




**Windows on Our Classrooms
Volume 12**

CRESS Center
School of Education
University of California, Davis



CRESS Center
WINDOWS
ON OUR CLASSROOMS
Volume 12

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and as such is the collaborative efforts of many.

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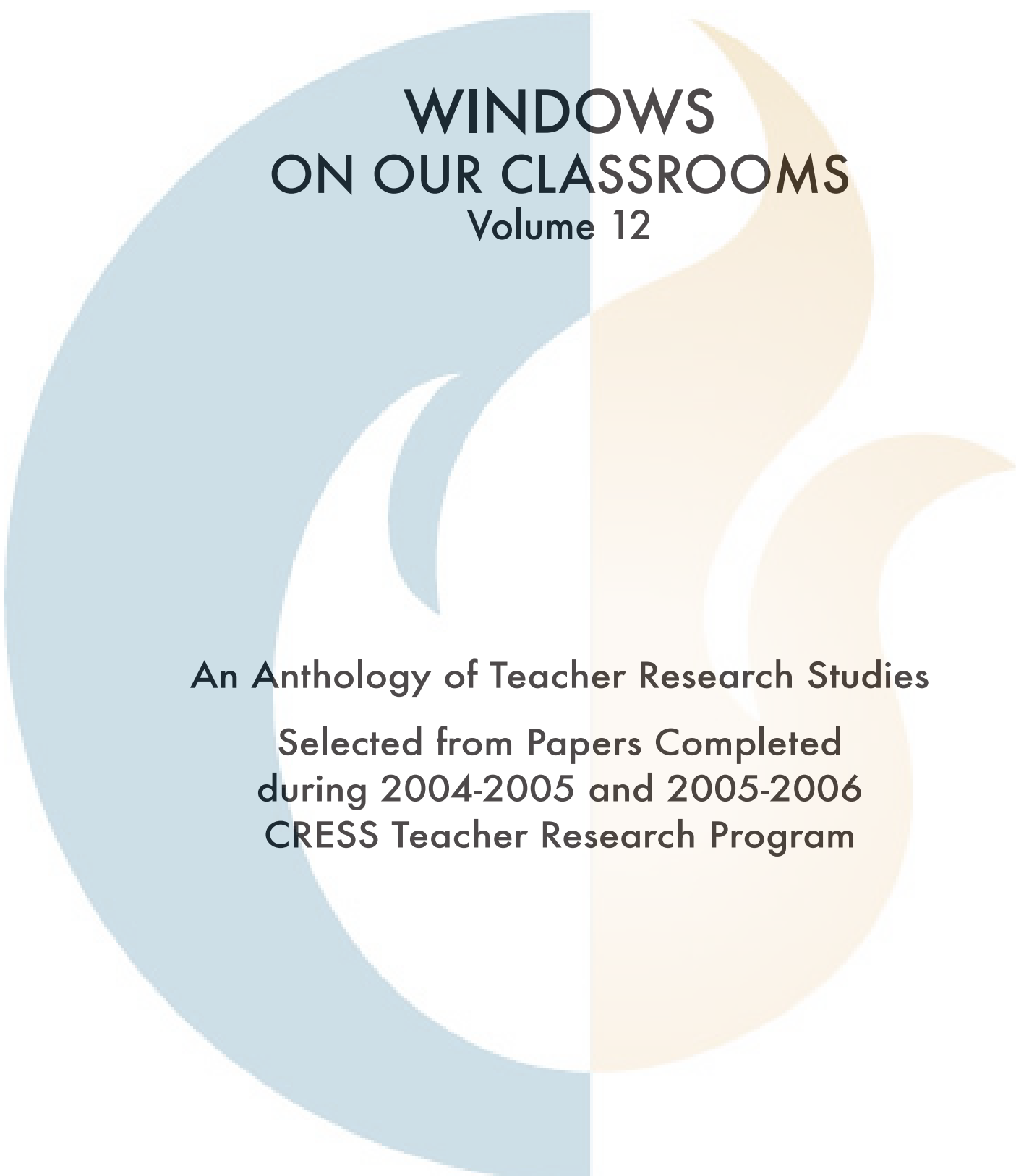
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**WINDOWS
ON OUR CLASSROOMS**
Volume 12

An Anthology of Teacher Research Studies

**Selected from Papers Completed
during 2004-2005 and 2005-2006
CRESS Teacher Research Program**

WINDOWS
ON OUR CLASSROOMS
VOLUME 12

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CRESS Teacher Research Program

The CRESS Teacher Research program, which began in 1987, has now served more than 1000 teachers. Located in the Center for Cooperative Research and Extension Services for Schools (CRESS) within the School of Education at the University of California, Davis, the CRESS Teacher Research Program supports individual groups of teachers who meet together, usually at a school site, to investigate and reflect on their teaching. The CRESS Teacher Research Program engages groups of teacher researchers, each facilitated by an experienced teacher researcher. Together the groups support teachers from all grade levels and disciplines. A few groups focus on a particular subject area; most draw on teachers across disciplines and grade levels. Some participants register for university extension credits; all participants are “volunteers.”

The format for the Teacher Research groups varies but basically consists of a year-long course that meets twice a month. During the fall quarter, teachers begin to keep field notes of their classroom activities, recording observations and reflections on a regular basis, and collecting samples of student work; in their Teacher Research meetings, they discuss their field notes in order to generate research questions that guide subsequent investigation. Throughout the year, teachers continue to observe students, collect data, analyze their findings, and engage in discussions with colleagues; then, in spring, they prepare drafts of their studies for review with their colleagues and carry out subsequent revision prior to submitting completed studies in June.

Participants agree that this act of systematically investigating the dynamics within their own classrooms improves their teaching; it hones observation skills, challenges them to ask difficult questions and to test workable solutions, and provides enough professional support that they can dare to envision change within and sometimes beyond their own classroom. CRESS teacher researchers contribute in real ways to the pool of knowledge about teaching and learning through presenting and publishing their research to the larger educational community. As one teacher researcher notes, "It's about professional development and about development of the profession."

Introduction

“Research is . . . rather simple. Essentially research is nothing but a state of mind . . . A friendly, welcoming attitude toward change . . . going out to look for change instead of waiting for it to come.

Research is an effort to do things better and not to be caught asleep at the switch. It is the problem-solving mind as contrasted with the let-well-enough-alone mind. It is the tomorrow mind instead of the yesterday mind.—Charles Kettering”

Living the Questions: A Guide for Teacher Researchers
By Ruth Shagoury Hubbard and Brenda Miller Power

Teachers research. We research initially when we first take education courses and survive student teaching to determine if this complex profession of curriculum knowledge, pedagogy, problem-solving and decision making is a positive match for our skills, aptitudes, and disposition. We research during the induction stage of our professional career when we plan, teach, reflect and apply our first learnings to the next time we plan, teach, reflect, and apply those learnings. We continue to research to refine our expertise, attend workshops, conferences and take courses to learn a wide variety of strategies to improve and expand our knowledge our teaching profession. We research when we become a community of teacher researchers who cross-pollinate our ideas, processes, and questions to improve our practice. And we research to focus on a particular problem or topic when we earn a higher degree, learning the more formal research methods.

At the CRESS Center, we have been fortunate to have created a community of teacher researchers who not only collaborate within their inquiry groups, but also are also willing to spend the extra time to document, analyze, reflect, and endure the writing process to publish their research. This edition of *Windows* reflects a wide range of inquiry focusing on both teaching and curriculum standards. Enjoy the insights of Robert Au, Holly Bigley, Elizabeth Brothers, Suzanne Carlson, Sandra Crepps, Erin E. DeWeese, Derek Dockter, Suzanne Galloway, Jennifer Healey, Sandee Henderson, Jacquelyn Hodge, Kristin Lui, Brandon Muranaka, Annie Oppman, Edwin Reed, Roger K. Shimer, Barbara Villatoro, and Courtney Young.

In addition, this *Windows* edition includes a description of the past twenty years of published teacher research, thanks to Robin Marion. “Browsing the Archive,” describes the three general types of studies (observational, experimental, and analytical) the CRESS Teacher Research Program has produced and “offers some insight into the impact of the process on teachers who studied their practice.”

Also included in this edition is a survey, thanks to Joanne Bookmyer, which captures the purpose of teacher research and how it is valued by those involved in the CRESS Teacher Research Program. The following responses to outcomes statements are significant in that they help define the CRESS teacher research model and serve to document the impact the program’s impact:

- 89% of the respondents indicated that teacher research is an important base for reflective practice;
- 85% of the respondents indicated that teacher research is an important foundation on which to develop greater professionalism;
- 84% of the respondents indicated that teacher research provides valuable knowledge for classroom practice, and
- 75% of the respondents indicated that teacher research provides a context for transformation of practice.

CRESS Center's Teacher Research Program would not have been possible throughout the last two decades without the vision, commitment, and efforts of many people: the coordinators who guided the research, Jim Hahn, Pam Castori, Janet Papale, Joanne Bookmyer, and Rich Hedman; all the facilitators who encouraged the research; all the teachers who conducted the research; and, of course, Rose Bacchini, who held it all together. Teachers' Research.

Susan U. Christiansen
Editor, *Windows 2006*

CALIFORNIA STANDARDS FOR THE TEACHING PROFESSION

STANDARD ONE:

ENGAGING & SUPPORTING ALL STUDENTS IN LEARNING
1-1 Connecting students' prior knowledge, life experience, and interests with learning goals
1-2 Using a variety of instructional strategies and resources to respond to students' diverse needs
1-3 Facilitating learning experiences that promote autonomy, interaction, and choice
1-4 Engaging students in problem solving, critical thinking, and other activities that make subject matter meaningful
1-5 Promoting self-directed, reflective learning for all students

STANDARD TWO:

CREATING & MAINTAINING EFFECTIVE ENVIRONMENTS FOR STUDENT LEARNING
2-1 Creating a physical environment that engages all students
2-2 Establishing a climate that promotes fairness and respect
2-3 Promoting social development and group responsibility
2-4 Establishing and maintaining
2-5 Planning and implementing classroom procedures and routines that support learning
2-6 Using instructional time effectively

STANDARD THREE:

UNDERSTANDING & ORGANIZING SUBJECT MATTER FOR STUDENT LEARNING
3-1 Demonstrating knowledge of subject matter content and student development
3-2 Organizing curriculum to support student understanding of subject matter
3-3 Interrelating ideas and information within and across subject matter area
3-4 Developing student understanding through instructional strategies that are appropriate enough to the subject matter
3-5 Using materials, resources, and technologies to make subject matter accessible to students

STANDARD FOUR:

PLANNING INSTRUCTION & DESIGNING LEARNING EXPERIENCES FOR ALL STUDENTS
4-1 Drawing on and valuing students' backgrounds, interests, and developmental learning needs
4-2 Establishing and articulating goals for student learning
4-3 Developing and sequencing instructional activities and materials for student learning
4-4 Designing short-term and long-term plans to foster student learning
4-5 Modifying instructional plans to adjust for student needs

STANDARD FIVE:

ASSESSING STUDENT LEARNING
5-1 Establishing and communicating learning goals for all students
5-2 Collecting and using multiple sources of information to assess student learning
5-3 Involving and guiding all students in assessing their own learning
5-4 Using the results of assessments to guide instruction
5-5 Communicating with students, families, and other audiences about student progress

STANDARD SIX:

DEVELOPING AS A PROFESSIONAL EDUCATOR
6-1 Reflecting on teaching practice and planning professional development
6-2 Establishing professional goals and pursuing opportunities to grow professionally
6-3 Working with communities to improve professional practice
6-4 Working with families to improve professional practice
6-5 Working with colleagues to improve professional practice
6-6 Balancing professional responsibilities and maintaining motivation.

The Effect of Student-Teacher Interaction on Student Performance

Robert Au

James Rutter Middle School, Elk Grove Unified, Sacramento, California

ABSTRACT

Research Question: How do positive teacher-student interactions affect student achievement? How is it that the same teacher interactions do not generate the same reactions in students, even if those students are similar in their interests, personalities, and parental involvement? **Context:** I am a first year teacher at James Rutter Middle School. The classes used for this study were two sections of seventh grade Honors English. **Methods and Data:** I conducted a student survey to determine the effects of student attitudes about teachers on effort and performance. I also collected “letters to incoming students” in which students reflected on the class and on working with me as a teacher. Furthermore, I present three case studies of individual students. **Results:** The results of the survey and letters were somewhat inconclusive, though they did provide some interesting insight into what students think about their interactions with their teachers. **Conclusions:** I discovered that, while positive teacher-student interactions can have a positive effect on student effort and performance, these interactions do more to create a setting in which students can be held accountable for their own performance.

Key Words—student motivation, student-teacher interactions, student surveys, English Language Arts, middle school.

CSTP 1.5 Promoting self-directed, reflective learning for all students

CSTP 2.4 Establishing and maintaining standards for student behavior

CSTP 5.1 Establishing and communicating learning goals for all students

CSTP 5.5 Communicating with students, families, and other audiences about student progress

CONTEXT

“It (attitude towards a teacher) doesn’t affect my performance in a class because it doesn’t matter who’s teaching it; I still have to learn it.”—Ian

Like many people who decide to become teachers, my experiences in school were mostly positive. I was, for the most part, a quiet student. I did my homework and rarely got into trouble at school. I got along with my teachers most of the time, and when I didn’t, I hid it well. I was, in many ways, the ideal student.

When I was in first grade, my test scores landed me in the school district’s “rapid learner” GATE program. In the second grade, I was moved to a new school where I was in a self-contained class with other “rapid learners.” In the GATE class, the students were encouraged, even expected, to be highly independent and driven. We were expected to work at our own pace, as well as keep up with the other kids. My own motivation often was internal. I grew up knowing that I was going to college. My parents never really had to put a whole lot of pressure on me. I didn’t need it. I worked hard, for myself and for my own ambitions.

There were, of course, over the years, teachers whom I liked better than others. These teachers were usually high energy and funny. These teachers were the ones who took the time to see beyond the quiet Asian boy in the third row (not brave enough to sit in the front, but not wanting to seem like a slacker in the back) and really cultivate a connection with me. I remember my eighth grade science teacher who often had nicknames for the kids in his class (I was Bob Gold, my last name being the chemical symbol for gold). I will never forget in ninth grade, when my English teacher had the class finger-painting our own islands during the *Lord of the Flies* unit. These were the teachers in whose rooms I ate lunch, the ones with whom I joked, the ones whom I remember years later.

Fast forward some years later and I am finishing my first year of teaching two sections of seventh grade Honors English at James Rutter Middle School. The classes are large, with thirty-three students in one class and thirty-two in the other. I had both sections for two fifty-minute periods a day. This extended time helped me to create the student–teacher connections, as I was able to spend more time with my students in class than their other teachers who had only one period apiece with them. James Rutter is a Title 1-type school, with approximately 70 percent of the student population qualifying for free or reduced lunch. The students in my honors classes were all either proficient or advanced according to their California Standards Test (CST) scores. My curriculum emphasizes the writing process, with several multi-draft, major writing projects over the course of the year. Students are also expected to develop a regular reading habit. Students are required to spend at least thirty minutes reading from a personally selected outside reading book that fits their personally selected reading goals. They are then required to complete a text log (a type of reading journal) in which they write about their thoughts on the previous night’s reading. All this work culminates in the semester portfolio. The portfolio is a collection of a student’s best work over the semester, as well as a series of reflective pieces in which the students discuss how they have grown as readers and writers over the course of the semester.

In my teaching style, I have tried to emulate the best qualities of the teachers I respected when I was a student. At twenty-seven years old, I am still extremely youthful looking, so much so that I sometimes resemble a student myself. While I realize that being liked is not the ultimate goal of teaching, I also realize that I have a real desire to be liked by my students, and I think that I was, for the most part. Over the course of the year, my students got comfortable with me. In several students, I cultivated the same sort of teacher–student relationships that I had valued when I was a student. Not all of the students whom I connected with were high achieving students, for although these were honors classes, not all of these students were necessarily living up to the potential that their test scores indicated. Some of these students were doing poorly simply because they weren’t doing any work, even work that they were capable of doing.

RESEARCH QUESTION

My research question was hard to pin down. It evolved constantly over the course of the year. In the end, I really wasn’t looking at what I thought I was looking at. Initially, I was disturbed by the idea that a student could like me, enjoy my class, and still not do the work necessary to succeed. My instincts told me that a student of high ability, who cared what his or her teacher thought, would put in the needed effort. This idea is, of course, not new. Existing research has drawn parallels between the teacher–student connection and student motivation. Students have reported being more motivated in classes where the teacher was more enthusiastic or where the teacher made some attempt at connecting with them, often in the form of humor (Boon and Spencer 2005; Jennings and Wedel 2006). Still, while I found that I was able to motivate some of the students with whom I had connected to improve their work, with others the connection that I had didn’t translate into effort on the part of the student. This led me to my original research questions. How do positive teacher–student interactions affect student achievement? How is it that the same teacher interactions do not generate the same reactions in students, even if those students are similar in their interests, personalities, and parental involvement? I wanted to know if it was possible for me to find a way to more regularly capitalize on close connections with students in order to inspire them to succeed in my class. In the end, I found that what I was really looking at was the effect of holding students accountable, with or without that teacher–student connection.

DATA: STUDENT SURVEYS AND STUDENT VOICE

“It affects my performance a lot because students need to know their teacher, so they know how to act with them.”—Janelle

One thing that I learned quickly in my teaching was that students know much more than many people give them credit for. I have found that they often have a high level of insight into their own learning. To capitalize on this strength, the first step I took to gather data towards my question was to give a survey to students asking them how much they felt their attitude towards the teacher affected their performance and effort in a class (see appendix A). Students were asked both to rate how much their attitude towards the teacher affects their classroom performance on a scale of one to five, as well as write out a brief explanation of their rating.

When I first began to analyze the survey data, I was somewhat dismayed by the results. The students had rated the effect of their attitude on their performance in a class all over the board. While some students did rate the effect as high as a four, this rating was in no way a majority. The ratings for their opinion on the effect of student attitude towards the teacher affecting student effort was even more upsetting with most of the students rating it a one, meaning not much at all. In retrospect, this response was not completely unforeseeable. The students in this class are honors students, and one might expect them to put forth effort no matter what the teacher is like. I could relate to this because of my own background as a self-motivated student. Still, this went against my own instincts. I still felt that students who had positive relationships with teachers would work harder in those classes. I started to think that my students had not been entirely truthful in their survey ratings. As honors students, I thought that they were giving the answer that they “thought they should give.” I decided to take a closer look at the data, focusing especially on the explanations of the ratings.

Upon closer examination, the students’ explanations of their ratings proved to be much more interesting than the ratings themselves because several of them seemed to contradict their ratings with their explanations. In the explanations, it seemed that there was much more honesty. Many students said that the level of effort that they put into a class was affected by their attitude towards the teacher. One student said, “It affects it a lot because that teacher has to help me understand [the lesson].” This implies that this student thinks that understanding is linked to his/her relationship with his/her teachers. One of the students who rated the effect as a one had an interesting explanation for her rating. She said, “[It] does not effect because it doesn’t matter what teacher teaches as long as it’s someone who teaches well in that subject.” I found this interesting because it seemed to contradict the student’s rating. This student simply has a different manner of determining her attitude towards the teacher. Her attitude was shaped, not by personality, but by how well the teacher teaches the subject. Some students seemed to directly connect attitude and grades. In response to the question about performance being affected by attitude, one student said, “When I be [sic] nice and friendly to a teacher, they would be nice and friendly to me.” This student seemed to be saying that a teacher who gives good grades is “nice and friendly.” This is echoed by another student who said, “Because if the teacher doesn’t like you, then they will find a way to dock off points of a student’s grade.”

Many of the students gave explanations that showed a great deal of insight into teacher–student interaction. One student said, “If you don’t like the teacher, then why would you want help from them if you’re struggling, unless you care about your grades that much.” I found this statement to be particularly powerful. This student suggests that a negative interaction with a teacher will make them not seek out help when needed. Another said, “If I don’t like the teacher then I don’t do my work when he or she makes me mad.” This attitude would seemingly affect the student’s day-to-day motivation in class.

While the results of the surveys were interesting, they were not as conclusive as I would have liked. At the end of the year, I had students write letters to the incoming seventh graders (essentially, next year's class). One part of the prompt asked them to give these future students advice on how to effectively work with me as a teacher. Many of the answers to this question were especially interesting because they told me about student–teacher interaction and its effect on student effort. Many of my students showed how comfortable they had become with me in their responses. Almost all of them said something about how it was “ok to tease Mr. Au a little bit.” While I'm sure that my students enjoyed this privilege over the course of the year, it had been one of the concerns that I had about my teaching style. I felt that my students had been too comfortable with me in class. Many times in class, my students would get too rambunctious. I disliked the momentary loss of control that went along with this, as well as the loss of instructional time it took to regain control of the class. It was one of the things that I wanted to change for next year. This is one example of how something that the students saw as positive was something that I thought had a negative effect on my teaching.

Especially interesting to me was that nearly all the students in my class seemed to have had positive experiences in my class. This was not limited to students who had done well. Pretty much across the board, all the students had positive comments about my class. This however, led me back to my original question. Why is it that positive interactions were beneficial for some students and not to others? Having looked at my classes as a whole, I decided that, in order to answer my question, I needed to narrow my focus to individual students.

CASE STUDIES

I decided to focus my attention on three particular students. Two of these students had forged strong connections with me, and I would say that I had positive interactions with them, whom I will call Allan and Mark. The difference between these students is that, while Mark demonstrated an increase in grade and effort over the course of the year, Allan decreased in these areas. Alicia, the third student whom I investigated, was one whose grade improved over the course of the year, but one with whom I had mostly negative interactions.

Allen—Allan immediately came to my attention because of my interaction with his mother. His mother had him moved into my class from another because the other class was being taught by a long-term substitute, and she wanted him in a class with a regular teacher. Allan was a quiet student who liked to read and who took a quick liking to me. He would often eat lunch in my room and sometimes stayed after school to talk about video games and to help me with various tasks around the classroom. Allan did well during his first semester in my class, earning a B. During his first semester he did most of his work, though it was not always of the quality that I thought he was capable. He was getting pressure from his mother to succeed as much as his overachieving older sister had at James Rutter.

It was in his second semester in my class that Allan's grade started to fall. This decline was mainly due to his not doing homework, which led to his falling performance on tests. I attempted to talk to him about it, trying to capitalize on my positive interaction with him in order to get him to bring his effort back to where it had been during the first semester. While Allan would constantly assure me that he would get his work in, I saw very little real improvement, and he ultimately received a C for the second semester. So why did my positive interaction not translate to increased performance here?

Allan's letter to incoming students was especially interesting in regards to what happened that second semester. He told them, “The secret to surviving in Mr. Au's class is to become friends with him,” and that “the more you know about video games the better.” He obviously saw himself as my friend. I think that in some ways, this negatively affected his work in my class. He saw me less as an authority figure and more as a buddy. Because of this view, he

seemed less likely to do the work for my class than for someone who took more of a hard-line stance with him.

There is some silver lining to Allan's case. I spoke with his mother on several occasions and found that my interactions with Allan were not isolated; he was having problems interacting with his parents at home and they were concerned. He also expressed these problems to me on occasion. This student obviously had other influences in his life that were impeding his schoolwork. In some ways, the small increase in work that I got from Allan in the last weeks of school is a testament to the positive influence of my interaction with him.

Mark—The effects of my interactions with Mark were much more obvious than my interactions with Allan. Mark was a typical class clown. He was one of the students whose behavior sometimes got out of hand in class. He was a likeable enough student but he could be somewhat infuriating at times and hard to control. He took longer to warm up to me than Allan did, but in the end he was one of the students who liked me the most. Mark brought me presents and even dressed up as me for twin day at school. I am happy to say that I was able to take his high opinion of me and use it to help Mark improve as a student.

In the first semester, Mark was not much of a student. He often did not do his homework, and when he did, he would do a lackluster job of it. He was sarcastic and whiney in his assignments, often opting to complain about the assignment in writing rather than complete it. In the first semester he received a D in my class. I spoke with Mark's mother after the first semester and found that she was concerned about his grade. I learned that she had "grounded" him until he improved his grade. At first, Mark saw me as the cause of this and was angry with me. The more I talked to him though, the more he started to see that he needed to take control of his own education if he was to succeed. Now, I won't go so far as to say that Mark made a complete turnaround in my class. Mark was not self-motivated to do his work even in the end of the year. His work was still not of the highest quality. What did improve was Mark's rate of turning in work. I had to constantly monitor and talk to him to get it, but I did get it. He needed that extra push from someone whom he respected and liked in order to motivate him to do his work.

In the second semester, Mark was able to improve his grade to a C. What's more, he was seriously thinking about enrolling in Rutter's AVID program, which is a program designed to help struggling honors students succeed. His assignments became less about whining and complaining and more about attempting to finish them according to instructions. There is no doubt in my mind though, that without my constant urging, I would have seen less work from Mark than I did. It was constantly a struggle to get him to turn things in. In the end, it turned out to be worth it, as Mark improved dramatically in his work habits.

Alicia—Alicia was another case entirely. While her grade improved from a D to C from first to second semester, my interactions with her were anything but positive. From the beginning of the year I had behavior problems from Alicia. Mostly the problems were those of "attitude." Alicia would talk back, roll her eyes, or speak with an extremely disrespectful tone. She also spent a lot of time off-task in class. She talked, wrote notes, or stared into space. Consequently, she was sent out of the room on many occasions and often did not do her homework.

Her behavior only changed in the last quarter when I realized that I, in some ways, had been allowing some of her behavior by giving her "second chances" time and again. Finally I told her that her behaviors were unacceptable in my class and that I was done with warnings. I told her that she needed to stop with any signs of disrespect in my class and that she would be sent out of class for any infractions at all.

I saw an immediate change in behavior from Alicia. She stopped her disrespectful behavior and started paying more attention. At any sign of slipping back into her old ways, a stern look was enough to get her attention. She spent more time in the classroom this way and

even got to the point where she was paying more attention in class. She also began turning in her homework more regularly.

It was my success with Alicia that really made me reexamine how student–teacher interactions affect student performance. Here was a student with whom I had primarily negative interactions. I forged no personal connection with this student, and I don’t think that she particularly liked me as a teacher. Still, her work and behavior improved over the course of the year. I was forced to try and figure out why this was. Why had taking a hard-line stance with this student been more effective than trying to connect with her?

CONCLUSIONS

“If I have a teacher I like, I don’t work as hard because I feel like there isn’t much effort needed.”—Jacob

By the end of the year, I found that positive student–teacher interaction had less of an influence than I had initially anticipated. Every student is different; and while some may be especially motivated by a positive interaction, there are also those who simply don’t care, or who can even have their grades negatively affected if they start to think of their teachers as their “buddies.” What proved to be effective in motivating students was holding them accountable for their work. With Allan, that involved contacting the parents and conferencing individually with the student. With Mark, it involved constantly making sure he was getting his homework done and talking to him about what was appropriate for formal assignments and what was not. With Alicia, it was holding her accountable for her behavior in class. What each of these students needed was some person (i.e., a teacher, a parent, or some authority figure) who made it clear that there were high expectations for them, and who held them accountable for reaching those expectations.

The importance of student accountability became more evident as I continued to observe the performance of the case study students in their eighth grade year. All three students remained in honors English, achieving varying degrees of success. Alicia’s mother remained active in her education. She kept in contact with Alicia’s teachers, and made it clear that Alicia was expected to live up to her expectations. Alicia herself though, seemed content to coast through her eighth grade year, achieving mostly C’s. Although Alicia’s CST test scores indicated that she was capable of higher-level work, she seemed determined to do the minimum required to earn a grade which would satisfy her mother. Allan’s performance, unfortunately, declined in his eighth grade year. His mother continued to be involved with his progress. When the time for grades came around, he often managed to make up enough work to pass, usually as a direct result of her intervention. Clearly there were high expectations for him from others, but Allan did not seem to share those expectations. He did not seem to care enough about these expectations to change his work habits in any significant way. A difference for Allan in the eighth grade was that he did not seem to develop strong personal relationships with his teachers during the year. The stage was not set for expectations to be meaningful to him.

The biggest change in work habit and attitude came from Mark. Mark did end up enrolling in the AVID program. In this program there was a high level of accountability placed on the students. The students in the program receive frequent grade checks, engage in peer tutorial sessions, and learn skills to help them succeed in the classroom. Another positive feature of this program is the high level of teacher involvement. AVID teachers work closely with students in an attempt to create a sense of *personal* accountability in the students. This is exactly what happened in Mark’s case. The same student who required me to constantly monitor his work and progress became a student who strived to get ahead in his work. The expectations that he began to have for himself actually started to surpass those held by his teachers and parents. By

the end of eighth grade, Mark was earning A's and B's. While Mark did have positive teacher interactions and there were high expectations for his performance, it wasn't until he began to hold *himself* accountable for these expectations that he truly began to thrive as a student.

It needs to be said, however, that positive teacher–student interaction is not completely irrelevant. If a teacher has a positive rapport with a student, it is much easier to hold a student accountable. At some level, a student needs to care in order to be held accountable. If a student doesn't care about what any of the authority figures around him think, then he will not respond to being “pushed” by those authority figures. In the end, it is not so much *positive* interactions that make the difference. Rather, it is interactions that show students that they are being held accountable for their own actions.

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Robert Au has been teaching seventh grade English for the last two years. Coming from a family of teachers, he was originally reluctant to “join the family business.” After a couple years of waiting tables and bumming around Europe, he finally came to his senses and enrolled in a credential program. Since then, he has come to love the profession, with all its little quirks. When he's not trying to teach/entertain his students, he enjoys creative writing, reading, and is an avid music aficionado/snob.

APPENDIX A
Motivational Study: Student Survey

On a scale of 1 – 5, rate how much you enjoyed the following items:

Reading:

Walk Two Moons: 1 2 3 4 5

Watership Down 1 2 3 4 5

HLL stories 1 2 3 4 5

Outside reading 1 2 3 4 5

Writing:

Short Story 1 2 3 4 5

Character Essay 1 2 3 4 5

Persuasive Essay 1 2 3 4 5

On a scale of 1 – 5, rate how much your attitude towards a subject affects your performance in a class.

1 2 3 4 5

Explain:

On a scale of 1 – 5, rate how much your attitude towards a subject affects you level of effort in a class.

1 2 3 4 5

Explain:

On a scale of 1 – 5, rate how much your attitude towards the teacher affects your performance in a class.

1 2 3 4 5

Explain:

On a scale of 1 – 5, rate how much your attitude towards the teacher affects your level of effort in a class.

1 2 3 4 5

Explain:

Running in Blocks

Holly Bigley

Edward Harris Jr. Middle School, Elk Grove Unified, Elk Grove, California

ABSTRACT

Research Question: How is the mile fitness run time affected if students are on the block schedule?

Context: Edward Harris is a new school in the district, which has only been opened for two years. The school is socio-economically diverse. The idea of this school is to see if being on a block schedule helps students in the classroom and on tests scores more than a more traditional schedule. **Results:** Students who had P.E. continually had the greatest number achieving the Healthy Fitness Zone; however, all groups did improve on their run times. **Methods and Data:** Collection of data, run times, occurred throughout the year and was then sorted by students who had P.E. term 1/3, term 1/4, term 2/3, and term 2/4. **Conclusions:** Every group improved in overall run time; however, the group with continuous P.E. (2/3) had the greatest number running in the HFZ, which is the overall goal.

Key words—physical education, middle school, block schedule, run times.

CSTP 4.3 Developing and sequencing instructional activities and materials for student learning

CSTP 4.4 Designing short-term and long-term plans to foster student learning

CSTP 5.4 Using the results of assessments to guide instruction

California Physical Education Content Standards

3.4 Participate in moderate to vigorous physical activity a minimum of four days each week. **3.5** Assess periodically the attainment of, or progress toward, personal physical fitness goals and make necessary adjustments to a personal physical fitness program.

CONTEXT

I have been a middle school teacher for nine years, teaching in five different content areas. Because of these experiences, I have a good understanding of standards and expectations in all areas. When I was going to college I knew I wanted to teach either physical education or English. I first declared physical education as a major with a minor in English, as I was and still am involved in sports. In my second year of college, many of the after-school sports programs in the Bay Area, my hometown, were being cut. There was some talk of cutting back on physical education, so I decided to get my degree in Multiple Subject Education with two supplementals in English and physical education to make myself more marketable; I knew I wanted to teach, and, at that time, any assignment was fine with me. My first few years of teaching were spent in a middle-class middle school in San Jose where I taught science, English, and a reading program.

Then, I was offered the opportunity to teach some P.E. at another middle school, so I transferred. This school offered me many new experiences. First of all, the majority of the students were Hispanic; in fact, in one of my classes, many of the students spoke Spanish only. I remember feeling excited about teaching P.E. because I was now able to teach the subject I loved the most. I also believed I would be a good role model—especially for the girls—because I was living proof that women could play ball and go to college on a scholarship. I had also hoped that the boys would gain a little respect for girls, as I had often heard them belittling girls, especially when girls were assigned to their teams. In addition to teaching, I ran the lunch-time soccer program, and I ran a soccer and swim program after school.

A year later, I made the decision to leave the Bay Area to move to Sacramento which meant teaching English again—this time, at a year-round school. Luckily, I was able to get back into P.E. two years later. As an educator, I appreciated the idea of having one month off for every three months, instead of having a traditional summer vacation. The month break was good:

Students did not lose as much ground as they might have over the long summer break. However, as an athlete, I had a difficult time taking an entire month off after working so hard for three. Then I realized that this system might be better than the three months off in the summer, where many students wouldn't do anything physical. Having some physical activity year-round, even with long breaks, was definitely a good idea.

Unfortunately, after two years, my position was downsized, which placed me back into the classroom—this time, at a brand new school on a traditional calendar *and* on a block schedule. This school was much like the school I had just left, ethnically and socio-economically. Approximately 28% of the schools' population were African American, 28% were Asian, 17% were White, 14% were Hispanic, and 47% of the total population were socio-economically disadvantaged. Of all the new challenges that faced me, the most difficult was teaching on the block schedule. At my school, this meant that students had four classes per nine-week term for 85 minutes each, after which they took four entirely different classes. This meant that students attended only half a year of P.E.

After one year, I was once again able to get back into P.E. One advantage of the block schedule, from a physical educator's point of view, is the ability to get a good fifteen to twenty minutes for students to run daily and still have time for the day's activity. This is important because today's children are not involved in physical play like I was when I was growing up. I can drive through many different neighborhoods today and not see a single child outside playing. In talking with my students, they confessed that they would rather talk on the phone, get on-line, or play video games. Few students play after-school sports, and few others play sports outside.

This inactivity affects students in many ways. An article in the March 2005 edition of the *NEA Today* states, "Some 18 million (America's kids) are officially overweight or obese, and the numbers are growing so fast that some experts are calling it a national crisis" (Crute, 2005, p 22). I know students are overweight, and it is not due solely to their diet. While strides are being made to take junk food out of schools and to be more careful about what we serve students for lunch, I can't help but wonder how wise it is to have our students going for nine weeks without any physical education. On a traditional schedule, students receive approximately 9,980 minutes of P.E. (180 days x 55 min.), while on a block schedule they receive 7,650 minutes (90 days x 85 min.). Not only do my students have at least nine weeks off between P.E. classes, but they are also receiving 2,330 minutes less instruction, which is about 42 days of P.E. on a traditional schedule. This is close to one fourth of a school year lost. Taking away minutes of instruction is not beneficial for anyone, even though it is great to have more time per day to do activities. The risk to students' overall health is too great.

Fitness testing is the one area that physical educators are accountable for their students' progress, and I can't help to think that my students are at a disadvantage compared with students on a traditional schedule.

RESEARCH QUESTION

I wanted to see what the effects might be on the mile fitness run for my students who have P.E. for only eighteen weeks compared to those who have it all year. It should have been easy to track, as I thought that I would teach the same students for terms one and three—likewise for students during terms two and four. However, due to conflicts in scheduling, this did not happen. Not only did I not get back all the students I had during terms one and two, but some students had to wait for as long as eighteen weeks before they took P.E. again, while others had P.E. in back-to-back quarters. Because of this, my focus and research question changed. I

decided to see how run times were affected for students who had P.E. during terms one and three or terms two and four (with nine weeks off in between), to those who had P.E. in back-to-back quarters (with no break in between), and to those who had P.E. terms one and four (with eighteen weeks off). I focused only on the seventh graders because they were the only ones who had to report fitness scores to the state. I also knew that the elementary schools had been cutting back on their physical education classes, so our incoming seventh graders had not spent much time doing structured physical activities. In fact, according to the *NEA Today*, “More than 50 percent of the nation’s schools have eliminated physical education classes altogether” (Crute 2005, 24). And *Newsweek* reported, “For more than a decade, schools have balanced their budgets by slashing physical education programs” (Tyre 2003, 66).

The overall lack of physical education in elementary schools is being felt in middle schools; it is difficult just to get students moving. To make matters worse, just when we make improvements and get our students running, they leave us for nine to eighteen weeks. No athlete would ever train in this way, nor should anyone with weight problems follow such an exercise regimen. While I understand that other content area teachers benefit from the block schedule because of the extended time, I personally feel that it hurts the health of our students.

METHODS AND DATA

When I first started this research, I believed that those students who had P.E. back-to-back (in terms two and three) would have the greatest decrease in run times, while those who had P.E. in terms one and four would have the lowest decrease in time. I wasn’t sure how those who had P.E. terms one and three or terms two and four would do. I thought there would not be much decrease in time, as they would have only about five weeks to get back into shape before they were tested. The most important factor is making the Healthy Fitness Zone (HFZ). The HFZ is determined by the state, and it is based on gender and age. The goal is to have our students running in the zone that is appropriate for them. Again, I had predicted that students who had P.E. during terms two and three would fare best.

The three tables below show pre- and post fitness run times and total decrease in time for students who had P.E. for terms one and three or terms two and four (table 1), term two and three (table 2), and terms one and four (table 3). The tables shown below are representative of the whole group. I chose to focus on decrease in time to show if students are running faster. Table 1 shows that students who had nine weeks off still had an overall decrease in time of one minute four seconds, while students who had P.E. for 18 continuous weeks (table 2) decreased by one minute three seconds. As expected, the students with an 18-week break (table 3) only decreased by 58 seconds. The decrease in time was fairly close, but the percentage of students who made the Healthy Fitness Zone is greater.

Table 1 shows that 67% of those students who nine weeks off were able to make the HFZ, while table 2 shows that 71% of the students who no break were able to make the HFZ. Only 64% of students with 18 weeks of (table 3) were able to make the HFZ. Also listed below (table 4) are the HFZs for children ages eleven to fourteen for the mile run.

Table 1. Terms 1/3 or 2/4. Total decrease in time = 1:04. Healthy Fitness Zone = 67%

Student	Pre Test Time	Post Test Time	Difference (decrease)
S 1	7:50	7:43	0:07
S 2	13:08	10:25	2:43
S 3	12:44	11:04	1:40
S 4	13:18	12:07	1:11
S 5	15:30	12:32	2:48
S 6	11:28	10:46	0:42
S 7	10:24	9:36	0:48
S 8	11:45	11:06	0:39
S 9	14:28	13:35	0:53
S 10	10:25	9:23	1:02

Table 2. Terms 2/3. Total decrease in time = 1:03. Healthy Fitness Zone = 71%.

Student	Pre Test Time	Post Test Time	Difference (decrease)
S 11	9:02	8:00	1:02
S 12	11:42	11:06	0:36
S 13	9:32	8:48	0:44
S 14	11:45	10:15	1:30
S 15	9:06	7:55	1:11
S 16	11:20	9:11	2:09
S 17	10:04	9:19	0:45
S 18	11:46	10:06	1:40
S 19	11:00	9:07	1:53
S 20	12:30	11:35	0:55

Table 3. Terms 1/4. Total decrease in time = 0:58. Healthy Fitness Zone = 64%.

Student	Pre Test Time	Post Test Time	Difference (decrease)
S 21	10:28	9:43	0:45
S 22	8:35	7:58	0:37
S 23	10:25	9:34	0:51
S 24	12:52	12:46	0:06
S 25	10:26	8:57	1:29
S 26	13:48	13:32	0:16
S 27	11:20	9:51	1:29
S 28	13:48	13:20	0:28
S 29	12:00	10:18	1:42
S 30	7:43	7:08	0:35

Table 4. Healthy Fitness Zones (HFZ).

age	boys	girls
11	8:30-11:00	9:00-12:00
12	8:00-10:30	9:00-12:00
13	7:30-10:00	9:00-11:30
14	7:00-9:30	8:30-11:00

RESULTS AND CONCLUSIONS

I was surprised to see how close the total difference in time was because I thought that terms two and three would be greater. While a minute improvement is great, I thought that the students with no break would have had better times. I was not the least bit surprised with the results of those students in P.E. during terms one and four, though I was pleased to see some improvement. And, just looking at the times was not enough; seeing which students made the Healthy Fitness Zone helped me to see if students were reaching state expectations. In all terms, students were fairly equal in ability, according to their start and stop times. I did not have any group of super runners, which would have caused discrepancies.

What I did learn from this research is that having P.E. continuously is best, whether it is for eighteen weeks or for thirty-six. However, if that is not possible, then the next best option is to have P.E. during every other term. Having a block of eighteen weeks off negatively affects student performance, and more importantly affects the students' readiness to be in the Healthy Fitness Zone. If our students had more continuous terms of P.E., then I believe we would have more students making the HFZ based on the data presented above. Just as increased instructional minutes in math and English would help our students with their academic skills, more minutes in P.E. could help our students become more fit.

In doing this research, I learned that there are other potential issues that could arise if the block schedule is continued. I would like to look into the eighth graders' run time next year, as some could potentially have as long as seven months off between P.E. classes. If a student has P.E. during term three as a seventh grader and does not have P.E. again until term two as an eighth grader, then that student would have seven months with likely no structured physical activity. I would also like to compare my school to a similar school on a traditional schedule where students have P.E. daily. These investigations are critical if we as a society are serious about improving the health of our children.

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Holly Bigley has been teaching for nine years. She is a graduate of San Jose State University, where she not only studied, but also played softball and soccer on an athletic scholarship. While it was short lived, she also played Professional Women's Baseball just before entering her teaching career. She spent her first three years teaching in the Bay Area before moving to Sacramento. Holly has taught in a multiple of areas including: language arts, history, science, reading programs, and physical education. Physical education is her preferred area to teach, as she believes it is essential for students to not only be knowledgeable, but also healthy.

Teachers: What They Teach and Why

Suzanne Carlson

With Charts and Graphs by FaraLee and Robert Wright

Armijo High School, Fairfield-Suisun Unified, Fairfield and Suisun City, California

ABSTRACT

Research Question: What are the differences between positions held by senior teachers and those held by new staff? What are the reasons for the differences? Is there an effect on students' education? Should any inequalities be addressed? If so, how should they be handled? **Results:** Senior teachers are distributed evenly across various worksites and levels, with the exception of the continuation high school, which has a large percentage of senior staff, and the alternative school, which has almost all new teachers. The number of senior educators is statistically significant at kindergarten, grade two, grade three, and physical education. The number of new teachers is statistically significant in science and special education. **Methods and Data:** I compiled statistics from the district seniority list, analyzed data, and interviewed educators. **Conclusion:** Reasons for a proliferation of senior or new teachers in certain subjects and sites vary by field and location. Various steps can be taken to address staff acquisition and retention. Teacher assignments and their effects on education warrant further study.

Key words—teaching assignments, senior teachers, probationary teachers, school personnel, teacher retirement, job statistics, credentialed teachers, certificated personnel, distribution of teachers.

CSTP 6.1 Reflecting on teaching practice and planning professional development

CSTP 6.3 Working with communities to improve professional practice

CSTP 6.5 Working with colleagues to improve professional practice

OVERVIEW

While perusing my district's seniority list in the spring of 2004, I speculated about the differences between the positions held by senior teachers and those of new employees and the possible effects on students' education. Are senior educators, those with the most time teaching in the district, likely to teach any subject or grade level more than another? Do teachers migrate to less stressful or demanding subject areas? Do teachers burn out in some fields and levels? If inequities exist, should they be addressed and remediated?

I work in the Fairfield-Suisun Unified School District (F-SUSD). These connected suburban municipalities, with a total population of 135,000, are situated on Interstate 80, halfway between Sacramento and San Francisco. The area is socio-economically diverse and has an agricultural history. The school district is composed of seventeen elementary schools, five middle schools, three comprehensive high schools, an alternative school, a continuation school, an independent study facility, and an adult school. The 54th largest school district in the state, F-SUSD serves 12,296 elementary (K-6) students, 3836 middle school pupils, 6684 high school students, and 518 alternative education students, for a total enrollment of 23,251. The student population is 31.5% Caucasian, 22.9% African American, 28.2% Hispanic, 8.8% Filipino, 5.8% Asian, 1.8% Pacific Islander, and 1% American Indian.

As of November 15, 2004, Fairfield-Suisun employed 1220 teachers, 108 management personnel, 567 support employees, 197 clerks, 16 supervisors, 10 psychologists, 7 child development instructors, and 8 nurses. The highest salary for credentialed teachers was \$67,588 while the lowest was \$39,960.

Employer-employee relations had been excellent since the formation of the Fairfield-Suisun Unified School District in 1968 when six individual school districts combined. However, goodwill soured in 2001 when the school board proposed cutting teacher-due-process rights. To protect students from teacher retribution, the district wanted the power to discipline teachers for

alleged infractions without naming the violations or the accusers. A contentious nine-day strike resulted at the end of the 2000–2001 school year. Many mid-career and probationary teachers fled the district, leaving senior teachers who could not afford to leave, as most would have had to accept lower positions on salary schedules elsewhere as well as the loss of future retirement benefits. As a result, F-SUSD now has a comparatively large group of senior teachers, a small number of mid-career staff, and numerous instructors who were hired after the teachers’ strike.

What are the differences between teaching positions of senior and new staff? Why are there certain differences? I decided to compile job statistics for both groups, compare the information, seek teacher input, and draw conclusions.

COMPARISON BY WORKSITE—150 MOST SENIOR TEACHERS AND 150 NEWEST TEACHERS BY YEARS OF EMPLOYMENT

I first compared work environments by reviewing information in the Fairfield-Suisun Unified School District’s *Certificated Personnel Seniority List (9/1/1964–2/17/2004)* for the 150 longest-employed teachers and the 150 newest staff members. My findings are presented in the table below.

Table 1. Comparison of senior teachers and new teachers at different sites.

	Senior Teachers	New Teachers	Difference
Elementary School	65	53	10%
Middle School	26	26	0%
High School	46	58	12%
Alternative School	0	6	100%
Continuation School	7	0	100%
Independent Study	1	1	0%
Multiple Levels/Sites	5	6	11%

Senior and new teachers appear to be fairly evenly distributed across elementary and secondary levels. However, there is a stark difference between staff members at the alternative school, Mary Bird, and at the continuation school, Sem Yeto. Mary Bird teachers, all of whom are probationary except one, describe their school as a “dumping ground,” a place where administration puts troublesome students whom no site wants. In contrast, while Sem Yeto Continuation School also has challenging pupils, students usually request enrollment and are selected through a school interview process. Most of Sem Yeto’s teachers are highly experienced.

COMPARISON BY JOB ASSIGNMENT—TEACHERS WITH 20 OR MORE YEARS EXPERIENCE AND TEACHERS WHO HAVE TAUGHT TWO YEARS OR LESS

Next, I compared job assignments for senior teachers and new instructors. For this part of my study, I first defined senior teachers as those with twenty or more years of district experience and new staff as those with two or fewer years of employment. Second, I counted the number of teachers in each of forty-two assignment areas and calculated the percentage of staff assigned to each as a part of the total for each of the two groups (see appendix A).

The Distribution of Teachers bar graphs in appendix B and appendix C show the number of senior and new teachers in each field and the percentages for each.

FINDINGS AND ANALYSIS

Armijo High School mathematics teacher FaraLee Wright and California Maritime Academy instructor Robert Wright graciously lent their expertise and created charts and graphs to illustrate the findings. FaraLee Wright then provided insightful data analysis.

A chi-square test for independence was run with a significance of 5%. The chi-square critical value is 26.51 at that level. Any chi-square value calculated from the data pairs of senior and new teachers greater than this critical value indicates that the two variables are dependent. A change in one of them affects the probability of a change in the other. The chi-square value calculated from this data is 96.086, a value so far into the critical region as to indicate the probability that the two variables not being dependent is infinitesimally small, approximately zero. The relationship between the two groups is absolutely dependent, and the percentages of senior teachers and new teachers are dependent variables with statistical significance.

As shown in the base data table, the difference between the percentages of senior and new teachers is statistically significant at close to or greater than the 5% level in only a small number of fields, as shown in Table 2.

Table 2. Difference between percentages of senior and new teachers.

More Senior Teachers	More New Teachers
Physical Education (6.29%)	Resource Specialist (5.12%)
Kindergarten (4.34%)	Science (5.17%)
Grade Two (4.95%)	Special Day Class (5.86%)
Grade Three (5.82%)	

Pareto charts, bar graphs that graphically summarize and display the relative importance of differences between groups of data, were developed. The Pareto chart (appendix D) is arranged from the highest percentage of senior teachers in each teaching assignment to the lowest percentage. One easily can see that a greater percentage of senior staff teach physical education, kindergarten, grade two, and grade three, while a greater percentage of new teachers work in science and special education, in both the resource specialist program (RSP) and in the special day class (SDC).

The point and line graph in appendix E is another visual illustration of the number of teachers in each assignment. Each dot shows the number of senior and new teachers in a particular field. Numbers for senior teachers are given on the *x*-axis, while new teachers are indicated on the *y*-axis. For example, point C (6, 20), science, indicates that six senior staff teach science compared to twenty new science instructors. The diagonal line on the graph is the “line of best fit” and shows where points would be expected in a normal distribution. Only one of the teaching groups, counselor/guidance teachers, at point G (3, 5), is exactly as anticipated mathematically. Many points are close to the line and thus near to what would be expected, although others are far from what would be anticipated. Points below the line show fields where there are more senior teachers than would be predicted, while points above the line demonstrate fields with a greater number of new teachers than expected. The farther a point is from the line, the more it differs from what would have been anticipated. In general, points are scattered with no distinct pattern, and the strength of the association of the two variables is virtually none. Only 23.09% of the variation in the number of senior and new teachers in the various fields can be explained by the regression line. Other factors must explain 76.91% of the variation.

Differences in personnel numbers are due in part to the district’s changing personnel requirements. However, to attempt to find other reasons for the variation in the number of teachers and percentages, I asked senior and novice teachers for their opinions in the fields where

the greatest differences occurred—special education, both the resource specialist program (RSP) and the special day class (SDC); science, kindergarten, grade two, grade three, and physical education. Although I gained some responses through personal interview, most replies came from e-mail queries (see appendix F). Respondents' explanations for the variance in senior and new teachers differed according to the subject taught and are categorized in the next section. It should be noted that the following explanations are the respondents' perceptions, and there has been no effort to verify the individuals' claims.

TEACHER RESPONSES IN FIELDS WITH SIGNIFICANTLY MORE NEW TEACHERS THAN SENIOR STAFF

Science

Low pay when compared with the private sector—Science professionals are paid considerably more in industry than in teaching. One instructor said that the elimination of the general science secondary credential and requirements of the No Child Left Behind legislation created a situation where teachers must have specific credentials in biology, earth science, or physical science/physics in order to teach those subjects. These individuals, particularly those trained in science, were attracted to higher-paying private industry. He said this makes a reality of the joke, “No Child Left Behind means No Teacher Left in the Classroom.”

Lack of qualified candidates—“True science teachers are hard to come by,” wrote one teacher. Since the district had trouble finding science teachers, individuals were hired to teach science who really don't plan to teach long-term in the field. The new testing and expanded courses required to obtain a specialized credential also increased the educational cost to the point that many just did not want to spend the money.

Dismissal of non-qualified teachers—One high school teacher pointed out that his school had not rehired five science teachers in the last five years. This instructor's opinion was that four of those individuals should never have been hired in the first place but were given jobs because of the lack of qualified candidates.

Lack of interest in basic science—A middle school science teacher commented, “It might be difficult for a scientist to see the value in simple experiments that form a scaffold for students with little experience... Someone with a science background may not have the patience for it.”

Teaching difficulties—Labs, lab write-ups, clean up, and little support for the extra duties are all thought to make teaching science challenging. “Teaching science is tough!” exclaimed one respondent. This person insisted that the district even made it difficult for teachers to have unpaid student assistants when they really needed them.

Poor equipment and lack of facilities—One instructor commented that the district's lack of updated science equipment, even at renovated schools, leads teachers to leave the profession. In addition, nice labs are “few and far between.”

Gender Bias—A former high school science teacher stated, “It is a man's world,” and cited that the “definite hostile environment and harassment on more than one occasion” prompted her to switch to a different teaching field.

Administrative issues—According to a high school teacher, administration would not hire some good science teachers because they were not “weak sisters” and had strong opinions of what needed to be done. This teacher also said that one science instructor was not rehired as a result of the teachers' strike.

SPECIAL EDUCATION—RESOURCE SPECIALIST PROGRAM (RSP) AND SPECIAL DAY CLASS (SDC)

Lack of qualified candidates—F-SUSD, like most school districts in the state, had difficulty in finding trained special education teachers for resource specialist programs and special day classes. Some senior teachers, now in other fields, said they originally taught special education because vacancies did not exist in their preferred fields. When openings occurred, they moved.

Problems with the hiring process—One special education leader noted, “We have had a total of nine new teachers come through this site just this year. Some lasted a few days and others a few weeks. The screening process just isn’t what it should be.” This teacher stated that the specifications of the job were not laid out, so new teachers did not have a realistic idea of what the job entailed. Another senior teacher agreed and wrote that non-credentialed, emergency credential people had no idea what they were stepping into.

Lack of proper training—A long-time educator said that new teachers were thrown into their jobs and expected to be fully functioning caseload managers while they were still trying to find the staff restroom. New teachers were given “multiple preps,” varied teaching assignments, which required extensive daily preparation. Then, “we start speaking a foreign language to them—IEP, ITP, RSP, SDC, and the list goes on” (see appendix G for definitions). Teachers believed they all needed time to learn such things as new curriculums, improved classroom management, and the changes in the IEP (Individualized Education Plan) process. Teacher training also may have been a problem. Apparently some colleges are preparing teacher candidates for an inclusive environment where their responsibilities are more case management than instruction, while F-SUSD special educators spend the majority of their time teaching classes.

Lack of time—In 2002, F-SUSD eliminated the prep period that special education teachers had been given in which to do a variety of tasks, including: holding student IEP meetings, completing IEP paperwork, providing federally-mandated testing, and helping other teachers. Some “newbies” floundered because seasoned teachers no longer had the time to assist them. One e-mail response was succinct, “No time to do a decent job! Signed, Overworked.” (Note: F-SUSD reinstated this assessment/IEP prep period at the high school level for the 2005–2006 school year.)

Workload—While the caseload for a special education teacher was limited by law to 28 for resource and 17 for the high school special day class, some teachers were responsible for daily instruction for 65 to 90 students, according to one staffer. In addition to teaching a full load of classes and numerous, challenging students, special education teachers had been required to complete what was seen as a mountain of paperwork. An IEP meeting, required at least once annually for each student, meant filling out about fifteen pages of forms. A reassessment meeting, mandated every three years per student, involves hours of testing and over twenty pages of forms.

Testing and stress—Teachers felt they were being asked to bring special education students with diagnosed (and sometimes severe) learning disabilities up to levels that are difficult, if not impossible, to reach. A former special education teacher said that the stress of testing and mandates for students to pass the high school exit exam caused her to leave the special education field. One resource specialist believed that teachers were forced to tell parents that their children were incapable of earning a high school diploma, while the state offered no alternatives. (Note: During the 2005–2006 school year, F-SUSD created an alternative program to address this issue.)

Parental expectations and increased litigation—A respondent said that parents of special education children were demanding more and seeking legal recourse more often. Teachers thought they were “being left holding the bag when parents complain.”

Lack of leadership—Educators noted a lack of leadership regarding the goals, the overall and long-range planning, and goals setting of special education. “High pressure and expectations to be all things to all people without guidance in how to do that,” was how one teacher put it.

Exploitation of special education teachers— Some staff members mentioned that principals and the district office, with the support of the district special education director, exploited special education teachers. Probationary teachers, without job security, could easily be manipulated to accept additional work above what was required or even contractually allowed. Probationary teachers knew that they ran the risk of not being reelected if they did not fully cooperate to avoid conflict.

Lack of respect and appreciation—Teachers frequently cited lack of respect and appreciation as a reason for leaving special education. They said that special educators felt that they had no voice, and decisions were made at the district office without their input. They added that district special education administrators rarely, if ever, showed their appreciation for site teachers who were dealing with some extremely difficult students, and these administrators even insinuated that teachers had their own best interests as their top priority. A former high school resource specialist who transferred to another field remarked that district office administrators thought that teachers made suggestions for their own personal benefit and not for the well-being of students. A middle school resource specialist stated that she was moving out of special education this year because she is “overworked, underpaid, and not appreciated.”

Administrative issues—Several probationary special education teachers whose job performance had not been questioned were not rehired following the teachers’ strike in 2001.

TEACHER RESPONSES IN FIELDS WITH SIGNIFICANTLY MORE SENIOR STAFF THAN NEW TEACHERS

Physical Education

Peripheral to academic education—Fairfield-Suisun USD had twenty-one senior physical education instructors, more senior teachers than in any other field. Yet none chose to respond to surveys for this study. One district employee observed that P.E. teachers perhaps are able to spend years in their field of expertise because they sometimes are seen as an appendage to education. The coaches, albeit justifiably due to coaching responsibilities, frequently miss faculty meetings and are not viewed as central to the school. They are able to “do their own thing.”

Less testing and stress— One staff member conjectured that physical education teachers did not have the same stress regarding STAR testing requirements as other educators. P.E. teachers were also not under pressure for their students to meet the state’s exit exam requirements because physical education was not included.

KINDERGARTEN, GRADE TWO, AND GRADE THREE

All of the lower grades, except first and multi-grade combination classrooms, are filled disproportionately by senior teachers.

Class size reduction—The primary grades became more attractive when their class size limit was lowered to twenty. According to one elementary teacher, however, the first grade was seen as more difficult. Another teacher agreed that first grade was especially challenging because it was without the teaming that occurs at kindergarten. A kindergarten teaching assignment, with its half-day schedule, was considered particularly desirable, and senior teachers had been able to

fill those positions. When an opening occurred, due to current district hiring practices, F-SUSD was required to consider current employees before looking at new applicants.

Tolerance—One instructor speculated that “older” teachers tolerated the behaviors of primary kids longer, and teachers’ tolerance of fifth and sixth grade behavior declined over time, motivating the educators to seek lower-grade teaching positions.

Uncomfortable work environment for new teachers—Perhaps new teachers were not comfortable teaching the lower grades which were so often taught by senior educators. One probationary teacher said she would be leaving the district because of personal reasons and her school situation. This year, she taught with two other new teachers and a group of educators who had worked together for a long time. The three new teachers felt alienated, finding it difficult to break down “teaching-style barriers.” Their ideas were not always well received, and there was not an “overall environment of cooperation and collaboration.” A probationary teacher stated, “Personal feelings and attitudes come out and professionalism is left behind sometimes. It is sad, and I wish it were different. I tried for a long time to make an effort, to use [veteran teachers] as a resource of experience. But it has blown up in my face too many times for me to want to keep trying. And I’m not a quitter. I don’t like to give up.”

CONCLUSIONS

When a vast majority of teachers at particular schools or in certain fields, such as special education, are new and lack experience, one can speculate that students’ educations suffer. The Center for Public Education has said that research shows a consistent positive correlation between years of teaching experience and higher student achievement, and some studies even suggest that inexperienced teachers can be a significant detriment to student performance. Many people would view staffing inequalities as a problem. A former district personnel director even believed that the most competent teachers should be placed with the students who need the most help. However, some educators don’t agree. They candidly stated that the more experienced staff should work with those students who show the most academic promise, not those at the alternative school and in special education.

These same teachers, however, are worried about the pending exodus of educators. The National Education Association reported in its May 2006 magazine, *NEA Today*, that teaching is a rapidly graying profession. While just 25% of the work force was 50 or older in 1966, 42% is in that age category today. The National Education Association also reported that a full 50% of high school teachers plan to leave by 2010. In an article in the *San Francisco Chronicle* (May 4, 2006) entitled, “Education is sinking ship; teachers bail,” columnist C. W. Nevius describes a tsunami of a teacher crisis. He explains that a huge percentage of teachers that went into the profession in the ‘60s is about to retire, and financial demands are causing other educators to flee. “It is a double whammy. The teacher shortage is coming, and schools are losing their top professionals. . . Education is the Titanic.”

According to numerous sources, including the National Commission on Teaching and America’s Future, nearly half of all new teachers leave the profession within the first five years of employment. The commission commented on the staggering attrition rate, “The real school staffing problem is teacher retention. Our inability to support high quality teaching in many of our schools is driven not by too few teachers entering, but by too many leaving.”

If a school district wishes to retain new teachers and to have staff fill particular fields, several options are available. Although one educator in F-SUSD noted that the greatest incentive to teach is the psychological reward of imparting knowledge to students, he also declared that salaries have to be higher. If a district wants teachers to work in difficult assignments, either the pay must be raised or the working conditions improved. Differential pay or a “bonus” for teaching in certain areas is an option, although the California Teaching Association and local

union leadership are not in favor of this. Working conditions could be improved by such amenities as smaller class size, a classroom instructional assistant, and a shortened work day. These are all components of the Solano County Office of Education's alternative education program, which has no trouble retaining staff, even though it serves many of the county's most needy students. Additional supports for novice teachers, such as strong principals who focus on professional learning, programs which encourage collegiality and cooperation, and intensive new teacher-induction programs with job coaches have also been cited as helpful.

To acquire talented teachers for hard-to-fill positions, the district could increase recruitment efforts and collaborate with colleges which have quality higher-education programs. One former personnel director thinks the district should consider an "indentured servitude" plan. The district could identify promising local high school students and encourage them to get college training in needed fields. Then the district could pay for the training and forgive the loans if the individuals teach in critical areas for a certain period of time.

To keep good teachers in needed areas, a school district also could limit transfers. However, this carries a risk. Tighter intra-district transfer policies might serve to keep teachers in critical fields but could prompt them to leave the district. For example, when a credentialed, F-SUSD alternative school teacher was denied a regular high school position, she resigned at the end of the year and took a job in Texas. Another F-SUSD teacher with fifteen years of special education experience wasn't allowed to transfer to a general education field, so he simply quit. After selling shoes for several years, this teacher returned to his previous school to teach social science.

To retain staff, one senior instructor indicated that teaching needs to be rewarding. He stated, "There's a fallacy that besets the administrative mind that whatever is good for teachers must be bad for students. Whatever is good for teachers and makes the job attractive *is* good for students because it retains competent teachers in critical positions. A large issue is that teachers are driven out by 33% of the students due to their motivational and/or behavioral issues. Teachers gravitate to fields and districts where students are more apt to accept instruction." Therefore, it is critical that teachers are backed by administrators and support staff that can deal with students who have behavioral issues or other difficulties which hinder their learning and undermine the teachers' efforts in the classroom.

For staffing purposes, districts need to be aware of impending retirements and that many senior teachers fall into certain fields. Districts should investigate ways to encourage employment of competent individuals in critical areas and retain those who are hired. While I have not yet investigated all of the educational implications of teaching assignments nor have I identified all the possible remedies for the problems, the teachers' comments can be used as a springboard for change and deserve further study.

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Suzanne Carlson graduated *Summa Cum Laude* from the University of Northern Colorado with a bachelor's degree in elementary education and a minor in English. She also holds a master's degree from the University of Texas at Austin in curriculum and instruction with an emphasis in special education. A former mentor, she has taught fourth through sixth grades in Kansas, Texas, and Maryland and has served as a special educator and department/grade level chair at elementary, middle, and high schools. Suzanne has taught for twenty-five years in the Fairfield-Suisun Unified School District. She currently works for Fairfield-Suisun as a special education consult and designated instructional services specialist and focuses on the Solano County Office of Education's community school, Golden Hills. She enjoys spending time with her husband, a Spanish teacher at Armijo High School, and twelve-year-old daughter. She likes to travel overseas, renovate her historic home in downtown Fairfield, and bargain shop.

FaraLee Wright holds a BS degree in economics from Elizabethtown College, Pennsylvania. She teaches statistics, AVID, and geometry at Armijo High School and has been a facilitator of the school's CRESS Teacher Research group for four years. FaraLee has taught for three years at the Vacaville Christian Academy, five years at Grange Middle School in Fairfield, and thirteen years at Armijo High School.

Robert Wright grew up in Dallas, Texas, and graduated from Texas A&M University. He has taught mathematics and computers for six years at Vallejo's California Maritime Academy, part of the California State University system. He and FaraLee have been married for thirty-four years and have two children and three grandchildren. They enjoy movies, reading, and road trips in their free time.

Thanks to Joe Summers, Armijo High School computer teacher, for additional technical assistance.

APPENDIX A

SUBJECT	BASE DATA								Expected		Observed-Expected		(O-E)^2/E	
	Number of Teachers with ≥ 20 Years	Number of Teachers with ≤ 2 Years	Percentage of Teachers with ≥ 20 Years	Percentage of Teachers with ≤ 2 Years	Difference between Numbers of Teachers	Difference between Percentage of Teachers	Percentage of Teachers in Subject with ≥ 20 Years	Percentage of Teachers in Subject with ≤ 2 Years	Number of Teachers with ≥ 20 Years	Number of Teachers with ≤ 2 Years	Number of Teachers with ≥ 20 Years	Number of Teachers with ≤ 2 Years	Number of Teachers with ≥ 20 Years	Number of Teachers with ≤ 2 Years
Adaptive PE	0	1	0.00%	0.40%	1	0.40%	0.00%	100.00%	0.459167117	0.540832883	-0.459167117	0.459167117	0.459167117	0.389832883
ROTC	0	2	0.00%	0.80%	2	0.80%	0.00%	100.00%	0.918334235	1.081665765	-0.918334235	0.918334235	0.918334235	0.779665765
Self-contained Alternative Regular Ed.	0	5	0.00%	2.00%	5	2.00%	0.00%	100.00%	2.295835587	2.704164413	-2.295835587	2.295835587	2.295835587	1.949164413
Combination K-1	0	5	0.00%	2.00%	5	2.00%	0.00%	100.00%	2.295835587	2.704164413	-2.295835587	2.295835587	2.295835587	1.949164413
Combination Grades 1-2	0	3	0.00%	1.20%	3	1.20%	0.00%	100.00%	1.377501352	1.622498648	-1.377501352	1.377501352	1.377501352	1.169498648
Combination Grades 2-3	0	5	0.00%	2.00%	5	2.00%	0.00%	100.00%	2.295835587	2.704164413	-2.295835587	2.295835587	2.295835587	1.949164413
Combination Grades 4-5	0	2	0.00%	0.80%	2	0.80%	0.00%	100.00%	0.918334235	1.081665765	-0.918334235	0.918334235	0.918334235	0.779665765
Home Economics	1	0	0.47%	0.00%	-1	-0.47%	100.00%	0.00%	0.459167117	0.540832883	0.540832883	-0.540832883	0.637023419	0.540832883
Independent Study	1	2	0.47%	0.80%	1	0.33%	66.67%	1.377501352	1.622498648	-0.377501352	0.377501352	0.103453453	0.087831981	
Low Vision	1	1	0.47%	0.40%	0	-0.07%	50.00%	50.00%	0.918334235	1.081665765	0.081665765	-0.081665765	0.007262385	0.006165765
Nurse	1	2	0.47%	0.80%	1	0.33%	33.33%	66.67%	1.377501352	1.622498648	-0.377501352	0.377501352	0.103453453	0.087831981
Student Activities	1	0	0.47%	0.00%	-1	-0.47%	100.00%	0.00%	0.459167117	0.540832883	0.540832883	-0.540832883	0.637023419	0.540832883
Young Mothers	1	0	0.47%	0.00%	-1	-0.47%	100.00%	0.00%	0.459167117	0.540832883	0.540832883	-0.540832883	0.637023419	0.540832883
Grade 5-6	1	1	0.47%	0.40%	0	-0.07%	50.00%	50.00%	0.918334235	1.081665765	0.081665765	-0.081665765	0.007262385	0.006165765
English Language Development	2	0	0.94%	0.00%	-2	-0.94%	100.00%	0.00%	0.918334235	1.081665765	1.081665765	-1.081665765	1.274046838	1.081665765
Foreign Language	2	9	0.94%	3.60%	7	2.66%	18.18%	81.82%	5.050838291	5.949161709	-3.050838291	3.050838291	1.842786037	1.564525345
Special Day Class (SDC)	2	17	0.94%	6.80%	15	5.86%	10.53%	89.47%	8.72417523	10.27582477	-6.72417523	6.72417523	5.182671293	4.400087928
Work Experience	2	0	0.94%	0.00%	-2	-0.94%	100.00%	0.00%	0.918334235	1.081665765	1.081665765	-1.081665765	1.274046838	1.081665765
Business/Computers	3	3.5	1.41%	1.40%	0.5	-0.01%	46.15%	53.85%	2.984586263	3.515413737	0.015413737	-0.015413737	7.96034E-05	6.7583E-05
Counselor/Guidance Teacher	3	5	1.41%	2.00%	2	0.59%	37.50%	62.50%	3.673336939	4.326663061	-0.673336939	0.673336939	0.123425278	0.104788061
Librarian	3	1	1.41%	0.40%	-2	-1.01%	75.00%	25.00%	1.836668469	2.163331531	1.163331531	-1.163331531	0.736845148	0.625581531
On Special Assignment	3	0	1.41%	0.00%	-3	-1.41%	100.00%	0.00%	1.377501352	1.622498648	1.622498648	-1.622498648	1.911070257	1.622498648
Psychologist	4	7	1.88%	2.80%	3	0.92%	36.36%	63.64%	5.050838291	5.949161709	-1.050838291	1.050838291	0.218629275	0.185616254
Reading Specialist	4	2	1.88%	0.80%	-2	-1.08%	66.67%	33.33%	2.755002704	3.244997296	1.244997296	-1.244997296	0.562619508	0.477663963
Resource Specialist Program (RSP)	4	17.5	1.88%	7.00%	13.5	5.12%	18.60%	81.40%	9.872093023	11.62790698	-5.872093023	5.872093023	3.492823294	2.965406977
Art	4.5	2	2.12%	0.80%	-2.5	-1.32%	69.23%	30.77%	2.984586263	3.515413737	1.515413737	-1.515413737	0.769446279	0.653259891
Music	5	8	2.36%	3.20%	3	0.84%	38.46%	61.54%	5.969172526	7.030827474	-0.969172526	0.969172526	0.157357721	0.133596705
Grade 4	5	9	2.36%	3.60%	4	1.24%	64.29%	35.71%	6.428339643	7.571660357	-1.428339643	1.428339643	0.317368753	0.269446071
Consult Teacher/Strategy Coach	6	2	2.83%	0.80%	-4	-2.03%	75.00%	25.00%	3.673336939	4.326663061	2.326663061	-2.326663061	1.473690296	1.251163061
Science	6	20	2.83%	8.00%	14	5.17%	23.08%	76.92%	11.93834505	14.06165495	-5.938345051	5.938345051	2.953838392	2.507808795
Speech	6	4	2.83%	1.60%	-2	-1.23%	60.00%	40.00%	4.591671174	5.408328826	1.408328826	-1.408328826	0.431953859	0.366728826
Industrial Arts	7	1	3.30%	0.40%	-6	-2.90%	87.50%	12.50%	3.673336939	4.326663061	3.326663061	-3.326663061	3.012706786	2.557788061
Grade 1	7	13	3.30%	5.20%	6	1.90%	35.00%	65.00%	9.183342347	10.816657653	-2.183342347	2.183342347	0.519090286	0.440707653
Grade 5	7	10	3.30%	4.00%	3	0.70%	41.18%	58.82%	7.805840995	9.194159005	-0.805840995	0.805840995	0.083191511	0.070629593
Grade 6	7	10	3.30%	4.00%	3	0.70%	41.18%	58.82%	7.805840995	9.194159005	-0.805840995	0.805840995	0.083191511	0.070629593
Math	9	15.5	4.24%	6.20%	6.5	1.96%	36.73%	63.27%	11.24959438	13.25040562	-2.249594375	2.249594375	0.449853984	0.381926033
English/Drama	12.75	16.5	6.01%	6.60%	3.75	0.59%	43.59%	56.41%	13.43063818	15.81936182	-0.680638183	0.680638183	0.034493397	0.029284894
Social Science	15	12	7.07%	4.80%	-3	-2.27%	55.56%	44.44%	12.39751217	14.60248783	2.602487831	-2.602487831	0.546314681	0.463821165
Kindergarten	16	8	7.54%	3.20%	-8	-4.34%	66.67%	33.33%	11.02001082	12.97998918	4.979989183	-4.979989183	2.250478033	1.91065585
Grade 2	19	10	8.95%	4.00%	-9	-4.95%	65.52%	34.48%	15.6841536	15.6841536	-5.684153597	5.684153597	2.426402433	2.060015666
Grade 3	20	9	9.42%	3.60%	-11	-5.82%	68.97%	31.03%	13.3158464	15.6841536	6.684153597	-6.684153597	3.355243666	2.848601872
PE	21	9	9.89%	3.60%	-12	-6.29%	70.00%	30.00%	13.77501352	16.22498648	7.224986479	-7.224986479	3.789501153	3.217286479
Totals	212.25	250	100.00%	100.00%	37.75	0.00%	45.92%	54.08%			0.000	-0.000	51.967	44.120

5.053571429 5.952380952 11.0060

0.898809524 8.17%

0.000

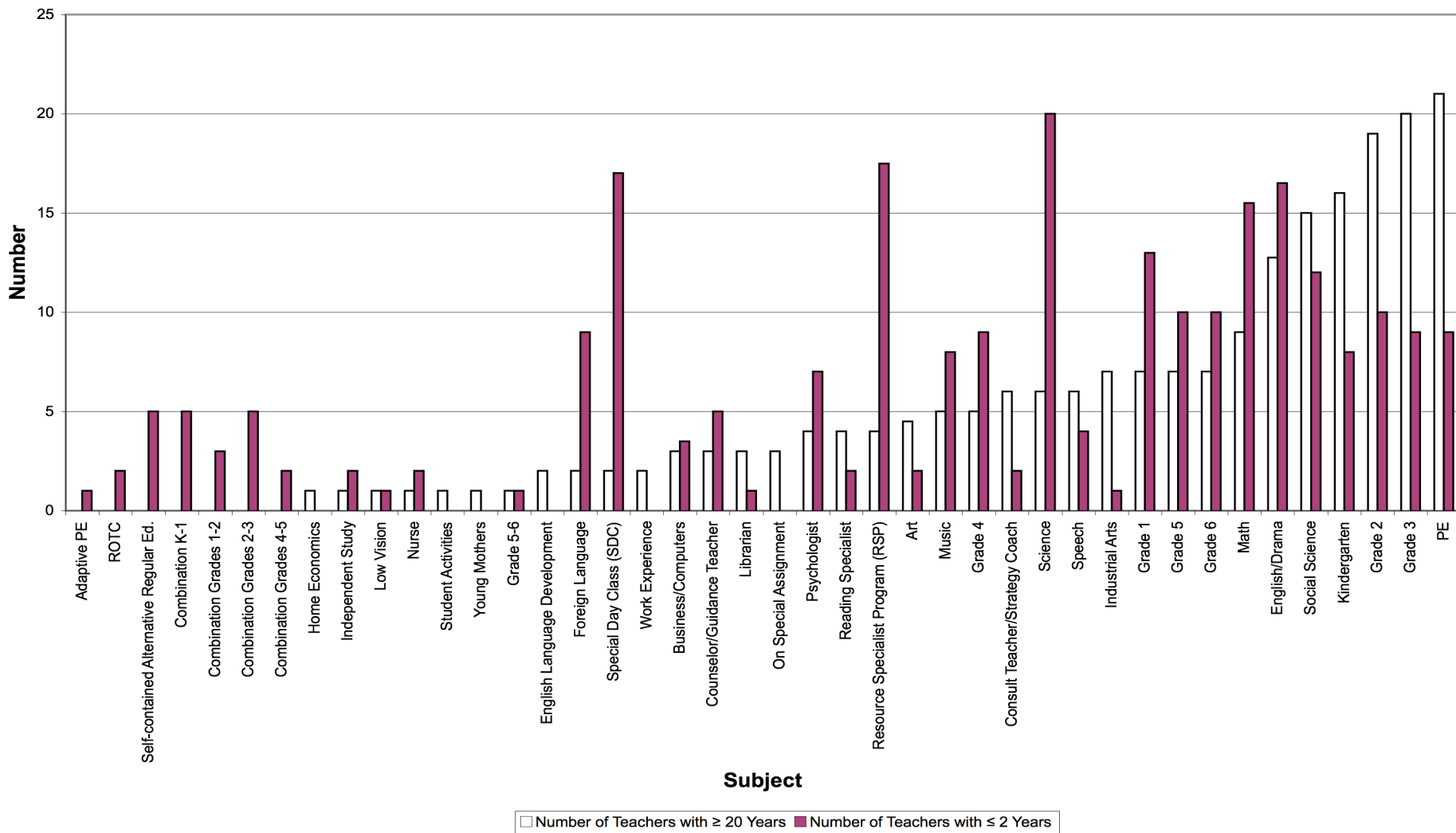
96.086

8.17%

26.51

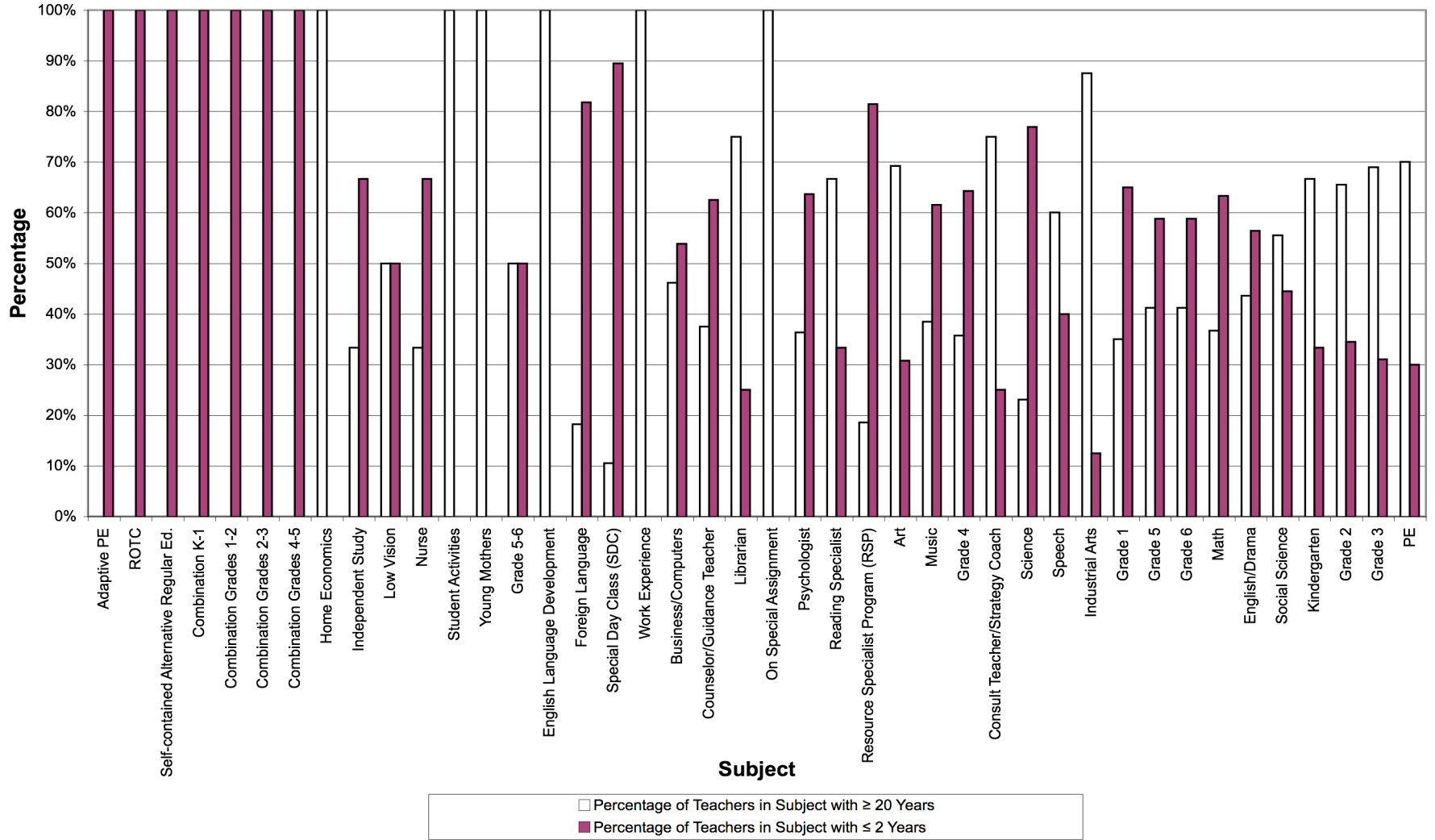
APPENDIX B

Distribution of Teachers by Number



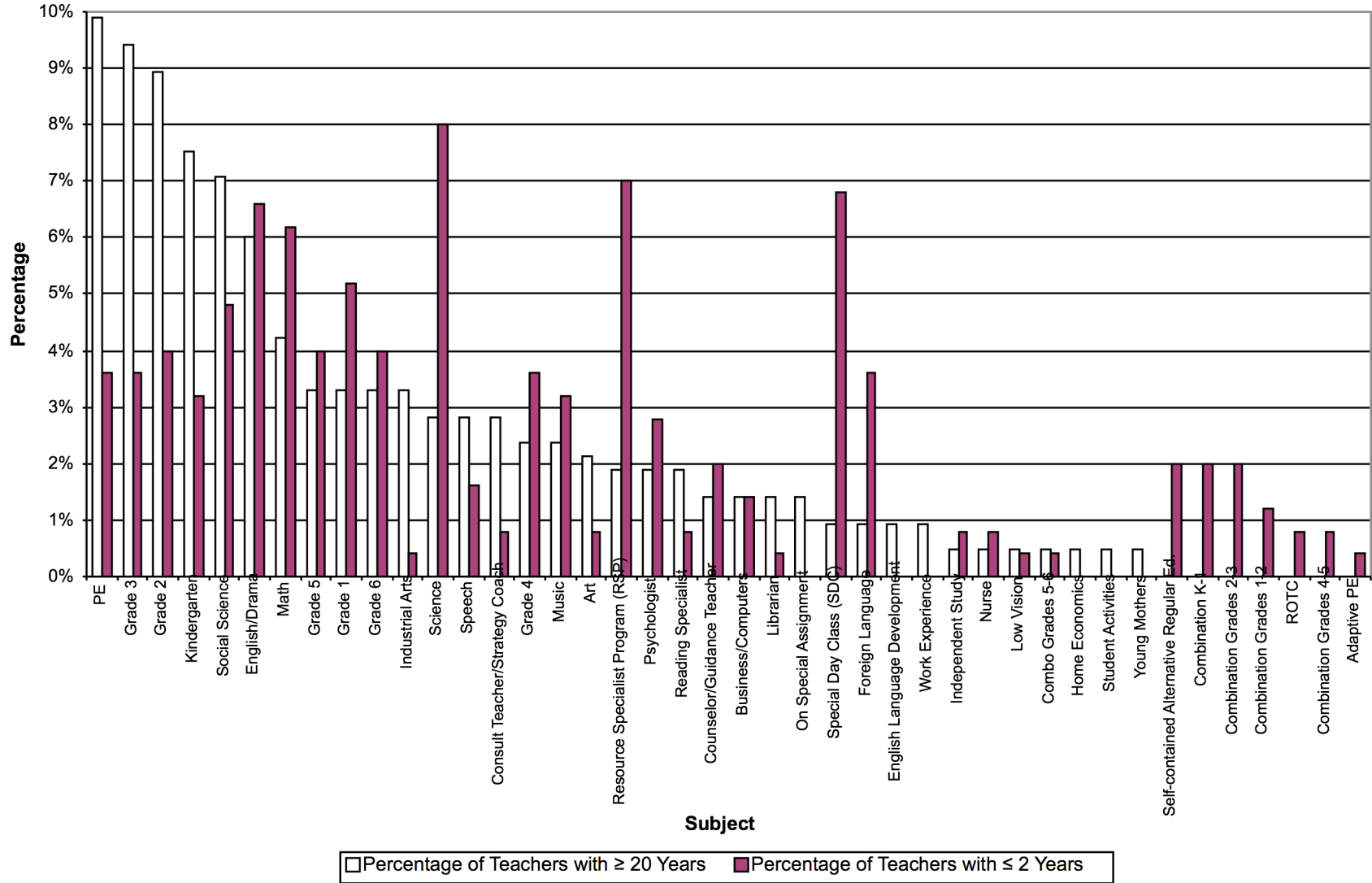
APPENDIX C

Distribution of Teachers by Percentage



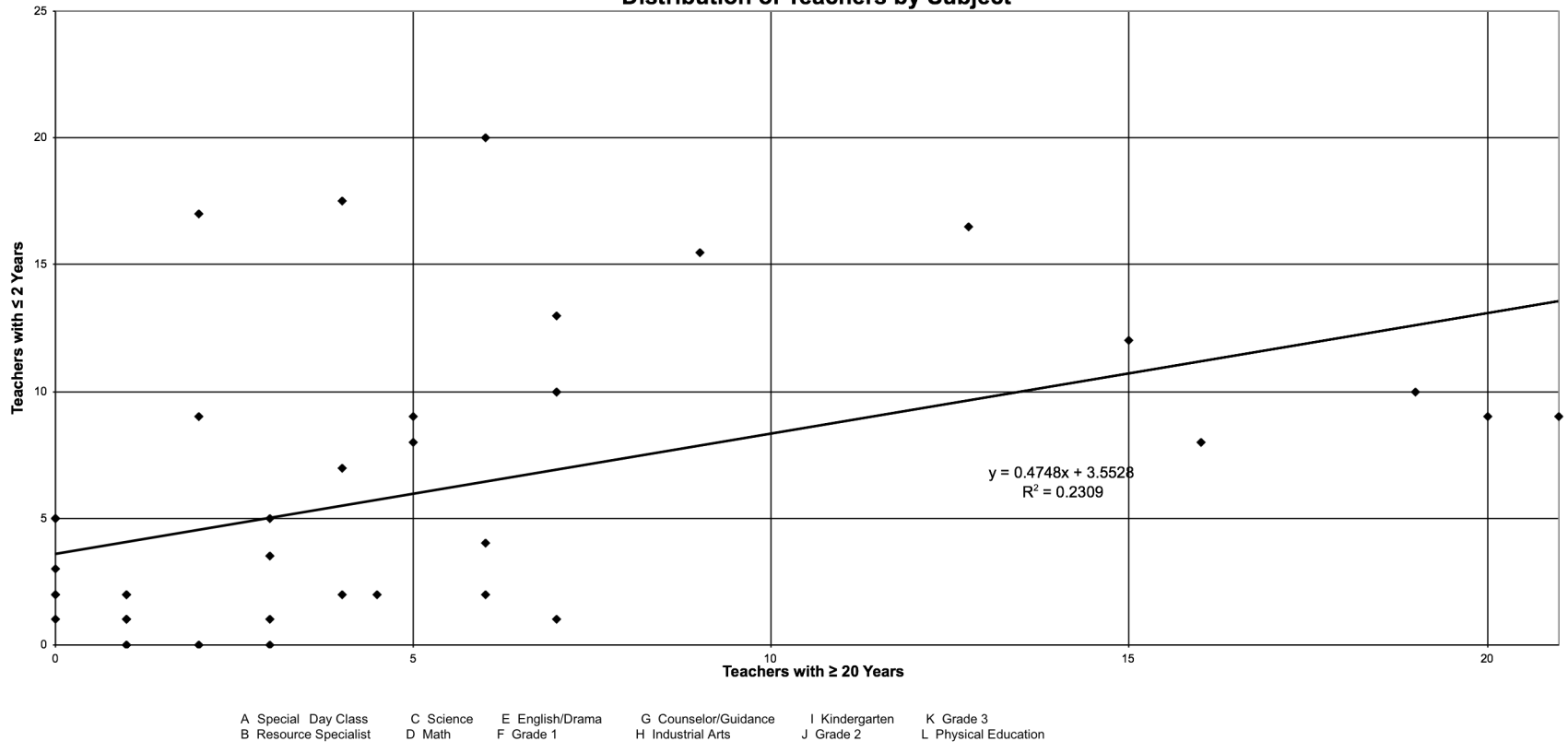
APPENDIX D

Pareto Chart by Percentage of Teachers ≥ 20 Years



APPENDIX E

Distribution of Teachers by Subject



APPENDIX F

Sample E-Mail Queries

Date:	Thu, 05 May 2005 14:36:41 -0700
From:	"Suzanne Carlson" <SuzanneC@fsusd.k12.ca.us>
To:	Special Education Teachers
Subject:	Your Input, Please

Hi!

I'm a member of Armijo's teacher research group and investigating teacher job assignments as part of the buy-back requirement. As you probably know, F-SUSD has very few senior special ed. teachers and many probationary instructors. What are your thoughts as to why few teachers stay in special ed. in this district? I promise not to use your name in my report.

Thanks for your ideas.

Suzanne

Date:	Thu, 05 May 2005 14:04:09 -0700
From:	"Suzanne Carlson" <SuzanneC@fsusd.k12.ca.us>
To:	Senior and New Elementary Teachers
Subject:	Your Input, Please

Hi,

I'm a member of Armijo's teacher research group and investigating teacher job assignments as part of my buy-back days this year. I've found that there is an appreciable difference between the number of senior and junior staff teaching certain grades. Many more senior teachers instruct kindergarten, second, and third grade than junior staff. However, more junior staff teach first grade than senior teachers. There is no marked discrepancy at grades 4 through 6.

Do you have any idea why any of this is the way it is? I'd appreciate your thoughts and promise not to use your name as the source of my information.

Thanks! Suzanne Carlson

Sp. Ed. Teacher

APPENDIX G

Glossary

IEP	Individualized Education Plan
ITP	Individual Transition Plan
RSP	Resource Specialist Program
SDC	Special Day Class
STAR	Standardized Testing and Reporting
USD	Unified School District

A Word Problem Study

Sandra Crepps, Elizabeth Brothers, and Courtney Young,
in collaboration with the NSF CCBI project with UC Davis math
students: Barbara Villatoro and Annie Oppman
Gretchen Higgins Elementary School, Dixon Unified, Dixon, California.

ABSTRACT

Research Question: How can we help our students be more successful at solving word problems?

Context: “A Word Problem Study” is part of an NSF Collaborative Classroom-Based Inquiry Project that connects University of California, Davis graduate and undergraduate students with K-12 math and science teachers conducting teacher research. This study took place in three regular, self-contained classrooms of second and third graders of diverse academic levels and needs, including English Language Learners. Our second and third grade students were struggling with solving word problems.

Results: Over time there was an improvement in student success in solving problems and in their ability to write and solve their own word problems. **Methods and Data:** Three elementary teachers collaborated with an undergraduate and a graduate student to investigate the effects of their teacher-made word problem curriculum on the abilities of their students to solve and write word problems. Collection of data included student word problems, surveys, interviews, teacher-made quizzes, and district tests.

Conclusions: It was found that using rubrics and a variety of instructional approaches, as well as having students write, solve, and present their own word problems, led to a noted increase in students’ ability to solve word problems.

Key Words—word problems, mathematics, writing, English Language Learners, rubrics, assessments, curriculum integration.

CSTP 5.3 Involving and guiding all students in assessing their own learning.

CSPT 5.4 Using the result of assessments to guide instruction.

California Mathematics Content Standards

Second Grade: Mathematical Reasoning 1.0. Students make decisions about how to set up a problem.
2.0 Students solve problems and justify their reasoning.

Third Grade: Mathematical Reasoning 1.0. Students make decisions about how to approach problems.
2.0. Students use strategies, skills, and concepts in finding solutions. **3.0.** Students move beyond a particular problem by generalizing to other situations.

CONTEXT

Few would contest the value of teachers collaborating on curriculum and students’ needs. Like most schools, our K–6 school of 650 students in Dixon, California, has a weekly time set aside for collaboration by grade level. But the needs our common planning time must fulfill are many and diverse: school-wide to district-wide issues, fieldtrips, schedules, standards, assessments, new programs; the list goes on and on. Time to really focus on a particular facet of our curriculum is severely limited, and it is even harder to collaborate with other grade levels.

Fortunately, being a part of teacher research and a GK-12 NSF grant this year has enabled us to do the important work of collaboration. That collaboration has not only improved our teaching practices and provided an outlet for creative thinking and planning, but it has also helped our students improve academically. The grant provided the three of us, Sandra Crepps, a third grade teacher; Elizabeth Brothers, also a third grade teacher; and Courtney Young, a second grade teacher, the privilege of working with two talented UC Davis mathematics students—graduate student, Barbara Villatoro, and undergraduate student, Annie Oppman—to help us with our data collection and analysis.

We three teachers work at Gretchen Higgins Elementary School where the makeup of the students in our classrooms closely match that of the school, which is approximately 47% white,

41% Hispanic, 3% African American, and 3% Asian. Forty-seven percent of our school's population participates in the free or reduced lunch program. English Language Learners comprise 19% of the student body. When we began to meet and discuss what our teacher research question would be this year, we discovered that we had a shared concern when it came to our students' lack of success in mathematics and their inability to solve word problems. We were concerned about both our second graders' lack of confidence in solving word problems and our third graders' unsubstantiated confidence that they could solve word problems.

Young describes how she came to the importance of looking at word problems and her students like this: *I quickly discovered word problems to be the "fear factor" in my classroom math lessons. I would look at a sea of waving hands and hear the same refrain when they got to the bottom of the page where there was always a word problem lurking: "Do we have to do the bottom problem?" "I don't get this!" "I need help!" My students perceived any problems containing words as impossible to solve without my help.*

At the third grade level, we found that the word problem lessons in the grade level math textbook were difficult and confusing for our students because they needed much more practice with a particular strategy rather than the short and mixed practice provided. We also noticed from the released questions and blueprints provided from the California Standards Assessments materials that word problems were not assessed separately; rather they were embedded throughout the test which increased the importance of our students being able to read and to solve word problems.

It was obvious to us that our students could benefit from focused work on word problems. Because we believe that problem solving abilities and critical thinking are crucial to our students' future academic success and are important life skills, we carved out word problem instructional periods above and beyond the required minutes that we taught core materials in English language arts and math. We were very limited in our options, but second-grade teachers were able to use two periods a week of approximately forty-five minutes, and third-grade teachers used four periods a week of thirty minutes, in which to begin our study of word problems. Our teacher research question became: How can we help our students be more successful at solving word problems?

HOW CAN WE HELP OUR STUDENTS BE MORE SUCCESSFUL AT SOLVING WORD PROBLEMS?

We determined that one measure of our students' success at solving word problems would be how well they performed on the word problem section of the district trimester math tests. We used our district trimester math tests and our core math materials to help us write similar types of problems to be used as pre and post assessments for the second grade and the third grade students (see appendices A and B). We administered these tests to our students before and after our word problem instruction. These assessments served as baselines and were useful tools in evaluating student improvement over time.

After administering the pretest, third grade decided to begin their word problem sessions in December. We began by taking some time to interview students to find out how they were solving word problems. The interviews were helpful, but also dismaying, as we found out that some students had fundamental misconceptions about math operations, such as thinking that a column of numbers could be subtracted as in addition. Many students could not explain how they arrived at their answers. We also discovered that some of our students had little or no understanding of money concepts.

We decided to have our third graders work with a five point version of the word problem rubric that Crepps developed last year (see figure 1). We used the rubric to talk with our students about the parts of word problems, and how we would like them to show their work. We then

practiced using the rubric to score word problem solutions and to help in the writing of word problems. This practice was done whole class, in partners, and individually.

We began the third grade’s focus on word problems with ambitious and detailed plans for a week’s worth of lessons. The thirty-minute daily lesson began with a teacher “think-aloud,” had student pairs discussing and solving a problem, then students individually solving a similar problem, and finally, students writing reflections in their journals. While students were writing in their journals, we planned to conference with individuals about their word problems and solutions. All too quickly, we found this structure too regimented and not doable in the allotted time. We needed to scale back what we were attempting to do each day, and we soon developed a more realistic four-day plan which we used for the rest of the year. This plan is discussed in more detail later.

WORD PROBLEM RUBRIC						
	0	1	2	3	4	5
<i>Number Sense</i>	No numbers	Single digit, simple numbers Very easy numbers	Two digit numbers Fairly easy numbers	Numbers in the hundreds Medium-difficult numbers	Numbers in the thousands, labeled with correct units Difficult numbers	Numbers in the ten thousands. labeled with correct units. multiple steps. Challenging numbers
<i>Math Vocabulary</i>	No math words	One math word or expression	Two math words or expressions	Three math words or expressions	Four math words or expressions	Five math words or advanced or exceptional math words
<i>Story: Who, what, where, why, when, and how</i>	Not done at all	Little information Simple word choice	Missing information pertinent to solving the problem. Basic word choice.	Complete information with adequate details. Includes a question	Complete information with good details. Includes a question	Complete information with excellent details. Excellent word choice. Includes a question
<i>Sentences: Punctuation/ Grammar/ Syntax</i>	Not done at all	Almost no punctuation One or no complete sentences	Many errors in spelling/punctuation. May have incomplete sentences, no question mark. 2-3 Sentences.	Some errors in spelling/punctuation. Must have a question mark. Three or four good sentences.	Very few errors in spelling/Punctuation. Must have a question mark. Four or five good sentences.	All grade-level spelling/punctuation correct. Five or more excellent sentences.
<i>Word Problem Solution</i>	None	Little or no work, one step Little or no understanding of the problem	Some work, some drawing. Incomplete Incorrect answer	Work shown with correct answer. Or minor calculation error with drawing or explanation.	Work shown with correct answer and labeled drawing or explanation.	Work shown with correct answer, labeled drawing, and explanation.

Figure 1. Modified version of rubric developed by Crepps in 2004-05.

More on Rubrics

Over time, the word problem rubrics became an important and integral part of second and third grade word problem sessions. Rubrics enabled both teachers and students to discuss word problems in explicit and specific ways. They helped students to understand what was required, and how they could improve their scores by answering more completely. Using rubrics helped ensure consistency in scoring our students’ word problems and solutions, and enabled us to chart their progress.

The third grade began using the solution part of the rubric to focus students on particular aspects of solving word problems that could help them have more success, such as showing their work, drawing a picture, and learning different strategies. The hope was that having a specific, multi-faceted way to arrive at a solution would help students read the word problems more carefully, and pay attention to important features such as specific numbers, and key words and phrases (see figure 2 below). A score of five was added to the rubric to encourage students to use multiple strategies. We hoped this would increase their understanding of the problems and prevent the occurrence of careless errors. While careless errors were not eradicated, we did see rubric scores improving and had students telling us that drawing and labeling helped them to catch some of their mistakes.

Third Grade Solution Rubric					
0	1	2	3	4	5
No work	Little or no work or a partial step. Little or no understanding of the problem.	Some work, partial drawing, or a step of the problem. Incomplete or incorrect answer.	Work shown with correct answer, or minor calculation error with drawing or explanation	Work shown with correct answer and labeled drawing or sentence with the solution.	Work shown with correct answer, labeled drawing, and a sentence with the solution.

Figure 2.

During the first few weeks of correcting the second graders’ work, we found that we wanted more detailed data than simply noting if the problems were correct or not. We wanted data that would give us more information regarding the types of errors the students were making. Also, we wanted students to write better solutions. The second grade rubric that we devised is shown below (see figure 3 below). The rubric was written so that students would receive less credit for an answer with little or no work shown, and more credit for a correct answer supported with work.

Second Grade Solution Rubric				
0	1	2	3	4
No work	Answer with no work or incorrect strategy	Incomplete solution with correct strategy	Error in calculation with correct strategy	Correct solution with correct strategy

Figure 3.

Second grade also used a chart to help students understand what features should be in the word problems they were writing. The specificity of the chart helped second graders write more complete and interesting word problems (see figure 4).

Second Grade
Write your word problem to include:
1. Setting
2. Characters
3. Characters' actions
4. Numbers
5. Question

Figure 4.

Writing and Implementing Our Plans for the Word Problem Sessions

We knew that we wanted to help our students become better at solving word problems, but how? What approaches should we take? We talked together and shared ideas. We studied the state standards and our second and third grade Houghton Mifflin core math materials. We also read books such as: Susan O'Connell's *Now I Get It, Strategies for Building Confident and Competent Mathematicians, K-6* (2005), and Suzy Ronfeldt's *Third Grade Math, A Month-to-Month Guide* (2003). Both second and third grades devised a calendar for planning the word problem sessions and outlining what instructional approaches to use. Also noted on the calendar were the concepts to be covered and the assessment dates. The following is a second grade example—Wednesday: solve fraction word problems in small groups; Thursday: write fraction word problems; and, the following Wednesday: test on fraction word problems. The calendar was a framework by which to navigate. Third grade's schedule evolved into the following pattern: on Mondays students took a four-problem quiz which was used to guide the week's lessons and to choose teachers for Thursday's lesson; on Tuesdays and Wednesdays, students solved teacher-generated word problems, often using manipulatives, and students wrote and shared their own word problems. Thursdays were reserved for small group work directed by a student designated as a teacher for that group's session. Often, they would work together to solve four word problems. A majority of the teacher-students were chosen based on their exemplary performance on the weekly quiz; however, all students were given at least one opportunity to teach. One of us would meet with the teacher-students shortly before they were going to be working with their small groups to give them the answers and go over the word problems. See appendices C-H for samples of the types of work students were asked to do.

At the end of each session, we reflected on what had gone well and what needed adjustment. We then used that information to modify our plans for the next session. We prized our ability to be so flexible, but it wasn't always easy to accomplish since it involved almost daily planning, writing, and/or revising.

Second grade held word problem sessions twice a week for forty-five minutes beginning in early January. They met for thirteen weeks, a total of twenty-six sessions, during which the students were assessed with biweekly quizzes. Third grade began its four times a week, thirty-minute word problem sessions in the second week of November. Weekly quizzes were begun the second week of January. Third grade met for sixteen weeks, which was a total of sixty-four sessions.

WHICH INSTRUCTIONAL APPROACHES DID WE USE?

Over the course of the word problem sessions we knew we wanted to use a variety of instructional approaches since we believe whole-heartedly in what Susan O'Connell states so aptly in *Now I Get It*: "When searching for effective instructional practices for mathematics, we recognize that one size does not fit all. Instructional strategies that work for some of our students

are often ineffective for others. Although students may sit in the same classroom and participate in the same lesson, all of them do not understand at the same level or apply their learning in the same way (2005, p. 83).”

In the second grade classroom, we wanted to ensure the participation of the less-confident students when students shifted from working with a partner to working in small groups. For this reason, we decided to use a technique called “talking chips.” As O’Connell explains, “Each student has a chip and places it in the center of the group as he or she shares an idea. When everyone has talked (i.e. placed a chip), students retrieve the chips and the process begins again (2005, p. 64).” This was highly effective. Immediately we noted that this technique gave each student an opportunity to contribute through thoughts or ideas to the group without being interrupted or overruled. Second grade instructional approaches included: whole class, partners, individual, and small groups.

Third grade also used a variety of approaches to insure that different students’ needs would be met. We named one method “coach/learner.” In this method, each student in the pair would take a turn coaching and guiding the other in the solving of a word problem. By far one of the most popular methods we used was to designate students as the teacher of a group of three or four students. The teacher-student’s role was to use a positive manner to guide their classmates in solving the problems and to check their work. Another popular strategy was when student pairs or foursomes collaborated on writing word problems as puppet plays or skits to perform for the rest of the class. The audience’s role was to participate by solving the word problems. Students were also noticeably engaged when the two classes were brought together and the teachers role-played how to solve word problems, and correct and incorrect ways of working with partners. Later in the year, we also grouped two third graders with one second grader. This was a favorite of both second and third graders, but due to time constraints, we were only able to schedule these triads a few times.

ASSESSING THE EFFECTS OF OUR WORD PROBLEM SESSIONS

We used a variety of data sources to evaluate the effects of our word problem sessions. We were fortunate to have the able assistance and time of the two UC Davis students to help score solutions using the rubrics and to convert the data into graphs. One effect we wanted to analyze was to see if our students performed better on tests and quizzes. Figure 5 is a graph of the third graders’ rubric scores on the weekly quizzes. The students’ rubric scores were grouped into three categories of high (16 or more points out of 20), medium (between 10 and 16), and low (10 or less). The graph shows that the results were not linear, however, there was an upward trend. We can explain the up and down trends in two ways, 1) students often use and confuse new strategies as they are gaining mastery, and 2) from week to week, the types of problems would change, and thus the level of difficulty could be different from week to week. For example, when the quizzes didn’t include multiple-step money problems, the students did better. It is noteworthy that the number of students scoring in the low category goes from 23 on the first quiz, to 7 on the last quiz. Also, the number of students scoring in the medium category on the first quiz changes from 6 to 12 by the last quiz, and the number of students scoring in the high category rises from 10 to 12.

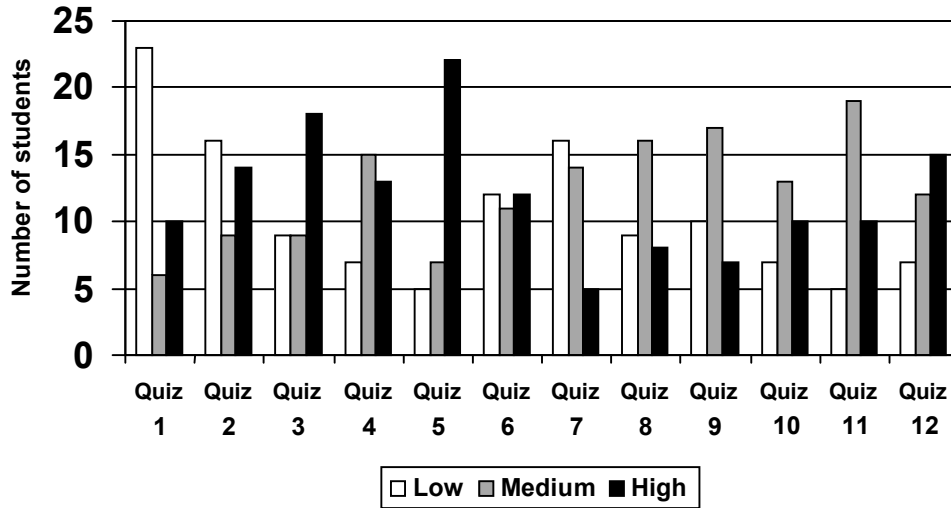


Figure 5. Third grade rubric scores on weekly quizzes.

The second grade rubric scores were treated similarly, except that a fourth category of “perfect” was made since there were only four points possible on each problem. Also, the number of questions on a quiz ranged from 4 to 7. As you can see in the graph below (figure 6), the number of student scores in the low category started at 6 and went down to 2 by the last quiz. The number of students scoring in the medium category rose from 7 to 10. The number of students scoring in the high category changed from 2 in the beginning to 3 by the end. There were three students with perfect scores at the beginning and three students with perfect scores at the end of the testing.

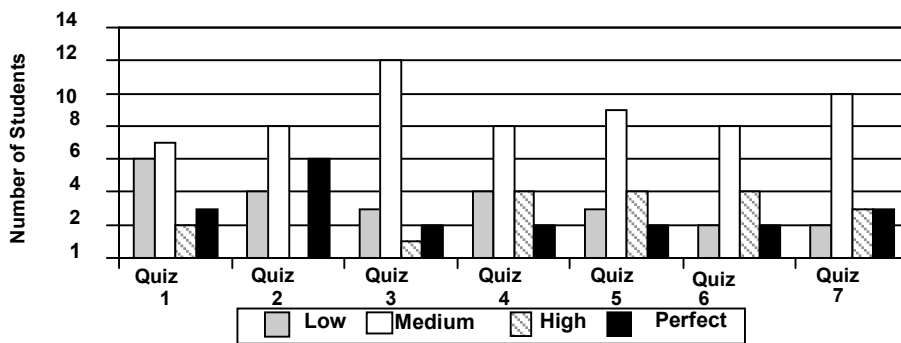


Figure 6. Second Grade Rubric Scores on Biweekly Quizzes

A second data source we used was to compare our third graders’ rubric scores on the eight-problem pre- and post test (see appendices A and B). The results are shown in the graph below (figure 7). By the end of the year, the number of third graders scoring in the low category (10 or less points) decreased by 72%. The number of students scoring in the medium category

(between 10 and 16) increased by 100%. Finally, the number of students scoring in the high category (16 or more) increased by 800%.

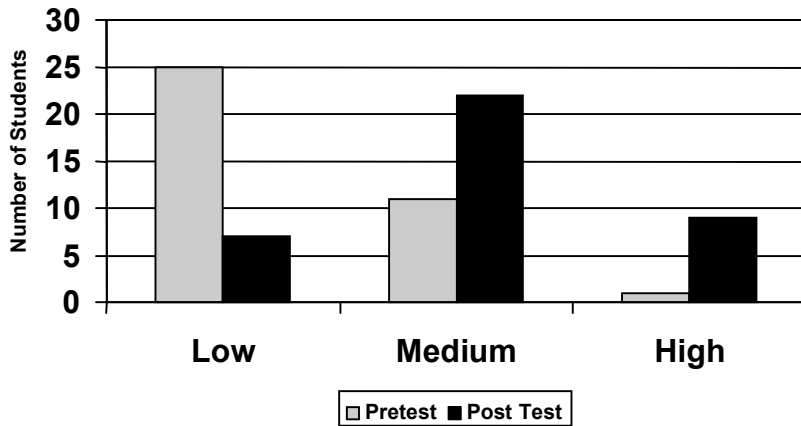


Figure 7. Third grade pre- and post test.

The results of the second grade pre- and post tests are shown in the graph below (figure 8). The number of second graders scoring in the low category decreased by 37.5%. The number of students scoring in the medium category increased by 100%. The number of students scoring in the high category increased by 50%, while the number of students scoring in the perfect category remained the same.

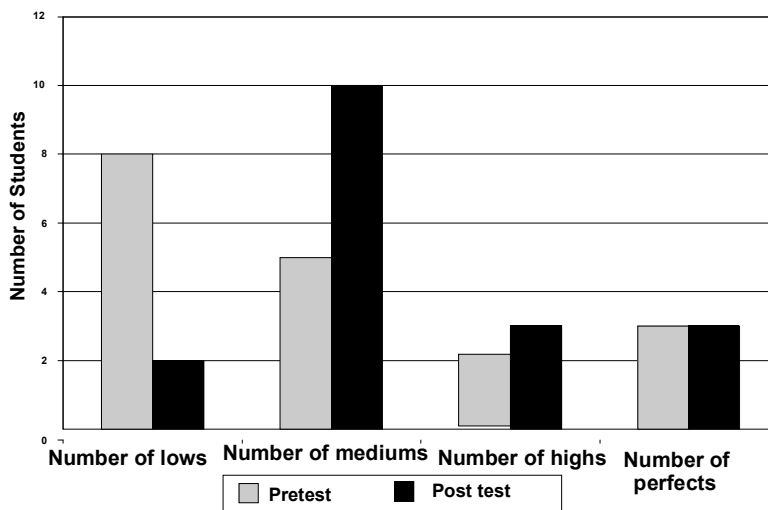


Figure 8. Comparison of second grade pre- and post tests.

In addition to comparing our pretest scores with our post test scores, we also compared our scores with another third grade class at our school. We feel this comparison is valid because the pretest averages among the three classes were similar. The results are shown in figure 9. On the post test, you can see that Brothers' class average doubled, and Crepps' class average increased by 80%, while the class average of the comparable class only increased by 39%.

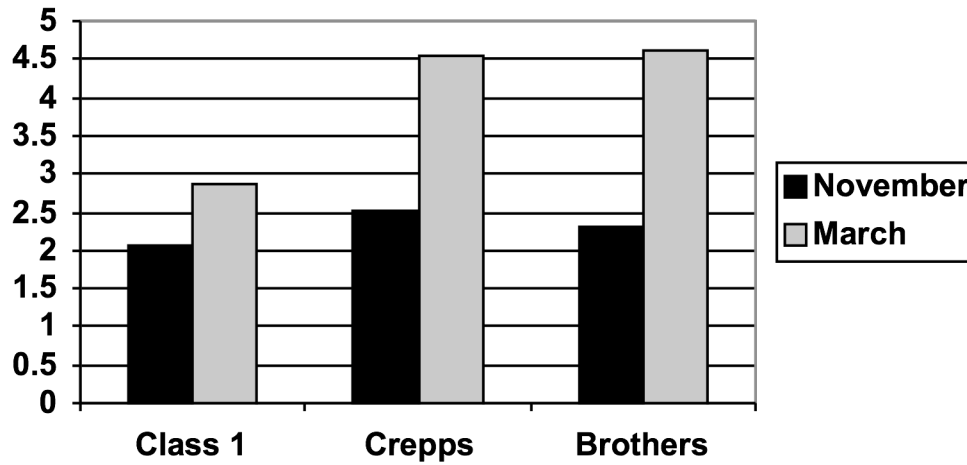


Figure 9. Average number of correct problems on third grade pre- and post tests.

Our two classes and a comparative third grade class were approximately equivalent in November since approximately 75% of all three classes scored less than 4 on the pretest (see figure 10).

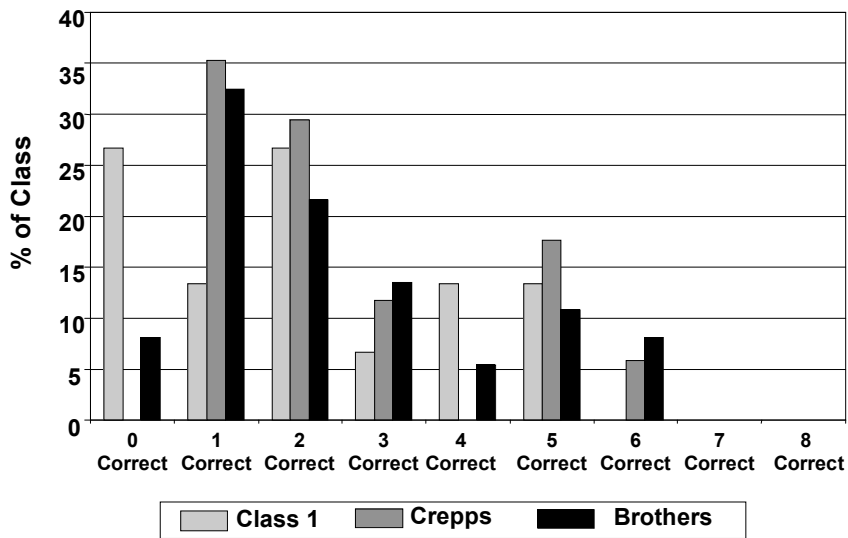


Figure 10. Third grade November pretest.

On the post test, 28% and 20% of our two classes scored less than 4, while the comparative class had more than 50% scoring less than 4 (see figure 11).

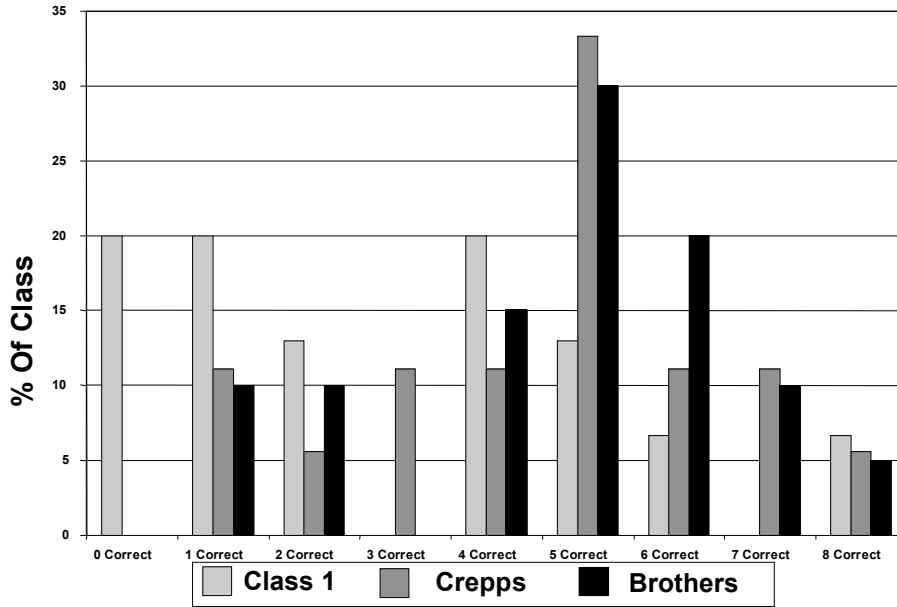


Figure 11. March post test.

A last bar graph (figure 12) compares Crepps and Brothers' classes with two other third grade classes at the school. Crepps and Brothers' classes had a combined average score of 13.9 on the pretest, while the other two classes' average combined score was 14.2. On the post test, the average score for the other two classes was 1.66 out of 4, compared to Crepps and Brothers' classes' average score of 2.33 out of 4. More than 65% of Crepps and Brothers' class scored 3 or better, as opposed to 32% for the comparison classes. Finally, more than 50% of the two other classes combined scored 1 or less, while only 25% of Crepps and Brothers' classes fell into that category.

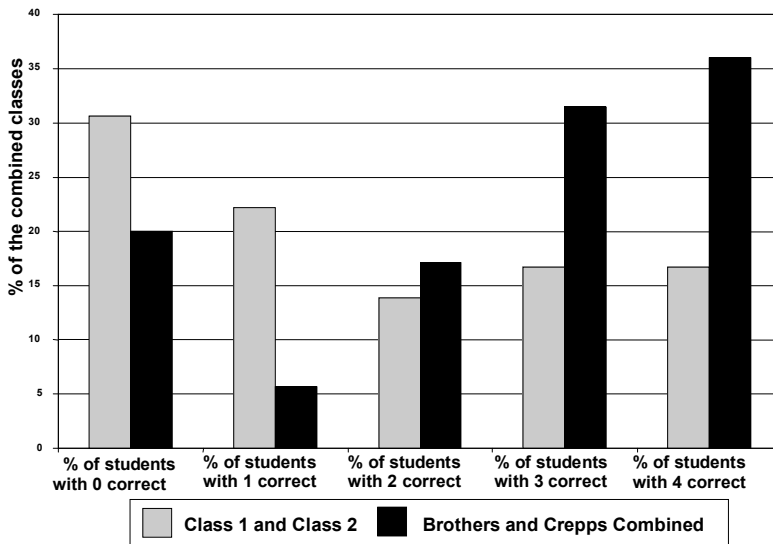


Figure 12. Percent of four problems correct on the last quiz.

The graph below (figure13) compares our third graders' scores on the word problem sections of the first and last trimester district math tests. The percentage of students answering one or less correctly decreased from 50% to 11%. Only 27% answered three or more questions correctly on the first trimester, while 67% did so on the third trimester test.

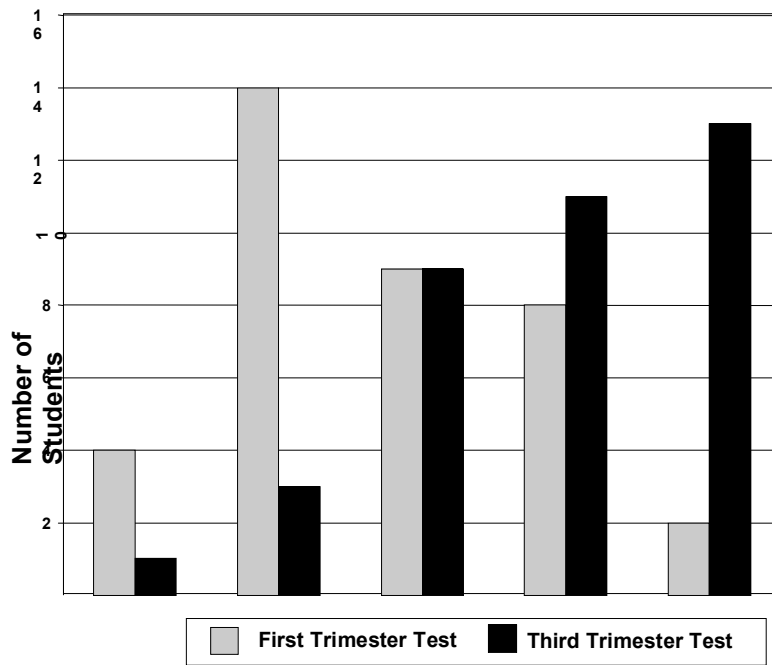


Figure 13. Third grade first trimester test compared with third trimester test.

The two line graphs below show the progress of third and second graders' rubric scores over the course of our word problem sessions. The types of word problems have been separated out so that we can see the general positive trend. Of the types of problems, the third graders did not do as well on the multiple-step money problems and the second graders did not do as well on the multiplication problems.

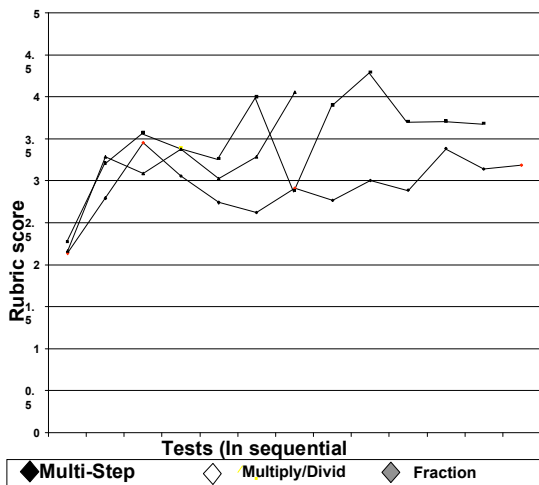


Figure 14. Crepps and Brothers' students' average scores.

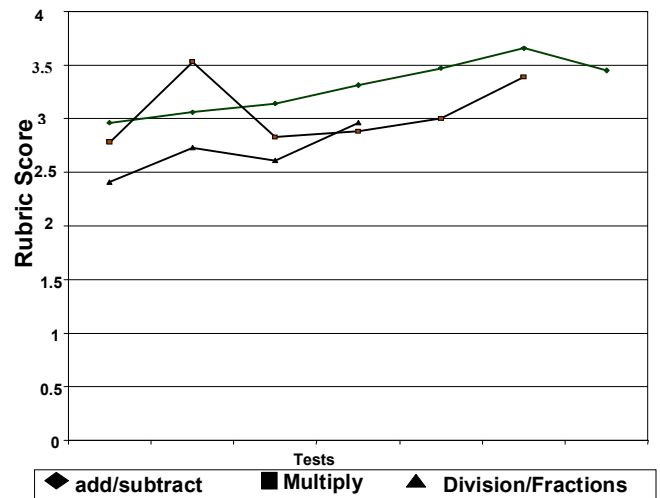


Figure 15. Second grade class average scores by types of problems

OUR STUDENTS IMPROVED IN THEIR ABILITY TO WRITE WORD PROBLEMS

In addition to looking at performance on tests and quizzes, we looked at our students' ability to write word problems. We believe that when students write word problems it increases their understanding of other word problems they may encounter in math textbooks and on tests. In the following three tables you can see a representative sampling of four students' work from each class. These samples illustrate how our students' ability to write word problems changed from the beginning of the word problem sessions to the end of the sessions. We have corrected spelling to ensure understanding of the ideas.

You can see from the work below that our students learned how to write better word problems with more details that used challenging numbers, and were more complete, than those written at the beginning of the year.

Table 1. Samples of student work.

Student	Beginning of the year	End of the year
3 rd grade boy, English Language Learner (ELL)	Marcos went to the store to buy pencils and gave 4 away?	On January 1, 2006, Marcos, Alan, and Juan went to the park and saw a soccer game. Then they went to the store to eat. They got beef for \$4.78 and chicken for \$2.75. They paid with a \$10.00 bill. How many did the clerk gave?
3 rd grade girl, ELL	Beth had 10 pencils and Carlos had 5 pencils how much is in all	One sunny morning Susana and Margarita went to find butterflies. Margarita found 17,864 butterflies. Susana found 62,842 butterflies. Then 8,083 butterflies flew out of Margarita's jar and 26,004 butterflies flew out of Susana's jar. How much did they find altogether and how much did they lose altogether?
3 rd grade boy	Miguel had 10 he gave 3 to Tom	It was in the middle of winter. Bob and Dave went outside to play in the snow. Bob saw 17,591 bugs and I saw 13,598 beetles. How many bugs did we see altogether?
3 rd grade girl	Melissa had 13 book she gave 6 away how many are there	Melissa and Christine went to Safeway. Melissa bought 2 candy bars for \$1.50 each and 3 apples for \$2.50 each. Christine bought packs of gum for \$1.75 each and 7 candy bars for \$1.55 each. They paid with \$35.00. How much money did they spend altogether?
3 rd grade boy	John has \$2,821 Joan has \$225 about how much more does John as than Joan.	One sunny day at the beach John saw 96,824 shells. Then he saw 49,351 more shells. How much does he have. Then he lost 13,892. How much does he have left. Ten minutes later, he found 16,235 more shells. How much does he have altogether?
3 rd grade girl	Marina had 49 papers and about 50 papers. How much papers did she have?	One Saturday Marina and Lisa went to Valley Glen. Lisa and Marina were collecting rocks for their rock collection. Lisa found 21,775 rocks for her collection. Marina found 11,654 rocks for her collection. How many rocks did they find altogether and how many more did Lisa find than Marina?
3 rd grade boy, ELL	Tim has 232 stamps and mark gots 392. about how do they have. How much	One sunny day in the park, Sam and Craig were counting birds. Sam counted 10,495 birds. His friend counted 12,049 birds and then he saw 2,345 more. Then they saw their friend Ed. Ed saw 3,505 birds. How much birds did they saw all together?
3 rd grade girl, ELL	There is 400 girls 500 are out.	One day Cathy went to the Forest she saw 10,999 trees. Cathy saw Maria. Maria saw 11,869. Cathy and Maria saw Caitlyn. Caitlyn saw 13,1096. How much did they see altogether?
3 rd grade boy	There were 2,002 planes. Dan took 20 how many does he have left.	Fred and John went to the grocery store in Dixon. They got 20 slices of bread for 2.25 each and they got 25 juice boxes for .25 each. They paid with a 200 dollar bill. How much money is that all together and how much money does he get back?
2 nd grade boy, ELL	15=13+28	Matt and Ricardo went to their classroom and made a game for all the second grade classes. 25 kids joined the first team and 58 on other team. how many kids were playing.
2 nd grade girl	There were 14 pencils and Rebecca got 10 more pencils. How many pencils does Rebecca have altogether?	Sara and Elizabeth planted trees and flowers around the playground in September. We planted 4,591 flowers and 8,912 trees. How many flowers and trees are there?
2 nd grade boy	Rick has 6 friends he gets 7 more friends. How many does he have	One day in May, Jason and Nick were planting trees at school for Earth day Nick planted 165 trees and Jason planted 170. How many were planted in all.
2 nd grade girl	There are 10 books. 8 of them came alive. How many are left?	In August, Jane went to the computer lab 163 times. This whole year Jane went 362 times. How many more times did she go to the computer lab this year?

THE WORD PROBLEM SESSIONS FROM THE STUDENTS' PERSPECTIVES

A last source of data that we used to assess the effects of the word problem sessions on our students was to ask them. We interviewed our students to find out their perspectives. although it was time consuming, it was also enlightening to hear their thoughts and opinions. Some of the questions and a sampling of student responses are shown below. An overwhelming majority of students were positive about solving word problems and in thinking that writing word problems helped them.

How do you feel about solving word problems?

I feel glad if I get it right. I feel proud of myself because I've gotten better at it. I would feel happy if they were hard problems because it challenges me. And even if I got it wrong I would be proud of myself for trying.—2nd grader

Good, because we're learning subtraction, division, multiplication, and addition all at the same time.—3rd grader

Do you think that writing word problems has helped you?

Yes, like if you didn't know it at the first of the year, and like you practice and you learn it little by little.—3rd grader

Yes, It helps me when we review the word problem with you. It helps me a lot. Like on tests I think about what I've done in the past.—3rd grader

Yes, because now I know all of the steps to write my own word problems. Now I can write my own word problems and I couldn't in 1st grade.—2nd grader

Yeah, because I didn't really know about word problems and there was stuff I didn't know so I kept trying and trying and I succeeded.—3rd grader

Do you like writing word problems?

Yeah, because when I write it I'm challenging myself to do something that will help me.—2nd grader

Yes, because it's fun writing word problems and sharing with your friends and seeing if they can solve them.—2nd grader

It helped me learn more about math. I learned to write a little more and faster and I learned to spell more words.—2nd grader

What was your favorite way to do word problems?

Solving word problems with partners. If you can't read something they can help you with it. Also, they can help you to spell and write.—2nd grader

Did you like working with students in another grade?

Yes. [I liked] Writing with 3rd graders because they knew much more and they're at a higher level, so if I need help to spell something I could just ask them.—2nd grader

Yes, it was nice. It was like tutoring the second graders. It was fun to help. It feels like you've done something big. It feels good.—3rd grader

Did you like having our students' names in the word problems?

Yes, because it felt like we were famous - like if you were in the newspaper.—2nd grader

Did you like being a teacher?

Yes, it's fun to teach the kids what they really need to know.—3rd grader

Yes, I liked it because you feel like you're actually in charge of them and it's your responsibility to make them more confident in word problems.—3rd grader

WHAT WE LEARNED ABOUT TEACHING WORD PROBLEMS

We learned that it was crucial to narrow our focus and only teach one type of word problem at a time. We also needed to provide more practices on that type of problem than we had previously thought. The amount of time spent on word problem instruction and how it was distributed over the week was crucial to its effectiveness: Frequency and consistency were important. We saw that we needed to continue to practice the previous types of word problems concurrently with the new type.

We noted that our students' learning curve was not linear from beginning to mastery, but had ups and downs as students learned and practiced different types of problems. For example, our students' success at solving multiple-step money problems would fall off if we hadn't practiced it for more than a week.

We saw the importance of using a variety of instructional approaches, and what worked for some students might not work for others. We learned that this group of students was engaged and motivated when we used the following practices: 1) having students work in pairs and small groups with students from another classroom; 2) designating students as teachers/coaches/guides of other students (while making sure that everyone had this opportunity and the tools to be successful); 3) having students write and solve their own word problems to share with others at the overhead, as puppet plays and skits, and through class-written books; 4) having students observe as we role-played, thought aloud; 5) were actively involved themselves in writing and solving word problems.

We learned the importance of making and using rubrics with students so that they could feel confident about what was expected. Providing clear examples of a variety of levels of accomplishment also helped our students understand how to be more successful. The solution rubric directed students to draw, label, and show their thinking, which helped them solve the problems, and helped us to better evaluate their levels of understanding.

We observed that having students working and teaching each other solidified and clarified their own thinking. It empowered students to take more charge of their own learning.

Lastly, we saw that even in this time of focus on standards and high-stake testing, that we can carve out small bits of time to work on important concepts and ideas which address standards in more diverse and engaging ways than those provided by a textbook.

What have we gained as teachers from developing and teaching the word problem sessions this year?

By developing our own word problem curriculum, we were able to be more flexible in responding quickly to our students' needs. It also pushed us to look closely at how we teach word problems, to reflect on those practices, and to evaluate what worked and what didn't work for us as teachers, and for our students. It led us to think much more deeply about word problems than if we had simply used a pre-made program or only our text.

Our research question of how to help our students be better at solving word problems has led us to collaborate more, to discuss student learning in depth, to try new ideas, and to share ideas with each other. By working as a team, we were accountable to each other, which increased our perseverance in the face of any obstacles, frustrations, and disappointments; and it also allowed us to celebrate the successes of all students, not just our own.

The task of creating our curriculum led us to develop a set of lessons which we can use as a scaffold to adapt to the needs of future students. We learned how we can help our students develop a positive attitude towards math and word problems by increasing their confidence through success at solving word problems.

What have our students gained from participating in the word problem sessions?

The word problem sessions were beneficial to our students. It encouraged them to look more closely at word problems, such as noticing the numbers, the question, and key words. Developing this protocol, or set of strategies, will help them solve similar word problems in the future, as well as give them a place to begin when attempting new types of word problems. Our students are less likely to be afraid or intimidated when trying to solve word problems in the future because they've learned how to break down a problem into parts and to draw quick sketches to help with their understanding. Students also developed more flexibility in thinking from seeing how other students solved problems.

Our students experienced the power of collaborating with classmates to solve problems. They have gained insight into how to work with others to accomplish a task and how to teach others. They learned to listen better to each other through group work. We overheard student comment to each other: "Oh, you did a good job!" and "That was a good idea!" Their improved success at solving a variety of word problems has given them confidence in their abilities to solve them.

The Future

In reflecting on our year of word problem sessions, there are aspects which we would like to change for next year. The three of us would like to increase the feedback we give by making more time for individual conferencing with students about their word problems and solutions. We would also like to be up and running with word problem sessions at the very beginning of the year and carry them on throughout the year. We want to make more time to have students writing word problems, possibly by integrating that writing into our language arts program. Second grade teachers would like to increase the number of weekly sessions to at least three and also use a more systematic approach in presenting strategies and types of word problems. Third grade teachers would like to increase the length of the daily session times by at least ten minutes.

There are many aspects of our word problem sessions that were strong components which we will continue to include. We want to continue to exchange with students in other classes to do the word problem activities. We want to maintain and increase the integration of visual and performing arts into our word problem sessions through such things as skits, plays, and songs. We will continue using a variety of instructional approaches such as teacher think-alouds; teacher modeling; students working in pairs and small groups; and students teaching small groups. We will have students write, solve, and present their own problems for others to solve. And last, but not least, we plan to continue to collaborate together and reflect on how we can help our students be even more successful at solving word problems.

Being a part of CRESS teacher research and the CCBI NSF grant this year has led us and our students on a grand and fruitful journey into understanding word problems. We have heartily enjoyed and are thankful for the collaboration and the capable efforts of UC Davis graduate student, Barbara Villatoro, and undergraduate student, Annie Oppman. Their dedicated efforts have allowed us to quantify our study in multiple ways.

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APPENDIX A

Third Grade Word Problem Pre and Post Test

Solve each problem below. Show all of your work, including drawings and numbers.

1. Marco drove 386 miles yesterday. Today he drove 464 miles. How many more miles did he drive today than yesterday?
2. Sara bought a sandwich for \$3.86 and a drink for 2.25. She paid with a twenty-dollar bill. How much change will she get back?
3. Four kids went to the May Fair. They each spent \$7 on tickets for the rides. They each spent \$4 on food. How much did they spend in all?
4. Some kids made 24 cookies to sell. They had 3 equal stacks of chocolate chip, peanut butter, and sugar cookies. How many sugar cookies were there?
5. Three animals were in line in a parade. The bear was not first. The giraffe was behind the elephant. The elephant was right in front of the bear. Who was first in line?
6. Steve's pizza was divided into 9 pieces. He ate 4 of them. What fraction of the pizza was left?
7. Laura has 3 more stickers than Katie. Together they have 45 stickers. How many stickers does each girl have?
8. Marisa has a bag of 20 apples. She put the same number of apples in each of 5 pies. How many apples were in each pie?

APPENDIX B

Second Grade Word Problem Pre- and Post Test

1. Lisa's favorite trip got more than 10 votes, but did not get the most number of votes.

What trip did Lisa like?

Favorite Field Trip	
Trips	Number of Votes
Zoo	12
Museum	7
Beach	16
Farm	8

2. Julio made 19 pancakes. His brothers ate 9 of them. How many were left?
3. Dan is writing a comic book. He writes 2 pages every day. How many pages does he write in 13 days?
4. Denise did 6 math problems before dinner. After dinner, she did 4 more. How many problems did she do in all?
5. Terri bought two different packs and still did not have as many marbles as a jumbo pack. What packs did she buy? (Beside the problem is a drawing of 4 bags with 12, 24, 18, and 36 marbles, labeled small, large, medium, and jumbo.)
6. Sue is reading a book that is 64 pages long. She has read 18 pages. How many more pages does she need to read?
7. Ari has 37 coloring books. Anna has 18 coloring books. How many books do they have altogether?
8. Kyle has 5 dimes. He saves another \$.23. He wants to buy a notebook that costs \$.80. How much more does he need?

APPENDIX F

A Word Problem Play

The title of word problem play is: _____

The characters are: _____ played by _____, _____
_____ played by, and _____ played by _____.

The setting of our play is _____

It takes place on _____ .

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

APPENDIX G

Script for students who are first-time teachers of other students.

Say:

- 1. Please read the word problem silently two times to yourselves.**
- 2. Who wants to read the problem out loud to the group? Please begin.**
- 3. Now, circle only the most important words and numbers.**
- 4. Which words did you circle?**
- 5. Here are words that I would circle:**
- 6. What drawings could you do to help solve this problem?**
- 7. This is one way to make the drawings:**
- 8. Now, make your drawings.**
- 9. How should you label the drawings?**
- 10. Now, label your drawings.**
- 11. What should you do next: add, subtract, or multiply?**
- 12. What do you do now: add, subtract, or multiply?**
- 13. Finish solving the problem.**
- 14. Let's check your answers together. What did you get?**
- 15. Last, write the answer in a complete sentence.**
- 16. Great job! We're done!**

Homework Hang-up: Finding the Most Effective Way of Presenting Homework Solutions to an Algebra Classroom

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ABSTRACT

Research Question: What is the most effective way to present homework solutions to a high school algebra class? Is presenting homework solutions a worthwhile use of class time? **Context:** After a couple of years using a strategy for presenting homework solutions to my mathematics classes that was originally suggested by my mentor teacher in my first year of teaching, I was frustrated that my students were not engaged in the process and that I was wasting a significant amount of class time in doing so. I decided to investigate and experiment with alternative methods for presenting homework solutions. I chose my algebra classes because those students were the least engaged out of all of my classes. I also entertained the option of not presenting homework solutions at all during class time and instead using “warm-up” quizzes to assess student learning. **Results:** Student motivation to correct their homework and overall engagement in the homework solutions process did not change significantly from one presentation strategy to the next among all classes involved in the study. **Methods and Data:** The research process included implementing various homework solutions strategies and evaluating each strategy in terms of efficiency and student engagement. Data was collected through surveys, teacher observations, and homework scores for each strategy compared with homework scores when using the original strategy. **Conclusion:** The students who are motivated to correct their homework and engage in the homework solutions process will do so no matter what form the homework solutions are presented. These are a select few who have actually completed the homework and come to class prepared to assess their work and ask questions. Using warm-up activities, however, motivates all students and provides the teacher with accurate assessments of student learning.

Key words: homework, solutions, answer key, warm-ups, motivation, assessment, algebra, high school.

CSTP 1.5 Promoting self-directed, reflective learning for all students

CSTP 2.5 Planning and implementing classroom procedures and routines that support student learning

CSTP 2.6 Using instructional time effectively

CSTP 5.3 Involving and guiding all students in assessing their own learning

A SMALL TOWN GROWING UP

My classroom has a history almost as old as I am. I once sat within these very walls and looked at my teacher with the same aimless indifference I see in the faces of so many of my algebra students today. Nestled amidst a trailer park of portable classrooms, Dixon High School



sits on the eastern border of the bustling small town of Dixon, California. A once primarily agricultural town, Dixon has lost much of its hometown appeal to urban sprawl as a result of its prime suburban location between Sacramento and the San Francisco Bay Area. Endless waves of track homes are fast engulfing the once vast sea of some of the richest cropland in the world, washing away the simple life of the Dixon where I grew up. The growth has had its advantages, however. Rising housing prices and the demand for quiet suburban life has cleaned up

deteriorating neighborhoods, attracted local businesses, and revived a once dilapidated historic downtown that includes the Dixon High campus which is over one hundred years old. We even have a Wal-Mart...we're in the big time now!

The farming culture is reflected in the student demographics that are approximately 42% Hispanic and 51% Caucasian. A significant number of migrant students come and go with the seasons or leave for months at a time to visit family in Mexico, making success in school difficult, especially in algebra. The state says we have to get all students through algebra, and we are doing our best to provide specialized instruction and support to accomplish this goal, which even under the best of circumstances is a challenge. Because algebra is such a focus of instruction this year, and because I am only in my third year of teaching, I felt it an opportune time for evaluating the quality of instruction. I can also reflect on how I can improve my teaching practices to make students' learning experience more valuable.

THE HOMEWORK HANG-UP

Homework is of particular interest to me this year, and I have always wanted to experiment with various alternatives to my current practices. If I am assigning homework on a daily basis, how can I make it more worthwhile for both my students and myself? More specifically, what is the most effective procedure for providing homework solutions and feedback that is manageable and sustainable?

Currently, I provide a list of the homework answers on the overhead projector for about the first three to five minutes of class. Students are required to correct their answers in pen or colored pencil during this time. Then I address common questions at the end for about five to ten minutes. Unfortunately, many students do not ask questions so that they can spend more time for the current assignment or because of lack of interest. This homework solutions strategy provided little, if any, assessment opportunities for me as a result. I would like a homework solutions procedure that requires students to take a more active role in their own assessments, that provides assessment opportunities for me, and also that holds students accountable for completing the homework to the best of their ability. Additionally, I would like a procedure that does not detract from the objective of the day and is time well spent for all learners in the classroom.

My current homework policy is actually a combined class work and homework policy. Students are assigned a set number of problems for the day and any problems not completed during class time are finished as homework. Students usually have two to five practice problems for homework each night. Homework is then checked for completeness and what is called *attemptedness* on the entire set of problems assigned the previous day (as well as corrections in colored ink). *Attemptedness* means the student has made a sincere attempt at completing each problem and showed work on his/her paper to receive credit on the problem. I then quickly check and score each paper during guided practice, browsing the problems in a matter of seconds. Checking off upwards of thirty to thirty-five homework papers in a short amount of time provides minimal assessment or discussion. Thus, I provide homework solutions for students to self-assess their homework in an effort to improve achievement and encourage good study habits. Unfortunately, this policy allows students to fairly easily "fake" attempting a problem in order to receive credit, by writing a colored answer by it during corrections. This also provides no incentive whatsoever for going back and reevaluating incorrect solutions.

Based on my own observations and discussions with other educators, I believe there is a strong correlation between homework scores and scores on assessments. Looking at my Algebra 1 fall semester grades for seventy-five students, all the students who failed the class had less than 50% for the homework portion of their grade (class work/homework only accounts for 20% of the total grade), with the exception of two students who were taking algebra for the second time and one "gifted" student. This is one of the main reasons I feel assigning homework, assessing it, and providing timely feedback is such a valuable learning tool. I also feel that individual practice is essential for mastering the algorithmic nature of algebraic concepts and also helping prepare students for higher levels of mathematics.

Where to Go from Here

I first wondered if providing homework solutions and addressing questions help my students become more self-directed learners, and as a result, more successful in algebra. If so, is there a more effective way for providing this information? So I formulated a plan for collecting data on the various new strategies that I wanted to try in my classroom and assessing each strategy's effectiveness compared to my current method. With three algebra classes this year—two ninth grade classes (referred to as Algebra 9) and one for all other grade levels (referred to as Algebra 10-12)—I made the Algebra 9 classes my *control group* and the Algebra 10–12 the *experimental group*. This way I could compare student responses through various surveys and my own observations on the different strategies. I will also question my fellow mathematics colleagues on their philosophies, policies, and experiences with providing homework solutions.

PRECONCEIVED NOTIONS

The first focus of my research was investigating the number of students actually completing their homework and how they perceived homework in the overall learning experience. I did this initially through the following anonymous survey. I also surveyed my ninth grade pre-algebra class to compare results across different levels of mathematics (figure 1).

Date: _____ Grade: _____ Current Teacher: _____
ANONYMOUS HOMEWORK SURVEY
1. Do you copy homework? If yes, please explain why. 2. When do you copy homework? 3. Who do you copy homework from? (please do not give any specific names) 4. Do you let others copy your homework? If yes, please explain why. 5. Do you ever fake doing homework?

Figure 1. Initial homework survey.

Based on my results of the survey (see tables 1 and 2), I was disheartened to find my students have such a low perception of the importance of homework in the overall learning experience. Approximately 61% of my algebra students admitted to copying homework from others at least some of the time, and an astounding 73% allow others to copy their work. The results for pre-algebra were strikingly similar with approximately 44% copying homework from others and 63% allowing others to copy. Additionally, approximately 51% “fake” completing their homework, which means they are writing mathematical gibberish to get credit for “attempting” each problem. Pre-algebra students did this somewhat less, with approximately 31% admitting to faking homework answers to receive credit. Thus, I believe it is safe to assume on any given day, only about half (or less) of algebra students bring homework that is of any instructional value, let alone work that is worth correcting. It is my hope that one of the new homework solutions strategies will reduce cheating and hold students accountable for completing their own work.

Table 1. Results of initial anonymous homework survey. Pre-algebra students surveyed: 16.

Question	Yes	No	Sometimes
Do you copy homework?	3	9	4
Do you let others copy your homework?	7	6	3
Do you every “fake” doing homework?	5	10	1

Table 2. Algebra students surveyed: 59.

Question	Yes	No	Sometimes
Do you copy homework?	21	23	15
Do you let others copy your homework?	36	16	7
Do you every “fake” doing homework?	20	29	10

Once I had an idea of how many students were actually completing homework, I became curious to know how much time and effort was being invested in completing it. I surveyed my students for a second time (see figure 2), only this time I used a named survey.

Date: _____ Name: _____
Grade: _____ Current Teacher: _____

HOMEWORK SURVEY—ALGEBRA

1. How much time do you spend on math homework each night?
2. Why do you do homework?
3. How does homework help you?
4. Assuming you will continue to have homework every night how would you change it to make it more beneficial for you?
5. On a scale from 0 to 10 how much effort do you put into your homework?
6. If you are given shorter assignments would you put more effort into your homework?
7. How many hours of tutoring do you get outside of class?
8. Why do you think your teachers assign you homework?

Figure 2. Algebra survey.

Based on these results, three questions became of particular interest to me regarding my research: the questions involving the amount of time spent on homework each night and how homework benefits each individual (see tables 3, 4, and 5). The responses provided additional insight for me to change my homework policy to make it more beneficial to students as a learning tool and to help them prepare for assessments.

Table 3. Students surveyed: 59.

	None	<1 Hour	1–1½ Hours	1½–2 Hours	>2 Hours
How much time do you spend on math homework each night?	10 17%	32 54%	11 19%	3 5%	3 5%

Table 4. Students surveyed: 62.

	Learn/ Practice	Self- Assess	Study Tool	It Doesn't	Other
How does homework help you?	13 21%	30 48%	5 8%	14 23%	0 0%

Table 5. Students surveyed: 61.

	Complete/ More Effort	Less HW	Work with others	Keep the Same	Other/ Turn in Weekly
How would you change homework to make it more beneficial for you?	12 20%	13 21%	22 36%	3 5%	11 18%

The results were interesting and enlightening to me as an educator. Some student recommendations were beyond my control because they involved activities outside of the classroom, such as working on homework with others, but some were within my control. Creating a homework policy that provides incentives for students to put more effort into completing their homework can be done through my research and through trying strategies with direct consequences if a student does not give his/her best effort toward completing the assignments. Additionally, although a high number of students expressed this desire, I am hesitant about collecting homework on a weekly basis because students have a difficult enough time completing the assignments on a daily basis, and I cannot imagine that making homework due on a weekly basis would improve homework habits. Once I have reevaluated my current policy and have seen improved results in homework scores, I may consider collecting homework weekly in the future.

The survey also shows that 17% of my students are not spending any time on homework each night. Since most students do not finish their homework in class on a regular basis, this shows 10% to 12% of my students are doing no homework outside of class time. However, that means the remaining 88% to 90% are making an effort to complete their homework each night. Having students simply correcting their answers as I am currently doing, however, does not provide accountability for students who are copying the work of others, nor does this provide any incentive for them to stop doing so. I needed to explore strategies that engage all learners and require accountability for completing and correcting one's own homework. Then, providing homework solutions, in whatever form, becomes worthwhile because a high number of students would then have some kind of product to assess their progress.

The results of the second question are also encouraging in my research. The survey showed that 48% of my students feel homework helps them monitor their own progress and prepare for assessments. Homework as a self-assessment tool is one of the main reasons I value and require daily homework in my classes and provide solutions for students to check their

answers. Year after year in algebra, homework and overall achievement have the strongest correlation out of all the other grade categories. This information, in addition to my own experiences as a student, leads me to believe good homework habits facilitate success in not only algebra, but in future math classes as well.

AN INVESTIGATION OF STRATEGIES

After my initial investigation of student opinions and perceptions of homework, I then experimented with various strategies of presenting homework solutions to investigate which strategy, if there was in fact one particular strategy, was: a) most effective in engaging students in self-assessing their learning, b) required accountability, and c) provided an incentive for completing assignments on a regular basis. In Algebra 9, I continued having students self-correct their homework from only a list of answers and addressing common questions for the first five to seven minutes of class. In Algebra 10–12, I created a plan for experimenting with different strategies of presenting homework solutions (see table 6).

Table 6. Homework strategy investigation plan.

Fall Semester		Spring Semester	
Unit Numbers	Solutions Strategy	Unit Numbers	Solutions Strategy
Units 0–3	Present typed answer key on projector at the beginning of class and provide detailed solution to class upon student request	Units 8–10	Corrected daily warm-ups with solutions presented to the class directly following the warm-up activity. No time allocated in class specifically for presenting homework solutions
Units 4–5	Present detailed solutions to class for requested problems only at the beginning of class		
Units 6–7	Homework solutions addressed on an individual basis during guided practice or outside of class time. No time allocated in class specifically for presenting homework solutions		

COLLECTING DATA

Based on my observations of the Algebra 10–12, I discovered minimal change in individual student’s self-assessment habits for correcting their homework regardless of how the answers were presented. Those students who took the process of correcting their homework seriously continued to do so and those who did not take the process seriously went through the motions enough to get credit for making the corrections. I then gave another survey investigating if my observations were accurate regarding student opinions on providing homework solutions and correcting their homework (see table 7).

Table 7. Follow-up survey to homework solution strategy investigation results. Students surveyed: 66.

Question	No Response	Yes	No
1. Do <i>you</i> do your homework on a regular basis?	0 0%	57 86%	9 14%
2. When you ask homework questions, did you have them before you corrected your homework?	3 4%	38 58%	25 38%
3. When the homework solutions are up, do you <i>really</i> correct your homework?	2 3%	38 58%	26 39%
4. Do you think homework solutions are worth the time to go over?	1 2%	45 68%	20 30%
5. Does correcting your homework help you learn better?	0 0%	47 71%	19 29%
6. Do you ever go back and figure out what you did wrong on problems you missed?	4 6%	37 56%	25 38%
7. Does correcting your homework help you do better on tests?	0 0%	37 56%	29 44%

As one can see, the survey did in fact support my observations that my kids do view homework and self-assessing their homework as an important learning tool but care little as to how the solutions are presented. I feel this is best displayed in the results to question 2: 58% of students know their questions before they correct their homework with the solutions provided. So, I question whether it is worth the time it takes going over all of the homework solutions, and I wonder if that time is better utilized addressing common questions briefly, enough so that the students can then finish the problem on his or her own to get the final answer. Then, students can check their answers during class work with the solutions sheet and leave me free to assist students on the current material of the day. But then what do I do with those students who do not have questions on the particular homework problems I am addressing to the entire class. Those students then lose the valuable class time from the current day's material as I spend ten minutes or more addressing homework questions of students who may still be left with questions, an issue that also needs to be addressed as one evaluates devoting a portion of class time for presenting homework solutions to the class as a whole. I would like to find a method that is fair, effective and efficient for all members of the classroom, including myself.

SAVING THE BEST FOR LAST

The last investigation into homework assessment I am trying this year in my research is giving daily warm-ups. *Warm-ups* (also called *openers*) are short quizzes that assess one or two key problems, given during the first two to five minutes of class. Warm-ups assess understanding of the key ideas from the previous day's assignment (and homework) and provide a baseline assessment for the new material of the day. The warm-up question is up on the overhead projector (or board) as students come into class. Students are given two to three minutes to complete the problem(s), and then hand them in to the teacher. The teacher then goes over the solutions in detail and talks about common errors she/he has seen from the warm-up, the previous day, or from previous experiences with the concepts.

I have always liked the theory behind giving warm-ups each day, but found grading them unmanageable in my first years of teaching. Now that I have been teaching for a few years, I am

considering trying them again. I have a number of colleagues who use warm-ups successfully, and they have given me ideas for maintaining an effective grading system—in addition to the ideas I have gathered over the last couple of years in my own reflections. Fortunately, my student teacher was implementing a warm-up policy in her (our) Algebra 10–12 class, which I was monitoring closely. As an observer, I was encouraged by the results that I was seeing over the course of the semester in terms of student motivation, recovered class time previously lost in getting students prepared for the lesson, and providing daily assessments. Additionally, students are held accountable for completing their own homework, as warm-up questions stem directly from the practice problems provided in the homework set. It also provides an incentive for students to perform successfully on the warm-ups because I factored it into their grades.

Based on my observations and discussions with my student teacher, all students were engaged; the teacher could monitor student progress daily; and the whole process took no more than five to seven minutes of class time as opposed to ten minutes or more for my original method. Unfortunately, the homework scores for the units involving warm-ups did not show significant change in achievement. Based on the difficulty level of the units, it is impossible to make any conclusions based on assessments scores. The results I am seeing in my observations, however, are very promising, and I am confident warm-ups improve achievement and accountability on both homework and assessments. I am strongly considering making warm-ups a part of my homework solutions policy next year instead of providing answer keys for self-assessment. I think it will be a valuable learning experience also to have students self-correct their warm-ups or occasionally exchange papers and correct each other's papers.

To compare my interpretations with those of the students, I surveyed the Algebra 10–12 students after they had been taking daily warm-ups for about three months to gain insight into their thoughts on the new “warm-up” strategy for assessing homework problems and providing solutions. I also surveyed one of my colleagues' Algebra 10–12 classes who had also been doing warm-ups for the entire year.

I was surprised by the student's responses to the questions in the survey in that their responses were not at all consistent with the actions and conversations that I was observing in the classroom during the warm-up process (see table 8). For example, question 1 regarding getting ready for class faster: An overwhelming majority responded that warm-ups at the beginning of class did not help them get ready for class faster. However, based on my observations in the classroom as the warm-ups were taking place, I witnessed a significant improvement in the time it took the students to get prepared for class. Students were in their seats, and quiet with at least a pencil in hand ready to begin their warm-ups in order to complete the problem in the time allotted. Additionally, the amount of time spent socializing following the bell had been virtually eliminated as the focus had transferred from discussing the latest happenings around campus to the problem on the board.

The responses to the remaining questions, however, were also all negative and inconsistent with my observations. I am curious as to why my interpretation of the situation regarding warm-ups deviates so significantly from that of the students. From listening to student commentary and informal discussions with individual students, I believe many students answered “no” for many of the questions because they did not like warm-ups. Warm-ups made them get prepared for class, required them think critically about the homework (and complete it) and previous day's material, and held them accountable for learning on a daily basis—not just between tests and quizzes. I am concerned the students' dislike for the process has clouded their ability to see warm-ups as a valuable learning tool, and they are responding negatively in the hopes that their feedback would dissuade me from continuing to use them. Of course, this is only conjecture, and my research into the effectiveness of warm-ups will continue this year and on into next year, as I plan on continuing to use them.

Table 8. Results of anonymous warm-up survey. Students surveyed: 44.

Question	No Response	Yes	No
1. Do warm-ups help you get ready for class faster?	0 0%	16 36%	28 64%
2. Does the warm-up help you answer questions you have about homework problems from the night before?	0 0%	26 59%	18 41%
3. Do you prefer your teacher to go over the warm-up directly after you hand your paper in?	1 2%	24 55%	19 43%
4. Do you prefer warm-ups to the other ways your teacher(s) have gone over homework solutions in the past year.	2 5%	17 40%	25 57%
5. Do you think warm-ups help you learn more than without them?	2 5%	20 45%	22 50%
6. Do warm-ups help you prepare for tests and quizzes?	2 5%	20 45%	22 50%
7. Do you think the warm-up should be part of your class work/homework grade?	0 0%	14 33%	29 67%

I am encouraged by the responses to question 2 regarding the homework aspect of doing daily warm-ups. The survey showed that 59% of students reported the warm-ups helped to answer questions they had from the homework the night before. Since my primary objective for giving daily warm-ups as part of my research was to measure its effectiveness as a homework solutions strategy, the results of that particular question supported the validity and value of warm-ups as an effective strategy. Additionally it is a strategy that requires student participation and accountability for providing meaningful work, in addition to providing immediate feedback.

SO WHAT DOES ALL OF THIS MEAN?

My research has led me to one basic conclusion: As a teacher, I feel that evaluating homework is a valuable learning tool, but my students, unfortunately, do not. Attaching a grade to a process that requires them to value the homework solutions and reevaluate their own work for some future consequence was the only way to change student habits and motivation to do homework. The prospect of preparing for a test or quiz that is days away and presenting homework solutions, in whatever form, is not a sufficient incentive for motivating students to value their daily work and its accuracy. Students have to want to care, and my research has shown the most effective strategy for presenting homework solutions that works consistently in achieving this goal is the daily warm-up quizzes. Additionally, the warm-ups must be collected, the solutions discussed immediately, and then returned in a timely manner with a score at the top. If there is no grade attached, although minor in the grand scheme of the overall grade, students do not “buy in” to the process. Although warm-ups present a significant increase in teacher workload in contrast to simply presenting a list of homework answers on the overhead projector, the benefits I have observed in classroom behavior and student involvement in the homework solutions process by *all* students in the classroom are well worth the effort.

Works Cited

Dixon High School. 2005. Image retrieved February 1, 2005, from Dixon High School Web site, <http://dhs.dixonusd.org/>.

Erin DeWeese has been teaching high school mathematics at Dixon High School in Dixon, California, since 2002. She received her Bachelor of Science degree in Mathematics in 2001, and Teaching Credential from the University of California, Davis, in 2002. After graduating from Dixon High School in 1995, Erin spent her early years at Solano Community College pursuing a degree in Elementary Education. Her passion for mathematics persuaded Erin to change her major to mathematics in pursuit of a career teaching high school mathematics. After a few years of teaching and finding her own way in the world of education, Erin enrolled in teacher research for the first time in 2004–2005 when this paper was written. Her primary goal was improving her current teaching practices and policies in offering her students quality educational opportunities. She is anticipating completing her Master of Arts degree in Curriculum and Instruction in 2006. Erin spends her leisure time enjoying the outdoors with friends and family.

Why Don't You Just Ask Them? Using Student Questionnaires to Gain Insight into Meaningful Self-Assessment

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ABSTRACT

Research Question: How are formal assessment and self-assessment used in the self-regulated learning of students in the high school chemistry classroom? **Context:** Pioneer High School in the Woodland Joint Unified School District has a population of 41% White (non-Hispanic); 48% Hispanic; 11% African-American, Pacific Islander, Asian, Native American, and Filipino students; and 25% of the students are limited English proficient (LEP) students. The study was conducted in three high school chemistry classes and two honors chemistry classes over an eight-month period. **Methods and Data:** The students were given a series of four surveys/questionnaires that inquired about assessment and learning success. Student responses from high-performing students (honors chemistry students) and low- to middle-performing (general chemistry students) were gathered, analyzed, and compared in addressing the research questions. **Conclusions:** (1) High-performing students tend to be better self-regulated learners than low- or middle-performing students; (2) low- and middle-performing students approach assessment differently than high-performing students; (3) low- and middle-performing students were more likely to strive to meet the expectations of teachers, while high-performing students were more likely to strive to achieve higher goals set by themselves; (4) low- and middle-performing students were more likely to review information in preparation for an assessment, while high-performing students were more likely to put information into practice using self-assessment techniques when preparing for an assessment.

Key Words—surveys, questionnaires, self-assessment, formal assessment, self-regulated learning, student responsibility, chemistry, high school.

CSTP 1.5 Promoting self-directed, reflective learning for all students.

CSTP 5.3 Involving and guiding all students in assessing their own learning.

California Investigation and Experimentation Science Content Standards

1d Formulate explanations by using logic and evidence

1k Recognize the cumulative nature of scientific evidence

INTRODUCTION AND PURPOSE

In my previous research paper, “The Mighty ‘SRI’ Quiz: Using Meaningful Assessment to Encourage Self-regulated Learning and Student Responsibility in the High School Chemistry Classroom,” I investigated the role that meaningful assessment plays in self-regulated learning within the high school classroom. I found that “low-stakes” forms of assessment (quizzes) that immediately inform students about their learning prior to “high-stakes” forms of assessment (tests), played a useful role in the development of self-regulated learning. They provided students with feedback that they could use to adjust the way that they study for tests. The study was exciting to me, since it revealed an effective way to encourage students to be self-regulated learners. I found that by using the SRI quiz, my role as a “supporter of learning,” rather than “director of learning,” did indeed encourage self-regulation.

In my previous research, I found that meaningful assessment was also useful to students learning to be self-regulated learners. While these findings were certainly encouraging and gave me much to write about in my last research paper, I still had questions when all was said and done. Can self-assessment be useful to increase student responsibility and self-regulation in the

classroom? How can poor performance on assessments be used to encourage students rather than to discourage them?

These two questions ask as much about assessment as they do self-regulation. The first question asks about self-assessment and lent itself to the following questions: How is self-assessment used as a tool in self-regulated learning? Is self-assessment a distinguishing factor in the self-regulated learning of high-achieving students?

The second question inquires about how assessment is viewed by students and lends itself to the following questions: What implications do assessments have to students? Do these implications affect the way that students approach assessments? Furthermore, do the students' views and approaches to assessments affect the usefulness of them in self-regulated learning?

In this study, I approached assessment and self-regulated learning in a different manner than I had done in my previous study. Since I now teach honors chemistry and general chemistry, I utilized the different levels of students as the major variables in my study. Data collected from my honors classes was used to represent the average high-achieving student, while data collected from my general chemistry classes was used to represent the average low- to mid-achieving student. (Note: I have some high-achieving students in my general chemistry classes, so in no way do I mean to imply that all general chemistry students are low-achieving or, at best, mid-achieving. However, there is a clear divide, on average, between the two groups of students.) I then attempted to address some of the questions that were left unanswered by my previous research study.

RESEARCH ISSUES AND QUESTIONS

My focus in this study explores the way that students viewed and used both in-class assessments and self-assessments as they pertain to self-regulated learning. I ventured to find why there is pain in (the) assessment for some, while there is progress in assessment for others. Do my high-achieving students differ from my lower-achieving students in the way that they view assessment? By investigating this, I hoped that I would discover just what keeps some students from utilizing assessment to become better self-regulated learners.

In addition to the formal assessments given by the teacher in class, I also recognize that a large component of self-regulated learning is self-assessment. In this study, self-assessment is defined as the tools that a student uses to determine his progress and to work towards achieving certain goals. While the goals discussed in this paper primarily apply to academics, they may also be related to life goals, since a great amount of insight into what makes a student "tick" can be extracted from how a student sees him- or herself in relation to long-term or lifetime goals. Having both honors chemistry and general chemistry classes, I hoped to study how self-assessment differed between the two differently-achieving groups. If self-assessment is an important component of self-regulation, and self-regulation is important for success, then the high-performing, successful students should shed some light on the topic. Perhaps then, this information would help inform the way that I teach the students who are not high-achieving. My research questions then became the following: How are formal assessment and self-assessment used in the self-regulated learning of students in the high school chemistry classroom? What purpose(s) and meaning do students assign to formal assessment? How does self-assessment reflect self-regulated learning?

CONTEXT OF STUDY

School

Pioneer High School is a public school in the Woodland Joint Unified School District. This year is the second year that the school has been open since 2003. In its first school year,

Pioneer High School served 852 freshman and sophomores and had 38.6 teachers, with a student/teacher ratio of 22.07. The following year has seen an increase in the student population with the addition of a junior class, increasing the school's population to 1168. The student/teacher ratio has also seen an increase this year, governed by the district to be 33:1 for most classes and 32:1 in laboratory science classes. The ethnic breakdown of the school this year is as follows: 41% White (non-Hispanic); 48% Hispanic; 11% African-American, Pacific Islander, Asian, Native American, and Filipino students; and 25% of the students are limited English proficient (LEP). The ethnic demographics for Pioneer High School reflect the ethnic demographics of the city of Woodland. In spite of severe budget cuts and decreased funding to the school and district, Pioneer High School has a wonderful staff of very dedicated teachers, administrators, and faculty. It also has a strong student government body, in addition to countless clubs that cater to students' diverse interests. The Academic Performance Index (API) data was unavailable since the school has been open for only one year prior to this year.

My Students

I teach three general chemistry and two honors chemistry classes. Both are college preparatory. My classes consist of mostly sophomores and juniors. The ethnic diversity of the classes parallels that of the school and the community very closely. The majority of my students are taking the class as a college prerequisite. The other students are taking the course to fulfill the science graduation requirement. Unlike in my previous experiences, there are numerous sophomores in my chemistry and honors chemistry classes, reflecting the accelerated sequence of science courses taken by some students. There are very few students in the class with 504 or IEP plans. Many of the students in my classes are also very involved with student government, music, drama, sports, and/or other clubs at the site.

The Curriculum

In my general and honors chemistry classes, I teach a curriculum designed to meet the California State Standards for chemistry. The curriculum that is taught in my honors chemistry classes utilizes a college-level textbook; it is accelerated and covers in greater depth the content described in the California State Standards for chemistry. Material is presented in text, homework, class discussions, group activities, lab activities, and lectures. Students are encouraged to bring their questions, concerns, and/or confusions to class. Students are expected to keep an organized binder containing all their homework assignments, notes, warm-up activities, tests, and SRIs. The binders are periodically and semi-randomly checked and graded. In addition to binder checks, student progress and understanding are also assessed by SRIs, homework checks, unit tests, lab reports, group presentations, and in-class discussions.

DESIGN OF STUDY

Having found that student feedback was the most useful data collected in my previous research, surveys and questionnaires were used to collect the data for this study (see table 1). The data for this study was collected from student responses to a series of four surveys/questionnaires. While the naming of these survey/questionnaires alternates between "survey" and "questionnaire," the name difference is not meant to imply different formats of questioning.

Table 1. Plan/Timeline of Study.

Time Frame	Task
October, 2004–June, 2005	Met in Teacher Research group on Thursdays of every school week.
December, 2004	Researched context of study.
December 1, 2004	Gave Assessment Survey #1 to all students (assessment and test-taking).
February, 2005	Interpreting Initial Data from Survey 1 and Questionnaire 2
February 23, 2005	Gave Questionnaire #2 to all students, (student’s role in learning).
May 17, 2005	Gave Survey #3 to all students (assessment and learning).
May 19, 2005	Gave Questionnaire #4 to all students (learning, goals, and success).
May, 2005-June, 2005	Data Analysis and Report planning.
June, 2005	Write Report of Study

PRELIMINARY DATA

I began my data interpretation by looking at questionnaire and survey questions that inquired about how students viewed their education. The question that intrigued me the most was the following question from Questionnaire 2 (Appendix C): “Who plays the most central role in your education?”

Since the theme of my research is self-regulation, I wanted to find out where students placed themselves and others in their education. The following pie charts show the breakdown of the responses (see appendix D for detailed responses).

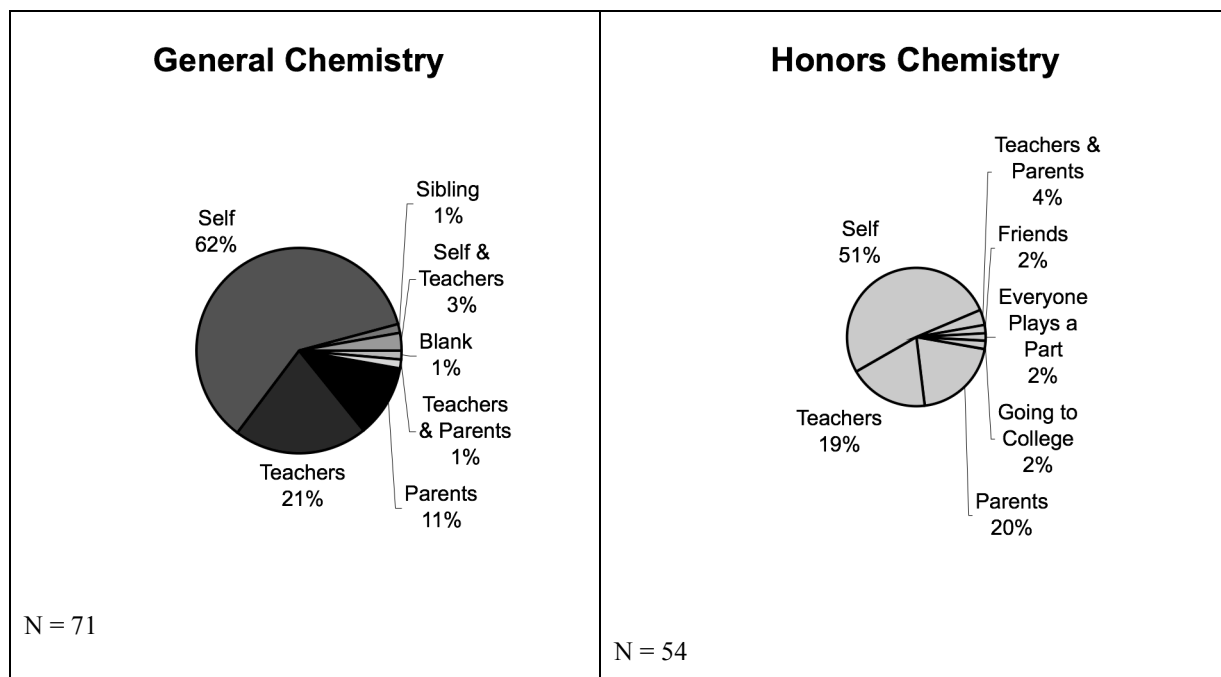


Figure 1. Comparison of student responses.

Preliminary Data Analysis

Surprising to me was that a greater percentage of general chemistry students (62%) said that they place themselves at the center of their education compared to 51% of the honors chemistry students. I would have thought that the honors chemistry students would have placed themselves in a more central role in their education, since they seem to have higher self-motivation and a better grasp of self-regulated learning. Perhaps self-regulated learning has less to do with relying on yourself and more to do with how you utilize your resources to achieve success. However, it seems strange that so many students would place themselves outside of the central role in their education. Isn't education for the person being educated? I suspect that some students may have read this question as "Who is the greatest motivator in your education?" "Who forces you to learn?" or something else of that nature. Nonetheless, it is worth mentioning that the majority of both general chemistry students and honors chemistry students do place themselves at the center of their education. Seeing themselves as active participants in their education is important in their development as self-regulated learners. Of course, this data is just preliminary, used to get a broad idea of where my students see themselves. In the following data and data analysis, I looked at more specific student responses to survey questions. I hoped that analysis of these student responses would give me greater insight into student views of formal assessment, self-assessment, and self-regulation.

CORE DATA

Description of Students

Since analyzing the responses of over 150 students would have made this study arduous and impersonal, I chose to approach the responses in more of a case-study fashion. I chose the questionnaire/survey responses of seven general chemistry students and seven honors chemistry students to be the focus of this study. I chose students whose grades, gender, and ethnicities reflected the academic and demographic breakdown of my classes. The student descriptions, provided below, gives the context in which the student responses were analyzed. The first set of seven students represent general chemistry students. The second set represents honors students.

A description of each individual student's whose responses I used as data in this study is described in table 2.

Table 2. Description of students. The G after the student number indicates that the student is a general chemistry student. The H after the student number indicates that the student is an honors chemistry student.

Student	Grade	Ethnicity	M/F	Semester 1 Grade	Other Characteristics
1G	11	Caucasian	F	C-	<ul style="list-style-type: none"> Talkative and social. Likes to say mean things just to get a reaction. Sometimes stubborn.
2G	11	Caucasian	M	B+	<ul style="list-style-type: none"> Confident and popular. Athletic. Helps other students in class. Always gets his homework done in class.
3G	11	Hispanic	M	D-	<ul style="list-style-type: none"> Nice kid, though has a hard time focusing Very good soccer player Says silly things without knowing he's saying it. Wants to do well in school, but has a hard time getting work done.
4G	10	Caucasian	F	A-	<ul style="list-style-type: none"> Works very hard and is responsible with schoolwork. A multisport athlete. Stays very focused until work is completed.
5G	12	Hispanic	F	B-	<ul style="list-style-type: none"> In AVID program. Social. Completes home- and classwork, but struggles on tests. Brother is an A student in the same class and period.
6G	10	Hispanic	F	C	<ul style="list-style-type: none"> In AVID program. Quiet and attentive in class. Completes home- and classwork, but struggles on tests. Friendly and respectful to everyone.
7G	11	Indian	M	B-	<ul style="list-style-type: none"> Quiet and attentive. Neat and organized with his class work and homework, but struggles on tests.
1H	10	Caucasian	M	A-	<ul style="list-style-type: none"> Quiet, attentive, friendly, and respectful. Plays golf for the school. Focused and hardworking. A little hesitant to ask questions.
2H	10	Mexican	F	B-	<ul style="list-style-type: none"> Into the Goth/skater look. Good musician. Gets her work done, but does not seem to aim beyond that. A little quiet and passive.
3H	10	Caucasian	F	A+	<ul style="list-style-type: none"> Outgoing and friendly. Always on top of everything. Always performs above and beyond the call of duty.
4H	10	Hispanic	M	A+	<ul style="list-style-type: none"> Intelligent and driven. Sometimes will not get material right away, but attains deep understanding with a little help. Often times, stayed after the class to finish work. Athletic (plays on sports teams year round). Friendly and respectful.
5H	11	Indian	F	B+	<ul style="list-style-type: none"> Quiet in class. Completes home- and classwork, but struggles on tests. Focused.
6H	10	Hispanic	M	B	<ul style="list-style-type: none"> Can be goofy. Gets distracted by/with other students in class. Gets most of his class work and homework done, but struggles a little on the tests.
7H	11	Caucasian/ Asian	M	D+	<ul style="list-style-type: none"> Distracted by everything (classmates, himself, his girlfriend, track) Fun to have in class. Irresponsible when it comes to doing work and studying. Intelligent, but lacks work ethic. Plays football and runs track.

RESULTS AND FINDINGS

Surveys and corresponding student responses can be found in appendices A-H.

Analysis of Student Responses – Assessment Survey #1

In reading the responses to question 8, “What is the most significant factor that causes you not to do well on a test?” I found that the responses from both honors and general chemistry students were mixed. However, the majority of students, four general chemistry students and five honors chemistry students, said that they attribute not doing well on a test to not being prepared, not studying well enough, and/or procrastination. The remaining students attributed poor test performance to being rushed, nervous, tired, and/or stressed. While these findings were not surprising, they were somewhat encouraging. Few students placed the “blame” for poor test performance on factors outside of their control. Most students noted that there was a direct correlation between being prepared for a test and how well they did. This implies that students accepted responsibility for their performance on tests, which is a necessary factor for self-regulated learning.

In response to question 9, “How do tests make you feel (before, during, and after)?,” most students from both groups stated that they felt nervous going into tests, and they felt relieved and happy when they were done. A couple of the students responded that they did not feel any different, or they feel fine throughout. One general chemistry student responded that it was dependent on how well he was prepared for the test. Again, I did not find the responses to be surprising. I will venture to say that most people get at least a little nervous going into a test, whether it is because they are unprepared, worried, anxious with anticipation, or something else. However, in spite of these similar feelings, honors chemistry students outperformed general chemistry students on tests. Furthermore, they outperformed general chemistry students on honors chemistry tests, which are more difficult than the general chemistry tests. Why is this the case? What makes honors chemistry students perform so differently than general chemistry students?

The responses to question number 13, “How do YOU use quizzes and tests in YOUR learning?,” revealed that most students used quizzes and tests to see how they were doing. Four general chemistry students said something regarding how they learned from their mistakes on tests and quizzes. This may be attributed to the fact that I allowed students to recapture some points that they missed on tests by doing test corrections. Five honors students said that tests and quizzes are used to determine what they needed to study for future tests and the final. The fact that students did not just simply state that tests and quizzes were used to see how much they know was encouraging. A majority of both groups of students said that they actually use tests and quizzes as feedback to guide their studies. This utilization of feedback is necessary for good self-regulated learning. However, what students do in response to this feedback is probably more indicative of how well they perform as self-regulated learners and the success that often comes as a result.

Analysis of Student Responses—Survey 2

Question number 2, “Who plays the most central role in your education?,” was used in the preliminary data discussed earlier in this report. However, student responses offered more information than can be illustrated by the pie chart. When I looked at student responses for the person/people they chose, it is worth noting that honors chemistry students were more inclined to explain why they chose the person/people they did, even though the question asked every student to explain their choices. Many honors students’ explanations illustrated how different people served a purpose in their learning. They appeared to be mindful of the roles of different people in

their education. Knowing that self-regulated learning requires other individuals to play roles in the scaffolding (or support) of learning, it is impressive to see that students recognized these learning needs. However, it is a little alarming that general chemistry students placed themselves at the center of their education without any explanation for this. Might this suggest that general chemistry students saw themselves as solely responsible for their education without acknowledging the importance of the input of others? Perhaps their lack of success was attributed to a poor understanding of how learning occurs. Perhaps these students were not being provided the necessary level of scaffolding inside and outside of school. Of course, while these responses were intriguing, some of the latter analysis was merely speculative.

Analysis of Student Responses – Survey 3

In response to question 5, “Finish this thought: When I don’t understand something in the homework, I...,” five general chemistry students reported that they asked for help when they didn’t understand the homework. The other two general chemistry students did not do the homework if they didn’t understand it. These findings were encouraging in that they revealed that a majority of the students do not simply give up when they don’t understand something. Furthermore, it is great that students were using one another to help understand the material.

Honors chemistry students responded differently. Only one said that he “leave(s) it blank” if he did not understand a problem. While five mentioned that they would ask a classmate or the teacher if they did not understand something, this was not given as the only other alternative to not doing the homework. Three mentioned that they would refer to the textbook or online sources to help them understand the concept. Overall, the honors chemistry students’ responses indicated more perseverance and resourcefulness in the way that they approached learning.

According to the responses to question 6, “How much time do you spend doing homework a night?,” the time that students studied varied. Most general chemistry students gave approximate times without explaining how the time was spent, while the honors chemistry students gave more detailed accounts of their time. Overall, there wasn’t really a clear difference in the amount of time that the general chemistry students spent doing homework versus honors chemistry students. Perhaps good self-regulated learning has more to do with what you do and less to do with how long you do it.

The answers for question 7, “How do you prepare for tests?,” offered the most notable differences between general chemistry students and honors chemistry students. When asked how they prepared for tests, six of the seven general chemistry students said that they studied by reviewing notes and worksheets. One general chemistry student said that she used flashcards when she studied for tests, which is a way of assessing herself. However, four honors chemistry students said that they used some form of self-assessment when studying, such as study-guides, book problems, or online quizzes. Most of the honors chemistry students used more active methods of self-assessment, rather than just reviewing the material as most of the general chemistry students had. Could the higher performance of honors chemistry students be attributed to this self-assessment while studying?

Analysis of Student Responses—Survey 4

There is another clear distinction between the answers given by general chemistry students and honors chemistry students for question 3 (“What can you do to ensure success?”). The general chemistry students responded, “I don’t know,” “always try(ing),” “(being committed),” “doing work and studying,” “work(ing) hard,” and “hav(ing) faith in (their) life.” Honors chemistry students responded, “practice, strategize,” “have goals, (do) not procrastinate,” “always do your best, don’t be afraid to ask for help,” “be prepared and go above and beyond

what others do,” “you should work hard...or you won’t to get them,” “don’t be lazy, and do everything on time,” and “don’t get lazy.” General chemistry students’ responses focused on effort and work to ensure success. The honors chemistry students also mentioned these factors; however, they also discussed expectations and goals that they set for themselves. General chemistry students did not mention anything about setting goals. Perhaps teachers set the standards for general chemistry students, while honors chemistry students were more likely to set their own standards. General chemistry students were more likely to measure success by achieving a high grade by the teacher’s standards, while honors students would measure success by how well they grasped the material and met their own expectations.

Five general chemistry students said that the advice that they would give to freshmen (question 4) would be to work hard, try, and/or never give up. The other two general chemistry students spoke about the importance of education and friends. Similar to the responses to question 3, general chemistry students emphasized work and effort. Honors chemistry students also mentioned these factors, but they also mentioned that being punctual, setting goals, and staying focused. In short, honors students expressed that success is attributed to more than just effort.

The answers to the question about the role of the teacher in education (question 5) were mixed. Both groups of students responded that the teacher’s role is to present the necessary material, to advise students, and to offer support. These answers were not surprising, but they were significant in that they showed that both groups see the teacher as a helper in education. As mentioned earlier, the majority of students saw themselves as playing the central role in their education. However, there was a difference between how the two groups used other people to help in the necessary scaffolding of learning.

When general chemistry students were asked about what they would say in a college admissions interview about their strongest qualities as a student (question 7), five mentioned that they work hard and try. These responses were similar to the responses to those given for question 3 in that they emphasized effort over goals or accomplishments. While many of the honors chemistry students also mentioned working hard, they also stated what they had accomplished. Similar to their responses to question 3, honors chemistry students also mentioned that they set their goals and expectations high for themselves. General chemistry students seemed to place more value on effort and perseverance, with little mention of accomplishing goals. Honors chemistry students were goal-oriented and set expectations for themselves—expectations that were used to gauge their success.

When asked if the transcripts accurately reflected their intelligence (question 8), both groups were split in their responses. There was no notable distinction between the two groups. They mentioned that while the transcripts showed their academic achievements, they did not show the whole student (e.g., personality). Also, students stated that transcripts did not always accurately represent their intelligence because different teachers grade differently, and students have “different types of intelligences.”

IMPLICATIONS AND CONCLUSIONS

In the beginning of the study, I was encouraged to see that the majority of students had placed themselves in the central role in their education. Knowing that they are responsible for their own education is important in the students’ development as self-regulated learners. However, I found that the different groups of students viewed their relationships with other people involved in their education differently. The analysis of how students approached formal assessments sheds light on this discrepancy.

When asked how students felt going into a test or quiz, most students said that tests made them nervous. While this was not surprising, the reasons that students were nervous did spark my

interest. It appeared to stem from performance anxiety for both the general and honors chemistry students. However, they both strived to meet far different expectations and goals. The general chemistry students strived to meet the expectations of the teacher, without striving to meet additional goals or expectations set by themselves, while the honors chemistry students were far more likely to strive to meet expectations or goals that they had placed on themselves. While learning goals (that fall within Vygotsky's zone of proximal development) set by the teacher are certainly necessary to provide the scaffolding in self-regulated learning, student recognition of their own goals in learning are evidence of higher-level self-regulated learning. The general chemistry students strived to meet the expectations set by the teacher, which were realized in the form of good grades, while the honors chemistry students strived to meet their own expectations, which were realized when the student fully grasped the material.

This difference in expectations was also evident in the way that the two groups of students prepared for tests. Although the groups did not spend significantly different amounts of time doing homework and studying outside of class, the way that they prepared for tests was far different. General chemistry students approached preparing for tests in the form of a review and study session. This would be analogous to a football player studying the playbook in preparation for a game. On the other hand, honors students took a more active approach by actually using self-assessments to prepare for tests; they used study guides, quizzes, and book problems to prepare for the test, in addition to reviewing the material. This approach would be analogous to a football player actually practicing on the field, running through drills, and running through plays with the practice squad. While reviewing the "playbook" does play a role in finding success, self-assessment and applying the knowledge in practice was found to be a major key to success. The general chemistry students approached studying for tests by reviewing (and most likely, memorizing) the information so that they would recognize it and "regurgitate" it on the test to meet the content knowledge expectations of the teacher. The honors chemistry students put the knowledge into practice so that they could achieve their goal of fully grasping the material in order to succeed on the test.

Evidence of students' different goals was also observable in their responses when asked about how success is found. The general chemistry students emphasized hard work and effort as being the most important, with little discussion about actually meeting goals. Honors chemistry students, on the other hand, were far more goal-oriented and focused on achievement, rather than focusing on the attempt at, or effort put into, achieving something.

While both groups placed the teacher in the role of helper in learning, they did not utilize the teacher in the same way. Honors chemistry students seemed to have a far better grasp of the teacher's role in scaffolding knowledge than general chemistry students had. Honors students were more likely to view the teacher as one of many resources in learning, while relying on the teacher to tell them what broad topics they needed to learn. General chemistry students were more likely to rely on the teacher for answers and a source of specific information that they would need to know for the test. Honors chemistry students were more self-regulated in the way that they strived as individuals to understand a concept that had been introduced by the teacher, while general chemistry students relied more on memorizing the specific information that the teacher had given to them.

Having said all that, connotations of assessment were different between the two groups of students. While both groups viewed formal assessment (tests and quizzes) as feedback in their learning, they did not use this feedback in the same manner. General chemistry students used the assessment to see where they stood in relation to the expectations and goals set by the teacher. Honors chemistry students used formal assessment to assess how they performed in relation to their personal goals and expectations. These different approaches certainly affected the self-regulated learning of students in the high school chemistry classroom. It is essential in self-

regulated learning that students progressively increase their ownership of expectations and goals in learning.

In addition to students recognizing their goals and expectations in education, self-assessment was also found to be extremely important in good self-regulated learning. Once the student had personalized the goals, they were more likely to use their resourcefulness as they put their knowledge into practice in the pursuit of accomplishing the goals. Instead of memorizing something because the teacher expected them to know it, honors chemistry students practiced using the knowledge because they wanted to understand it. This practice took the form of self-assessment and reflected good self-regulated learning. Their learning was more about understanding and being able to apply their knowledge than just knowing a set of facts.

As mentioned in my previous research study, assessment is important to becoming an effective, self-regulated learner. While my previous research study revealed the usefulness of meaningful (formal) assessment in the self-regulated learning of students, this study focused on the role that personal expectations and self-assessments play in good self-regulated learning. These findings will certainly inform my instruction as I seek out ways to encourage personal goal setting and self-assessment in my classes. Having seen the success that my high-performing students have found, I hope that what they have taught me will help me to raise the achievement of the low- and middle-performing students in my general chemistry classes. Ultimately, my goal is to see my students develop as self-regulated learners in preparation for the real world that awaits them as productive citizens in the academic arena and/or in the work force.

WHERE TO NEXT?

Having been informed about the usefulness of self-assessment in this study, I would really like to find ways of encouraging it in my classroom. Many of my students have gotten through years of school using memorization as a method of learning, without really learning to gain understanding. They have struggled to meet the expectations of others, without truly owning any learning expectations for themselves. While “owning your education” has become somewhat of a catch phrase in education, it is a necessary quality of effective, self-regulated learning. Increasing students’ interest in their education is certainly an interesting topic of research, which lends itself to further inquiry:

- How do we get students to “buy-in” to their education?
- How do we get students to set goals for themselves? Can we communicate the expectations for a class in a way that is conducive to student goal setting?
- What other factors in education prevent students from becoming effective, self-regulated learners?
- How can teachers become better builders of cognitive scaffolds to improve self-regulated learners?
- Can formal assessment be modified to encourage student self-assessment and personal goal-setting?
- What teaching techniques can be used to increase student self-assessment and personal goal setting?

Perhaps in the answers to these questions lies the key to success for all students. My next research study will probably address one or more of these questions.

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APPENDIX A

Survey 1

- 1) What does “assessment” mean to you?
- 2) What makes assessment meaningful to you?
- 3) What do you think of quizzes?
- 4) What style/type of test are you most successful with?
- 5) Describe your most negative test-taking experience.
- 6) How do you prepare yourself to do well on tests?
- 7) Describe your most positive test-taking experience.
- 8) What is the most significant factor that causes you not to do well on a test?
- 9) How do tests make you feel (before, during, and after)?
- 10) Finish this thought: In a perfect (but realistic) world, tests would be...
- 11) What is the purpose of quizzes?
- 12) What is the purpose of tests?
- 13) How do YOU use quizzes and tests in YOUR learning?

APPENDIX B

Responses to questions 8, 9, and 13 from Survey 1

Student	Response
1G	<p>"Stuff I am not 'f(a)miliar with"</p> <p>"Nervous before→bored during→relieved after"</p> <p>"You learn from your mistakes"</p>
2G	<p>"Not getting enough time to finish."</p> <p>"I feel fine the whole way through a test."</p> <p>"I use them to assist me by seeing if (I)'m learning the material."</p>
3G	<p>"(Not) doing worksheet and work in class"</p> <p>"They make me feel very excited when I know what (I)'m doing and bad when I don't know and I feel (relieved) when I finish the test"</p> <p>"When you learn from your mistakes"</p>
4G	<p>"Not study at all and teacher not telling us what is on the test or only half is what is on the test."</p> <p>"Before: kind of nervous, during: if they are hard, confused easy; happy, after; tired."</p> <p>"To see what I need to work harder on for the final."</p>
5G	<p>"I get nerv(ous)"</p> <p>"I feel nerv(ous) before and during the test, but once it's over I feel relieved"</p> <p>"They tell me how good/bad I'm doing in school"</p>
6G	<p>"When I fell rushed or I go blank or not studying."</p> <p>"Before I anticipate the test day. During the test I feel nervous. After I feel relieved because it's done with."</p> <p>"I go back to see why I got a certain problem wrong and I find the correct answer. They help me review and better prepare myself."</p>
7G	<p>"If I don't study hard or something."</p> <p>"Before = nervous / during = ok. / after = happy."</p> <p>"I don't use them."</p>
1H	<p>"If I was (not) prepared"</p> <p>"No different, a little frantic to finish"</p> <p>Reviewing what I got wrong or studying what I need to.</p>
2H	<p>"stress, tiredness."</p> <p>"Before – stressed/nervous/incompetent/not prepared during – tired/dizzy After: Nervous"</p> <p>"Honestly, I try hard on quizzes & tests, but when I fail them, I usually don't take a backwards glance at them. I just try harder on the next test."</p>
3H	<p>"Time limits! As soon as I am told that I only have so many hours/minutes to do something, I either rush and make mistakes or freeze and can't think at all!"</p> <p>"Nervous, then focused, and then happy that it's over. Once it's done I feel satisfied about finishing it."</p> <p>"To make sure I know everything I need to learn! I also use quizzes/tests to study for future tests."</p>
4H	<p>"My procrastination habits occa(s)ionally tend to affect my test scores, or lack of studying."</p> <p>"I am nervous before the test, calm when I am doing it, and nervous after I take it because I want to know how I did on it."</p> <p>"To help me excel my knowledge in my subjects."</p>
5H	<p>"When I don't study or when (I) don't get home to do something."</p> <p>"Before test make(s) me feel nervous, during confusing and after worried."</p> <p>"I use my quizzes and tests when I (take the) final exam at the end of the semester."</p>
6H	<p>"I am lazy and I don't like to study"</p> <p>"Before – I am a little nervous during – I am focused after – I am relieved."</p> <p>"I use my notes to fix the problems that I missed."</p>
7H	<p>"Being unprepared and not knowing the material"</p> <p>"The same as I normally do unless I don't know much about the subject"</p> <p>"To assess how well I know a subject or topic."</p>

APPENDIX C

Survey 2

Fill out this questionnaire honestly. If you need more room, please use the back.

- 1) Do you feel that you are in control of your learning? Explain.
- 2) Who plays the most central role in your education? Explain.
- 3) How do you learn best? Explain.
- 4) What do tests tell you? What do quizzes tell you? How are they different? How are they similar?
- 5) How do you prepare for tests? How long does this take?
- 6) How often do you choose to do schoolwork over having “fun”?
- 7) Who (other than yourself) has the greatest influence on your education?
- 8) Is doing well in high school important to you? Why?
- 9) What is the most useful feedback that you have received in high school? Explain
- 10) If you were not in school, what would you be doing? Why?
- 11) Where do you see yourself in 5 years from now, ten years from now, 50 years from now? How does “now” affect “then”?

APPENDIX D

Responses to question 2 from survey 2.

Student	Response
1G	No answer.
2G	"Me because I have a choice."
3G	No answer.
4G	"Me I choose to work or not."
5G	"I do"
6G	"Me and my surrounding."
7G	"Myself."
1H	"Parents, they're there to make sure I do the work and do good on projects."
2H	"I think I play the central role, not many teachers here have an impact on my learning & I am the one who tries to keep on going for myself."
3H	"Other than myself, my teachers. They do whatever they can to make sure I learn."
4H	"The teachers because I rely on them to help make sure that I understand all that we are supposed to know, and to challenge my academic skills."
5H	"Teachers"
6H	"My parents do, they create an environment at home that allows me to do my HW."
7H	"Myself, because it depends on how hard I decide to work."

APPENDIX E

Survey 3

- 1) Who wants you to learn?
- 2) Finish this thought (please be serious): A test is good for...
- 3) Would you rather be in a higher-level chemistry class? Why or why not?
- 4) What do you want to get from high school?
- 5) Finish this thought (please be serious): When I don't understand something in the homework, I
- 6) How much time do you spend doing homework a night?
- 7) How do you prepare for tests?
- 8) Do you think education is a right or a privilege? Explain your answer.
- 9) Finish this thought: The thing that I like most about school is...
- 10) Finish this thought: The thing that I dislike most about school is...
- 11) Describe how you see yourself as a student. Are you the student that you want to be?

APPENDIX F

Responses to questions 5, 6, and 7 from survey 3.

Student	Response
1G	<p>"I get help(ed) by friends"</p> <p>"1 1/2 hours"</p> <p>"Study"</p>
2G	<p>"I don't do it."</p> <p>"0"</p> <p>"I don't"</p>
3G	<p>"I don't finish the HW"</p> <p>"1 hr maybe 2 hr"</p> <p>"I sometimes study or look at my worksheets"</p>
4G	<p>"I ask a friend."</p> <p>"About 15-30 min depends"</p> <p>"Look over what we talked about in class"</p>
5G	<p>"I ask for help."</p> <p>"It depends on what day of the week it is"</p> <p>"I go over notes"</p>
6G	<p>"I ask questions."</p> <p>"About 2-4 hours. I(t) depends on the amount of homework given."</p> <p>"Study and review"</p>
7G	<p>"I go to my cousins house for help."</p> <p>"An hour."</p> <p>"Using flash cards."</p>
1H	<p>"I look through the chapter and try to figure it out"</p> <p>"Maybe 45 minutes to an hour and a half"</p> <p>"Reading through notes, NT/NM, and the book"</p>
2H	<p>"I usually leave it blank, copy off someone else's or say I'll do it later & fall asleep."</p> <p>"Most of my clas(s)es are easy, so I finish the HW right in class. As for my harder subjects, I spend about 2-3 hours, with many unneeded interruptions."</p> <p>"I usually write note cards, do the study guides (if any) & the work that I think might be helpful. If I still feel unclear, I'll try to read the book a few times. After a while, I'll give up."</p>
3H	<p>"I ask a parent or a friend if the teacher is not available. If the teacher is still not available, I try the internet or a different book."</p> <p>"It truly depends! Sometimes as little as 10 minutes, sometimes as much as an hour and a half (for chemistry alone). Rarely more than 45 minutes."</p> <p>"I make study guides or crib sheets (whether I can use them or not)"</p>
4H	<p>"I look it over in the text book and ask the teacher."</p> <p>"2-3 hours"</p> <p>"By studying the text that we are being tested on"</p>
5H	<p>"I should ask my teacher."</p> <p>"Half hour to one hour."</p> <p>"I read the chapter and do homework problems."</p>
6H	<p>"I ask a classmate how to do it."</p> <p>"About an hour"</p> <p>"I study the night before"</p>
7H	<p>"Try to figure it out for a while then either ask a classmate the next day or ask the teacher."</p> <p>"Depends on what time of year but usually about two or three hours."</p> <p>"Study thin(g)s I don't know and try and find quizzes online."</p>

APPENDIX G

Survey 4

- 1) What is the key to success?
- 2) What is a good indicator of success?
- 3) What can you do to ensure success?
- 4) If you were giving advice to freshmen about being successful in school, what would you tell them?
- 5) What is the teacher's role in education?
- 6) What do you want to get out of school?
- 7) You are being interviewed for admission to a college, and you are asked, "what are your strongest qualities as a student?" How would you respond?
- 8) Does your transcript accurately reflect your intelligence? Does it correctly reflect the type of student that you are? Explain.
- 9) If you were to start high school all-over again, would you change anything that you do? Explain.

APPENDIX H

Responses to questions 3, 4, 5, 7, and 8 from survey 4.

Student	Question	Response
1G	3	"I don't know"
	4	"Try your best"
	5	"Teaching"
	7	"I always try my best"
	8	"Yes, it shows the kind of student I am"
2G	3	"Always try"
	4	"Never give up"
	5	"To provide help and basic info."
	7	"I always try and I learn very quick."
	8	"Yes, except 9 th grade. I am a pretty good student, but I do have weaknesses."
3G	3	"To be (committed)"
	4	"To have (commitment) and to not give up"
	5	"To give information and to help out"
	7	"That I am (committed) and willing to do anything to be successful in class"
	8	"No because students have lack of effort"
4G	3	"Doing work and studying."
	4	"Do your work and study for all the test(s) and do all extra credit and do <u>ALL</u> homework."
	5	"To teach us what we need to learn."
	7	"I do my work and I try."
	8	"I think some of my grades could be better but they should be higher."
5G	3	"Work hard."
	4	"Get good grades and make lots of friends"
	5	"To explain the information on textbooks and provide moral support for students"
	7	"I'm responsible, organized + neat"
	8	"Not really, some teachers grade on test scores not HW"
6G	3	"Have faith in my life."
	4	"Don't think school is about dressing and acting the best. In the long run, it's the education that can get you far. Looks don't last forever."
	5	"To believe each and every (student) can learn what they teach, even if they think it is the worst of students."
	7	"I'm a great listener and I have perseverance."
	8	"In a way it does because the higher grades means the more knowledge that student can gain. Although, it doesn't reflect the type of student. It reflects their knowledge, but not their personality."
7G	3	"Work hard"
	4	"Work hard"
	5	"Teach students"
	7	No answer.
	8	"Yes, it does."

APPENDIX H CON'T

Student	Question	Response
1H	3	"Practice, strategize."
	4	"Do homework on time and study."
	5	"To teach, to show students how to do stuff"
	7	"Doing my work on time and not forgetting what I've just done in class."
	8	"No, it just lists grades and classes. It doesn't list absences or missed tests and work"
2H	3	"Have goals. (Do) not procrastinate."
	4	"Set some kind of goals for the future so you always have something to look (to)."
	5	"If it's a good teacher, they're there to help & teach stuff. If it's a bad teacher, they're there to stand idly by, wasting people's time & to use their period as a study session for other classes."
	7	"I would say if something's really important to me, I'll give it my all & the outcome will turn out good."
3H	8	"For the 1 st semester grades, they reflect how I like that class & how well I keep up w/the work. For 2 nd semester, it shows how I slacked off or how I'm busy w/other activities. I know as a student, I can start to slack off in 2 nd semester."
	3	"Always do your best, don't be afraid to ask for help"
	4	"Always try! Don't assume you'll fail. Just put in some effort, and do your work. If you don't understand something or have questions, ask the teacher!"
	5	"Providing the tools and help a student needs to learn."
4H	7	"I am a hard worker with an amazing drive to learn. I set goals almost higher than possible."
	8	"I hope so! It would mean that I'm very smart! I have all A's, and I think it definitely reflects the type of student that I am."
	3	"Be prepared and go above and beyond what others do."
	4	"To do all their homework and really focus on their school work and not get distracted."
	5	"To teach students standards and how to work together."
	7	"I work hard, am focused, and am respectful to all my classmates and teachers."
5H	8	"It does not necessarily reflect how intelligent you are because different people have different types of intelligence. But, it does reflect your work habits, how you get along with others (citizenship grades), and if you are book smart."
	3	"To ensure success you should work hard. Things that you join or you want to get them."
	4	"I would tell them work very hard."
	5	"To teach students, to describe when they ask you questions."
	7	"Hard worker creative"
6H	8	"Yes, it tell(s) if I'm intelligent or not."
	3	"Put in extra time + effort to things that are important."
	4	"Don't be lazy, and do everything on time."
	5	"To ensure that students learn the standards."
	7	"My strongest qualities are that I am very attentive, I turn things in on time, and I put my best effort into all my school work."
7H	8	"It reflects my intelligence by showing my grades, but it does not show what kind of student I am b/c it does not show work ethics and character."
	3	"Work hard"
	4	"Don't get lazy"
	5	"Advise students what to do."
	7	"Learn thin(g)s quickly"
	8	"Not necessarily because it's just like stats for a game, you could have had a wonderful night just not statistically."

The A B Cs of Successful Math Students (Attitudes, Behaviors, and Characteristics)—A Critical Look at the Math Program and Student Achievement

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ABSTRACT

Research Question: What factors affect student success in mathematics at the high school level? We studied students' performance in various mathematics classes based on their attitudes, behaviors, and characteristics (the ABCs of learning). In particular, we looked at why so many students fail algebra and what behaviors they might adopt to enable them to be successful. **Method:** To investigate this, we interviewed, surveyed, and observed students; analyzed standardized test results; reviewed school-wide demographics; and engaged in student performance assessments in selected classes. **Data:** Our data enabled us to develop an accurate picture of the strengths and weaknesses of the mathematics program at Dixon High School. **Results:** We verified that successful students made individual decisions to motivate themselves to succeed in their classes. They indicated an understanding of the usefulness of mathematics and the importance of asking questions in class. **Conclusion:** We found little correlation between different performance assessments and a student's course grade. Using our results, we hope to develop a clearer road map of what we need to do to improve the mathematics program at Dixon High School and to encourage more students to be successful in mathematics.

Key words—mathematics, math program, math test scores, student motivation, student surveys, student interviews, English language learners (ELL), student achievement, Algebra 1, student attitude, CAHSEE results, math placement.

CSTP 4.5 Modifying instructional plans to adjust for student needs

CSTP 5.4 Using the results of assessments to guide instruction

CSTP 6.5 Working with colleagues to improve professional practice

DESCRIPTION OF THE PROJECT

We began teacher research at Dixon High School (DHS) in 2004-2005 with two different, yet related, projects. Suzanne began investigating if there is a way to determine early in the year which students would or would not be successful in a geometry class. Ed began his project by asking which students (especially Algebra 1 students) failed and why they failed. As the projects evolved we began to investigate the types of data we could gather in order to get a better understanding of individual students, classes, and the entire math program at Dixon High. After identifying students who had previously failed and were now successful, we began to examine reasons how these students became successful in an attempt to “infect the symptoms of success” in unsuccessful students. As these projects developed over the course of the year, the investigations began to fuse and form one large investigation of Algebra 1 and geometry students. Collectively, we seemed to be investigating which students failed, why they failed, and how to help those who failed. We wanted to both identify which students were most likely to struggle, and determine which attitudes and behaviors impeded success and which ones seemed to foster success in students who had failed previously.

In particular, we were interested in discovering why such a large proportion of our Algebra 1 students were repeating the course. We already knew that at DHS, similar to many other high schools, many students have to repeat Algebra 1. However, after looking at the school-wide data, even we were surprised by the sheer number of students who had to repeat

algebra. If we really do have a high-quality math program, (and we firmly believe we do) then why are so many students failing?

What kind of data would help us? How could we collect it? Would it give us an accurate picture? Once we identified some behaviors and attitudes that led to success, what could we do to foster these positive traits in our students? Was there some kind of pattern of prerequisite knowledge, skills, personal behaviors, and characteristics that separated the successful from the unsuccessful math student? If so, what steps could we take to support and aid struggling students to enable them to be successful also?

The Community and the School

Once a small farming community, Dixon is now a booming suburban town of about 17,000. Highly influenced by I-80, Dixon is becoming a bedroom community for both the Sacramento and San Francisco areas. Our proximity to the University of California, Davis, also has a powerful impact on our school community, allowing us access to a stream of competent, young, and energetic student teachers and other types of valuable educational support.

About 1100 students attend Dixon High. Approximately 44% of the students are Hispanic, 49% Caucasian and the rest a mixture of Asian, American Indian, and African-American. About 25% of the students are English language learners (ELL) or have been re-designated as fluent during their school years.

At Dixon High School, we typically have about a dozen Algebra 1 classes, of which half are freshman classes funded under the state's twenty-to-one class-size reduction plan. The others are tenth-through-twelfth grade classes of thirty to thirty-five students each. All of the students in these classes have experienced some struggles in their math career. According to the California state standards, algebra is an eighth grade class, so even the ninth graders taking this course are technically a year behind. Realistically, however, freshmen in Algebra 1 are right on track to fulfill a complete college preparatory sequence of math courses. However, the students in the tenth-through-twelfth grade Algebra 1 classes really do have difficulties in math. Of the 119 students surveyed in these classes, 79 had failed at least one math class in their previous years. This means that 66.4% of our Algebra 1 students in grades ten through twelve are either repeating Algebra 1 or have repeated pre-algebra. Clearly, we had a problem. The only solace we could find in our data was that apparently these results were fairly consistent for students and programs throughout the state. Some high schools had tried eliminating pre-algebra courses at the high school level, but, as a consequence, they had even more students fail Algebra 1; or they were forced to dilute the Algebra 1 curriculum.

This year the authors each taught three geometry classes. Half were freshman classes and the others were tenth-through-twelfth grade classes. Theoretically, all of the geometry students had experienced some degree of success in math since they were required to have earned a C or better in Algebra 1 in order to enroll in the course. Because geometry is not a graduation requirement (Algebra 1 is a state high school graduation requirement), in one sense geometry is an elective math course, and most of these students see themselves as college-bound. Since all these students experienced some form of success last year (except for those repeating geometry) and possess the prerequisite math skills, there should be almost no unsuccessful students in geometry. Certainly there were not as many failures as in algebra since all have learned at least some math skills. However, too many students still struggled. And, since many of the geometry students come from the ninth-grade Algebra classes, technically they are still behind.

CCBI—The Role of the Fellows

This year Dixon High was extremely fortunate to be part of a university-public school project called the Collaborative Classroom-Based Inquiry Project (CCBI). This National Science

Foundation (NSF) grant funded fellowships and associated training that enabled graduate and undergraduate students in science, technology, engineering, and mathematics to improve their communication and teaching skills while enriching the instruction in k-12 schools through interactions with teacher researchers. Expected outcomes included improved communication, teaching and team building skills for the fellows; professional development opportunities for k-12 teachers; enriched learning for k-12 students; and strengthened partnerships between institutions of higher education and local school districts.

Having two undergraduate students and one graduate student on campus ten hours each per week enabled us to collect, organize, and critically examine massive amounts of data that had previously been prohibitive. The CCBI fellows created huge spreadsheets for the data collected from students in our classes. This database included a large range of information for each student including course title and grade for the previous year, Math Diagnostic Testing Program results (through UC/CSU), performance on various hands-on geometry activities and visual perception problems, puzzle solving ability, performance and interaction in group situations, test scores, homework averages, survey results, views on math and school in general, attitudes about learning and teaching, and perceptions of student relationship to the world of math. The research team also conducted individual student interviews regarding student awareness of how they were performing in math class and what they or the teacher could do to improve or support their learning. Later in the semester, once it was clear which students were struggling in algebra and geometry, the fellows observed individual student behaviors in the classroom and then met with the students to determine if they were aware of their classroom behaviors. They were also asked to identify which behaviors might help or hinder their learning. The fellows further conducted interviews with selected students to determine how and where they had finally found the key to success in math.

SCHOOL-WIDE DATA ANALYSIS

The fellows performed correlation tests on many pairs of variables in our spreadsheets looking for patterns and associations. So, what did we learn from all this data? First, many assessments were not very good predictors of success. We gave the Mathematics Diagnostic Testing Project (MDTP) test each fall. UC Davis stresses that the test results should not be used to exclude students from courses but rather to offer insights on their strengths and weaknesses. As it turned out, performance on the test did not predict success or failure in geometry classes. There was a very low correlation (0.21) between the MDTP test score and a student's grade in geometry class (a correlation co-efficient of ± 1 would mean one variable is a perfect predictor of a second variable; a correlation coefficient of 0 means there is no association.) Correlation between the MDTP and a student's individual test average was somewhat higher, about 0.60 for fall individual tests and 0.44 for spring individual tests. Thus, the better the score on the MDTP test, the better the test scores, more or less. Homework was not factored into this score.

On the same note, when homework (worth approximately a third of the total grade) was correlated with individual test scores the correlation coefficient was 0.43. One would hope that doing homework would be highly correlated to test scores, but unfortunately it is not very high. So, this brings up a bigger issue: how much do we care about homework and the work ethic involved versus how much math is learned? Homework apparently tells more about the former than the latter. But, if a student learns that it is acceptable not to do homework, will he or she be able to make the transition to higher level math classes and to the college environment, where homework is more critical? This sounds like a whole new question to research.

In trying to get a "big picture" of the math program at DHS, we gathered information from the California High School Exit Exam (CAHSEE), California Standards Text (CST) results, student grades in individual courses, and course enrollment data. All data spreadsheets are

included (see appendices D-G) with the general reflections on the aggregate data appearing below.

The class of 2006 was the first class to be required to pass the CAHSEE in order to obtain a high school diploma. The 246 students in the class of 2006 first took the CAHSEE in the spring of 2004. All students, including special education students and ELL students, were tested. Eighty-seven percent passed the test on their first try. Scores were approximately the same for both genders. It is interesting to note that the Hispanic and white subgroups, and the disadvantaged and not disadvantaged subgroups, had almost identical scores. This is probably appropriate since there is a large overlap between the two groups. In the English language learners category 16 out of 40 did not pass the test, but this is not surprising since reading the test in English was no doubt an issue for these students. Of the 31 students who failed the test, 21 were Hispanic and 7 were non-Hispanic. However, 16 of the Hispanics who failed the test were the ESL students mentioned above. When this overlapping group was removed, the non-pass results were that 5% of Hispanic students and 5.5% of the non-Hispanic students did not pass.

It was encouraging to see that both of our subgroups scored equally well on the CAHSEE. We were confident that as the ELL learners gained more proficiency in both English and math, they would have a better chance of passing the test.

The breakdown of the 31 students who did not pass the test are in math courses were enrolled in a variety of math courses: two students had no math courses listed in their schedule, three were in special education math, one was in a general math class, twenty were in pre-algebra, four were in algebra, one was in geometry, and one was a special education student. Their grades in their math classes were also varied: no grades for the two who were not taking any math, eighteen failed, three earned Ds, three earned Cs in regular math (one student left in the middle of the test), three earned Cs in Spanish language math, one earned an A in Spanish math, and one earned an A in special education math.

It was reassuring to know that for the most part, students who were passing their high school math classes are also passing the CAHSEE. Also almost all of the students with the prerequisite skills for algebra passed the exit exam as did most of the students passing pre-algebra.

The students were retested in the fall. Nine passed, eighteen failed again, and four were absent.

The 2003-2004 STAR test data revealed the following trends at our site:

- Dixon scored slightly below the state mean in the General Math and Algebra 1 categories;
- Dixon scored above the state average in geometry;
- Dixon scored below the state average in Algebra 2;
- Summative math data for 2003 were incorrectly reported so no conclusions could be drawn for 2003;
- Summative math data for 2004 showed Dixon at or above the state average in almost all categories (these students are a subset of the students who were below the state average in Algebra 2 the year before);
- Typically, Hispanic students scored lower than white students; however, they are usually above the state average for this group;
- More girls than boys are enrolled in all math courses at the geometry level and higher;
- Not enough Hispanic students are enrolled at the geometry level and above.

This data showed us that the geometry curriculum closely matched the state test but that we needed to closely examine the released information about the Algebra 2 exam and compare it with the course curriculum to see if certain topics needed to be emphasized more. It was also

disturbing to see that the Hispanic students in a given course did not score as well as their white counterparts. This information led us to examine course grades to see if there was also a corresponding disparity between the two groups. Were lower test scores in the Hispanic subgroup a standardized testing phenomenon, a language issue, or a true difference in math knowledge? It was reassuring to find that in all courses with a significant number of Hispanic students, the class averages for the two groups were similar. However, in almost all courses the female class averages were somewhat or substantially higher than the male averages. The same was true for both the Hispanic and non-Hispanic subgroups. It appeared that in our classrooms, we could compensate for language or cultural differences by restating questions, by careful use of terminology, by explaining anything that may not be familiar to a social group, and by continual reinforcement of key concepts. Since these techniques could not be used on a standardized test, any change in vocabulary or the way a question was worded may have confused even a fairly proficient ELL student. The question of why more girls enrolled in higher level math classes, why they outperformed boys at almost all levels, and what could be done to change this trend was a completely different question yet to be explored.

Student Surveys

We administered three surveys during the year. The first survey was designed to examine the reasons and causes for student failure in math. In particular, we asked the students about their native language, the amount of time and effort they put into their homework, their attendance, their extracurricular activities, their perception of support from their parents, their failure in previous math classes and what they intended to do differently in order to pass the course. (See appendix A for the complete survey.)

We also conducted a geometry survey early in the fall. This survey explored student attitudes about various math topics, asked about the games and activities they enjoyed as children, gathered data on any musical or artistic interest students had, and examined student expectations about learning and the usefulness of geometry. (See appendix B for the complete survey.)

The last survey asked students to describe good teaching experiences and methods, to describe good learning experiences and methods, and to rate the applicability of what they learned in school to their future. (See appendix C for the complete survey.)

Student Interviews

Early in the second semester, we decided to identify and interview students who had failed previously and were currently succeeding, as well as some who were still failing. The interviews covered some of the same questions as the survey, but we were able to explore more deeply the student's beliefs about their own success or failure.

Our surveys and interviews clearly showed one commonality: a student's own motivation is the greatest determiner of his or her success or failure. The students who had failed in the past and were currently succeeding told us over and over again that they just finally made up their minds to do the work, learn the material, and pass the class. Something finally gave them the individual motivation to learn the material do well in the class.

One student who had been in Algebra 1 for four years said he was finally doing well because he was showing up for class more and paying attention: "Not showing up to class and stuff like that made me have to repeat it. I show up pretty much every day now. I just decided I've got to pass this sooner or later. I just started showing up so I can pass it this year. I know I've got to get through algebra to graduate from high school and I don't want to have a math class senior year, so I want to get done with it."

Another Algebra 1 repeater said, “I am doing probably the best I’ve ever done in my four years. I think it’s because of the people in my class. I’m probably one of the only seniors. When I don’t have other people around me, I pay attention more. I get distracted easily. And I’m more focused too. It’s senior year...gotta get out of here.”

An “A” geometry student confessed she wasn’t always an A student. In response to the question “What motivates you to try hard in math?” she responded, “This year I have a goal. If I have a goal it helps me to motivate myself. This year if I get straight A’s, then I get to go to France next summer. Last year I was doing really bad in class and my parents couldn’t figure out how to get my grades up. They like grounded me and it didn’t work. So they like tried this and it worked.”

At the beginning of the year all students thought they personally controlled their ability to succeed or fail in their math class. Even at mid-year, struggling students thought they had the ability to learn what was required of them. It wasn’t until midway through the second semester that some students gave up and decided it was too late to learn the material and pass the class.

While this message could be seen as discouraging, in fact there is much we, as teachers, can see as positive. As teachers, we cannot make that crucial decision to work and learn for our students. We can’t do the work for them. We can’t provide the parental support that they need. What we can do is provide and maintain a safe place for the students in our classrooms. We can create an environment where learning is expected and encouraged, and occasionally even fun. We need to do all that we can to get as much math knowledge into the students as we can, so that when they do make the decision to make the most of their talent, they will have a strong foundation.

WHAT DID WE LEARN?

What did we, as a math department, learn from the school-wide data?

- We need to take a closer look at the Algebra 2 curriculum and determine how we can supplement it so that it more closely matches the STAR test;
- we need to make changes in the Algebra 1 course for students who are repeating the course;
- we need to revisit our views on the purpose, methodology, and importance of homework;
- we need to devise new and/or different motivational strategies for “at risk” students;
- we need to be quick in diagnosing and intervening with these “at risk” students.

What did we learn about our classroom teaching, grading practices, and our students’ learning?

- The impact of social and home issues on our students is probably greater than our teaching impact;
- lots of things we thought might be important, aren’t!
- the motivation to be successful is a very individual matter for each student;
- students are surprisingly aware of their behaviors during class and how they affect their learning;
- at the beginning of each semester, students feel they control their own success and that success is attainable;
- students feel they lose control of success quite late in the semester;
- we need to try to design a classroom learning and grading framework that puts students in control of their success as long as possible;
- our ideas of success in the classroom may not be the same as each student’s idea of success;
- students decide when to learn, not the teachers.

WHERE DO WE GO FROM HERE?

In addition to curriculum revisions, there are a number of issues which present themselves as likely topics for future research projects. One issue we could look at is the impact of student behaviors which sabotage success. In order to minimize their risk of failure, many students deliberately minimize the amount of effort they expend on any learning task, thus preserving the excuse that they could have succeeded if they had tried harder. Some avoid engagement in the task altogether—"it was boring" or "I forgot to do it." Others exhibit self-handicapping behaviors such as procrastination or setting goals that are unrealistic.

Another question is the gender difference issue: Why are more girls than boys enrolled in higher level math courses? Why do the girls have a higher class average than the boys? Is there something we can do to encourage more boys to take higher level math classes?

Still another question is the importance of homework: How does it support student learning and how should it be counted in a grading structure?

Finally, in order to further research the question of why students do poorly in Algebra 1, we plan to survey the students who are repeating the course in the fall and ask them three questions:

1. How many times you have taken algebra, including this time?
2. Why have you failed?
3. Who was the teacher in the class(es) you failed?

We can then ask the previous teachers for their opinions about why each student failed. Hopefully, comparing student and teacher responses will give us insight into ways to work more effectively with each student to enable them to succeed.

Near the end of the second semester, we need to identify those who are once again not succeeding and ask them why they are failing this time. Hopefully by analyzing the information from early in the year, closely monitoring accommodations throughout the year, and assessing student progress at the end of the year, we will gain valuable insight into how we can best help students pass Algebra 1 in the future.

CONCLUSION

At the beginning of our research project, we hypothesized that we should be able to find at least one predictor of student success or failure in the data we collected. While we were unable to determine any definitive predictors of success or failure, we did uncover things that were not related to students' final grades. The MDTP scores did not correlate with students' final grades; while individual test scores correlated well with grades in the same semester, individual test scores from the previous semester did not correlate with grades the following semester; test scores and homework correlated only slightly which prompted the question: Do we want them to correlate more?; when comparing student attitudes about various concepts at the beginning of the year, student performance in individual and group assessments appeared not to be significant between the students who had passing grades and non-passing grades at the end of the year.

What we did find was that student interviews verified our preconceived notion that students will be successful when they are motivated and focused. Interviews also revealed that successful students seem to have an idea about why mathematics is useful to them, and they are not afraid to ask questions. As teachers, we cannot provide this internal motivation or focus; this is something that must come from within the student. However, we can provide a foundation from which the students can begin to realize their own motivation. By making an attempt to really understand our students on a more personal level, we can shape the way we teach mathematics to them. We can try to make the math we teach them more relevant to their own lives. In doing so, we can hope to strike a nerve that causes the student's motivation to awaken and thrive.

Although we did not determine why students fail we did determine symptoms of success that we can try to induce in students who are failing. While this might not be a definite means of fixing student failure, it does provide us with a starting point from which to begin further investigations.

Suzanne Galloway has been teaching math in Dixon, California for thirty-two years both at the middle school and high school levels. Being involved with teacher research for many years has given her the opportunity to more fully explore educational interests and questions and to strengthen ties between Dixon High School and UC Davis. She feels teacher research provides a great opportunity for her to collaborate and communicate with teachers across many grade levels and curricular areas about a wide variety of educational issues and concerns.

Edwin Reed has taught college and high school math for eighteen years and is currently working at Dixon High School. His involvement with teacher research for over a dozen years has allowed him to regularly and carefully examine the practice of teaching, always seeking ways to improve student learning. The collaboration across all grade levels that teacher research provides brings insight and perspective to the learning process in general and that of certain students in particular.

Brandon Muranaka has recently finished his first year of teaching mathematics at American River College. Prior to his hire, Brandon earned his MA in mathematics from the University of Hawaii at Manoa and his MAT in mathematics from UC Davis. Taking part in the NSF CCBI project has given him an interest in and a starting point to begin teacher research at the community college. He hopes to share the benefits and joys of teacher research with his colleagues at American River College.

Kristin Lui received her BS degree in Mathematics from UC Davis in June 2006. She will be pursuing a MS degree at UC Davis in Applied Mathematics. Participating in the NSF CCBI Project gave her the unique experience of working with teacher researchers and exploring with them how students struggle with and succeed in mathematics. She hopes to contribute to the mathematics education field either through research or becoming a teacher herself.

Jennifer Healey is a senior at UC Davis and has been accepted to the UC Davis Credential/MA program for single subject mathematics for the 2006–2007 school year. Her experience as an NSF CCBI Undergraduate Fellow was her first introduction to teacher research, and it has helped to solidify her desire to go into the teaching profession and work to fight educational inequity.

APPENDIX A

Student Survey: Success vs. Failure

1. What language did you learn first?
2. What language do you learn best in?
3. What language do you speak with your friends?
4. What language do you speak at home?
5. How much time do you spend on math homework per night?
6. How much time do you spend on all homework per night?
7. Do you have a job? If so, how many hours per week do you work?
8. Are you involved in any extracurricular activities (sports, clubs, etc.)? If so, please explain.
9. About how many days of school do you miss per semester?
10. Have you ever repeated algebra?
 - If no, continue to question 11.
 - If yes,
 - a. How many times?
 - b. Why do you think you did not do well?
 - c. What needs to be different this time for you to be successful?
- d. Who were your previous algebra teachers?
11. Have you ever repeated any other math classes? If so, which classes, when, and who were your teachers?
12. What makes you try hard in class?
13. What makes you succeed in class?
14. How do your parents react when you do well in school?
15. How do your parents react when you do poorly in school?

APPENDIX B

Geometry Survey

1. Using the following scale rate your comfort in doing the following.

Scared Confident
0 5 10

Algebra:

Solving Equations:

Graphing:

Geometry:

Positive and Negative Integers:

Fractions:

Area:

Perimeter:

Logic Games:

Trying New Things:

2. As far back as you can remember, what types of games did you play as a child?
3. Why are you taking this class?
4. How do you think you will use geometry in the future?
5. Do or did you ever play an instrument, read music, sing, or draw artwork? If yes, explain.
6. What are you good at?
7. What do you enjoy?
8. What do you expect or hope to learn this year?
9. Is there anything else I should know about you?

APPENDIX C

Reflective Research Survey

1. Think of a good learning experience. What made it good?
2. Describe a good teacher or class you have now or have had in the past. What made them good?
3. Imagine you are asked to design courses and units so that you could really learn well. What's important in a good class?
4. What's the one thing you would change about how your classes are taught that would help you learn better?
5. How do your teachers try to make school interesting to you? How could they be more successful in their attempts?
6. How do your teachers help you see that the course is useful or important? What else would you like to see them try?
7. How is school preparing you for your future? Is there anything else you think you or your teachers could do to prepare you even better?

APPENDIX E

2003 STAR Results

2003 STAR Data Dixon vs. State											
Class	Category	All Students		Hispanic or Latino		White (not Hispanic)		Female		Male	
		Dixon	State	Dixon	State	Dixon	State	Dixon	State	Dixon	State
General		118		64		46		63		55	
	Mean Scale Score	300.7	305.9	287.9	294.1	319.6	325.3	303.7	306.7	297.4	305.2
	Advanced	0%	2%	0%	1%	0%	4%	0%	2%	0%	2%
	Proficient	18%	18%	8%	12%	34%	29%	18%	18%	18%	18%
	Basic	34%	32%	31%	30%	39%	35%	38%	33%	31%	30%
	Below Basic	28%	29%	39%	34%	14%	21%	28%	29%	27%	29%
	Far Below Basic	20%	19%	22%	23%	14%	11%	16%	17%	24%	20%
Algebra 1		250		119		103		126		124	
	Mean Scale Score	306.7	309.5	290.1	291.6	306	324.4	304.1	310.8	297.2	308.2
	Advanced	0%	4%	0%	1%	0%	5%	0%	4%	1%	4%
	Proficient	12%	17%	5%	10%	17%	25%	13%	18%	11%	17%
	Basic	37%	29%	35%	26%	39%	33%	40%	30%	34%	28%
	Below Basic	37%	34%	44%	42%	33%	27%	36%	34%	39%	35%
	Far Below Basic	13%	16%	16%	21%	12%	10%	11%	14%	15%	17%
Geometry		143		46		86		81		62	
	Mean Scale Score	325	317.5	309.6	292.8	332.8	331.5	324.5	314.9	325.6	320.3
	Advanced	3%	6%	0%	1%	5%	8%	1%	5%	5%	7%
	Proficient	31%	20%	20%	10%	33%	27%	32%	19%	30%	21%
	Basic	36%	29%	42%	26%	36%	33%	38%	30%	33%	28%
	Below Basic	27%	38%	33%	52%	24%	28%	28%	39%	26%	36%
	Far Below Basic	4%	7%	4%	10%	2%	4%	1%	6%	7%	7%
Algebra 2		115		31		73		62		53	
	Mean Scale Score	291.1	318.2	284.5	291.8	293.4	325.5	294.2	314.5	287.4	322.4
	Advanced	1%	7%	0%	2%	1%	7%	2%	6%	0%	9%
	Proficient	12%	22%	0%	12%	16%	25%	15%	20%	9%	23%
	Basic	23%	28%	29%	26%	21%	31%	21%	29%	26%	27%
	Below Basic	41%	26%	55%	33%	36%	24%	40%	27%	42%	24%
	Far Below Basic	23%	17%	16%	28%	26%	13%	23%	18%	23%	17%
Summative		42		13		27		23		19	
	Mean Scale Score	315.9	331.2	246.8	273.1	349.7	339.9	310.8	327	322.1	335.4
	Advanced	7%	13%	0%	3%	11%	13%	4%	11%	11%	16%
	Proficient	31%	30%	15%	15%	41%	34%	30%	29%	32%	31%
	Basic	24%	22%	15%	20%	22%	25%	30%	24%	16%	20%
	Below Basic	19%	19%	15%	28%	22%	18%	13%	22%	26%	16%
	Far Below Basic	19%	15%	54%	35%	4%	10%	22%	14%	16%	17%

APPENDIX F

2004 STAR Results

2004 STAR Data Dixon vs. State											
Class	Category	All Students		Hispanic or Latino		White (not Hispanic)		Female		Male	
		Dixon	State	Dixon	State	Dixon	State	Dixon	State	Dixon	State
General		101		63		34		41		60	
	Mean Scale Score	290.5	305.6	282.2	294.5	299.4	323.4	293.9	307.1	288.1	304.3
	Advanced	2%	3%	0%	1%	0%	5%	2%	2%	2%	3%
	Proficient	5%	17%	5%	11%	6%	26%	2%	17%	7%	17%
	Basic	33%	32%	30%	31%	41%	35%	44%	34%	25%	30%
	Below Basic	40%	30%	35%	35%	50%	22%	29%	30%	47%	29%
	Far Below Basic	21%	19%	30%	23%	3%	12%	22%	17%	20%	21%
Algebra 1		262		126		123		132		130	
	Mean Scale Score	301.5	304.9	299.1	289.4	303.2	321.4	301.9	306.1	301	303.7
	Advanced	0%	3%	0%	1%	0%	4%	0%	3%	0%	3%
	Proficient	10%	15%	9%	8%	11%	23%	9%	15%	11%	15%
	Basic	37%	26%	31%	23%	40%	31%	37%	27%	38%	25%
	Below Basic	45%	42%	54%	50%	39%	33%	49%	42%	41%	42%
	Far Below Basic	8%	14%	6%	18%	9%	9%	5%	12%	10%	15%
Geometry		190		67		105		104		86	
	Mean Scale Score	308.5	314.2	299.5	291.4	314.1	328	305.5	311.7	312.1	317
	Advanced	2%	6%	0%	1%	4%	8%	1%	5%	3%	7%
	Proficient	13%	18%	11%	9%	13%	24%	12%	16%	14%	19%
	Basic	42%	31%	38%	28%	47%	35%	44%	31%	41%	30%
	Below Basic	39%	37%	47%	50%	31%	28%	39%	38%	38%	35%
	Far Below Basic	4%	8%	5%	12%	5%	5%	5%	8%	3%	9%
Algebra 2		72		17		50		45		27	
	Mean Scale Score	302.4	312.4	276.1	288.6	310	318.9	295.8	308.6	313.3	316.7
	Advanced	1%	6%	0%	1%	2%	6%	0%	4%	4%	7%
	Proficient	14%	18%	0%	9%	18%	21%	11%	16%	19%	19%
	Basic	29%	30%	18%	26%	32%	33%	29%	30%	30%	29%
	Below Basic	43%	31%	59%	40%	38%	29%	47%	33%	37%	29%
	Far Below Basic	13%	16%	24%	24%	10%	12%	13%	16%	11%	16%
Summative		38		6		25		25		13	
	Mean Scale Score	340	340.8	na	300.3	353.7	343.8	338.8	332.5	343.5	349.7
	Advanced	8%	12%	0%	3%	12%	11%	8%	9%	8%	16%
	Proficient	26%	29%	0%	16%	36%	32%	28%	27%	23%	31%
	Basic	47%	29%	83%	30%	32%	32%	44%	31%	54%	27%
	Below Basic	18%	24%	17%	39%	20%	21%	20%	27%	15%	21%
	Far Below Basic	0%	6%	0%	13%	0%	4%	0%	6%	0%	5%

APPENDIX G

Dixon High School Math Courses

Final Grade Summary Fall 2004

	All Students	All Hispanic	All Non-Hispanic	All Female	All Male	Hispanic Female	Hispanic Male	Non-Hispanic Female	Non-Hispanic Male
Average Final Grade:	74.75	72.1	76.32	77.52	72.1	75.56	69.06	78.67	74.06
Median Final Grade:	77.19	75.83	78.06	79.48	75.17	78.05	72.41	80.65	76.32
Number of Students:	957	366	591	467	490	174	192	294	297
Percent of total students		38.24%	61.75%	48.80%	51.20%	18.18%	20.06%	30.72%	31.03%
Summary by Course									
	All Students	All Hispanic	All Non-Hispanic	All Female	All Male	Hispanic Female	Hispanic Male	Non-Hispanic Female	Non-Hispanic Male
General Math									
Average Final Grade:	73.73	75.76	71.7	74.9	72.85	72.75	77.13	75.87	68.58
Median Final Grade:	76.1	76.5	75.4	76.1	72.2	76.3	78.9	76	67.85
Number of Students:	14	7	7	6	8	3	4	3	4
Percent of total students		50%	50%	42.86%	57.14%	21.43%	28.57%	21.43%	28.57%
Pre-Algebra									
Average Final Grade:	65.94	62.77	70.42	70.98	61.48	67.6	58.85	75.26	65.73
Median Final Grade:	70.03	66.73	73.22	75.86	64.61	72.83	62.53	77.65	70.44
Number of Students:	164	96	68	77	87	43	53	34	34
Percent of total students		58.54%	41.46%	46.95%	53.05%	26.22%	32.32%	20.73%	20.73%
Algebra 1									
Average Final Grade:	72.29	72.9	71.88	74.18	70.92	76.63	70.45	72.49	71.25
Median Final Grade:	75	74.59	75.2	76.83	73.59	78.33	73.03	76.21	73.88
Number of Students:	273	112	161	115	158	47	65	68	93
Percent of total students		41.03%	58.97%	42.12%	57.88%	17.22%	23.81%	24.91%	34.06%
Geometry									
Average Final Grade:	79.87	79.26	80.18	80.92	78.78	79.45	79.08	81.67	78.63
Median Final Grade:	80.8	80.48	80.95	82.26	78.9	80.53	80.13	83.6	78.64
Number of Students:	217	74	143	110	107	37	37	73	70
Percent of total students		34.10%	65.90%	50.69%	49.31%	17.05%	17.05%	33.64%	32.26%
Intermediate Algebra									
Average Final Grade:	75.5	70.99	77.79	80.22	71.1	77.9	64.08	81.47	74.49
Median Final Grade:	78.25	70.43	80.63	80.65	70.57	77.77	66.34	80.85	74.78
Number of Students:	83	28	55	40	43	14	14	26	29
Percent of total students		33.73%	66.27%	48.19%	51.81%	16.87%	16.87%	31.33%	34.94%
Algebra 2									
Average Final Grade:	79.61	81.57	78.91	79.79	79.38	83.6	79.2	78.48	79.45
Median Final Grade:	78.76	82.29	77.8	78.76	78.7	86.09	80.16	77.44	78.5
Number of Students:	99	26	73	55	44	14	12	41	32
Percent of total students		26.26%	73.74%	55.56%	44.44%	14.14%	12.12%	41.41%	32.32%
Math Analysis									
Average Final Grade:	80.87	75.57	82.51	81.61	79.64	74.72	78.13	83.92	80.25
Median Final Grade:	79.63	77.26	81.32	80.63	78.65	76.59	78.65	83.76	79.59
Number of Students:	51	12	39	32	19	9	3	24	15
Percent of total students		23.53%	76.47%	62.75%	37.25%	17.65%	5.88%	47.06%	29.41%
Calculus									
Average Final Grade:	76.75	43.59	78.59	86.24	66.2	None	43.59	86.24	69.03
Median Final Grade:	78.23	43.59	81.49	89.97	76.45	None	43.59	89.97	76.62
Number of Students:	19	1	18	10	9	None	1	10	8
Percent of total students		5.26%	94.74%	52.63%	47.37%	None	5.26%	52.63%	42.11%
Statistics									
Average Final Grade:	78.1	74.5	79.43	81.16	73.6	77.85	66.68	82.71	75.33
Median Final Grade:	77.67	71.43	81.71	83.14	69.86	77.35	67.96	86.48	75.48
Number of Students:	37	10	27	22	15	7	3	15	12
Percent of Total Students		27.03%	72.97%	59.46%	40.54%	18.92%	8.11%	40.54%	32.43%

The Impact of Yoga with Special Needs Students

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ABSTRACT

Research Question: Does using yoga daily, in my classroom, meet the emotional and physical needs of special needs students? **Context:** I teach first through third grade students in a special day class at Bannon Creek Elementary. **Methods and Data:** Observations of student behaviors and participation; parent interviews, outside research. **Results:** After several weeks, students became more verbal and were able to interact with others. **Conclusions:** Yoga not only provides physical benefits, it also aids special needs students in cognitive functions.

Key words—yoga, physical education, special education students, special day class (SDC) students, special day class, autism, elementary school.

CSTP 1.3 Facilitating learning experiences that promote autonomy, interaction, and choice

CSTP 2.1 Creating a physical environment that engages all students

CSTP 2.3 Promoting social development and group responsibility

BACKGROUND

At the time of this study, I taught first through third grade students in a special day class (SDC) for special needs students at Bannon Creek Elementary School in the Natomas Unified School District. The students in my classroom had a variety of mental and physical handicapping conditions. One of the students that I will be focusing on is nine-year-old Aaron, who was autistic. Several of my students had auditory processing problems (see appendix A). Mathew not only had auditory processing problems, but he also had cerebral palsy. The calf in his right leg was extremely tight, which caused his foot to remain in a downward point. Because of this condition, he walked on his right toes. In general, all of the students had social deficits. Social deficits were usually due to the lack of the correct tools and the knowledge-base to interact appropriately in social situations. Most of the students received speech services to assist them with their communication deficits. Communication remains a primary challenge in autism. Autistic students have sensory problems and are bothered by certain sights, sounds, smells, or touch. All of the students in my classroom had difficulty with sensory integration.

Sensory Integration Theory is based on the work of Dr. Jean A. Ayres (appendix B). The premise of her work is that the senses are the primary building blocks of the central nervous system. Students with sensory integration problems have difficulty with information processing within their nervous systems. The consequences of a disorganized central nervous system are developmental lags and behavioral, emotional, and learning problems. The main senses involved in sensory integration are the tactile, proprioceptor (a sensory receptor), and vestibular senses. It is important to reduce sensory disturbances in these three areas. The tactile senses are those related to the surface area of the body, the skin (touch). The proprioceptive senses are based in the muscles, ligaments and joints (where the body is in space). The vestibular senses are linked to the inner ear (sense of balance).

I have always been interested in finding activities that would help my students with sensory integration. I have found several activities that help remediate the students tactile defensiveness, but I had not found any activities that will help remediate all three of these senses. My hope was that yoga would be one of the activities that would remediate all three.

RESEARCH QUESTION

Does using yoga daily in my classroom meet the emotional and physical needs of special education students? This is the question that I pursued the 2002–2003 school year. I was also curious to see if daily yoga practice would improve the students' communication and cognitive skills. I was looking for something that would transfer from the classroom into my students' home life. For the 2003–2004 school year, I decided to continue teaching yoga, but I also wanted to focus on using breathing exercises to help with the emotional aspect.

PLAN FOR YOGA

To insure that I had the knowledge to write a lesson plan for yoga postures, I enrolled in a yoga course for educators in the fall of 2002. Through this class, I learned that yoga has three parts: physical movement (postures), breathing, and deep relaxation. There are six areas of yoga movement: side bend, forward, backward, bend, twist, invert. Knowing these areas helped me to decide which types of postures would benefit my students the most. I wanted to make sure that they encompassed all six of these areas. As part of the yoga course for educators, I pulled several different postures together for a daily lesson plan (appendix C). I read several yoga books for doing yoga with children to find the postures with which I felt my students could be successful. I found several of my postures in a book by Eve Diskin, *Yoga for Children*. Sonia Sumar's *Yoga for the Special Child* gave me the idea to incorporate animal sounds and actions to make the postures more fun and easy to remember. The animal sounds became a natural way to get the students to use breath. An example of a fun visual posture is the Elephant. The students sit cross-legged on the floor. They cross their right arm over their left arm and clasp their fingers together. They then reach out to pick up pretend peanuts and turn their hands in towards their chest and up to their mouths to eat the peanuts. Next, they straighten their arms and pick up another peanut and continue to feed themselves. Their arms become the trunk of the elephant. To encourage them to reach to different body locations, I would say, "Look, I am eating peanuts on my right side. Oh, no, they are all gone. I will have to eat the ones on my left side." An example of using animal sounds to encourage the use of breath is the Snake posture. The students lie on their belly to make their bodies as long as they can. They place their hands under their shoulders, keeping their elbows close to their sides. They inhale as they stretch their chest up lifting higher and higher until they are ready to strike. Then they stick their tongues out and hiss as they breathe out. Lastly, they bring their heads down until they are ready to take another big breath and strike out with a hiss. The students loved this posture. After only a few tries, they understood when to inhale and when to exhale. They were not consciously thinking of the need to inhale and exhale; instead, it just became part of the pretending they were doing.

Because transitions were difficult for my students, I grouped the lesson into three sections: sitting, standing, and laying down. I started the lesson plan with floor postures. To transition from the floor postures to the standing postures, I used the squat. I used the same squat posture to transition from the standing postures to the laying down postures.

In late fall of 2002, I slowly started yoga in the classroom. I did this by introducing a few different postures each week until we had practiced all the postures in the beginning lesson plan. By this time it was Christmas break. I was surprised to find how easy it was to incorporate yoga into the daily schedule. The few times that yoga was canceled, the students were disappointed. They quickly made yoga a part of their regular routine and even took turns helping lead the postures. How fast the students were able to learn and remember the different postures was amazing. I believe they were able to do so because of the association with animals, which gave them a concrete and visual image. In working with special needs students, I have found that they

are able to grasp and obtain new information if it is presented as concretely and as visually as possible. They were also having fun and never thought of it as exercise.

YOGA RESULTS

In January, I started charting academic behavior before and after the yoga session. I was looking to see if the students' work behaviors improved. The behaviors I was looking for were staying on task, being less frustrated, and focusing better. I also weighed the students in the fall of 2002 and spring of 2003 to see if there were any notable weight changes.

The first improvement I noticed was the students communication and social skills. I was really pleased to notice that as they developed their skills with the different postures, they also developed their ability to interact more appropriately. As they practiced becoming the different animals, they became more animated and interacted more with each other. For example, when Aaron came to my classroom in the fall of 2002, he was extremely auditory defensive and would go under his desk to shut himself off from the classroom world. He had no social interaction skills. He would avoid eye contact and rarely initiated speech. His parents enrolled him in a special program after school that specialized in assisting autistic children with social interaction skills. After a few months, the mother removed him from the program because he had not gained any new skills. Initially, Aaron would only sit on his yoga towel and hide his head during exercises. Towards the end of the school year while the rest of the class was doing the standing yoga postures, he began doing them on the floor lying on his back. At this time, he also began to interact with his classmates a little more. He started out the 2003–2004 school year doing all the yoga postures, though he remained lying on the floor, never standing to do them with the class. After about two months, he began to do the postures the same way as the rest of the class, even standing for the standing postures. Around this time we noticed him initiating speech and giving sustained eye contact to everyone in the classroom, as well as an occasional visitor to the room. In January, Aaron's mother reported to me that their relatives noticed a dramatic change in him. When they came to visit, he greeted them with a smile and said, "Hello." The last time they had seen him, he gave no eye contact and avoided any interaction. This time he initiated the contact. At the end of this school year, his mother said she now had to watch him because he would open the door to anyone and invite the person in. He was no longer introverted or avoiding human contact.

The next major improvement I noticed was that yoga calmed the students. After each yoga session there was a noticeable quietness about them. They also concentrated on their assignments and did them faster and with fewer mistakes. The question of cognitive improvement was also answered. There was a noticeable improvement in staying on task and an improvement in quantity and quality of work done in the thirty-minute period following the yoga sessions. This became a good time period to present new material because the students appeared to be more focused.

I had expected the daily yoga to have a calming effect on the students. I had been doing yoga myself for a few years, and it had always left me with a calm feeling. As I researched other people's findings, I found that yoga at an early age encourages self-esteem and body awareness with a physical activity that is noncompetitive (Distin 1976). I really saw how true this was when I watched Mathew change. Mathew had never been able to do physical activities like other boys his age. At recess time he would normally walk out across the playground to the ball field to watch his classmates throw a football around. After a few months of doing yoga, he became very good at several of the standing postures. One of his fellow classmates commented on how well he did the Tree posture. He immediately began beaming with a radiant smile. Within days I noticed how much his confidence level rose. The biggest change was what he did at recess. Instead of walking across the playground, he was running as fast as his gait would allow him.

Once he got onto the field, he was actively pursuing the ball just like his classmates. The greatest joy was hearing his laughter and watching him smile.

PLAN FOR BREATHING

In the fall of 2003, I introduced belly breathing. The students sat at their desks with their hands on their belly. To find the correct location on their stomachs, I would say, “Sit tall in your chair. Shoulders back. Find your belly button. Now put your hands just above your belly button. Take a big breath and make your belly a great big balloon. Hold it. Now pop your balloon and make your belly really small.” We repeat this at least five times. When belly breathing was introduced in the fall of 2003, it was at the beginning of morning group. We would do the belly breathing and then start our morning group routine. A few days later, I decided to use it with individual students throughout the day when I would notice that they emotionally needed it.

Breathing Results

The morning belly breathing was a quick success. Before I started having my students do the breathing, I had about 40% student participation in the morning activities. The first day I initiated the breathing exercise, I had 90% student participation. Aaron was my only hold-out that first day. He was not willing to try something new. I was able to get him to place his hands above his belly button, but that was the extent of his participation. By November of 2003, Aaron was actively doing the exercise. I decided to try this deep breathing technique at other times with individual students to see if there was any benefit. When students became fidgety and were not focusing well, I took a quick break to refocus and calm them by using deep breathing exercises, instructing them with a quiet and slow speech. This strategy had become a great benefit to the students both emotionally and academically. I found this especially true for one of my autistic students while teaching reading. When I noticed that Sonya was becoming a little frustrated, we took a quick minute or two to take some big deep breaths. She absolutely loved it, and after this Sonya was able to refocus and continue with the lesson. Before I started taking the breathing breaks with her, she could only handle a five-minute session. Sonya was now able to tolerate a fifteen to twenty minute session with maybe one to two breathing breaks. At the beginning of the 2002 school year, Sonya was a non-reading third grader. By the end of 2003, she was able to read forty-five words. Her mother started using the breathing technique at home to help calm her and reported having great results.

SUPPORT FOR YOGA

Since introducing yoga in my classroom, I received positive support from the parents of my students. I made sure that I explained to them why I was going to introduce a lesson plan of yoga postures before I started the program. I was given permission by every parent to go ahead and start the program. They have reported their children doing the various postures at home and getting family members to do the postures with them. One parent noted that this was the first time that her child had learned something new that he wanted to teach other family members. Parents also commented on how much confidence their children had while demonstrating the postures. One overweight student had lost twenty pounds since he started doing yoga. Parents have also noticed a significant difference in this student’s energy level. A fellow teacher who had joined us for a yoga session incorporated some of the postures into her classroom to help establish on-task behaviors. She reported that she saw a substantial improvement with work behaviors after implementing yoga exercises.

SUMMARY AND NEXT STEPS

The benefits that the students experienced from doing yoga were significant. In our District, first through third grade students receive thirty minutes of PE. The California State Standards requires students to have 200 minutes every ten school days, which is twenty minutes a day. With the district scheduling only thirty minutes a week, that requires the individual teacher to facilitate the remaining seventy minutes a week. My yoga routine is approximately twenty minutes a day, which more than covers the minimum minutes required by the state.

Yoga gives physical benefits because it is a whole body exercise, incorporating all the major muscles. Mathew is an example of the physical benefits of yoga. He started the year watching his friends play football and ended the year participating in the sport. Yoga also produces cognitive benefits by helping students focus better and stay on task. I believe this because my students were able to learn new material more easily after doing yoga. The plus for my program was the improvement in communication and social skills. When I first started my research, I was not sure that yoga could have an impact on the students' communication skills or social skills. Aarons' dramatic improvement at school and at home was proof that yoga works.

For a future study, I am curious about long-term benefits of yoga, especially during puberty. I am hopeful that other educators will write about their experiences in teaching yoga. I believe that this research has answered my question about whether yoga meets the emotional and physical needs of my students. The answer is a definite yes. The goal for the 2005–2006 school year is to encourage other classrooms to try yoga to see if they also experience the benefits that my students did.

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Sandee Henderson has been teaching special education to primary students for nineteen years. Currently, a special education teacher in the Natomas Unified School District in Sacramento, California, Sandee graduated with a dual degree in Elementary and Special Education from Oklahoma State University. Sandee has always sought out new innovative instructional practices to incorporate into the special needs classroom to enhance and enrich her students learning. Teacher research has provided her with the opportunity to communicate to other educators her own classroom experience of incorporating yoga for sensory integration into the curriculum.

APPENDIX A

AUDITORY PROCESSING DISORDER

As stated by the National Institute on Deafness and Other Communication Disorders, auditory processing is a term used to describe what happens when the brain recognizes and interprets sounds. Children with APD often do not recognize subtle differences between sounds in words, even though the sounds themselves are loud and clear. The problems are more likely to occur when the student is in a noisy environment or when he is listening to complex information.

The cause of APD is often unknown. In children it has been associated with conditions such as dyslexia, attention deficit disorder, autism, or developmental delay.

APPENDIX B

SENSORY INTEGRATION THEORY

According to Dr. Jean A. Ayres, all learned skills are complex processes based on a strong foundation of the sensory integration of these special senses (tactile, proprioceptor and vestibular). The biggest part of this is the vestibular system, which detects motion, gravity and provides us with our sense of balance. It is believed to provide the foundation for many other functions. The vestibular system supports the development of bilateral coordination. The vestibular system is anatomically joined with the cochlear system, and it has many close neuronal associations with the pathways for auditory processing and language. Decreased vestibular processing can impact on the area of speech and language development. The central nervous system receives input from the environment, which is organized and processed to produce a motor or behavioral output, resulting in accurate feedback and additional input. If the input is not processed and organized accurately, the result is abnormal motor output with abnormal feedback. As a result of the abnormal feedback, the vicious cycle continues with increasingly more disorganized sensory input and chaotic output and feedback. The result is a disorganized central nervous system. The consequences of a disorganized central nervous system are developmental lags and behavioral, emotional, and learning problems. Some signs of sensory integration problems are: overly sensitive to touch and sounds, under reactive to touch and sounds, easily distracted, social or emotional problems, impulsive, delays in speech, language, motor skills, and delays in academic achievement.

APPENDIX C

Yoga Lesson Plan

Happy Feet (improves circulation in the feet, relaxes back and neck)

Sit on your feet. Hands on your knees. Place your hands on the floor behind you. Drop your head back and push your back up. Hold. Count to 10. Raise your head. “Walk” your fingers toward your toes. Sit on your feet. Do twice.

Curling leaf (relaxing)

Sit on your feet. Bend forward, placing your chest on your thighs, your forehead on the floor, your arms beside your legs. Hold. Count to 10, Slowly sit back on your feet.

Frog (strengthens and keeps legs flexible)

Sit with hands on the floor. Bring your feet together. Place your hands around your feet. Pull your feet toward your thighs. Bring your knees as close to the floor as you can. Try to have them touch the floor. Sit up straight. Make ribbit sounds and count to 10. Straighten your legs.

Elephant (strengthens fingers and keeps fingers, wrists, and elbows flexible)

Sit. Bend your knees and put one leg on top of the other. Cross your right arm over your left arm. Clasp your fingers together. Pick up a pretend peanut, turn your hands in towards your chest and up to your mouth and eat the peanut. Straighten your arms and pick up another peanut and continue to feed the elephant. Drop your hands to your knees. Cross your left arm over your right arm and repeat the exercise. Relax.

Kitty cat (increases circulation to brain)

Kneel. Hands on the floor. Raise your head. Bring your back in. Hold. Count to 5. Lower your head. Push your back up. Meow. Hold. Count to 5. Sit on your feet. Do twice.

Rag doll (wakes up brain, helps with concentration, relaxes back and neck muscles)

Stand with your feet apart. Raise your arms above your head. Slowly bend forward as far as you can. Keep your head down. Hold. Count to 10. Drop your chin to your chest and straighten up slowly. Hands to your sides. Rest.

Strong man (strengthens toes and ankles, helps with balance)

Stand. Hands at your sides. Feet apart. Come up on your toes. Raise your arms over your head, palms together. Hold. Count to 5. Slowly lower your arms and bring your heels back to the floor. Rest.

Tree (helps with balance, improves posture)

Place your right foot high up on the inside of your left thigh. Raise your arms, palms touching. Hold. Count to 5. Lower your arms and your leg slowly. Repeat with your left foot high on the inside of your right thigh. Try to bring your foot as high up on the inside of your thigh as you can.

Triangle (relaxes back and neck, brings blood to brain)

Stand with your feet apart. Lean to the right and place your hand on your right thigh. Slide your arm down your leg and drop your head to the right. Raise your left arm straight up in the air. Hold. Count to 5. Straighten up slowly. Relax. Repeat on the other side.

Snake (stretches and strengthens back, relaxing)

Lie on your belly. Make your body long. Try to keep your shoulders relaxed as you become the snake. Place your hands under your shoulders. Elbows close into your sides. Inhale as you stretch your chest up lifting higher and higher. 1, 2, 3 strike. Stick your tongue out and hiss like a snake as you breathe out. Bring your head back down and gather your strength. Do several times. Relax.

Rowboat (stretches and strengthens lower back. Keeps knees, legs, and ankles flexible)

Lie on your tummy. Hold your left foot and gently pull it up to the outside of your thigh. Gently pull your right foot to the outside of your thigh. Push your feet closer to the floor. Hold. Count to 5. Lower your arms and legs, and rest.

Sleeper (relaxes away tension)

Lie on your back, legs apart, the palms of your hands facing up. Close your eyes. Keep your mouth open a little. Breathe through your nose. Make a fist with your right hand. Tighten your arm. Relax your arm. Make a fist with your left hand. Tighten your arm. Relax your arm. Tighten your right leg. Relax your leg. Tighten your left leg. Relax your leg. Tighten your eyes, nose, and mouth. Relax your eyes, nose, and mouth. Breathe slowly through your nose. Relax.

THE DIFFERENCE: THE EFFECT OF TEACHER-STUDENT RELATIONSHIPS IN THE CLASSROOM

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ABSTRACT

Research questions: To what extent do teacher-student relationships affect a student's performance in an academic setting? When the relationship is positive, does one teach better? Do students learn more? Conversely, when the relationship is negative (interactions resulting in referrals to the silent work center or to administration) does one teach poorly? Do students learn less? **Context:** I focused on students in my math intervention class, a course designed for students who scored below and far below basic in math according to the California Standards Test. **Results:** As compared with higher achieving students, lower achieving students are greatly affected by teacher-student relationships, both negative and positive ones. **Methods and Data:** Student surveys, student interviews, personal observations. **Conclusions:** The teacher-student relationship is a critical one not only for students, but also for teachers.

Key Words—student motivation, surveys, student-teacher relationship, Ruby Payne, middle school, math, intervention.

CSTP 1.0 Standard for creating and maintaining effective environments for student learning

CSTP 4.0 Standard for engaging and supporting all students in learning

THE CONTEXT: MY OWN MOTIVATION

I was a teacher's pet. I did everything my teacher asked me to do because I wanted to do well. I wanted to please her. I wanted her to teach me. I wanted her to be my friend. Why? To me it meant the world. I grew up in a single-parent home. I am the youngest of four children—two of whom have severe physical handicaps. I rarely saw my father but always missed him. The most prominent male figure in my childhood was my uncle, a self-proclaimed hustler, but more importantly, an alcoholic and a drug addict. My mother worked constantly to keep us clothed and fed. My father sent support, but it was minimal. A high school teacher in my senior year was a godsend. She came along at a time when I needed the most support. As I was frantically preparing for college, she taught English, and she had this way of making it come alive for her students. Her nature was gentle and her delivery was honest, direct, and easily understood. She would have her room open everyday at lunch, and my friends and I would come in and have lunch with her. I felt that could talk to her about anything. This camaraderie inspired me academically, and I did well in her class and in school in general. When I was accepted into all of the colleges to which I applied, she took me on a road trip to visit a couple of them. She was so proud, and I was thankful and happy. I was even happier when she asked me to write a letter of recommendation for her for a Teacher of the Year nomination. I did, and she won. I went off to college, but I have never forgotten the influence that she had on me. The success I experienced in high school continued in college and in my career.

However, not all of my high school experience was positive. I had another teacher who made me feel that I was not capable of doing math. I had just changed schools for the third time in three years. In the second week at this new school, I came down with a bout of food poisoning. I missed a week of school and fell behind in my coursework as a result. I tried to catch up and complete all missed assignments, but I waited too long because when I tried to hand in the work the teacher refused to accept it. I ended up failing that semester of math and was transferred to another class, where I did extremely well. I then took the first semester of that course again in summer school and earned the highest grade of the class. The next year, I had

that same teacher again. I treated this occurrence as an opportunity to prove her wrong. I continually earned the top grade in the course, and the teacher even admitted to my mother and me that I was a mathematician. But I never did come to like that teacher. I did not enjoy our interactions. I did however enjoy proving her wrong.

Having grown up poor, I knew that school was going to be a way out of that life. I had to do well. Her opinion of me, or what I thought was her negative opinion of me, made me do better than I ever thought I could. My relationships with these two teachers affected me even though at the time I did not realize they would. Even when I found the situation to be negative, it turned out to be positive. Is that because of who I am? Or was that because my home life was so terrible? Whatever the case, these relationships have forever altered and shaped the course of my life. My relationships with these teachers affected me in ways that they may not have intended. Now I am a teacher who affects the lives of the students in my classroom. I have an influence that, depending upon the student's interpretation, is positive, negative, or neutral.

THE EVOLUTION OF MY RESEARCH: STUDENT MOTIVATION AND TEACHER–STUDENT RELATIONSHIPS

As I embarked on the journey that is teacher research, I wanted to look into something that would be earth shattering and groundbreaking. I thought if I could just find the thing that could solve so many educators' problems, I would be rich. On my way to finding my question, I considered many factors like the context of the school in which I taught, the background I bring to the classroom, and the issues my students bring to the classroom.

One issue which immediately stood out from the rest was the school's socioeconomic status (at the time, it was James Rutter Middle School in the Elk Grove Unified School District in Sacramento). I taught at a school that, before our district changed the designation, was a Title I school, meaning that a majority of the students come from a lower socioeconomic level, or are considered poor. I thought I knew in my heart of hearts that being poor had nothing to do with how a student performs in school, but I soon realized this was not necessarily true. Moreover, I started wondering what would make some of my students do well in school while others did not. If they were all designated as poor, how come some performed better academically in school? Was it motivation? I thought that this might be the key. Some students were intrinsically motivated while others were only extrinsically motivated. So I asked a question to all of my students—why do you do your homework? The students in my intervention classes, (students who all scored below basic or far below basic on the California Standards Test), said that if they did their homework, it was because they would get into trouble with family if they did not. While my algebra students, (who all scored at the basic, proficient, or advanced level), said they did homework because they wanted to for themselves. Here it was: intrinsic versus extrinsic motivators!

As the year progressed, I noticed that as my relationship with my students in my intervention class grew stronger and more positive, more students started to complete their work. Why? I posed another question in a survey: "If I like my teacher, I will do my homework a) always, b) sometimes, c) never, d) does not matter if I like my teacher; I will still do my homework." The responses were quite alarming. My intervention classes overwhelmingly answered that they would always do their homework if they like their teacher, while my algebra students answered that it did not matter. This was the key. It is something that I did not notice as a child, but I definitely do notice as an adult. Ruby Payne argues that students who come from working class families do not value education as much as someone would if they were middle class. She argues that to these student–teacher relationships are, therefore, more important (Payne 2001).

THE RESEARCH QUESTION

With these thoughts, I set out to research the following question: To what extent do teacher–student relationships affect a student’s performance in an academic setting? But this question just wasn’t enough. This whole idea of finding the one groundbreaking idea was proving to be a challenging experience. What I came to realize was that teacher research is not something that the whole world has to stand up and notice, but something much more personal: something that made me take a painfully honest glimpse at myself and my teaching in the classroom. As I gathered data for this question I noticed that not only does the teacher–student relationship affect the students academic performance it also affects the teachers work performance. Namely, when the relationship is positive does one teach better? Do students learn more? Conversely, when the relationship is negative (interactions resulting in referrals to the silent work center or to administration) does one teach poorly? Do students learn less?

AN ANECDOTE

For this study I focused on students in my math intervention class, a two-hour course designed to help low-performing students to fill in academic gaps and become more skilled mathematicians. These students generally had trouble with their multiplication facts, division rules, number sense, and fractional parts of numbers including decimals.

I spent some time every week getting to know my students by asking them what they did over the weekend and sharing what I did. I would also try to ground every math lesson in something concrete and real-world applicable. This course was challenging for me because many of the students had a huge aversion to mathematics. They had been underperforming in this subject area for years, and for their efforts they now earned an additional hour of something they did not like in the first place. Although the aversion was with math, it was often directed towards the teacher as well. So I knew that in order for this class to work and for the students to achieve some sort of success, I had to spend time getting to know them and them, me. It worked, and my students were doing well: in a class of twenty students, seventeen of the students were passing the course with 68% (a percentage derived primarily from tests and quizzes) or higher. The remaining three were not passing because of missed instructional time due to home suspensions resulting from behavioral issues.

Just when we had gotten to a point where the classroom dynamic was positive and productive, I got another student: a student teacher.

He had a very interesting background, with a Ph.D. in mathematics psychology. He worked previously as a professor at a local university. I asked him why he was going into teaching at secondary schools, and he replied that he had difficulty finding a tenured position. He also thought he would try his hand at junior high school. Neither one of us was prepared for what happened next. The students disliked him immediately. They would tell me how they thought he did not explain things well, how he made things difficult, or how he was boring and nerdy. So, they chose not to listen to him. If he told them to do something, they would do the opposite and their grades all plummeted (by the end of his involvement with the class, half of the students were earning below 68%). The majority of students started to misbehave and tune out—this included the student teacher. He began to complain constantly, and he repeatedly ignored any prescriptive feedback I gave him. His confidence was shaken and the students knew it. They did not like or respect him. Eventually, he quit teaching at the site, telling me that it was because he did not like the students. He found them very difficult to deal with and that it ultimately affected his desire to teach. I later found out that after he quit working with my students, he also quit the teaching credential program. He gave teaching up completely.

THE STUDENT SURVEY

I noticed that the results of this particular teacher–student relationship were very negative. It not only affected the students in a harmful way, it also affected the teacher as well. I realize that it is always difficult to take over a course taught by a veteran teacher with good teacher–student rapport, but what I came to realize now was that the student teacher did not do enough groundwork in building relationships with the students (nor did I with him). When working with children coming from poverty, one must not forget, “the key to achievement for students from poverty is in creating relationships with them” (Payne 2001). Payne further argues that to create these healthy relationships with students, we have to have support systems (networks of relationships), care about our students, promote student achievement, be a role model, and insist upon successful behaviors in school (p. 145).

In my attempts to build a healthy relationship with my student teacher, I failed, and ultimately it led to his failure in the classroom and then to the eventual quitting of the teaching profession as well. At this point, I knew intuitively that teacher–student relationships were important, but I still needed more evidence. This need led to a survey that I gave to seventy-two students (see figure 1).

- 1) If I like my teacher, I will do my homework—
 - a) sometimes
 - b) all of the time
 - c) Never
 - d) Does not matter if I like the teacher or not, I will still do my homework

- 2) If I do not like my teacher, I will do my homework—
 - a) sometimes
 - b) all of the time
 - c) Never
 - d) Does not matter if I like the teacher or not, I will still do my homework

Figure 1.

The results were quite informative. On average 54.8% of the students surveyed answered that it does not matter if they do or do not like the teacher; they would still do their homework. This seems to suggest that a little over half of these students did not need the relationship to be positive because they were going to do their work regardless. I thought my theory was wrong; perhaps the relationship didn’t affect academic performance as much I as thought it did. However if 54.8% of the students argued that it did not matter for them, then that means for 45.2% of the students, it did make a huge difference.

SURVEY RESULTS AND ANALYSIS

So what does it all mean? The data in table 1 shows that, yes, healthy relationships between students and teachers affect both the teacher and student performance. It also shows that a negative relationship affected their performance as well. So, we as teachers have to do everything we can to ensure that our relationships with students are positive and productive.

Table 1. Total number of students surveyed: 72. The top row of numbers indicates the number of students who selected that option.

Question 1				Question 2			
a) 21	b) 9	c) 3	d) 39	a) 23	b) 4	c) 4	d) 40
29.17%	12.50%	4.17%	54.17%	31.9%	5.56%	5.56%	55.56%

How can we make it happen? I interviewed a group of eight students (four from algebra and four from intervention). They responded as follows.

1) A teacher is likeable if

- They have a cool personality.
- Do fun stuff in class.
- They are outgoing and funny.
- If they seem young (even if they are not).
- They do not give a lot of homework.
- They give packets of work or if homework can be turned in weekly and not daily.
- They are trendy (keep up with the types of things students are interested in).
- Talk about themselves and their lives away from school.
- Ask questions about the student's lives and weekends.
- Explains the work clearly with a straight-forward, to-the-point, short explanation.

2) A teacher is not likeable if

- They are boring.
- Give too much homework.
- Annoying or not genuine (with their comments and interactions with students).

3) A teacher can become likeable if

- They give clear guidelines for what they expect.
- Give opportunities for hands-on learning.
- They do not yell just because.
- They are reasonable with their homework.
- They do not compare you to other students.

4) When I like my teacher, I will

- do my work in class.
- respect them.
- Try.
- I might misbehave sometimes, but I would still like them.
- Act like a kid but still do my work.
- Ask my teacher for help.
- I will pay attention.
- I will like the subject more
- I will focus.

CONCLUSIONS

Out of the mouths of babes! Children are often treated as if their opinions do not matter, but when given an opportunity to express their opinions, the results are quite surprising. These children articulated clear and concrete steps any teacher could do to improve their relationships with their students. Students are asking for their teachers to be engaging; they are giving credence to every off-the-wall, cutting-edge idea teachers have thought of doing in their classrooms. I am convinced that teachers who try these suggestions would find themselves in the company of hard working, well behaved children who genuinely enjoy their classes. What teacher would not want that?

In a time where teachers are struggling to connect with a new generation of students and are willing to try just about anything to reach them comes these suggestions. These ideas are free and doable. As a result of this study, I plan to incorporate all of these students' tips into my own classroom. I am not sure if all my future students will behave as these students have suggested, but it seems like a gamble worth taking.

I now know that I have to do everything I can to ensure that what takes place in my classroom is meaningful for all involved because if I don't, then the results can be disastrous. School is a place for learning and students are not the only ones doing the learning; we teachers do, too. In my everyday life, I would never interact with someone on a daily basis without trying to build some sort of amicable relationship with them. Why should it be any different with students?

WORK CITED

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Jacquelyn Hodge has worked in a variety of educational capacities including mathematics teacher, Mathematics Department Lead, Trainer of Trainers participant, Summer School Administrator, School Climate Committee member, Planning Committee, and Club Advisor. As part of her preparation to become an educator, she earned her B.A. degree in Mathematics and a M.Ed. degree from the University of California, Santa Barbara. She then taught mathematics in Santa Barbara for two years. She has also served as a MESA (Mathematics Engineering Science Achievement) Club Advisor. Her work with students in this area earned her a teacher of the year award in 1999. In 2000, she relocated to Sacramento and continued teaching mathematics and advising MESA at James Rutter Middle School in the Elk Grove Unified School District. Additionally, she was the site's coordinator of AVID (Advancement via Individual Determination), a program designed to ensure students access to four-year colleges and universities. In an effort to affect a more positive change in the lives of her students, she pursued her Administrative Services Credential at the California State University at Sacramento. In 2006, she accepted an assistant principal/teacher position at Sol Aureus College Preparatory, a charter middle school in South Sacramento.

A Worksheet Helps Students Better Comprehend Videos

Roger K. Shimer

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ABSTRACT

Research Question: How does a good set of questions enhance the learning from a video? And how does this impact student comprehension and behavior? **Context:** Videos can enhance the learning of science content but often the questions that accompany videos are more confusing than the video. Using KWL as a model format, I devised a worksheet to help students comprehend and ask additional questions. **Results:** Most students found that the worksheet helped in their understanding of the material. In addition, the worksheet is easy for the teacher to modify for a variety of uses, and it helped the students stay on task. **Methods and Data:** I used video questions, a survey, several different worksheets, class discussions, and written feedback (about the process) to reach a conclusion about effectiveness. **Conclusion:** This worksheet seemed to increase student understanding and help the students stay on task. Students benefit from structured worksheets to aid video comprehension.

Key words—video, worksheet, middle school, student questions, student assessment, science.

CSTP 1.4 Engaging students in problem solving, critical thinking, and other activities that make subject matter meaningful

CSTP 2.5 Planning and implementing classroom procedures and routines that support student learning

CSTP 5.3 Involving and guiding all students in assessing their own learning

CSTP 5.4 Using the results of assessments to guide instruction

CONTEXT

I teach at Natomas Middle School, a sixth through eighth grade middle school located in a rapidly growing area in north Sacramento with a diverse student population of just fewer than 900 students. Because of this rapid growth, I have students arriving and others leaving school almost daily. The racial mix is very diverse with approximately 30% African American, 21% Hispanic, 20% Asian and Filipino, 22% Caucasian, and 8% other (or not designated). Just over 17% of our students are designated English Language Learners, representing over fifteen different languages and cultures. We are a Title 1 school and are dealing with the growing pains of new staff and a constant flow of new students. I teach Earth Science to approximately 180 sixth graders each day spread out over six periods.

RESEARCH QUESTION

My original research question was: How much influence does a solid lesson plan have on student comprehension and behavior? Through research, the final question became: How does a good set of questions enhance the learning from a video? Secondly, how does this impact student comprehension and behavior?

METHODS

I began by planning to show a Bill Nye video called, “Rocks and Soil.” I developed a list of questions that I handed out at the beginning of the period but then modified each video showing as follows. For the first class, I handed out a worksheet (shown in figure 1) and told them to answer the questions while watching the video. For the second class, I handed out the worksheet then went over each question before starting the video; then, in the third class I went over the questions and warned them when the answer was coming; in the last class, I even stopped the video to make sure everyone was getting the answer. In each instance, all papers were due at the end of the period.

Bill Nye: Rocks & Soil

1. Where does "igneous" get its name?
2. How are igneous rock formed?
3. How are sedimentary rocks formed?
4. What does "metamorphic" mean?
5. What is it called when rocks change from one form into another and another?
6. What is an auger used for?
7. What is it called when you look at soil layers from the side?
8. Name 2 ways that cracks get into rocks.
 - a.
 - b.
9. How do rocks get broken down into sand?
10. What is a conglomerate?
11. If diamond is the hardest thing on Earth, how do you cut it?
12. What is diamond made of?

Figure 1.

RESULTS

After the video, I handed out the survey form to see how they liked the different approaches (see figure 2). After getting all of the surveys back, I tallied them and converted the raw data to percentages. Not surprisingly, most of the students wanted structure and did not want to write facts and a summary (see appendix A). I thought I had too many questions, so I focused on just questions 3 and 4. The data indicates that students will behave better and learn more when they have structure while viewing a video. Because of this information, I revised and reformatted my questions to present to the class (similar to a K-W-L worksheet). I planned to do this with another Bill Nye video "Waves" (see appendix B) and did so, but I was absent that day and I am not sure how the substitute presented it. In correcting the papers and discussing the video form with the students, I now have even a better idea about what works. What really got my attention was that I had almost a 100% turn-in rate with this worksheet. In addition, several students told me they liked that they could ask questions instead of always answering them. I used those questions all week at the start of class for class discussions. This seemed to create a better class climate where the students were asking sophisticated questions that are about the topic and related ideas. I have since revised the worksheet again and presented it to students before showing them the video, another one by Bill Nye, this time about the "Earth's Crust, Volcanoes and Earthquakes" (see appendix C).

Please write the number in the space before the question.

strongly agree – agree – somewhat agree – do not agree - strongly disagree

1 2 3 4 5

1. _____ Was this video easy to understand?
2. _____ Were the questions helpful in understanding the video?
3. _____ Did the questions before the video help you?
4. _____ Did stopping the video help you to answer the questions?
5. _____ Would you prefer to write down facts and a summary?

What suggestions do you have that would help you to learn from a video? (Write on the back.)

Figure 2.

CONCLUSIONS

The results of the Volcano worksheet were consistent with my previous trials and proved that this method is successful in helping students view a video. Again, I used their questions as starters for each class and covered most of their answers in the next several days.

Since this project, I have modified this format and used it in several ways. Once as a surprise, I gave a quiz modeled from the worksheet, and had great results. I had them exchange papers and grade the first three questions, then respond to the student's questions. We had a class discussion and answered almost all of the questions. The owners reclaimed their papers and could add more corrections, then turned them in for points at the end of class. Most of the students who started out with incomplete papers had completed papers by the end of class to get credit. It empowered the failing students to see that they could get good grades by applying themselves. It worked for most of my classes except for my lowest achieving class, which needed lots of handholding to get through the process.

Finally, I again modified the worksheet as an exit questionnaire to evaluate how well the last trimester went. The information I gathered helped me start the final trimester by answering several misconceptions students have about science before we start on the next section. I think this form is easy to use for both students and teacher. It is a great resource in gathering information about students' progress and it helps with behavior because they have a simple format in front of them.

Work Cited

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Roger K. Shimer has been teaching middle school for five years. He is always searching for positive ways to motivate students to enjoy school, especially science. He is an entomologist who started teaching after spending more than a decade in agriculture as a crop consultant followed by another decade in vector control. He enjoys many outdoor activities with his family including hiking, camping, cross-country skiing, gardening, and woodworking.

APPENDIX A

Questions 3 & 4 from survey results

3. Did the questions before the video help you?

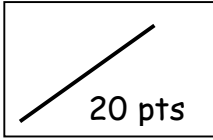
periods	1	2	3	4	5
2nd	23%	29%	10%	23%	16%
3rd	17%	13%	40%	7%	23%
4th	18%	21%	32%	71%	21%
5th	22%	39%	22%	6%	11%
total	20%	24%	26%	11%	19%

4. Did stopping the video help you to answer the questions?

periods	1	2	3	4	5
2nd	33%	3%	26%	16%	20%
3rd	50%	16%	3%	20%	10%
4th	71%	7%	11%	4%	7%
5th	39%	44%	0	0	17%
total	49%	15%	11%	11%	13%

APPENDIX B

Video Notes: Bill Nye Waves

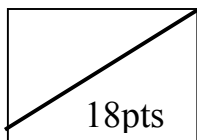


Name:	
Date:	
Period:	

I know this about waves...	I learned this about waves...
3 questions I have about waves are ... 1. 2. 3.	Draw a wave and label the parts...

APPENDIX C

Video Notes: Bill Nye VOLCANOES



Name:	
Date:	
Period:	

Can YOU answer these:

<ol style="list-style-type: none">1. What causes a volcano to erupt?2. What is lava, and how does it form?3. What causes earthquakes?4. What are tectonic plates?	I learned these things about the Earth, volcanoes (two kinds) and/or earthquakes:
Write three questions about the Earth <ol style="list-style-type: none">1.2.3.	Draw the Earth and label the layers. crust, mantle, outer core & inner core

Findings from a Survey of the CRESS Teacher Research Program

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INTRODUCTION

Since its inception in what was then the University of California, Davis' Department of Education, now School of Education, the Center for Cooperative Research and Extension Services for Schools (CRESS) has played a key role in strengthening the university's contributions to the improvement of elementary and secondary school education. One such contribution was the CRESS Teacher Research Program.

Teacher Research is part of a national "movement toward recognizing teachers' knowledge and thinking as critical components in teaching."¹ While definitions and models differ, at the heart of teacher research is the focus on self-reflection for the "purpose of documenting children's learning in school context, for helping teachers to uncover and clarify their implicit assumptions about teaching, learning, and schooling, and for solving a variety of school-based educational problems (Carini, 1975, 1979, 1986)."²

Between the years of 1987³ and 2005, CRESS provided direct service to over 1000 K-12 teachers in the greater Sacramento valley through the administration of the Teacher Research Program. The program provided yearlong seminars for teachers interested in conducting systematic research in their own classrooms or schools. An experienced teacher researcher, who received a small leadership stipend from CRESS, facilitated the groups.⁴ The facilitators, in-turn, were supported by a half-time CRESS Academic Coordinator who provided program oversight and support, including facilitation of a Summer Planning Institute and quarterly meetings for facilitators, and coordination of biennial CRESS Supper Seminars in which all teacher researchers were invited to participate. The Academic Coordinator also worked with teacher researchers to prepare teacher-research papers for publication in the CRESS teacher research anthology, *Windows on Our Classroom*, and to prepare presentations of their teacher-research at the CRESS sponsored conference, called "Voices from the Classroom."

In 2005, due in large part to changes in CRESS leadership, support for the CRESS Teacher Research Program was suspended. This decision created an opportune time and the justification to conduct an investigation into the Program's impact on participating teachers. A decision was made by CRESS to design and conduct a survey of teachers who have participated in the CRESS Teacher Research Program since its inception. This paper presents the results of that survey.

¹ Cochran-Smith, M. & Lytle, S. L. (1993). *Inside Outside: Teacher Research and Knowledge*, New York:Teachers College Press.

² Ibid.

³ The Teacher Research Program began in 1987 with a group of seventeen English and elementary teachers. CRESS took over coordination of the Program upon its inception in 1990. Early participants were primarily California Subject Matter Project Fellows. In later years, teachers tended to be those recruited by other teacher researchers, although many were also affiliated with the California Subject Matter Projects, the CRESS Grants program, and/or the School of Education's Teaching Credential program.

⁴ In early years, groups were composed of teachers within the same discipline. Over time most groups became cross-disciplinary, with many groups supporting a specific emphasis (e.g., math assessment, school-wide change). Groups typically included from 4 to 12 teachers. In a given year between 10 to 15 groups formed, many of which were sustained for multiple years.

TEACHER RESEARCH AND SURVEY FRAMEWORK

The goal of this investigation of the CRESS Teacher Research Program was to learn more about why teachers participated in the Teacher Research Program and what it has meant to them. To help explore these questions, a survey was developed around four statements listed on the website of the Teacher Research Program at George Mason University's Graduate School of Education summarizing desirable outcomes typically associated with effective teacher research.⁵ While the CRESS Teacher Research Program did not articulate a specific goal beyond supporting teachers as they conducted systematic investigations in their own classrooms, it is the author's⁶ belief that these statements are consistent with the philosophical and theoretical framework in which the program functioned.

The four statements summarizing investigations of Teacher Research are as follows:

1. Teacher research provides valuable knowledge for classroom practice.
2. Teacher research experience provides a context for transformation of practice.
3. Teacher research is an important foundation on which to develop greater professionalism for teachers.
4. Teacher research is an important base for reflective practice.

SURVEY METHODOLOGY

Survey Design

During the spring of 2006 a CRESS staff member, with the input of a small group of CRESS teacher researchers and School of Education Teacher Education faculty,⁷ developed and administered an on-line survey to learn more about why teachers participated in the CRESS Teacher Research Program and what it has meant to them. As a pilot, Teacher Research Program Facilitators active during 2004-2005 were asked to complete the survey and to provide input on the overall design and individual questions.

Survey Administration and Response Rate

The survey was distributed to 800 people included in the CRESS Teacher Research database. This database included as current information as was available at that time. A request to complete the survey was first sent via an email request. Two email reminders and a paper copy of the survey, which was mailed to home addresses, followed this request.

One hundred and forty one individuals completed and returned the survey.

Characteristics of Respondents

Because of the nature of the database used to identify teacher researchers to participate in this survey it was not possible to compare the characteristics of these respondent to those of all teachers who participated in the CRESS Teacher Research Program since its inception.

Primary role of respondents. Over half of the majority of respondents (62%) indicated that they were currently teachers; 10% that they currently held other positions at either the school or district level (e.g., school administrator); and 9% that they were college or university-based teacher educators.

⁵ See the George Mason University Teacher Research program (<http://gse.gmu.edu/research/tr/TRgoals.shtml>). These outcomes are linked to the findings of Cochran-Smith and Lytle; Fenstermacher; Cochran-Smith, NBPTS; Sockett, Deming, and Fenstermacher.

⁶ The author served as co-coordinator of the CRESS Teacher Research Program between 2003 and 2005.

⁷ Dr. Robin Marion, a former CRESS Teacher Researcher who is currently a faculty member at CSU San Marcos, also participated in this process.

Current grade level. Sixty-five percent of respondents indicated that they were currently teaching in a K-12 setting, with 1st through 12th grade teachers represented. An additional 14% reported teaching in a higher education setting, and 22% of respondents reported that they were not currently teaching.

Education Experience. The majority of respondents are highly experienced. Over half (57%) of respondents have been employed in the field of education for sixteen or more years, with another 15% having been employed between 10 to 15 years and 19% between 6 to 10 years (meaning 85% of respondents had at least six years of experience in the field of education).

This survey did not explicitly explore the connection between teacher research and teacher retention but findings do suggest that it might be useful to explore the correlation between participation in a teacher research program and staying in the profession. One teacher wrote that the CRESS Teacher Research Program “has been a professional home for me, and has truly been a factor in keeping me in the profession.”

Employment at current district. Sixty nine percent of respondents have been employed in the same district for at least six years (27% between 6 to 10 years and 42% for 11 or more years).

Teaching Credential Program. Of the 135 people who responded to this prompt, 20% completed their Teaching Credential Program at UC Davis, and 20% completed their Credential at California State University (CSU) Sacramento. The vast majority of the remaining respondents completed their Credential Programs at other state universities within California.

Participation in the CRESS Teacher Research Program. A small number (4%) of respondents were in their first year of participation in the program at the time in which the survey was conducted (2005-06). Sixty-one percent of respondents first participated in the program within the last ten years (40% of those within the past five years). Another 25% first participated over ten years ago (1995-96 or earlier), and 12% indicated that they were unsure of the dates in which they participated.

Fourteen percent of respondents to this prompt were actively participating in the program in the year in which the survey was conducted (2005-06). Seventy-seven percent last participated in the program within the past ten years (59% of those within the past five years). Seven percent last participated over ten years ago (1995-96 or earlier), and 12% indicated that they were unsure of the dates in which they participated.

Length of participation in the Teacher Research Program. Roughly a third (36%) of respondents reported that they were affiliated with the CRESS Teacher Research Program for one academic year or less. Sixty-two percent of the remaining respondents indicated that they were involved for multiple years, either continuously (44%) or intermittently (18%). The remaining 3% indicated that they did not participate in the Program.⁸

CRESS Teacher Research Facilitators. Thirty percent of respondents served as Teacher Research Facilitators. Of those, 5% served for six or more years, 19% for between two and five years, and 6% for one year or less.

⁸ These people most likely received surveys because they participated in a CRESS Teacher Research activity (e.g., Voices Conference, Supper Seminar).

SURVEY RESULTS

The following survey results are organized around the four statements summarizing desirable outcomes typically associated with effective teacher research that were mentioned earlier in this report.

Teacher research provides valuable knowledge for classroom practice.

Teacher Research has been associated with improvements in an individual's teaching and/or in the context in which their teaching is conducted. It is also associated with providing teachers with a better understanding about a particular aspect of their teaching practice, and with leading to a greater capacity to find, develop, and implement strategies that meet the learning needs of students.

To determine if the CRESS Teacher Research Program contributed to meeting this outcome, respondents were asked to rate their level of agreement with three statements. As Table 1 shows,⁹ over 80% of all respondents either agreed or strongly agreed with each of the three statements.

Table 1. Teacher research provides valuable knowledge for classroom practice.

	Disagree/ Somewhat Agree #/Percent	Not Sure / Neutral #/Percent	Agree/Strongly Agree #/Percent
TR has provided me with a better understanding about a particular aspect of my teaching practice.	3/2	15/11	121/86
TR has improved my teaching or the context in which my teaching is conducted.	7/5	15/11	117/84
TR has led to a greater capacity to find, develop, and implement strategies that meet the learning needs of my students.	7/5	18/13	114/82

Teacher research experience provides a context for transformation of practice.

Teacher Research is believed to contribute to a teachers ability to better assess their own teaching practice; the development of a better understanding of why and how children have learned or failed to learn; and with discernable changes in teaching practice.

To determine if the CRESS Teacher Research Program contributed to meeting this outcome respondents were asked to rate their level of agreement with three statements. Table 2 shows that 89% of all respondents either agreed or strongly agreed that the CRESS Teacher Research Program provided them with a way to assess their own practice. About three-quarters (73%) indicated that as a result of their participation they now have a better understanding of why and how children learn or fail to learn, and 62% indicated that their teaching has changed as a result of their participation in teacher research.

Table 2. Teacher research experience provides a context for transformation of practice.

	Disagree/ Somewhat Agree #/%	Not Sure / Neutral #/%	Agree/Strongly Agree #/%
TR has allowed me to better assess my own teaching practice.	7/5	18/6	124/89
I have developed a better understanding of why and how children have learned or failed to learn as a result of my participation in TR.	13/9	26/18	100/73
My teaching has significantly changed as a result of my participation in TR.	18/13	36/25	85/62

⁹ Reversed ranking procedure was used in the survey.

Understanding of how children learn. Respondents were given an opportunity to respond to an open-ended prompt asking what impact teacher research had on their understanding of how children learn. The following responses, representative of the 105 individuals who completed this prompt, indicate that many of the respondents were able to provide concrete examples of how teacher research impacted their understanding of how children learn.

I know that I don't know what my students really know (i.e., just based on body language) without actually asking them—often in multiple ways, times. It has helped me to document and follow my students' learning in ways I wouldn't have otherwise.

I chose reading comprehension [as a research topic] and used a variety of strategies such as literature circles, comprehension projects and questioning strategies to increase comprehension. I found that my students' comprehension of a variety of texts increased when I focused on one concept.

After researching collaborative learning in my classroom, I now realize that students need to transition from concrete examples before they can grasp more abstract concepts.

Teacher research supported an increased understanding and awareness of gender issues in my curriculum and classroom, which provided me with opportunities to differentiate my curriculum in different ways.

One of many examples: Students who appear to be off task can return from being "off task" with new insights into the problems they are working on.

Many of the responses to this prompt did not actually address the impact on their understanding of how children learn. Instead, respondents provided either examples of what they, as teachers learned as a result of their participation in the Teacher Research Program, or examples of how teacher research changed their practice.

I did a case study, which helped me assess the needs of my students, especially the need to be active physically and mentally in the learning process.

[I] Looked at prior knowledge compared to knowledge after unit completion—asked students what helped them learn material—it turned out to be a variety of things, which demonstrates the need for different types of teaching and assessment.

I've learned that my personal viewpoint on what students are or are not learning is prejudiced by my own style of learning. Talking with other teachers, interviewing students and doing questionnaires for my students has pointed out areas where I was blind. "Not all students taking art want to make it, some prefer to write or talk about it."

Others noted that teacher research both changed the way they view student learning and provided insight into the challenges youth face in learning.

It was a good initiation in my constant inquiry about ways to meet the needs of ALL my students. It brought me closer to articles on different learning styles.

At the time I was researching how bilingual students responded to the writing process. I gained real insight into the challenges they face.

TR has helped me understand that children are always capable of learning. My experience with writer's notebooks as an intervention in one class showed me that my students could all do the same assignment but learn different things from it.

Finally, respondents in administrative roles indicated that they learned more about how adults learn than how students learn.

I have served as an administrator supporting teacher research facilitators and teacher research groups. Therefore, my interest has been more at the level of TEACHER learning than student learning. I have observed a teacher who created more student input into the writing process as a result of her teacher research on such. I know of a school that changed the way it structured common time across bilingual and EO programs because of teacher research.

Changes in teaching practice. Respondents were given an opportunity to respond to an open-ended prompt asking how participation in teacher research changed or guided their teaching practice. The following examples, drawn from the 113 responses to this prompt touched on the notion of teacher research's ability to change teacher's self-image, how they think about teaching, an increase in the amount of self-reflection about what they are teaching, and how students learn.

It [teacher research] changed my image of myself as a self-directed learner and facilitator of learning and change.

TR has changed my thinking about teaching. I am always thinking of data and ways to find answers to questions I have about my teaching.

I have always said that T.R. was the most powerful tool for changing my practice as a teacher. T.R. caused me to establish the habit of continually reflecting on my practice. Then again maybe I already was reflective, and T.R. gave me an opportunity to share my reflections with colleagues. I think you cannot separate the two concepts.

I can easily dissect lessons and make them work for me and my students. I reflect on lesson presentation and then keep the parts I like and change the parts I don't like.

Respondents also indicated that teacher research changed their teaching practices. Teacher research was credited for fostering a willingness to experiment and for an increase in inquiry-based approaches.

[It] has encouraged trials of procedures that would have not otherwise been tried.

I am much more likely to try inquiry approaches in my own teaching. I was recently asked to cover a chemistry lab lecture on campus over spectroscopy and took the time to build models to take to the students to give them time to work in groups with a manipulative, and challenged them to think about the concepts that we had just discussed for an hour in a different way.

Teacher research is an important foundation on which to develop greater professionalism for teachers.

Teacher Research has been linked to a teacher’s perception of their ability to influence practice and/or policy at their school site; to participate in collegial work, balanced with opportunities for individual learning; and with the production of knowledge that will be useful to other educators in either their own or other settings. Teacher research has also been found to be conducive to a comfortable, respectful environment in which adult learning can occur.

To determine if the CRESS Teacher Research Program contributed to meeting this outcome, respondents were asked to rate their level of agreement with four statements. Table 3 shows that a vast majority (94%) of all respondents either agreed or strongly agreed that teacher research is conducive to adult learning. Another 87% indicated that teacher research supports collegial learning, balanced with opportunities for individual learning, and 74% that the knowledge they gained from teacher research has been useful to other educators. Far fewer respondents (50%) indicated that they are better able to influence practice and/or policy at their school site as a result of teacher research.

Table 3. Teacher research is an important foundation on which to develop greater professionalism for teachers.

	Disagree/ Somewhat Agree #/%	Not Sure / Neutral #/%	Agree/Strongly Agree #/%
TR is conducive to a comfortable, respectful environment in which adult learning can occur.	3/2	5/4	131/94
TR has allowed me to participate in collegial work, balanced with opportunities for individual learning.	2/1	17/12	120/87
The knowledge I have gained from TR has been useful to other educators.	9/7	26/19	104/74
As a result of TR I am better able to influence practice and/or policy at my school site.	24/17	46/32	69/50

Collaboration. The survey findings suggests that the Teacher Research Program is effective in fostering collaboration and contributes to the production of knowledge that is useful to other teachers. When asked if their participation in teacher research increased their level of collaboration with stated categories of people (79%) indicated both some or a great degree of change with teachers at their same site and with other teacher researchers. Sixty-five percent indicated some or a great degree of change with teachers at other sites in their district, and 56% with administrators. Between 14 and 33% indicated that their participation did not change their level of collaboration with any of the stated categories and between 7 and 10% indicated that they were not sure.

In addition, as a write-in option, five respondents indicated that they collaborated with university faculty, employees and/or students, and one individual noted they had collaborated with school board members and political figures.

Contribution to the production of knowledge that is useful to other educators. The Teacher Research Program encouraged teacher-researchers to publish their work, either in the CRESS anthology *Windows on our Classroom*, or through other professional venues. Approximately half of respondents had their teacher-research published. Of those, 24% were published in *Windows*, 9% in a professional or trade journals, and 9% in a school/district document/publications.

Examples of other teacher research publication venues mentioned under the write-in “other” option included the BAWP (Bay Area Writing Project) Newsletter, the LMRI (UC Davis Language Minority Research Institute) Website, a Master’s thesis and a doctoral dissertation.

The Teacher Research Program also encouraged teacher-researchers to present their work. Three quarters of respondents noted that they did present their teacher-research, 36% for

other teachers and / or administrators at their school site, 35% to their Teacher Research group, 33% at the CRESS Voices Conference, and 23% at a professional conference (e.g., CABE, AERA).

Examples of other presentation venues mentioned under the write-in “other” option included speaking to credential students about their research, a California Science Project director’s workshop, and a range of professional forums and conferences (e.g., NCTM, NASSP, AASA, NSBA, CLMS, Project Impact Teacher Research Conference, and a National Teacher Research Conference.

Teacher research is an important base for reflective practice.

Teacher Research has been found to promote the use of continuous inquiry and reflection; to allow for thinking systematically about teaching practice and to learn from experience; and to be pursued because of a desire to identify new connections and meanings in a teacher’s work.

To determine if the CRESS Teacher Research Program contributed to meeting this outcome, respondents were asked to rate their level of agreement with three statements. Table 4 shows that a vast majority (93%) of all respondents either agreed or strongly agreed that teacher research promotes the use of continuous inquiry and reflection. Eighty-eight percent indicated that they participated in teacher research as a result of their desire to identify new connections and meanings in my work, and 87% that teacher research allowed them to think about and to learn from their experiences.

Table 4. Teacher research is an important base for reflective practice.

	Disagree/ Somewhat Agree #/%	Not Sure / Neutral #/%	Agree/Strongly Agree #/%
TR promotes the use of continuous inquiry and reflection.	2/1	8/6	129/93
I participate in TR because of my desire to identify new connections and meanings in my work.	7/5	10/7	122/88
TR allows me to think systematically about my practice and learn from experience.	3/2	15/11	121/87

Teacher expertise and leadership. A goal of CRESS is to facilitate teacher quality and to foster leadership to teachers in the greater Sacramento region. For this reason, several of the survey prompts related to the connection between teacher research and highly qualified teachers and to teacher leadership. Analysis of these prompts suggests a possible connection between teacher research and teacher quality. Additional investigation, however, would be necessary to fully explore this issue.

Connection between teacher research and highly qualified teachers. Eight percent of respondents indicated they are National Board Certified Teachers. Roughly three quarters of respondent’s hold/have held some type of leadership position, many having served in multiple positions. Of the options provided, the two most commonly held leadership positions were as professional development trainer (42%) and department lead or chair (35%). Eighteen percent indicated serving as instructional coach/reading specialist, 18% as Peer Assistance and Review (PAR) / Beginning Teacher Support and Assessment (BTSA) coach, 11% as school administrator, and 4% as district administrator.

In addition, thirty-one percent of respondents served as CRESS Teacher Research Facilitators and roughly one quarter of respondents noted holding other types of leadership positions than were provided as options. Examples of other types of leadership positions mentioned under the “other” option included: Teacher Research Special Interest Group Chair,

American Educational Research Association; grade level representative, collaborative research grant project Principle Investigator; Association President and Vice President; Technology Coordinator; Education Foundation Officer; school site council and site leadership team member; Co-Director, Sacramento Area Science Project; instructor for National University's Educational Administration and Teachers' Education program; the Center for the Future of Teaching and Learning, Commissioner appointed by the Governor and as Director of National Association for Biology Teachers OBT; Master Teacher; AVID Coordinator, District Program Specialist, Lesson Study leader and project director, Western Association of Schools and Colleges accreditation Chairperson, university professor, Director of Teacher Education; and Academy coordinator.

A definition of CRESS Teacher Research

As Tables 1-4 indicate, respondents rated all four statements about desired outcomes highly. This is not an unexpected finding as CRESS's Teacher Research Program was intended to serve the multiple needs of participating teachers, both as individual teachers and as members of a teacher research group. Further there was a great deal of flexibility in how the individual teacher research groups operated (e.g., practices, norms, values) so it would be reasonable to conclude that on-going groups successfully met the interests and needs of participants. Based on an average of the three¹⁰ responses to each of the four outcome statements:

- 89% indicated that teacher research is an important base for reflective practice,
- 85% indicated that teacher research is an important foundation on which to develop greater professionalism,
- 84% that teacher research provides valuable knowledge for classroom practice, and
- 75% that teacher research provides a context for transformation of practice.

To more fully explore what teacher research has meant to them, respondents were asked to describe how they would describe teacher research to another teacher. Collectively, these responses provide additional insight into the desired and/or perceived outcomes of participation in teacher research.

Descriptions provided by the 114 individuals who responded to this prompt touched on each of the four outcomes statements. While elements of each statement emerged in a fairly even distribution pattern, embedded in the majority of comments was a reference to the role of teacher research in improving practice. A representative response in relationship to each of the four outcome statements follows.

Teacher research provides valuable knowledge for classroom practice:

It's about studying an issue/problem/situation in your own classroom, about looking for solutions or strategies to address that issue, trying them out and carefully examining the outcomes.

Teacher research experience provides a context for transformation of practice:

I would say it is a way to have an in-depth study of your teaching process. As you are studying your teaching you are able to ask for suggestions of other educators and bounce off ideas about the strategy you have chosen to study or research.

¹⁰ The fourth statement included under the reflective practice outcome was not included in this calculation. The CRESS Teacher Research Program did not consider this a priority area and only 50% of respondents indicated that they were able to influence practice and/or policy at their school site as a result of their participation in teacher research.

Teacher research is an important foundation on which to develop greater professionalism for teachers:

[It is where] you get out of your little microcosm called a classroom and actually talk to other adults. You get new ideas/perspectives on teaching issues when you share what you are doing, and seek meaningful feedback versus just downloading of emotions. It is a proactive process.

Teacher research is an important base for reflective practice:

A process of purposeful introspection—looking at one’s own practices, beliefs, and assumptions in a methodical way—in the context of a support group, all of whom are engaged in the same process, but around different questions/issues.

In addition, a small number of responses focused on the process of conducting teacher research, rather than on outcomes.

Teacher research is a process to find answers to teaching-related questions. Teachers develop a research question, collect data, analyze the data, and develop powerful conclusions directly related to teaching and student learning.

Finally, many respondents alluded to the idea that teacher research might also meet a more personal and often emotional need. One respondent wrote that teacher research is “like a transfusion” and another that teacher research will allow them to “say at the end of my career (next June), wow, what fun I had learning to be a better teacher for all my 25 years.”

CRITICISMS OF THE CRESS TEACHER RESEARCH PROGRAM

While much of the data presented up to this point portrays the CRESS Teacher Research Program positively, respondents did point out a number of ways in which the program could have been improved and in some instance noted that it did not meet their professional needs.

Among the criticisms are those similar to the one made by this individual, who suggested that the program was so flexible that it failed to foster inquiry as effectively as it might have within a more structured venue.

In all candor, the CRESS teacher research program needs to give greater focus to the how of facilitating and mentoring teacher research. Goals for the inquiry and windows of the inquiry need to be more tightly focused. I would advocate a two-year window of participation with the concrete goal to produce an inquiry report at the end. I think that the way we have set up teacher research within our teacher education program is more likely to foster inquiry that ends up yielding powerful insights about teaching and learning for a greater number. I do understand how much harder this is when teachers are not also students.

While this individual called for a tighter structure, others made strong cases for a much more unstructured approach.

Please keep the format not so strict and structured, because that will drive teachers away. Keep the format loose enough so that facilitators can tailor it to the personality of their groups and the needs of the group. Trying to overly formalize it will not add legitimacy to it. It will only create more obstacles to the process of teachers' freedom of inquiry.

These two comments are indicative of an ongoing tension experienced by CRESS’s Teacher Research staff over the course of the project. On one hand was a group of teachers who appeared

to be interested in generating knowledge and willing to hold teacher research to many of the standards and practices of traditional academic research. On the other hand, was a group of teachers who enjoyed the flexibility of the program and who seemed to view teacher research as an inquiry process that often yielded insight into their teaching practice. The following insightful comment summarizes this tension nicely.

I think I was unclear about the point of the research: is it to contribute to the body of educational research out there, to influence where educational thought is going? If so, the actual research methodology would need to be rigorous, and it's not. Or, is it really just to provide an avenue for teachers to think and reflect? If that is true, there are many other models that would do that without having to follow a research model, per se.

A second criticism of the program had to do with the inconsistency in which the way the program was administered at the school site level. While CRESS provided basic support to facilitators (e.g., a small honorarium, summer institute, on-going meetings, resource materials, and coaching) it was up to the facilitators to ensure effective implementation and to provide the leadership needed to meet the interests and needs of both the group and individual participants. Based on the reality that many teachers participated in the program for one year or less and that the number of groups that sustained beyond a year or two was small it is clear that the program did not meet the needs of all of its participants.

Finally, a third criticism of the program is that after many years “it seems to have little or no impact in the very big world.” As this individual wrote, the program should have been institutionalized in the partner districts and that failed to happen. There are any number of reasons for this, one being that CRESS failed to provide the staff support needed to market the program effectively. At no point in time did staff support exceed .5FTE. In recent years this support decreased to .25FTE.

CONCLUSION

The CRESS Teacher Research Program clearly met the professional development needs of hundreds of teachers throughout the region. As the survey findings indicate, the CRESS Teacher Research Program served as an important base for reflective practice, offered a foundation on which to develop greater professionalism, contributed to the generation of valuable knowledge for classroom practice, and provided a context for transformation of practice.

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Browsing The Archive: A Journey Into Two Decades of Teacher Research Studies

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CONTEXT

The path toward this moment has been two decades in coming. As a high school teacher with more questions than answers, I responded to a flyer put in my mailbox at Will C. Wood High School in Vacaville, California that advertised “\$2,000 to use in your classroom for participating in a year-long teacher research process.” My decision to participate that year, primarily for the money and because the group would be meeting in my school right after the last bell had rung, began a process that led to thicker and richer thinking about my teaching practice, significant changes in the way I went about teaching high school science, and a deep social justice commitment to meet the learning needs of every young person in my classroom.

The flyer came from the Center for Collaborative Research and Extension Services for Schools (CRESS) at the University of California, Davis. (My prior interactions with the Center were related to participation in the Area 3 Writing Project for a three-week institute.) Over the next two decades nearly 1000 teachers in the Northern California region, myself included, from Redding to Stockton and from Vallejo to the foothills east of Sacramento would participate in the process of studying our practice. Our intent was to gain insight into our teaching, and to improve our practice. This process was Teacher Research. The results of that process were year end reports or studies that we constructed throughout the year by asking questions, collecting data, making observations, perhaps trying new strategies in our classrooms, analyzing what we collected, and trying to make sense of what we observed so that we could share it with others both in writing and at Supper Seminars.

The result of those two decades of teachers engaging in inquiry is an archive of studies that is the focus of the study that resulted in this paper. The archive has been tapped before. After studying my practice for a number of years, a group of us was invited to participate in the Teacher Research for Publication Seminar. This group was led by a faculty member at UC Davis who worked with us to polish our writing and discern where to make it public. We returned to our earlier studies and revised, edited and added to them to bring them to a level acceptable to make public. An Education Extension Specialist at the CRESS Center also delved into the archive, when she read the studies and wrote abstracts and descriptors to increase access to them. Later, publications specialists selected studies around themes and polished them in collaboration with the authors to produce collections of studies called, “Windows on Our Classrooms.” But, in spite of all of this activity, much of the archive remained unavailable to the public.

In Spring of 2006, in the wake of the possibility of dismantling the Teacher Research program at the CRESS Center, the opportunity arose to revisit the archive and prepare a framework of what existed therein in order to get a larger view of the body of knowledge, and what might be learned from the years of struggle, reflection, hand wringing over writing, and honest intentions that went into the writing of so many stories of classroom practice. The intent was to make some sense of the collective wisdom contained therein, and to develop a way to access the knowledge so that others might use it to think in new ways about teaching and learning, to impact and reform teaching practice based on the findings, and to renew commitments to students, to social justice, and to practices that enhance student success in school. This is a report of that effort.

THE QUESTION

What are some of the ways we might imagine having the insights and understandings that emerge from teacher conducted studies become a more integral part of the thinking, the dialogue, the classroom practice, the teacher commitments, and of policy setting around teaching and learning?

THE HISTORY

There has been a historical criticism of educational research for the disconnect between research findings and classroom practice. There may be many explanations for this, or we might challenge that assumption altogether, but for our purposes let us accept that some sort of gap has existed and does exist. Explanations for this divide range from:

- The time lag between understanding and implementing changes;
- Problems with translation from theory to practice;
- Imposition of change by outside forces (school, district, state administration);
- Partial implementation followed by abandonment for a new idea.

Each of these factors could be minimized if teacher research findings were a larger part of the dialogue, if teacher research findings could be determinants of classroom practice, and if they played a more integral role in policy setting. This does not imply that teacher research findings should replace the “outsider” perspective on teaching and learning, rather that as complimentary perspectives they provide a more complete picture of the complexities of the process of learning.

There is evidence of localized impact of teacher research on teachers and classrooms in addition to the testimonials from participants and their facilitators (Marion, 1998). There have been numerous regional conferences for sharing teacher research such as Voices from the Classroom sponsored by the CRESS Center, and the Philadelphia Ethnography Conference. Similarly there have been publications of varying duration that showcased teacher authored studies such as the online journal *Networks*, *Voices from the Field* online forum for practitioners to tell stories of reform, and *Focus on Basics* sponsored by the Harvard Graduate School of Education.

There have been numerous books written on the subject of teacher research or the related practitioner research, action research, classroom action research, teacher led inquiry, inquiry seminars and the like. An Amazon search pulls up many titles under these searches, including: *Studying Your Own School*, *Teachers Doing Research*, *Inside/Outside*, *Teacher Researchers at Work*, *Action Research for Educational Change*, *Reclaiming the Classroom*, *Art of Classroom Inquiry*, *Workshop By and For Teachers*, *Action Research as Living Practice*, and *Living The Questions*. Review of these texts, however, reveals that most are about the process of studying one’s practice, with perhaps a few excerpts of studies, and a much smaller number actually focus on the knowledge created by the process, the product of the inquiry. More often than not, teacher research is seen as an effective form of professional development, as a nice alternative to workshops and motivational speakers, more than as a systematic inquiry process that illuminates issues and problems, that contributes to knowledge about how children learn, that is connected to fundamental reform in education, and that is impacting the setting of educational policy.

This study represents a challenge to expand upon that description and move toward a vision of teacher research that contributes significantly to deepening our understanding of teaching and learning, fundamentally influencing practice in more classrooms, impacting the learning of more students, and contributing to policy decisions at the school, district, county, regional, state and national levels.

THE METHOD

This study was conducted over several months, and involved systematically selecting studies from the archive, reading them, and documenting some key information about them. This information was then analyzed for patterns, themes and trends.

The archive exists as folders of studies conducted by groups of teacher researchers stored in boxes, and is labeled by year conducted, and facilitator of the group. This series of file folders was systematically labeled. Every tenth study was labeled with a stick-on post-it consecutively numbered.

Each selected study was then read and a review sheet entitled, “The Imprint Left by CRESS Teacher Research” filled out with the following information:

- Name
- Classroom
- Department
- Grade Level
- School
- District
- Change in Thinking
- Change in Teaching Practice
- Change in Commitment
- Leadership by Teacher Researchers
- Oral Publication
- Written Publication
- Influence on Policy

Room was provided for summary statements for each category of impact. Impact was based only on self-report by the author of the study, and may not always reflect the full impact of the study or the author in their context. The scope of this study, however, was limited to the information that could be determined from the final reports themselves, recognizing that this was only part of the whole picture. These summary sheets were then analyzed, collated, categorized and emerging themes, patterns and findings were described.

It became clear that this process, while an extensive undertaking, would tell only a fraction of the story contained in the archive.

THE FINDINGS

At the time of this publication, the analysis is still ongoing. Some interesting trends over time are beginning to emerge and should be the focus of further study. However, several interesting categories of studies have emerged, that hint at the wealth that resides in the collection. Each of the categories will be described, and some insights about the impact of that form of study will be shared, in an attempt to imagine what might be accomplished with more extensive examination of the entire archive.

There is evidence of impact on teachers and their thinking, practice and commitments. There is also evidence of many struggles and barriers teachers face in their efforts to reform and improve. In some cases the external forces and institutional structures dominated progress to such an extent that little progress appeared to be made. In others, teachers found ways around barriers to celebrate small successes. In some cases, progress and movement forward, was preceded by discouragement and movement backward. There were some instances of significant progress.

These stories of struggle do offer some insight into the forces at work on classroom teachers that may have little to do with the day-to-day practices we imagine are teaching and learning. These insights may offer some direction for reform in schools beyond addressing the education of teachers, the curriculum and classroom practices. A focus on institutional barriers may be more effective at supporting teachers in their quest to improve student learning.

THE CATEGORIES OF STUDIES

The nature of the studies randomly selected varied greatly. Some were quite detailed in their discussion of the journey that the teacher research process led them on; others were quite brief in their elaboration of the process they went through. In spite of the wide variety of styles of write-up, three general groups emerged from the sample studies.

- Observational
- Experimental
- Analytical

Discussion of these three formats offers some insight into the impact of the process on teachers who studied their practice.

➤ Observational

This group of studies involved the teacher as participant observer, honing their skills of noticing what was going on in their classrooms on a daily basis. These were most often studies of what was already in place. The research procedures suggested by group facilitators or other peer group members may have assisted this illumination process, as participants often engaged in journal writing by recording events as they unfolded, or using some means of chart or diagram to understand the complexities of classroom practice. The authors of these studies began noticing things that previously had eluded them, such as the nature of student-to-student talk, the ways in which they called on students in class, their own movement around the class, or the impact of their teaching practices on student learning. These studies took two major forms in the sample studied, confessional and documentary.

The confessional studies often involved the author of the study realizing at some point in the process that the language or actions they were taking or strategies they were using were having a negative or at least a range of impact on student learning. These studies often contained descriptions of loss of confidence in their practice or guilt over unintended consequences of their behavior. Kurt Lewin believes that this is the value of self-study, since it inspires people to change their behavior in order to improve the impact they are having on others or on a process in which they are involved. In this type of study authors are most likely critical of themselves as practitioners, and are most likely to either change their practice or anticipate changing their practice as a result of what they find. These personal journeys often took the form of stories about individual students and instances of classroom practice and ended with determination to do better in upcoming interactions with students. There are implications for the education of teachers with these studies. If we embed self study into teacher preparation programs, as teachers graduating from the University of Wisconsin, Madison School of Education Credential Programs do when working with Ken Zeichner, we may enable teachers to course correct as they observe less than success with student learning and begin examining their role in improving the situation.

The documentary studies most often involved the teacher researcher taking note of what was occurring in their classroom, but took a more detached stance on the process than the confessionals. These studies serve to paint a snapshot of what happens behind closed classroom doors, a view not readily apparent to those outside of the classroom, and therefore make a

valuable contribution toward understanding what is versus what we imagine to be going on. These studies generally do not reflect much self-examination of the role of the author in the events; rather they describe the lessons or projects going on in some detail. These rich descriptions of classroom practice offer an invaluable insight into ways teaching strategies play out in real settings, with real students. The form of these reports was more news item than personal journey, with descriptions of classroom setup, types of activities students engaged in, and samples of lesson artifacts attached as appendices. These studies might be most helpful with new teachers or teachers implementing new curriculum or practices as models of practice from which to gather ideas and imagine possibilities. The authors of these studies often ended up validating current practices, making suggestions for future fine tuning, or offering materials for other teachers to follow, but rarely examined the practices critically or with an intention to change substantively.

➤ **Experimental**

This group of studies most often engaged the teacher as tester of curriculum, teaching strategies or classroom management techniques. They may have taken the form of trying a new way to solve a problem, implementing a new strategy they learned about voluntarily, or examining implementation of a newly imposed change. In each case, however, change in practice was the impetus for the study, followed by some means of evaluating the change. It differed from observational studies in this regard since those studies focused on “seeing what was.” Two types of experimental studies emerged from this group, referred to here as individually initiated, and initiated from outside. This distinction seemed to have an impact on the nature of the findings of each type of study.

Individually Initiated

These studies usually involved a teacher deciding to try something new either to solve a specific problem, or because they had learned about a new way of teaching from a peer, a workshop or a professional group. This voluntary implementation most often was accompanied by enthusiasm about a fresh perspective on a situation, an eagerness to obtain the requisite materials, and a high motivation to look for impact on student learning. These studies began with description of the new idea, initiative, curriculum or strategy, followed by some details of implementation, and documentation as implementation unfolded. Often these authors started and ended enthusiastically, leaving the reader of the study to wonder to what degree they may have anticipated the success of the new idea from the outset. The value in these studies was the complete immersion of the teachers in the implementation, in spite of what often took tremendous time and energy to reach fruition. The authors of these studies often made significant changes in their practice and were willing to do so in spite of the obstacles that stood in their way.

Initiated from the Outside

These studies still met the “testing” dynamic that is characteristic of the experimental category of studies, but differed from individually initiated changes in that the researchers studied what happened in the midst of a broader imposed implementation of a strategy, curriculum or program. Often these imposed implementations were recently in place as a result of local, regional, state or national initiatives. This imposed implementation most often was accompanied by skepticism, frustration and cynicism about the value of the change or indicated very little knowledge of the rationale for the change. These studies most often began with some consternation about the new initiative, and described partial or less than enthusiastic implementation. In contrast to the individually initiated changes, these researchers were more

likely to assume that the new idea would fail to significantly impact student learning. Issues of workload, unrealistic expectations, and lack of good data to justify the change often preceded any discussion of the merits of the initiative. There were some cases in which researchers did find some merit in the change, but most often the end did not justify the means from the perspective of the authors. Obstacles to the change became major barriers to implementation for some. The most prevalent impact of this type of experimental study was rationale for resisting the change, validation of wrong headedness of the plan, and lack of patience with the change.

This group of experimental studies offers some insights into which means of introducing new curriculum, initiatives, or policy might best serve student-learning outcomes. When teachers felt a part of the implementation, had knowledge of the rationale, and had choice of what would be implemented, the degree of implementation, motivation to do so, and satisfaction with the change was enhanced.

➤ Analytical

This group of studies was among the richest in terms of both depth of study and impact. They moved beyond the surface features of classroom practice, and began to get at larger questions about teaching, learning, social justice and equity. While it was not always possible to tell, there were some indications that this type of study were most often conducted by veteran teacher researchers, as noted in the final reports in a number of ways. Three types of analytical studies were found in the samples reviewed: studies to understand, reflective studies, and critical studies.

Studies to Understand

These studies were most often initiated due to a problem, conundrum or issue that nagged at the researchers, sometimes for years prior to the initiation of the study. It might revolve around the curriculum or some teaching practice, some which involved social justice or inequity issues, and most often focused on a situation or event. The passion of these researchers was evident from the outset, and often began with stories that illustrated the issue, often in a heart wrenching way. These nagging problems in many cases were cause for the teacher to consider leaving the profession. These researchers often looked first to the literature in hopes of finding wisdom from others facing similar problems. They then were likely to employ means of documenting that might result in deeper insights or seeing beyond the surface, such as open ended interviews, video or audio taping or sociograms that tracked interactions or movement. The resulting reports were filled with rich, thick description, often cited prominent educational thinkers, and provoked thoughtful discussion of larger social issues. The impact on these individuals was most often in the form of increased understanding leading to increased commitment to pursue a remedy or change a practice based on that deepened understanding.

Reflective Studies

These studies were characterized by a need to look beyond the surface to get at forces at work. While the studies to understand focused more often on a situation or event, these reflective studies were more often focused on the people within a setting. These studies focused on behaviors of individuals, nature of interactions, or behaviors of groups of individuals. Like the studies to understand, these most often began with a look to the literature prior to beginning any classroom study. The questions often directed attention to the sociological aspects of a classroom setting rather than the curriculum or practices. These deeper studies of human interaction often resulted in linking teaching and learning behaviors together in ways that helped teachers develop a philosophical rationale for why to teach a certain way to elicit particular student learning

outcomes. These studies often resulted in paradigm shifts in the way authors of studies thought about their teaching practice and the way their students learned. The resulting changes in thinking may have resulted in changed practice, but more often authors projected forward to the changes they expected to make in the future as a result of their insights.

Critical Studies

These studies most often focused on institutional structures that by their very nature embed social injustice and inequity. They most often relied on one or two philosophers that have influenced a researchers thinking about children's experience in school. These studies were often heavy on literature review and stories of social action with regard to schooling. The reports were characterized by sophisticated philosophical rationales for some practices over others, and often led to political actions at the local, regional or national level. The studies in this category directed frustration more broadly than locally, toward deeper cultural norms and barriers to learning and even barriers to teaching embedded in educational institutions as we know them. This type of study was most likely to result in changes in the author's professional status, perhaps indicating a return to graduate school, work in another profession like counseling or non-profits, or personal acts such as volunteering or joining social movements. The impact on teacher researchers was often changes in their thinking, practice, commitment and even professional goals and aspirations.

While these analytical studies were smallest in number, they did exist, and the authors often influenced more individuals when they changed their professional roles, acting in leadership roles to facilitate others in teacher research, or offer workshops or other means of providing similar critical opportunities for teaching colleagues.

IMPLICATIONS

This limited review of the archive has uncovered numerous impacts on teacher thinking, practice and commitments. It has identified varied ways of going about teacher research, some beginning with documentation and observation, others with implementation and testing, and still others with an eye to the wisdom of others and political action. These findings have the potential to impact facilitators as they work with teacher researchers in the future, and indicate ways to deepen the questions asked, the methods used to document, and to direct the intentions of the researchers.

But this signals the beginning rather than the end of the search through archives of teacher studies. It represents a one in ten look at the studies produced by teachers in just one network, the CRESS Center at the University of California, Davis, and no doubt there is much more to learn from a closer examination of what teachers have constructed. This study was limited to one archive, and many such collections exist in localities around the country and internationally. There is much more work to be done, understanding to be uncovered, and richer dialogue to result from further delving into archives of teacher research studies.

INCREASED ACCESS TO TEACHER CONSTRUCTED KNOWLEDGE

There is an effort underway to increase access, being initiated by those who believe teacher research has the potential to offer a too often overlooked perspective in the educational conversation, that of practicing teachers. It is emerging from development of the League of Teacher Researchers by Pam Castori, formerly director of Teacher Research at the CRESS Center, University of California, Davis, Janet Hecsh, Sacramento State, and Robin Marion, California State University, San Marcos. In collaboration with teacher researchers, this group is developing both a searchable digital archive of teacher-authored studies (Google: League of

Teacher Researchers) and a physical hard copy archive housed in the Hansen Curriculum Library at CSU San Marcos.

The purpose of the archive is to increase accessibility to classroom perspective by both K-12 teachers seeking authentic examples of how educational practices, initiatives, curricula and policy are implemented in real contexts, and for scholars seeking opportunities for cross-study and cross-network analysis of theory in practice.

WAYS WE MIGHT IMAGINE USING TEACHER CONSTRUCTED KNOWLEDGE

While the work to increase access is admirable, in and of itself it will have little impact unless it is utilized in meaningful ways. How might we imagine doing just that once we can locate and study the knowledge?

- 1) Replace hierarchical forms of decision making and evaluation with inquiry
 - Inquire about evidence from teacher research prior to making campus decisions/policies;
 - Replace committees with study groups;
 - Use teacher research as an alternative evaluation process in collaboration with site administrators.
- 2) Build more support for teachers to participate and present at state, regional, and national conferences, not as incidental or unique guests, but as substantive contributors to the dialogue
 - Teacher as researcher Special Interest Group (SIG) at the American Educational Research Association (AERA) Conference
 - Keynote presenters
 - Travel money budgeted item for teachers
- 3) Increase communication among and across networks
 - Networks currently exist in Alaska, Australia, California, Canada, England, Georgia, Rhode Island, Maryland, Massachusetts, Missouri, Virginia, Wisconsin
- 4) Build in expectations to include teacher research findings to deepen our understanding of teaching, learning and decision-making in the work of schools, graduate programs and research agendas. We need to expect and ask for teacher researcher perspective and seek it out.
 - School improvement plans framed as teacher research questions
 - Inquire about evidence from teacher research prior to making campus decisions/policies
 - Look to the teacher research process as a means to select and adopt texts/revise curriculum/implement initiatives and document the impact
 - Master's programs
 - Assign teacher research studies as class readings
 - Cite practitioner research when writing articles/reports/theses
 - Require half teacher authored sources for assignments
 - Incorporate teacher research component into research proposals by individuals/schools/districts/universities
- 5) Quote practitioner researchers alongside better known educators and scholars at conferences, in pre-service, in-service and master's courses, and workshops. This is currently not easy to do due to limited access to teacher studies.
- 6) Develop a research agenda focused on particular issues that looks across teacher research studies and communities.

One of the largest barriers to the strategies delineated above is access to teacher-authored findings. Communication between networks of teacher researchers themselves is limited, and has tremendous potential for deepening our understanding of educational issues. I recall my teacher research peers asking why anyone would want to know about their findings about small groups of students in their classrooms, and questioning the significance of their localized insights for others. When asked this in 1988, our facilitator Jim Hahn said, “Once a critical mass of teacher research is completed, and teachers across the country do similar studies and find similar patterns and insights, there will be important things we can learn from looking across them.” We have reached a point of critical mass we need to tap into further. Enough evidence is available to move us forward.

CHALLENGES TO MOVING FORWARD

This notion of increased access is not without challenges and dangers of its own. We will be increasing access for those who are extremely critical of teacher research as a form of knowledge production. The challenges include, but are not limited to:

- Co-opting teacher research and turning it hierarchical—a constant struggle to draw the line and be certain teachers are in control of the process.
- Invite criticism for lack of rigor, validity and generalizability—the teacher research community needs to determine its own criteria for quality practitioner research, but Lee Shulman in a slightly different context, that of teaching portfolio development may help us think beyond the four great forms of validity, particular given where this paper started, with the assertion that educational research has been criticized for its relative lack of impact on practice:

...(P)sychometricians write about the fifth form of validity. Some call it consequential validity, some call it systemic validity. The notion is rather simple (and) requires that you offer evidence that when you deploy it, it has positive consequences for the entire system of which it is a part.

Shulman 1998

- Perhaps knowledge from teacher research will help bridge the theory-practice gap that educational research is so often criticized for leaving large.
- Overly expose teachers to critique of their research—this risk is exactly what is needed to bring teaching out of the closet, ask hard questions of our practice, and take seriously the teaching/learning process in ways that will elevate the profession. Bring on the critique, and support professional growth.

In spite of these dangers, and others we haven’t articulated here, the potential benefit to the level of dialogue, the positive impact on classroom practice, the chance for a change in direction of educational policy, and the opportunity to increase the professionalism of teaching are too great not to take the risk. The body of knowledge arising from teacher research is a relatively untapped resource and the numbers of studies have reached a substantial level that can no longer be overlooked.

Our expectations drive change, if we raise our expectations of the degree to which teacher voice is integral to dialogue in the field, has a major impact on classroom practice, and forms the heart of policy setting around teaching and learning, and we match our actions to those expectations, teachers will be heard and influence the course of the field in more substantial ways. I challenge each of us to do more to imagine and make real the possibilities.

Please join in this commitment. Please submit studies to the archive, sign up to be part of the League, volunteer to serve on the Board to review studies, and post your studies and those of your colleagues to the archive.

Robin Marion will be on sabbatical during Spring 2007 working full time to bring the League of Teacher Researchers digital searchable archive to full working status. The semester long sabbatical will consist of four activities:

- *Create and facilitate an Advisory Board to consult with on development of the archive made up of K-12 teacher researchers and university faculty who support them;*
- *Provide concentrated time for supervising procurement, cataloging, loading, shelving and insuring access to both the digital and physical archive;*
- *Allow for travel to network sites to search local archives, promote donation and digital loading of studies by authors, and give regional presentations about the archive;*
- *Facilitate the collaborative design of a framework for cross study analysis along several dimensions (e.g. federal and state initiatives and their implementation, issues in education, content areas, grade levels, roles of researchers in schools) and beginning analysis for themes and patterns that emerge.*