and student assent forms in a locked file cabinet in her office.
   - Teacher researchers will gather any necessary materials for planned interventions.
2. Pre-Intervention Documentation
   a. Week 1 (August 18-22, 2008)
      i. Teacher researchers will begin using normal teaching methods such as lecture, direct questioning, and classroom discussion.
      ii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.
      iii. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be

graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

b. Week 2 (August 25-29, 2008)
   i. Teacher researchers will continue using normal teaching methods such as lecture, direct questioning, and classroom discussion.
   ii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.
   iii. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

c. Week 3 (September 1-5, 2008)
   i. Teacher researchers will continue using normal teaching methods such as lecture, direct questioning, and classroom discussion.
   ii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.
   iii. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

d. Week 4 (September 8-12, 2008)
   i. Teacher researchers will continue classroom teaching through normal teaching methods such as lecture, direct questioning, and classroom discussion.
   ii. Teacher researchers will pass out and administer the Student Survey (pre-intervention) on September 11th or 12th. They will be collected during class on that same day.
   iii. Each teacher researcher will keep her Student Surveys in a locked file cabinet in her office. Only the teacher researchers will be able to access the surveys.
   iv. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.
   v. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

3. Intervention
   a. Week 5 (September 15-19, 2008)
      i. The teacher researchers will place students into heterogeneous groups based on student test scores. Teachers will begin modeling cooperative learning.
      ii. The teacher researchers will also model self-recording strategies. Teachers will have students keep a Strategy Journal in class.
      iii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.
      iv. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be

graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

    v. The teacher researchers will analyze the Student pre-intervention Surveys and pre-intervention Effort Rubrics from the individual Bell-ringer Questions and Homework Checks. This information will be added to Chapter Two of the research paper at this time.

b. Week 6 (September 22-26, 2008)

    i. The teacher researchers will continue modeling cooperative learning methods.

    ii. The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

    iii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

    iv. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

c. Week 7 (September 29-October 3, 2008)

    i. The teacher researchers will continue modeling cooperative learning methods.

    ii. The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

    iii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

    iv. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

d. Week 8 (October 6-10, 2008)

    i. The teacher researchers will continue modeling cooperative learning methods.

    ii. The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

    iii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

    iv. Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

e. Week 9 (October 13-17, 2008)

    i. The teacher researchers will continue modeling cooperative learning methods.

    ii. The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

    iii. Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

        iv.  Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

  f.  Week 10 (October 20-24, 2008)

        i.  The teacher researchers will continue modeling cooperative learning methods.

        ii.  The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

        iii.  Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

        iv.  Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

  g.  Week 11 (October 27-31, 2008)

        i.  The teacher researchers will continue modeling cooperative learning methods.

        ii.  The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

        iii.  Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

        iv.  Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

  h.  Week 12 (November 3-7, 2008)

        i.  The teacher researchers will continue modeling cooperative learning methods.

        ii.  The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

        iii.  Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

        iv.  Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.

  i.  Week 13 (November 10-14, 2008)

        i.  The teacher researchers will continue modeling cooperative learning methods.

        ii.  The teacher researchers will continue modeling self-recording strategies. Teachers will have students keep a Strategy Journal in class.

        iii.  Teacher researchers will have students individually complete a Bell-ringer Question once a week. It will be collected and graded using the Effort Rubric, and the results recorded on the Tally Sheet.

        iv.  Teacher researchers will conduct a Homework Check on one homework assignment per week. One complex problem on this assignment will be

> graded using the Effort Rubric, and the results will be recorded on the Tally Sheet.
> v. Teachers will copy the Student Post- Intervention Surveys in preparation for the completion of the Intervention period.

4. Post-Intervention
    a. Week 14 (November 17-21, 2008)
        i. Teacher researchers will pass out and administer Post-Intervention Student Surveys on November 17th or 18th. They will collect the surveys on the same day within class.
        ii. Each teacher researcher will keep her Student Surveys in a locked file cabinet in her office. Only the teacher researchers will be able to access the surveys.
    b. Week 15 (November 24-28, 2008)
        i. Teacher researchers will compare results of Post-Intervention Student Surveys to Pre-Intervention Student Surveys.
        ii. Teacher researchers will analyze data collected from Post-Intervention Student Surveys and Post-Intervention Effort Rubrics of the Bell-ringer Questions and Homework Checks.
    c. May 7, 2009
        i. All data and consent/assent forms will be destroyed.

## Methods of Assessment

The research team surveyed their students twice so that they could compare students' effort and motivation prior to and after the intervention. After the teacher researchers taught their students how to work in cooperative groups and how to self-regulate their learning, the teacher researchers administered the Post-Intervention Student Survey on November 17-18 to the same two classes that initially took the Pre-Intervention Student Survey. This survey was distributed to approximately 38 students by both members of the action research team. The teacher researchers ensured that the Student Surveys were anonymous by having the students turn in the surveys without their names on them.

The teacher researchers conducted a Homework Check once a week prior to the Intervention period and during the Intervention period. The teacher researchers graded one complex problem using the Effort Rubric and recorded scores on the appropriate Tally Sheet. No score was placed on the homework assignment, which was then passed back to the student. This

was done in order to determine if student effort improved on work completed at home as a result of the intervention strategies.

The teacher researchers also conducted a Bell-ringer Question every week prior to the Intervention period and during the Intervention period. The teacher researchers graded the Bell-ringer Question using the Effort Rubric and recorded scores on the appropriate Tally Sheet. No score was placed on the Bell-ringer Question, which was then passed back to the student. This was done in order to determine if student effort improved on class work as a result of the intervention strategies.

CHAPTER 4
ANALYSIS AND CONCLUSIONS

Historical Description of the Intervention

The ultimate goal of this research project was to implement cooperative learning and self-recording strategies in an attempt to improve students' effort on complex problems. Through these techniques, students were exposed to strategies which helped to motivate them, teach them ways to self-regulate, and improve their own learning. Overall, the teacher researchers hoped that students would learn to become more independent and effective self-regulated learners in their math and science classes.

The action plan that the teacher researchers used was relatively simple. The first four weeks were designated as the Pre-Intervention period. The students took a Pre-Intervention Survey and had one Homework Check and one Bell-ringer Question per week. All lectures and work were done with students in rows. After the first four weeks, the teacher researchers began the Intervention phase for a total of nine weeks (Weeks 5-13). During the Intervention period students were moved into cooperative learning groups and began to use a Strategy Journal. In their cooperative learning groups, students completed group work and had to learn to effectively communicate with each other. Students helped each other with lecture notes and during homework time. Students also reflected as a group on how to complete complex problems together. The Strategy Journal was used frequently during the week to help students track successful strategies that they learned in class. Students would be prompted to write down the difficult problem in the journal and then monitor how they would successfully solve this problem in the future. Students were encouraged to keep the Strategy Journal out during class and to refer back to it while completing other complex problems. The teacher researchers continued the once-weekly Homework Check and Bell-ringer Question. Starting with Week 14, teacher researchers

began the Post-Intervention period. Students were moved out of their cooperative learning groups and back into rows. They no longer used the Strategy Journal in class. Students took a Post-Intervention Survey and continued to have their once weekly Homework Check and Bell-ringer Question. The Post-Intervention period lasted three weeks (Weeks 14-16).

Teacher researchers attempted to stay with the original action research plan and there were no notable variations from the original schedule.

## Presentation and Analysis of Results

Pre- and Post-Intervention Survey Changes

A total of 36 students from Sites A and B took the Post-Intervention Survey. Two students of the original 38 students who took the Pre-Intervention Survey changed classes, thereby decreasing the total number of students participating in the research project. The Post-Intervention Survey consisted of the same four questions as the Pre-Intervention Survey in order to better show a change in attitude of the students. Students were first asked to indicate which strategies they currently use in order to finish their homework. The most popular response for the Post-Intervention Survey was to look at their notes or example problems done in class. This represented 44% of the total responses for this question, which was the same percent as the Pre-Intervention Survey. Relatively few students reported that they rely on an adult, like a parent or guardian to help them with homework. This represented only eight percent of the total responses for this question on the Post-Intervention Survey, which was a decrease in five percentage points compared to the Pre-Intervention Survey. Complete listings of percentage of student responses on both the Pre- and Post-Intervention Surveys can be seen in Appendix D.

Responses from Question 2 supported findings from Question 1, reasserting that students' primary strategy for attempting difficult problems is to look back at problems done in class. This

represented 43% of the total responses for this question, which was a decrease in six percentage points compared to the Pre-Intervention Survey. The second most frequent response on the Post-Intervention Survey was that the student would simply skip the problem. This represented 30% of the total responses for this question, which was an increase in nine percentage points compared to the Pre-Intervention Survey.

Responses from Question 3 indicated that when students are asked to solve a difficult problem when in a group setting, the vast majority will work with the group to solve the problem, and not on his/her own. This represented 83% of the total responses for the question, which was a decrease in one percentage point compared to the Pre-Intervention Survey. The least frequent response on the Post-Intervention Survey was that the student would not include his or herself in the group and would skip the problem. No one chose this response just as in the Pre-Intervention Survey.

Responses from Question 4 suggested that when students cannot solve a complex problem that they will write down the strategy that the teacher gives them. This represented 44% of the total responses for this question, which was a 4% drop compared to the Pre-Intervention Survey. The second most common response on the Post-Intervention Survey was that students listened to what the teacher was saying and assumed they will remember it. This represented 23% of the total responses for this question which is an increase in two percentage points compared to the Pre-Intervention Survey. Originally, on the Pre-Intervention Survey, the second most common response was that students write down the errors they make on the problem and then use that strategy to solve the problem. That represented 29% of the total responses for this question, which decreased to 21% in the Post-Intervention Survey. Also, Post-Intervention Survey results show that more students (13%) will write down the error they made when trying

to solve a complex problem, an increase of 11% from the Pre-Intervention Survey. Fewer students on the Post-Intervention Survey indicated that they would write down the error they made on the problem and a helpful strategy in their notes that could be used to solve that problem, a decrease of eight percent from the Pre-Intervention Survey.

Some items of note: on Question 2 in the Post-Intervention Survey, one student chose two responses even though the directions asked them not to. Also, on Question 4, one student chose two responses and one student chose three responses even though the directions asked them not to.

Pre-, During and Post-Intervention Homework Check Changes

The Pre-Intervention period took place over the first four weeks, the Intervention period took place over the next nine weeks, and the Post-Intervention period took place over the last three weeks. After compiling both Site A and Site Bs' data, the total number of students whose homework was checked each week was recorded and an average homework effort score for the week was computed. The tables below show the number of students who received an effort score of 0, 1, 2, and 2+ for each week, as well as the average effort score for each week. The total number of students per week varies, as students were either absent or withdrew from the class.

*Table 10*. Average Homework Effort Scores During Pre-Intervention

|  | Homework Effort Scores | | | | | |
|---|---|---|---|---|---|---|
|  | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 1 | 10 | 10 | 6 | 11 | 37 | 1.2 |
| Week 2 | 16 | 8 | 5 | 9 | 40 | 0.9 |
| Week 3 | 10 | 3 | 7 | 19 | 39 | 1.4 |
| Week 4 | 12 | 8 | 7 | 6 | 33 | 1.0 |

Table 10 shows that effort scores fluctuated during the Pre-Intervention phase of the research project.

*Table 11*. Average Homework Effort Scores During Intervention

| | Homework Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 5 | 6 | 4 | 12 | 14 | 36 | 1.6 |
| Week 6 | 11 | 7 | 14 | 4 | 36 | 1.2 |
| Week 7 | 2 | 4 | 10 | 17 | 33 | 1.8 |
| Week 8 | 5 | 6 | 15 | 8 | 34 | 1.5 |
| Week 9 | 6 | 1 | 11 | 13 | 31 | 1.6 |
| Week 10 | 2 | 2 | 12 | 16 | 32 | 1.8 |
| Week 11 | 3 | 2 | 10 | 16 | 31 | 1.7 |
| Week 12 | 4 | 2 | 7 | 15 | 28 | 1.6 |
| Week 13 | 5 | 7 | 9 | 7 | 28 | 1.4 |

Table 11 shows that average homework effort scores increased during the Intervention period of

the research project in comparison to the Pre-Intervention period.

*Table 12*. Average Homework Effort Scores During Post-Intervention

| | Homework Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 14 | 5 | 0 | 18 | 12 | 35 | 1.7 |
| Week 15 | 4 | 2 | 15 | 10 | 31 | 1.7 |
| Week 16 | 5 | 0 | 19 | 7 | 31 | 1.7 |

Table 12 shows that the average homework effort scores remained constant throughout the Post-

Intervention period. These scores were still elevated compared to the Pre-Intervention period.

Pre-Intervention data showed that students' effort on homework ranged between average

scores of 0.9 and 1.4, all of which are classified as students putting forth "some effort" on the

problems. The graph below shows the trend of average homework effort during the Pre-

Intervention period.

*Graph 3*. <u>Average Homework Effort Scores During Pre-Intervention</u>
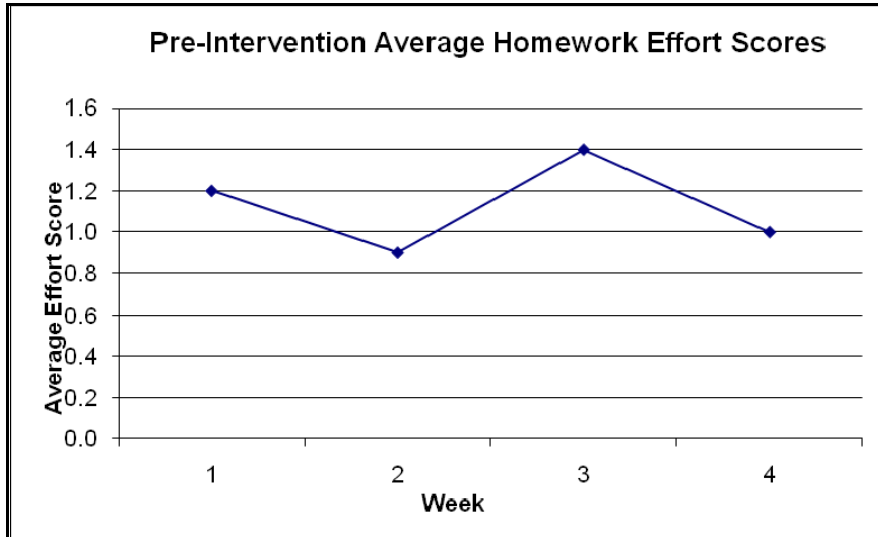


This graph shows that effort fluctuated each week. Effort was at its lowest during Week 2 and then peaked during Week 3.

Intervention data showed that students' effort on homework ranged between average scores of 1.2 and 1.8. This represents an increase in average effort scores compared to the Pre-Intervention data.
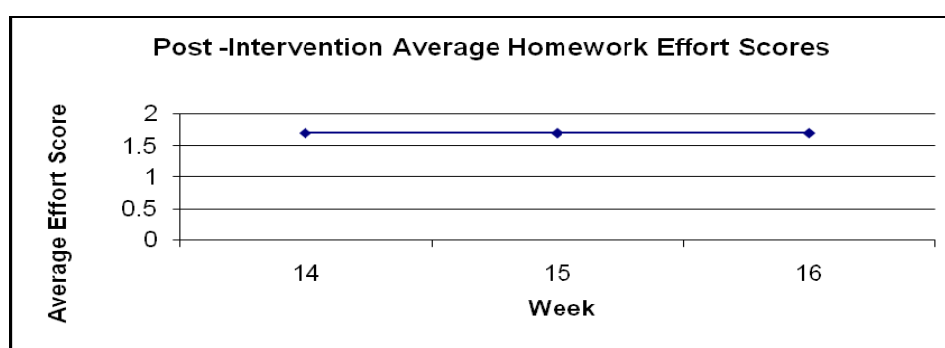
*Graph 4*. <u>Average Homework Effort Scores During Intervention</u>
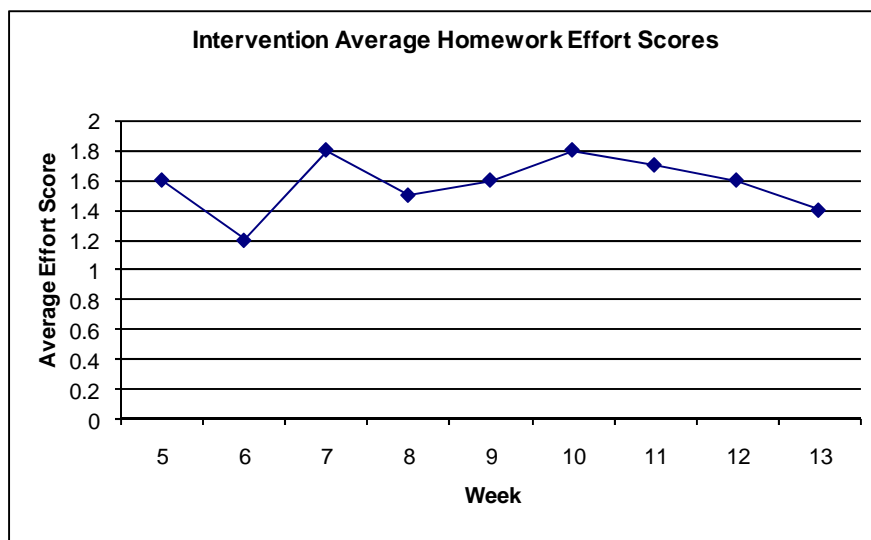
This graph shows that effort fluctuated each week but remained fairly consistent during Week 9 through Week 12. Effort was at its lowest during Week 6 and then peaked during Week 7 and Week 10.

Post-Intervention data showed that students' effort on homework remained constant at 1.7, which is classified as students putting forth "some effort" on the problems. The graph below shows the trend of average homework effort during the Post-Intervention period.

*Graph 5*. Average Homework Effort Scores During Post-Intervention



This graph shows that average effort scores remained constant during weeks 14 through 16. These values are still elevated compared to Pre-Intervention results.

Overall, Pre-Intervention results for the Homework Check showed average effort scores between 0.9 and 1.4. Over the course of the Intervention period, average effort scores rose to a maximum of 1.8 and had a minimum of 1.2. During the Post-Intervention period, average effort scores remained constant at 1.7, showing an overall increase in effort scores compared to the Pre-Intervention period.

Pre-, During and Post-Intervention Individual Bell-ringer Question Changes

After compiling both Site A and Site B's data, the total number of students whose Bell-ringer Question was checked each week was recorded and an average Bell-ringer Question effort score for the week was computed. The tables below show the number of students who received

an effort score of 0, 1, 2, and 2+ for each week, as well as the average effort score for each week.

The total number of students per week varies, as students were either absent or withdrew from

the class.

*Table 13*. Average Bell-ringer Question Effort Scores During Pre-Intervention

| | Bell-ringer Question Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 1 | 1 | 6 | 13 | 14 | 34 | 1.8 |
| Week 2 | 11 | 9 | 14 | 2 | 36 | 1.1 |
| Week 3 | 2 | 4 | 5 | 24 | 35 | 1.8 |
| Week 4 | 3 | 4 | 5 | 25 | 37 | 1.7 |

Teacher researchers noticed that Bell-ringer Question effort scores were higher than Homework

effort scores. Three of the four scores were comparable to an effort score of "2", which denotes

high amount of effort put forth on the problem.

*Table 14*. Average Bell-ringer Question Effort Scores During Intervention

| | Bell-ringer Question Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 5 | 4 | 4 | 18 | 10 | 36 | 1.7 |
| Week 6 | 0 | 9 | 14 | 11 | 34 | 1.7 |
| Week 7 | 4 | 5 | 18 | 9 | 36 | 1.6 |
| Week 8 | 1 | 6 | 18 | 10 | 35 | 1.8 |
| Week 9 | 0 | 1 | 23 | 9 | 33 | 2.0 |
| Week 10 | 1 | 2 | 7 | 22 | 32 | 1.9 |
| Week 11 | 1 | 0 | 13 | 18 | 32 | 1.9 |
| Week 12 | 0 | 3 | 21 | 11 | 35 | 1.9 |
| Week 13 | 2 | 0 | 16 | 15 | 33 | 1.9 |

Table 14 shows that average Bell-ringer Question effort scores rose slightly during the

Intervention period of the research project in comparison to the Pre-Intervention period.

*Table 15*. <u>Average Bell-ringer Question Effort Scores During Post-Intervention</u>

| | Bell-ringer Question Effort Scores | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 0 | 1 | 2 | 2+ | Total Students | Average Effort Score |
| Week 14 | 2 | 4 | 20 | 10 | 36 | 1.8 |
| Week 15 | 1 | 0 | 6 | 26 | 33 | 1.9 |
| Week 16 | 4 | 6 | 10 | 15 | 35 | 1.6 |

Table 15 shows that the average Bell-ringer scores slightly fluctuated during the Post-Intervention period. These scores were similar to the Pre-Intervention period.

Pre-Intervention data showed that students' effort on the Bell-ringer questions ranged between average scores of 1.1 and 1.8, all of which are classified as students putting forth "some effort" on the problems. The graph below shows the trend of average Bell-ringer Question effort during the Pre-Intervention period.

*Graph 6*. <u>Average Bell-ringer Question Effort Scores During Pre-Intervention</u>
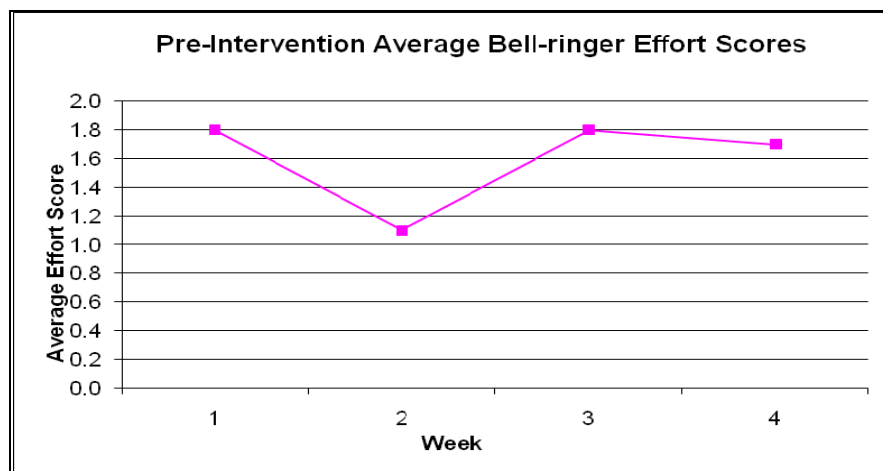


This graph shows that effort fluctuated each week during the four week period. Effort was at its lowest during Week 2, which was also true of the Homework effort scores, and then rebounded during Week 3 and stayed relatively constant during Week 3 and 4.

Intervention data showed that students' effort on the Bell-ringer question ranged between average scores of 1.6 and 2.0. This represents a slight increase in average effort scores compared to the Pre-Intervention data.

*Graph 7*. Average Bell-ringer Question Effort Scores During Intervention
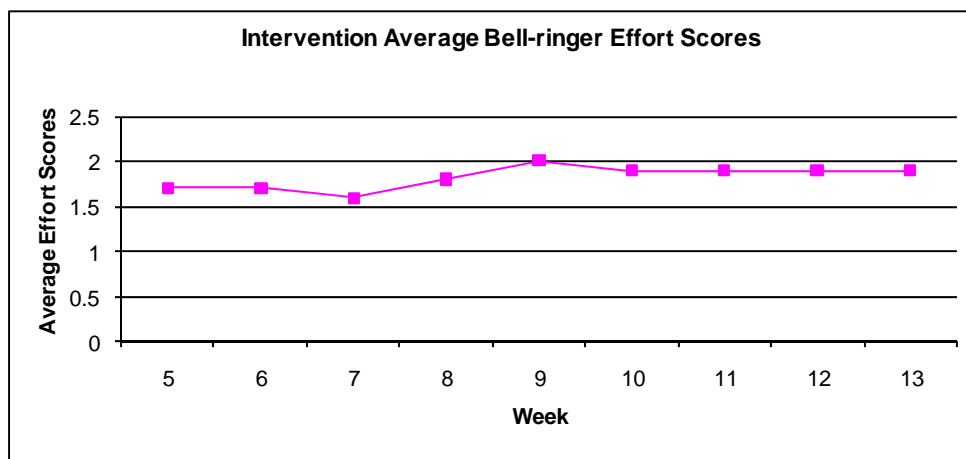


This graph shows that average effort scores remained fairly consistent during Weeks 5 through 7 and then again during Week 9 through Week 13. Effort was at its lowest during week seven and then peaked during week nine.

Post-Intervention data showed that students' effort on the Bell-ringer question varied between scores of 1.6 and 1.9, which is classified as students putting forth "some effort" on the problems. The graph below shows the trend of average Bell-ringer Question effort during the Post-Intervention period.

*Graph 8*. <u>Average Bell-ringer Question Effort Scores During Post-Intervention</u>
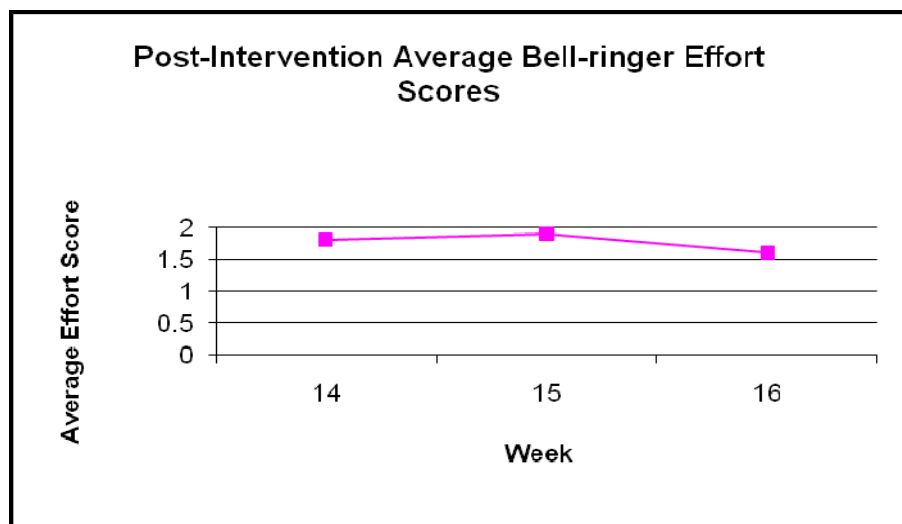


This graph shows that average effort scores fluctuated during Week 14 through Week 16. These values are similar to Pre-Intervention results.

Overall, Pre-Intervention results for the Bell-ringer question showed average effort scores between 1.1 and 1.8. Over the course of the Intervention period, average effort scores rose to a maximum of 2.0 and had a minimum of 1.6. During the Post-Intervention period, average effort scores fluctuated between 1.6 and 1.9, showing an overall increase during the Intervention period that leveled off during the Post-Intervention period.

<div align="center">Conclusions and Recommendations</div>

The ultimate goal of this research project was to implement cooperative learning and self-recording strategies in an attempt to improve students' effort on complex problems in math and science classes. Teacher researchers used three tools to collect data: a Pre/Post Intervention Survey, a weekly Homework Check, and a weekly Bell-ringer Question. The Pre/Post Intervention Surveys were identical surveys consisting of four questions and were given once during the Pre-Intervention period and once during the Post-Intervention period. Effort scores on the Homework Check and Bell-ringer Question were recorded using the Effort Rubric and then

averaged to show a weekly effort score. These scores were then compared to see what, if any, changes existed between the Pre-Intervention, Intervention, and Post-Intervention periods.

The results of the Pre- and Post- Intervention Surveys showed both positive and negative behavior changes in students. On Question 1 of both Pre- and Post- Intervention Surveys, the same percentage of students indicated that their primary method of finishing their homework was to look back at notes or example problems. However, more students responded that they would skip a problem if they did not understand it after intervention had taken place, which seems to indicate that the interventions of cooperative learning and Strategy Journal did not improve effort on complex problems. However, in both Pre- and Post- Intervention Surveys students indicated that working with a group to solve a complex problem was their method of choice. This shows that students continued to prefer cooperative learning strategies when completing complex problems. Also, Post-Intervention Survey results show that more students would write down the error they made when trying to solve a complex problem. This is a positive change as a result of the intervention strategies. However, on the same question, fewer students responded that they would both write down the error and the strategy that could be used to fix the error. This appears to show that the students did not perceive that both writing down the error and the helpful strategy were important, which the teacher researchers had hoped to achieve with the Strategy Journal.

Overall, the student responses to the Pre- and Post- Intervention Surveys indicated some positive changes in behavior, such as more students recording that they would write down errors they made. However, there were also some negative changes, with more students reporting that they were likely to skip a complex problem.

Examining the Homework Check data showed a slight increase in effort scores from the beginning of the Pre-Intervention period to the end of the Post-Intervention period. The Post-Intervention effort scores were 0.3 higher than the highest average effort score in the Pre-Intervention period. Also, effort scores remained elevated and constant at 1.7 during the Post-Intervention period. This suggests that the strategies used during the Intervention period had lasting effects.

Finally, in examining the Bell-ringer Question data, the teacher researchers saw that effort on the daily Bell-ringer Question did increase slightly. This was especially evident during the Intervention period, when scores reached a maximum value of 2.0 and maintained a 1.9 average effort score for a total of four weeks straight. The effort scores did decline slightly during the Post-Intervention period, but did not dip lower than the original Pre-Intervention scores. Thus, the data revealed that the Strategy Journal and cooperative learning strategies used did not decrease student effort.

The average effort scores from the Homework Check and Bell-ringer Question suggest that the cooperative learning strategies and Strategy Journal used by the teacher researchers did have a positive effect upon student effort on complex problems in the math and science classroom. However, the teacher researchers recommend using these two strategies in their classrooms for a longer period of time in order to fully determine how successful each of these strategies is in increasing effort among students. Perhaps using one strategy at a time, as opposed to both, would provide insight into what increased the effort scores on the Homework Check and Bell-ringer Question.

Reflections

Teacher Researcher A

Teacher Researcher A initially expected to find a greater effort score for the Bell-ringer activities than for the Homework Check. Teacher Researcher A felt this way because she felt students were more likely to put effort into an activity when there was a teacher present to monitor their progress. Although there were not large differences between the effort scores of the Bell-ringer and Homework Check, Teacher Researcher A's initial hypothesis was accurate.

Teacher Researcher A was surprised that even in the Post-intervention period, students' effort scores were still slightly elevated from their Pre-intervention levels. This showed Teacher Researcher A that the research she had done was truly valid and had made a difference in student effort.

Ultimately, Teacher Researcher A learned that her students were capable of showing more effort on complex problems and that using different strategies did help students to reach their potential. The overall classroom environment improved because students learned how to work together. Teacher Researcher A was optimistic that if the strategies used during the Intervention period were continued, that the class would continue to excel.

Teacher Researcher B

Teacher Researcher B originally believed that student effort on complex problems would improve on both Bell-ringer and Homework Checks. She was surprised to see that the effort scores on the Bell-ringer questions were slightly elevated compared to the Homework Check scores. She learned that students were more motivated to complete the complex problems when they were in the presence of their peers because they liked to have a friendly competition to see who got the question correct.

Teacher Researcher B learned that her classroom environment could be positively influenced by cooperative learning and the use of the Strategy Journal. Students would refer back to their journals without prompting during the Post-Intervention period. Overall, the research project was a positive experience for both Teacher Researcher B and her students because both learned valuable lessons from it.

Combined Reflection

Teacher researchers A and B learned a lot from this action research project. They discovered that their students could put forth more effort on complex problems with a few simple changes to the classroom routine. These positive side effects even carried over into the Post-Intervention period.

Teacher researchers A and B enjoyed working together and learning how to implement new teaching strategies together. They also enjoyed learning how to create and implement an action research plan.

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APPENDIXES

APPENDIX A

**Pre-Student Survey**

As you have been previously notified in the student assent form, a group of teachers are conducting a research study in order to determine how to improve student effort on complex problems. We would appreciate you filling out this survey. Please answer all questions honestly because all research is confidential and anonymous. Please do not write your name on this survey.

1. Which of the following strategies do you currently use in order to finish your homework? <u>Circle all that apply.</u>

    a. I ask a friend for help.
    b. I ask a parent/guardian for help.
    c. I ask the teacher for help.
    d. I look back at my notes or example problems done in class.

2. If you are working on your homework and come across a difficult problem, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

    a. I would skip the problem.
    b. I would ask someone else to help me with the problem.
    c. I would look back at my notes from class and then reattempt the problem.
    d. I would try to create my own way of solving the problem.

3. If you were working on a difficult problem with a group, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

    a. I would not include myself in the group and would skip the problem.
    b. I would work with my group members to solve the problem.
    c. I would try to work on the problem myself without my group's help.
    d. I would not include myself in the group and would ask the teacher for help.

4. If the teacher reviews how to do a complex problem that you were unable to solve, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

    a. I listen to what he or she is saying and assume I will remember it.
    b. I write down the strategy in my notes.
    c. I write down the error I made when trying to solve the problem.
    d. I write down the error I made on the problem and then the strategy that can be used to solve the problem.

5. Any other comments?

Thank you for your time and input!

**Post-Student Survey**

As you have been previously notified in the student assent form, a group of teachers are conducting a research study in order to determine how to improve student effort on complex problems. We would appreciate you filling out this survey. Please answer all questions honestly because all research is confidential and anonymous. Please do not write your name on this survey.

1. Which of the following strategies do you currently use in order to finish your homework? <u>Circle all that apply.</u>

   a. I ask a friend for help.
   b. I ask a parent/guardian for help.
   c. I ask the teacher for help.
   d. I look back at my notes or example problems done in class.

2. If you are working on your homework and come across a difficult problem, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

   a. I would skip the problem.
   b. I would ask someone else to help me with the problem.
   c. I would look back at my notes from class and then reattempt the problem.
   d. I would try to create my own way of solving the problem.

3. If you were working on a difficult problem with a group, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

   a. I would not include myself in the group and would skip the problem.
   b. I would work with my group members to solve the problem.
   c. I would try to work on the problem myself without my group's help.
   d. I would not include myself in the group and would ask the teacher for help.

4. If the teacher reviews how to do a complex problem that you were unable to solve, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

   a. I listen to what he or she is saying and assume I will remember it.
   b. I write down the strategy in my notes.
   c. I write down the error I made when trying to solve the problem.
   d. I write down the error I made on the problem and then the strategy that can be used to solve the problem.

5. Any other comments?

Thank you for your time and input!

APPENDIX B

**HOMEWORK CHECK---PRE-INTERVENTION Tally Sheet**

|  | **0** | **1** | **2** | **2+** |
|---|---|---|---|---|
| **WEEK 1** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 2** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 3** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 4** | ☐ | ☐ | ☐ | ☐ |

**HOMEWORK CHECK--- INTERVENTION Tally Sheet**

|  | 0 | 1 | 2 | 2+ |
|---|---|---|---|---|
| **WEEK 5** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 6** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 7** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 8** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 9** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 10** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 11** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 12** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 13** | ☐ | ☐ | ☐ | ☐ |

**HOMEWORK CHECK--- POST-INTERVENTION Tally Sheet**

|  | 0 | 1 | 2 | 2+ |
|---|---|---|---|---|
| **WEEK 14** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 15** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 16** | ☐ | ☐ | ☐ | ☐ |

APPENDIX C

**BELL-RINGER QUESTION---PRE-INTERVENTION Tally Sheet**

|        | **0** | **1** | **2** | **2+** |
|--------|-------|-------|-------|--------|
| **WEEK 1** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 2** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 3** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 4** | ☐ | ☐ | ☐ | ☐ |

**BELL-RINGER QUESTION --- INTERVENTION Tally Sheet**

|  | 0 | 1 | 2 | 2+ |
|---|---|---|---|---|
| **WEEK 5** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 6** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 7** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 8** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 9** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 10** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 11** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 12** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 13** | ☐ | ☐ | ☐ | ☐ |

**BELL-RINGER QUESTION --- POST-INTERVENTION**
**Tally Sheet**

|  | 0 | 1 | 2 | 2+ |
|---|---|---|---|---|
| **WEEK 14** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 15** | ☐ | ☐ | ☐ | ☐ |
| **WEEK 16** | ☐ | ☐ | ☐ | ☐ |

APPENDIX D

PRE/POST-INTERVENTION STUDENT SURVEY COMPLETE RESULTS

The following tables show the percentage of students responding to each option in each question for the Pre-Intervention and Post-Intervention Student Surveys.

Please note that rounding was done to the nearest percentage.

1.  Which of the following strategies do you currently use in order to finish your homework? <u>Circle all that apply.</u>

| Answer | Pre-Intervention Percentage Response | Post-Intervention Percentage Response |
|---|---|---|
| a. I ask a friend for help. | 27% | 28% |
| b. I ask a parent/guardian for help. | 13% | 8% |
| c. I ask the teacher for help. | 16% | 19% |
| d. I look back at my notes or example problems done in class. | 44% | 44% |

2.  If you are working on your homework and come across a difficult problem, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

| Answer | Pre-Intervention Percentage Response | Post-Intervention Percentage Response |
|---|---|---|
| a. I would skip the problem | 21% | 30% |
| b. I would ask someone else to help me with the problem. | 16% | 14% |
| c. I would look back at my notes from class and then reattempt the problem. | 49% | 43% |
| d. I would try to create my own way of solving the problem. | 14% | 14% |

3. If you were working on a difficult problem with a group, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

| Answer | Pre-Intervention Percentage Response | Post-Intervention Percentage Response |
|---|---|---|
| a. I would not include myself in the group and would skip the problem. | 0% | 0% |
| b. I would work with my group members to solve the problem. | 84% | 83% |
| c. I would try to work on the problem myself without my group's help. | 11% | 14% |
| d. I would not include myself in the group and would ask the teacher for help. | 5% | 3% |

4. If the teacher reviews how to do a complex problem that you were unable to solve, which of the following would <u>best</u> describe how you would respond? <u>Circle only one answer</u>.

| Answer | Pre-Intervention Percentage Response | Post-Intervention Percentage Response |
|---|---|---|
| a. I listen to what he or she is saying and assume I will remember it. | 21% | 23% |
| b. I write down the strategy in my notes. | 48% | 44% |
| c. I write down the error I made when trying to solve the problem. | 2% | 13% |
| d. I write down the error I made on the problem and then the strategy that can be used to solve the problem. | 29% | 21% |