

THE INFLUENCE OF SCHOOL AND PARENT COMMUNICATION
ON SCIENCE ATTITUDES AND ACHIEVEMENT
IN FOURTH GRADERS

by

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Susannah Spradlin Murphy

July 2012

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ABSTRACT

I teach in the community of Frenchtown, Montana. This small, rural school is grappling with the recent loss of the community's largest employer, a large paper mill. Families who were once living quite comfortably are now struggling to survive. Most of the jobs lost were very skill specific, and those skills are not helping those displaced to find meaningful work that can support their families. This stress is played out every day in my fourth grade classroom. Montana's timber economy is shrinking. According to the U.S. Bureau of Labor and Statistics, nine of the twenty jobs with the fastest projected growth are STEM (Science, Technology, Engineering, and Math) related (Bureau of Labor and Statistics, 2010). Given better educational background and more flexible skills, the children in my classroom will be more prepared to handle such a catastrophic economic blow if it should strike in their adult life. Students with positive science experiences in their elementary through high school years are more likely to choose science related studies after graduation. The purpose of the study was to improve student achievement in science and student perception of their own abilities by implementing a structured and supportive program of communication between family and school. Using home visits to each child, a class website focusing on science related explorations, and frequent contact via e-mail, newsletters, phone calls, and one-on-one visits, I established a culture of communication. I found that this increased focus on keeping parents and children in close communication and contact with our school and classroom had a significant positive impact on student attitudes and academic performance in science. Hopefully this is one piece of what it takes to help them seek out a challenging future in higher education and beyond.

INTRODUCTION AND BACKGROUND

Frenchtown Elementary school has 596 students in pre-kindergarten through sixth grade. Fifty-three percent of students are male, with 47% female. In 2012, Frenchtown Elementary School had 39% of students eligible for Free and Reduced Lunch programs. The ethnicity of the school is 91.5% Caucasian, 2% Asian/Pacific Islander, 2% American Indian, and 2% Hispanic, 0.5% Black, and 2% two or more races (J. McKay, principal, personal communication, February 21, 2012). In the past year, Frenchtown Elementary enrollment has declined by thirteen students. Nineteen students from my fourth grade class were included in the study. The research methodology for the project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

Frenchtown recently experienced the loss of its largest employer, the Smurfit-Stone Container paper mill. Families that had not struggled before are now holding down three and four jobs, fighting to hold on to their homes, and hoping to stay in the community they love. Declining enrollment across the school district can be largely attributed to the closing of the Smurfit-Stone paper mill. The steady increase in Free and Reduced Lunch numbers reflects this economic transition.

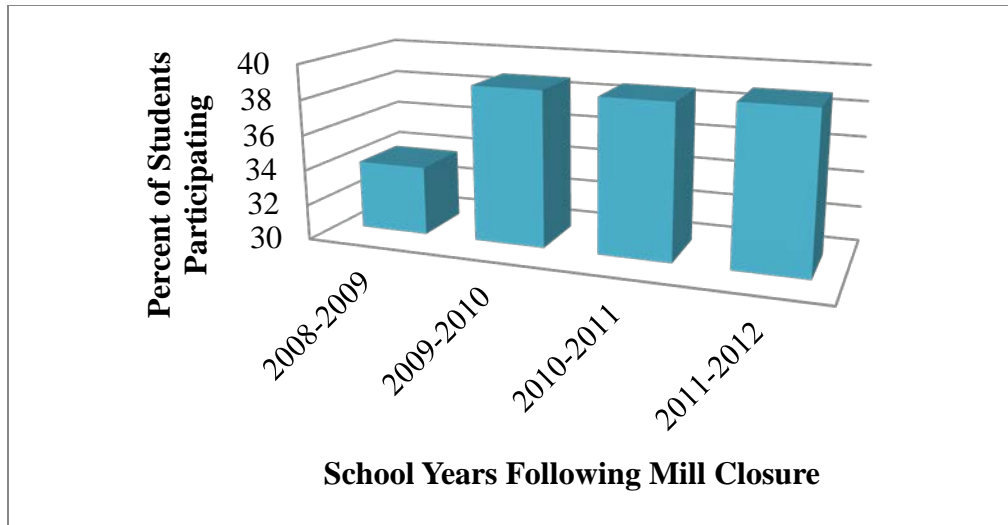


Figure 1. Increase in free and reduced lunch percentage in Frenchtown schools.

Observing the struggles of these families with very limited flexibility in their marketable job skills and a generally small amount of education, I sought a way to encourage students to seek out more opportunities for education and training in their future, especially in Science, Technology, Engineering, and Math (STEM) fields with high projected growth in job numbers.

Before the school year began, I visited 15 of my 19 students at their homes. I have maintained contact with all of my homeroom families through phone calls, written notes, and school newsletters that are sent home weekly. Midterm parent teacher conferences provided the students with a chance to update their family on their progress and gave us an opportunity to discuss grades, attitudes, and expectations for the remainder of the school year. Parents have the most significant influence on their child's decision to further their education. Therefore, I looked to generate stronger family/school communication. The goal of my study was to improve student attitudes and performance

in science by implementing a structured and supportive system of communication between school and home.

CONCEPTUAL FRAMEWORK

Parent-school connections have never been more needed than they are today (George & Kaplan, 1998). With increasing stressors from school violence to widespread unemployment and to falling national test scores, the realms of academics and family can no longer function in isolation (Wright & Stegelin, 2003). As our families respond to the increasing strain, students are more successful when the communication lines between home and school are open and active (Lee & Bowen, 2006).

Parent involvement connects two of the child's worlds and has a profound impact on all students' learning, in and out of the classroom (Lee & Bowen, 2006). Parents are spending an increasing amount of energy to be involved in their child's school. The current trend toward more parental involvement could be attributed to an increase in the average education level of mothers or the influence of Head Start and other federally funded programs. Student perceptions of parental involvement have very little influence on standardized achievement test scores, but make a large impact on the grades of high school students. Increasing parent involvement requires attention to some barriers such as race, poverty, parental levels of education, parents' attitudes toward school, physical resources, and connection to school. When parents do not feel comfortable at school, they miss out on important information, skills, and resources. These tools, information and skills, could help promote achievement. Greater engagement and background in the culture of education gives parents an advantage in gaining additional access to education

both for themselves and their child. Conversely, lack of background can cause individuals to encounter inequalities in access to cultural advantages such as education, resources, and cultural understanding (George & Kaplan, 1998).

Powerful and empowering partnerships can be created when communication is effective. Positive relationships between family and a teacher require warmth, sensitivity, the ability to listen, openness, and nurturance from both parties involved (Swick, 2003). Parents are far more able to communicate effectively when they have a positive self- image, feel empowered, and are consistent. Once partnerships are established, shared learning activities are a natural part of that progression (Swick, 1992). When communication is working the outcomes can include: class and school improvement activities, collaboration on curriculum enrichment, participation in school decision making, advocating for children and support for each other's roles (Swick, 1992). Culture is a major strength in classrooms and should not be overlooked as a resource. Teachers need to learn about students' culture to better understand not only how to adapt instruction, but also how best to connect with families. When a family is surveyed about their child's interests or worries that feedback can reveal the life of a child in ways that we could not otherwise know (Baeder, 2010).

Parent involvement in student learning is affected by the quality of communication and interaction initiated by the school. A few key suggestions can increase the effectiveness of initial contact with families. Discuss the kind of learning activities that are common in the classroom. Ask about the child's accomplishments. Teachers should also let parents know how their child's learning can be supported at home. Academic achievement is a benefit of parent involvement. Other benefits include:

better behavior, increased motivation for learning, better attendance, and more willingness and a better attitude toward school and homework. When communication is established, teachers have more opportunity to focus on curriculum and instruction, and a greater understanding of their students' needs, as well as increased morale (Swick, 2003).

Connections are made between school and home when teachers make home visits. In the case of Cleveland High outside Seattle Washington, teachers have a more difficult time understanding their students than in years past (Baeder, 2010). Because teachers often commute to school, they lack opportunities to meet their students and their families in the market, out for a walk, or at community functions. In response, Baeder's school decided to implement teacher home visits. They were rewarded for their efforts with a richer understanding of students and their families, rather than relying on student files, or general perceptions of the neighborhood, or cultures. In addition to the greater understanding these teachers gained, students were aware right away that there was a unique new level of understanding and trust between the family and school. This open communication provides the opportunity for families to share in a way that the teacher can then target instructions to the specific needs and interests of that student (Baeder, 2010).

Some districts require teachers to make home visits and other teachers simply find them valuable without the requirement from a district. In an unstructured, non-threatening environment, both parents and student can benefit from the stress reduction and connection made during a home visit (McDonald, 2011). Students come to class with a more positive attitude and greater enthusiasm. Cultural sensitivity is paramount.

Teachers should familiarize themselves with specific cultural norms before making a visit (Swick, 2003).

Several communication modes can be used in addition to the home visit. Informal science nights at school, ongoing phone and e-mail contact, or establishing a website are possibilities. A more intensive and one-on-one intervention is a home-family notebook. When considering a daily notebook style of communication there are several special considerations. It's important to consider the cultural background of the student (Davern, 2004). Some cultures and families will see such frequent written communication as punitive, rather than informative. Asking parents what news they want to hear about regularly helps to alleviate some of those potential misunderstandings (Davern, 2004). Open ended questions about how families wish to communicate signal a receptive and listening partnership. Teachers also need to offer options for modes of communication. The guiding principal should be keeping all parties involved, up to date, and this can provide the input needed to determine when it is time for a face-to-face meeting (Davern, 2004). Communication that is family and child focused is one way to promote high quality education for every student.

George and Kaplan (1998) showed that positive attitudes toward school subjects are indicators of increased cognitive development, learning in and out of school, positive attitudes toward friends, enrollment in science courses, and future learning behaviors. An increasing number of students are beginning college majoring in science and technology fields. A new study shows that those same students just are not finishing out their degree (Epstein 2010). As the need for a scientifically literate populace continues to grow, the gap between supply and demand grows. In order to reverse this trend, research has

focused on identifying scientific attitudes. To foster a future interest in science, early formal and informal experiences are pivotal (Yanowitz & Vanderpool, 2004; Joyce, 1999). Since 85% of a child's awake time is spent outside the classroom, life experiences bear a profound impact on student attitudes (Joyce, 1999). Informal science experiences like trips to a library or science museum with their class or family, scientifically rich field trips, and parental involvement all have the potential to influence science attitudes and achievement. Pursuing scientific learning outside the classroom can spark an interest that creates deeper and more complex learning outside the context of the structured learning environment (Esach, 2007). Schools have not usually nurtured, taught, or encouraged the skills necessary to be successful in an informal learning environment outside the school walls (Esach, 2007).

Programs that seek to improve attitudes about and involvement in science careers have been successful, but missed some key elements. Most programs target students in middle school and older (Joyce, 1999). Early experiences have a profound impact on future participation in science (Joyce, 1999). The addition of late elementary programs could have a greater impact than with middle school students. Starting earlier could solidify those positive attitudes before it is time to make choices in course work for high school or college. Post assessments of fifth grade workshops showed that a moderate investment in resources and personnel can impact girls' perceptions of science as a career option (Joyce, 1999).

Several valid tools exist to measure students' attitudes toward and achievement in science. Formative assessments can provide helpful information through surveys, interviews, and student self-assessments (Angelo & Cross, 1993). The Test of Science

Related Attitudes uses a battery of seventy questions to uncover student perceptions about seven scales: social implications of science, normality of scientists, attitude of scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science (Fraser, 1981). The Draw a Scientist Test (Mason, Kahle, & Gardner, 1991) seeks to explore student perceptions of the people involved in scientific professions.

METHODOLOGY

In the late summer before school began, each student in my fourth grade homeroom class received a letter of introduction from me, letting them know that I'd like to meet them at their front porch (Appendix I). Families were then contacted to set-up a home visit. The home visit was designed to set the student and family at ease. With that in mind, families were offered an alternate meeting location like a public park or playground. None of the families asked for an alternate meeting site. This time served to inform students and parents of our classroom routine, share some basic school supply information, and show them the class list. During the informal visit, a Parent Survey was left regarding their student's attitudes and performance in science, as well as their opinions about family/student communication with the school (Appendix D).

Before the first quarter midterm, two instruments were administered to establish a base-line of student attitude. A survey of student attitudes regarding science, based on the Test of Science Related Attitudes, or TOSRA (Appendix A) was evaluated using a Likert scale. On a Likert scale a response of five means, *Strongly Agree*, a response of four means, *Agree*, a response of three means, *Neutral*, responding with a two means,

Disagree, and responding with a one means, *Strongly Disagree*. Completing the TOSRA helped to quantify student attitudes. The Draw-A-Scientist Test (DAST) (Appendix B) was also given at this time. The DAST provided information about the presence or absence of stereotypical ideas of scientists and their work. Points were administered for several key elements of their drawing, focusing on gender, tools of science, physical appearance of the scientist, evidence of technology, as well as others. Two points were given for strong evidence in the drawing of a category, such as flasks containing solutions, one point for some evidence, and no points if the element was absent from the drawing. Both of these tests provided data that illuminated their preconceived notions about the nature of science and the students' abilities in science.

Throughout the study, several support systems were made available to families and students to encourage communication. An online grade book program called the PASS system was available for parents to check their child's grades. Updated weekly, this program detailed student performance on individual assignments, gave parents a list of all work expected of their student, and offered an opportunity to review the material covered in class. The students were responsible for keeping a journal with reflective questions to prompt sharing of their attitudes and ideas about science and themselves (Appendix G). Once a week, students used this journal to write a short note to their parents sharing one of the things they learned in class. A teacher treatment journal was kept with a structured, consistent rubric was kept to track each student's attitudes and performance (Appendix E). The rubric rated each of six areas: attitude, homework completion, organization, illustration, tables and graphs, and narrative. Students earned five points for exceeding classroom expectations, four for meeting expectations, three

points for partially completing requirements, two points for showing a beginning of some work, and one point for no evidence of the criteria. Also included was a Family Contact Ledger that tracked the frequency, nature, and format of all parent and teacher communication (Appendix F). This communication was scored with one point for each contact made. A class website provided science study guides, links to related materials, and updates on current science topics.

At the end of quarter one, formal student interviews were held to assess student attitudes about science both in and out of the classroom and to get an overview of their perceptions about fourth grade so far (Appendix C). A short Parent Survey was offered to families to assess their perceptions of the quality of communication and attitudes so far (Appendix D). The Parent Survey was evaluated on a Likert Scale. In conjunction with a fourth grade study of energy transformations, a family science night was offered at the midterm of third quarter.

At the end of the third quarter, the Parent Survey was re-administered to update information about their attitudes and opinions. Students also took part in a formal interview (Appendix C); each student completed a follow-up posttest on the Draw-A-Scientist Test (Appendix B), and the TOSRA survey of attitudes (Appendix A). Scores in each area were compared to scores from the first assessments to assess changes in attitudes and perceptions.

Research targets and treatment methods are summarized in Table 1.

Table 1
Triangulation Matrix

Research Questions	Data Source		
	1	2	3
1. Does family/school communication influence student attitudes about science?	Draw A Scientist Test Age-appropriate TOSRA	Student Journals	Formal Student Interviews before and after treatment Family Contact Ledger: Teacher ledger-style journal to track all parent-teacher communication.
2. Does family/school communication improve student performance in the science classroom?	Teacher Journal focusing on student science classroom performance and engagement.	Report Card Grades	
3. Do home visits, phone calls, notes, e-mails, a class website, and science night increase parent involvement with school?	Pre and post treatment Parent Surveys using Likert scales		Family Contact Ledger

DATA AND ANALYSIS

Every family was contacted by me at least six times outside of conferences by home visit, e-mail, phone, or meeting at the school, with an average of 14 contacts per family during the treatment. One student, whose parent volunteered weekly in the classroom, was not included in the contact averages and qualified as an outlier.

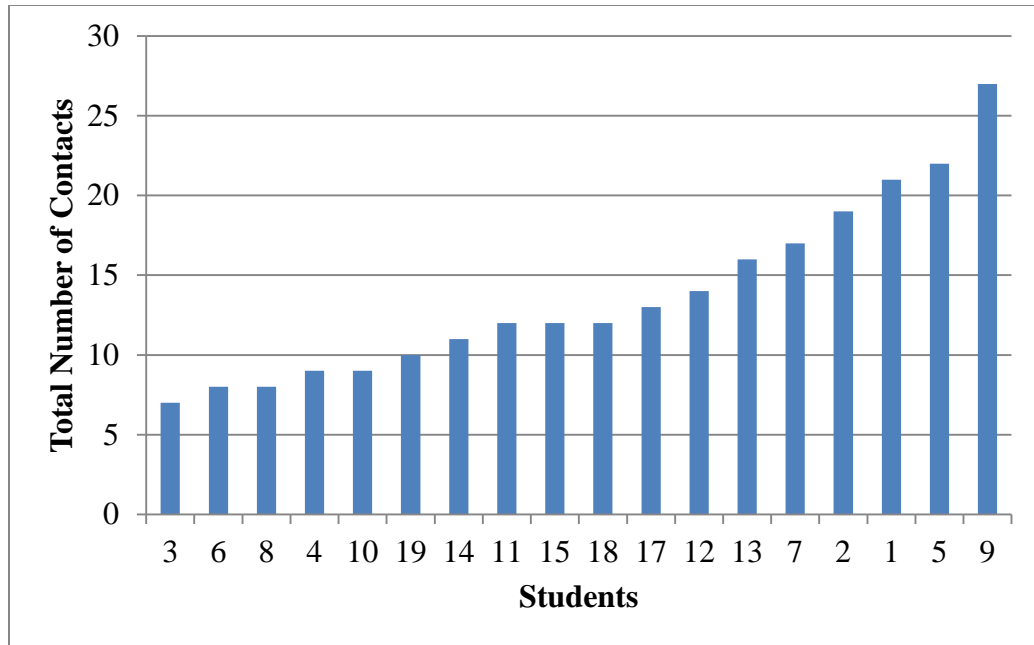


Figure 2. Contact frequency, ($N=18$).

Weekly letters home were not included in the average. Parent Contact Log results showed the highest number of teacher initiated contacts being positive phone calls home averaging 3.36 calls. To compare student results in all areas, two sub-groups were created. Contact frequencies from 0 to 15 were considered low frequency, and 16 and above were considered high frequency. The largest disparity between families with high contact frequency and those with low contact frequency emerged in e-mails. The number of e-mails ranged from 0 to 28, with the whole class average at 4.52 e-mails per student. Families with low contact frequency averaged less than one e-mail, and those with high contact frequency averaged 6.7. All families had access to the internet. This difference in contact was evidence of parental responses to my contact, and parent initiated communication. Positive phone calls averaged from 2.67 calls per student with low contact frequency, and 4 calls for those with high contact frequency. Averages for informal visits such as field trip chaperoning, athletic events, or classroom volunteering

varied between 3.12 visits for low frequency to 4.29 for high communication frequency families.

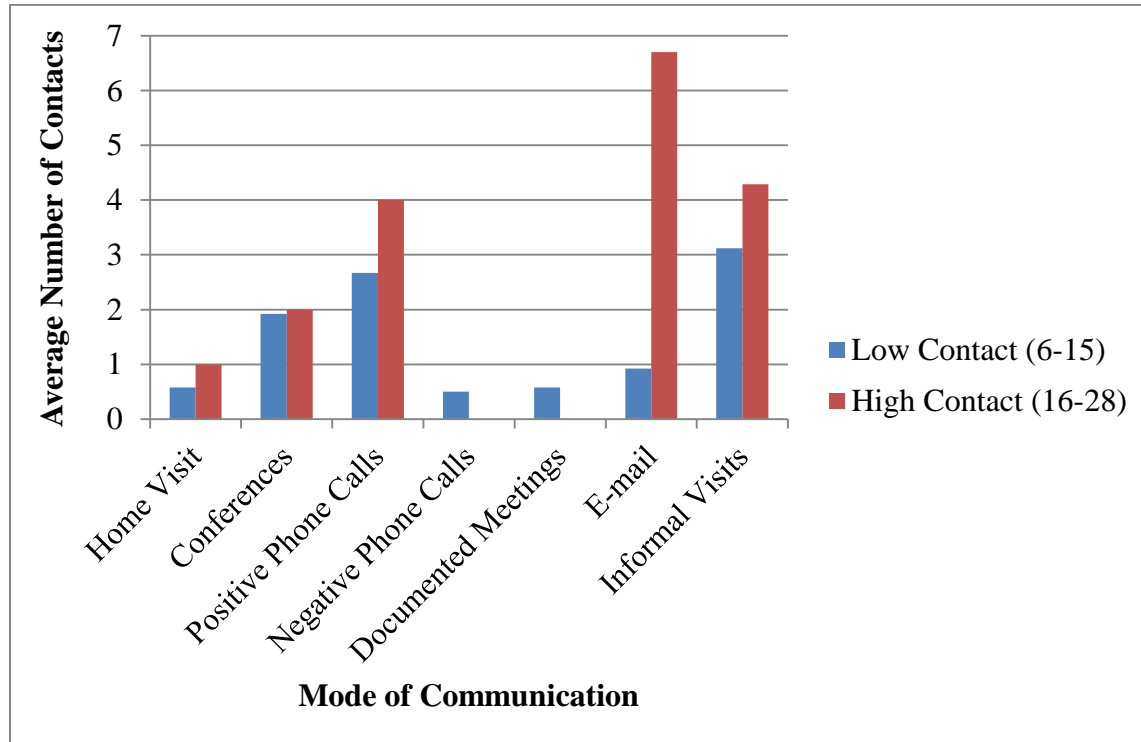


Figure 3. Low versus high contact frequency, ($N=19$).

The sample size for the Draw a Scientist Test was smaller than the total class size because four of my students receiving Special Education Services were pulled out of the classroom during nearly every science lesson.

In the DAST, the low incidence of negative images of scientists remained a constant 7% from pre to post treatment. Only one child on the Pre Treatment DAST and one child on the Post Treatment DAST drew a negative image of a scientist.

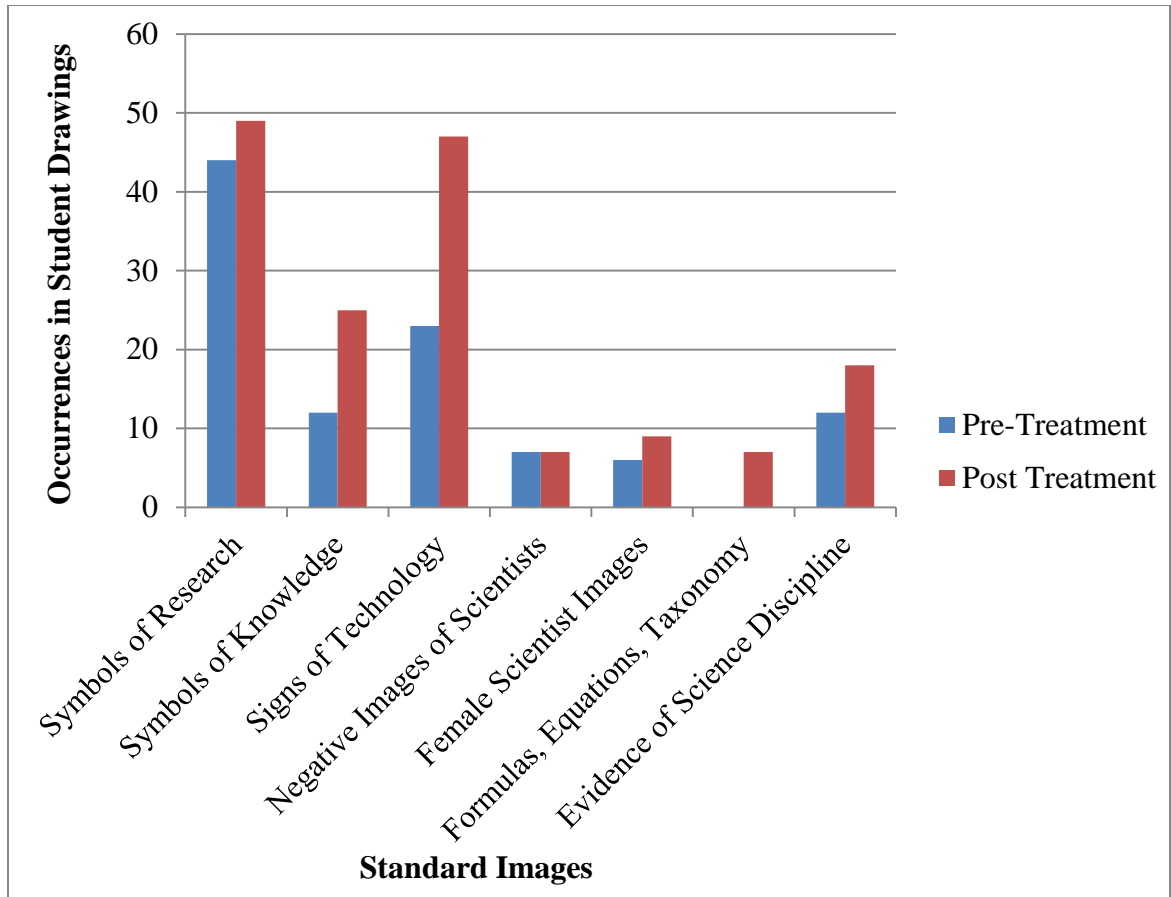


Figure 4. Draw a scientist test, (N=15).

One difference from pre-treatment to post-treatment on the DAST emerged in signs of technology and symbols of knowledge. On their first drawings, students received 19 points for items such as solutions in glassware and machines, with a few students featuring computers on their first drawings. In the Pre-Treatment Interview, one student stated, “Scientists work in labs and explode stuff sometimes.” On the post-treatment drawings, 27 points were noted for signs of technology, boosted largely by the students’ persistent images of machines, computers, and telescopes.

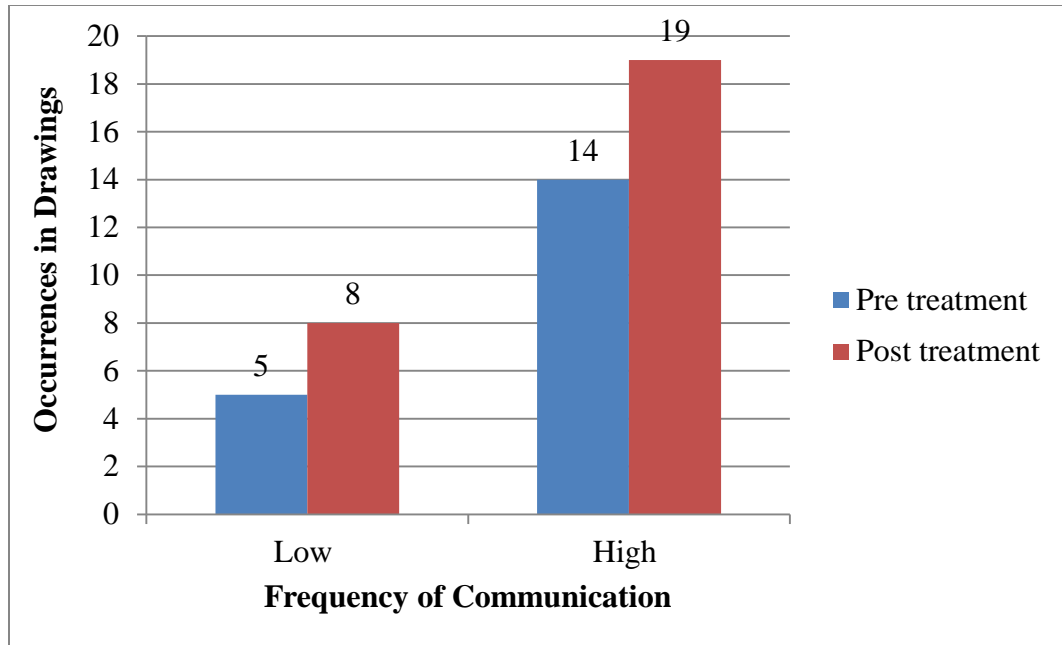


Figure 5. DAST signs of technology changes and communication frequency, ($N=15$).

Symbols of knowledge, such as books, filing cabinets, and bookshelves doubled from 10 to 20 examples. Students with higher school/family communication showed an increase of 8 occurrences, whereas those with lower levels of communication showed an increase of 2 occurrences in their DAST drawings.

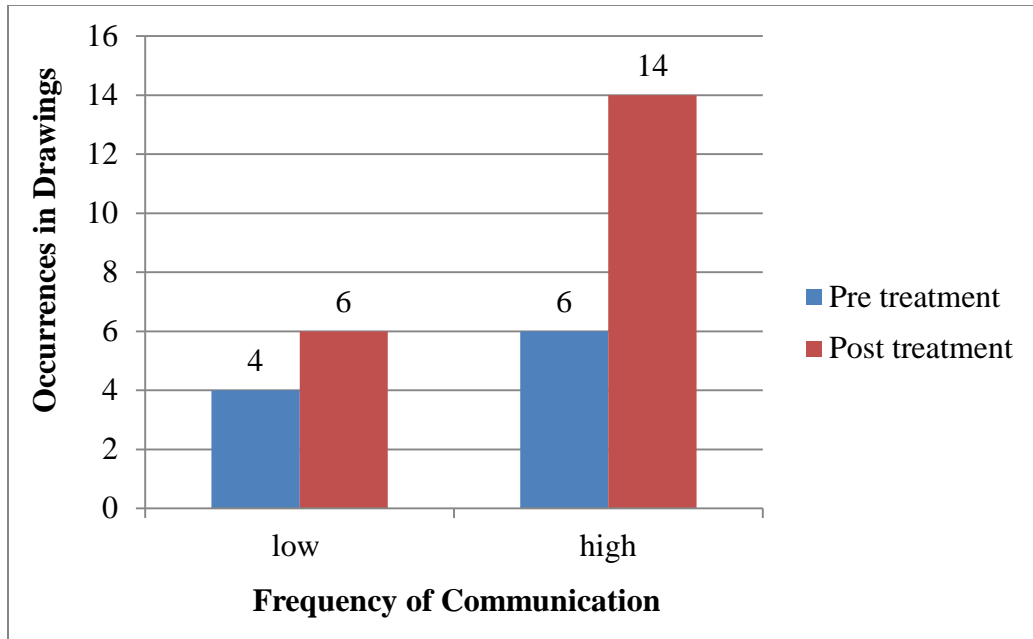


Figure 6. DAST symbols of knowledge changes and communication frequency, (N=15).



Figure 7. DAST pre and post treatment results for individual student.

This trend was also reflected in Post Treatment Student Interviews, with one student stating, “As I got older, I found that they (scientists) were people who studied space, and plants, and animals, and they studied humans I guess, and technology.”

In the pre-treatment TOSRA, three students disagreed that scientists are normal, but no students disagreed in the post treatment survey. Thirty-nine percent of students

showed an increase in their opinion of scientists as normal people, 46% showed no change, and 15% gave answers that showed less agreement with the idea that when meeting a scientist, they would probably look like anyone else. This 15% represents a single child in the low contact frequency group whose answer changed from *Agree to Uncertain*. Fifty three percent of students showed an increased preference for inquiry learning in science class on the TOSRA. Stated one student, “You don’t have to be a real scientist to like it and do, like, an investigation.” When asked what a real scientist is, she said, “When someone invents stuff, they test it out to see if it’s dangerous.”

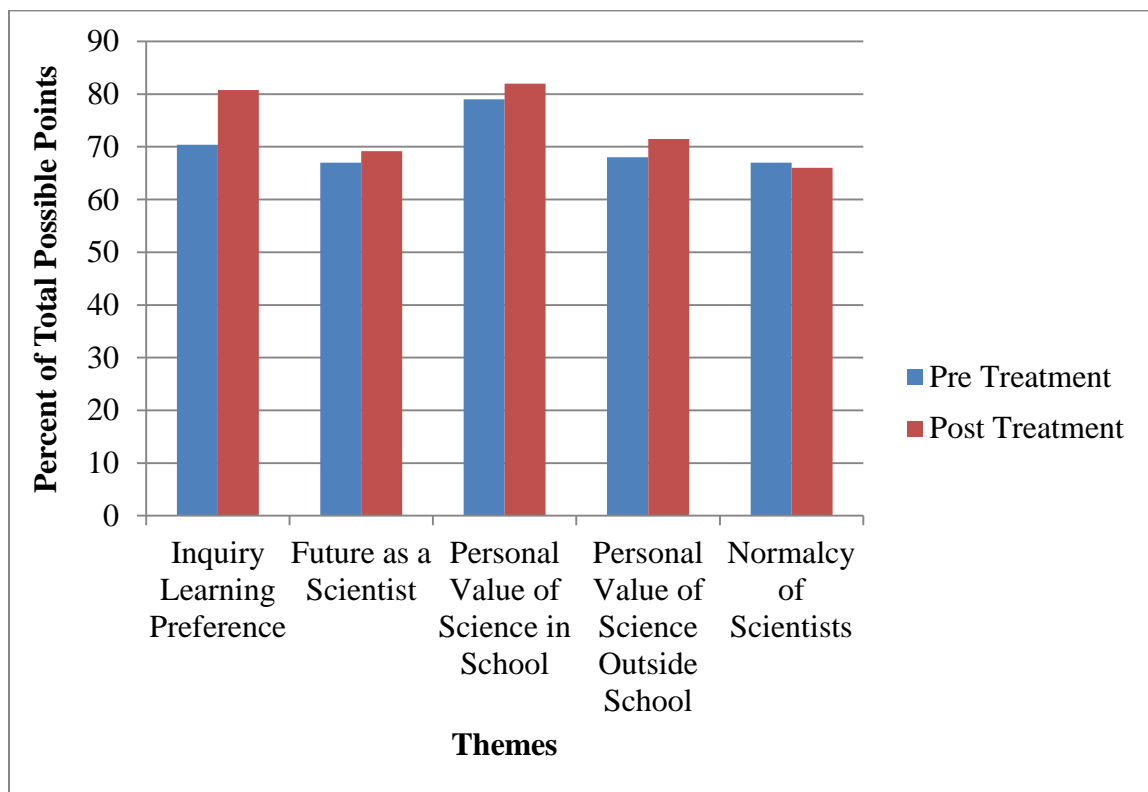


Figure 8. TOSRA scores, (N=15).

The Parent Survey also reflected an increase in student preference for inquiry learning. In response to questions on the TOSRA about their future as a scientist, 53% of students showed more positive responses in the post treatment survey. Average total scores on the

TOSRA increased 6 points for low frequency family communication and 9.94 points for students with high frequency family communication.

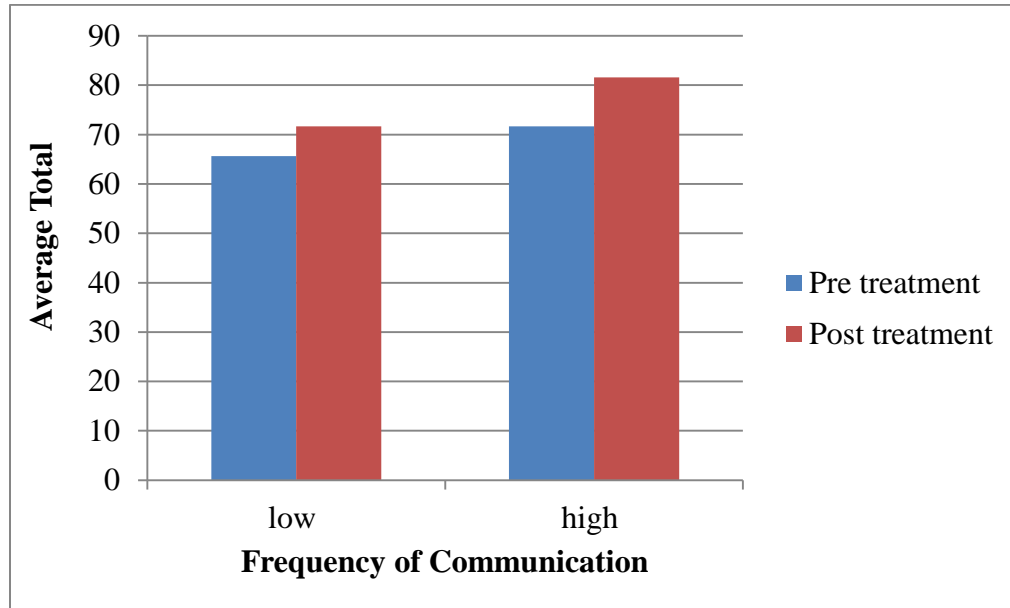


Figure 9. TOSRA scores as a function of communication frequency, (low $n=8$, high $n=7$).

Comparing student value of science between students with high frequency parent contact and those with lower parent contact, the students in the low contact group showed a decrease of 145 points, while the students in the high contact group had an increase of 25 total points.

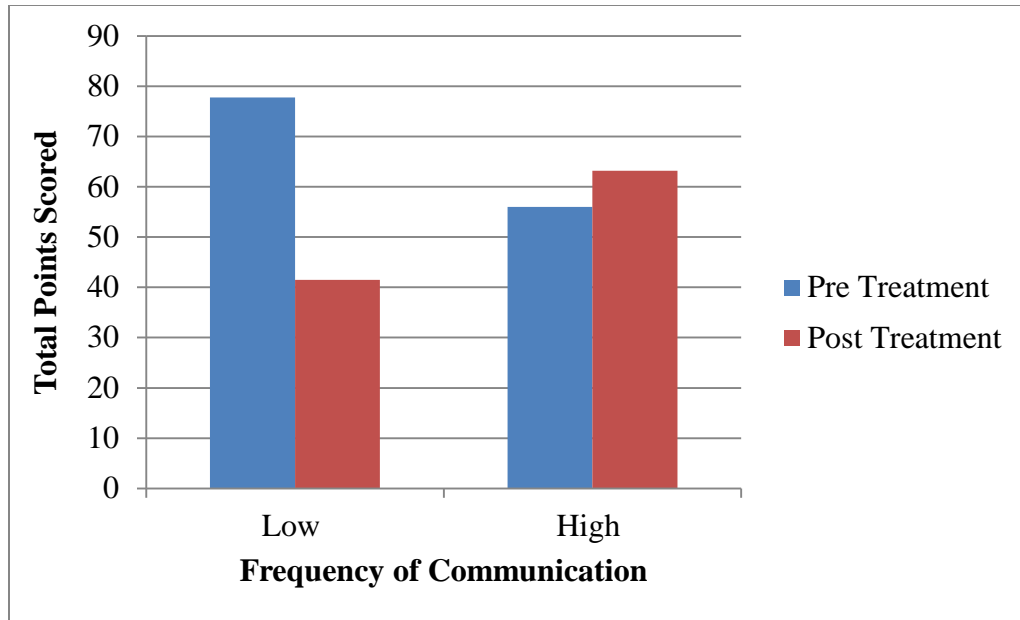


Figure 10. TOSRA value of science as a function of communication frequency, (low $n=8$, high $n=7$).

Student responses on the TOSRA showed an even split between the 47% who showed an increased value of science and 47% whose opinion of the importance of science decreased. It should be noted that no students responded in disagreement as to the value of science in the post treatment TOSRA, whereas eight students showed at least some disagreement in the pre-treatment TOSRA.

Students' grades stayed high throughout the treatment. Sixty three percent of students received an A in the first quarter, while 79% achieved an A in the third quarter. The change from first to third quarter Science Grade point average of 0.64 in a comparison class I also taught contrasted with a decrease of 0.375 in the lower contact group, and 0.125 for the higher contact group.

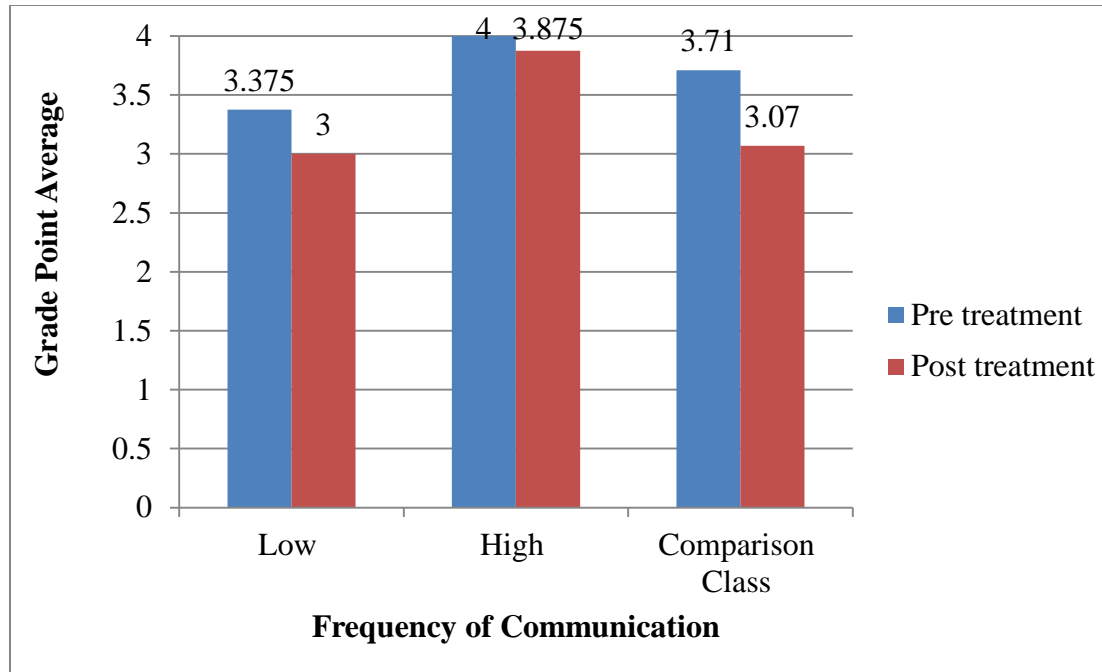


Figure 11. Science grade and communication frequency, (low $n=8$, high $n=8$, comparison class $n=18$).

Over the course of the treatment, student work in the science journals showed a steady increase in performance in all areas: attitude, homework completion, organization, illustrations, tables and graphs, and narratives. Comparing high to low communication, students with lower communication frequency showed an upward trend in Science journal performance from 18.85 total points to 20.6 points as opposed to high

communication frequency with a change from 19.8 to 27.6 total points.

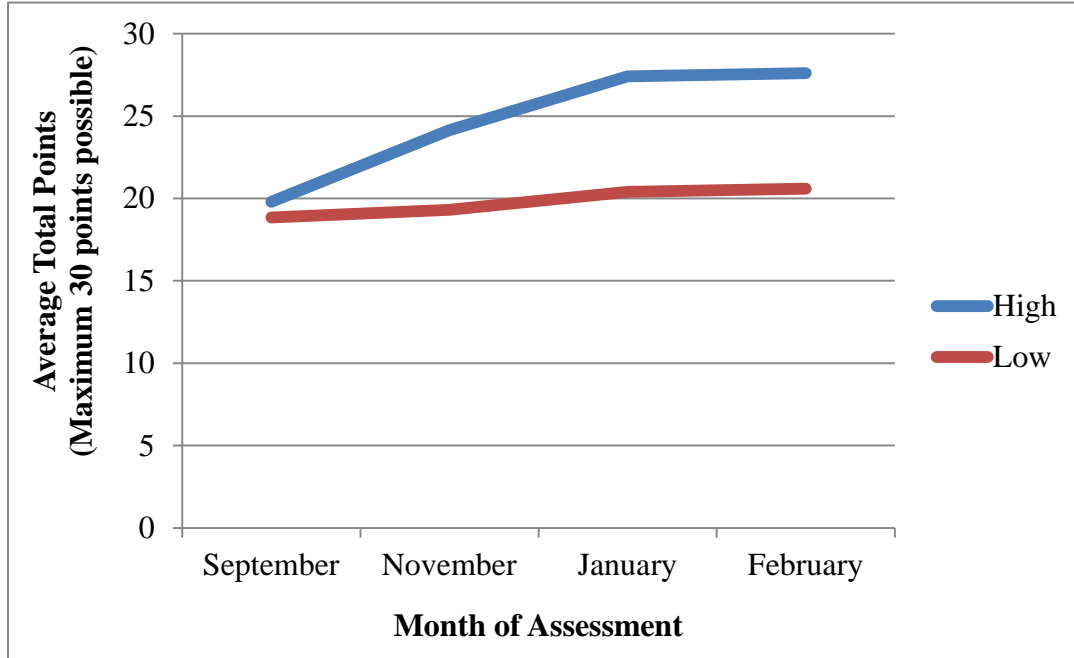


Figure 12. Student journal performance and communication frequency, ($N=15$).

In a journal note home, one student wrote, “Today, Mrs. Murphy started a fire in class. Not really! Jokes. But we learned about how friction can make smoke.” As the school year progressed, expectations of students were adapted to push their abilities. In December a new journal format was implemented. Student journals now included a referenced index, requirements for investigation questions and word banks, definitions and tables were being copied from the interactive white board. This increase in the structure of the science journal coincided with a decrease in scores for student attitudes, as well as a slight decrease in science grades across classes. One child said, “Science is really fun. I like doing the experiments, but I didn’t like writing all the things. It would be better if we didn’t do any writing.”

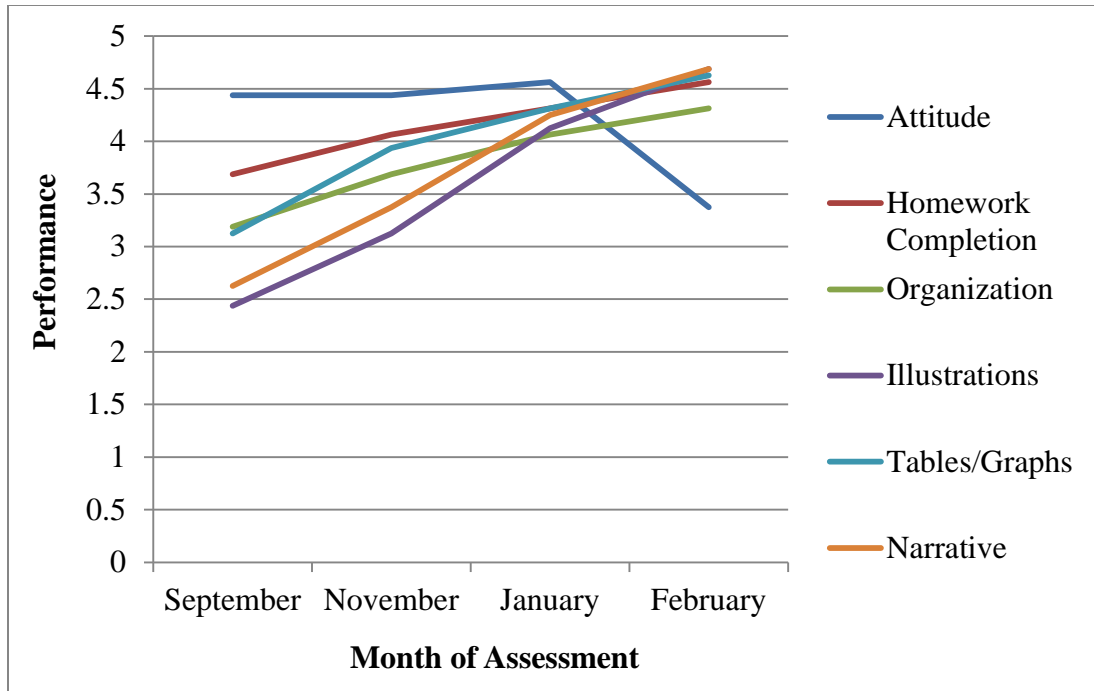


Figure 13. Student journal performance, ($N=15$). Note. 0= No Evidence, 5=Best Work.

The Parent Survey results started high and finished high. When asked about the effectiveness of family and school communication, parents initially responded 3.97 on the Likert scale in agreement. In the post-treatment survey, parents' responses averaged 4.28 in agreement. The PASS online grade book program had a parent participation rate of 20%. Close to the time of the first survey, midterm parent teacher conferences were held. This first quarter progress check had 89% attendance. By the third quarter midterm conference there was 100% attendance at the conferences, with 74% of students attending with their parents. This increase may not have been a direct result of the study. The average spring conference attendance is 90% or higher. No comparison data is available on student attendance. The highest initial thematic response on the Parent Survey was in the parents' perceptions of their student's success in school at 4.09 on a Likert scale. The post treatment Parent Survey showed a slight average increase in the parents' confidence about their student's success in school at 4.33. Across the study, parent attitudes showed

more change than student attitudes. Parents' opinions about the value of science increased from an average of 3.91 on a Likert scale to 4.07.

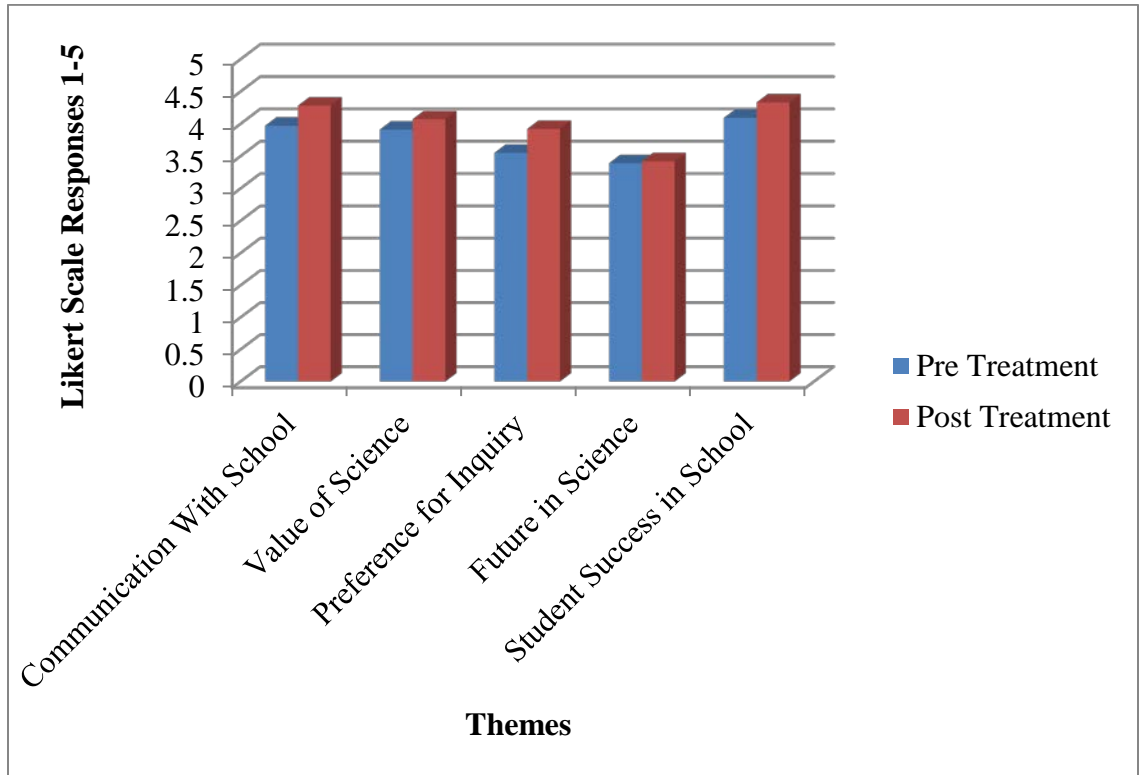


Figure 14. Parent survey, (N=11). Note. 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

At the end of third quarter, seven families attended a Family Science Night focusing on an engineering challenge and energy transformation experiences. Among families attending, 100% agreed on the parent survey that their child had potential for pursuing science in their adult life, compared to 50% of the class as a whole. The results of the Parent Contact Ledger showed a correlation between the frequency of communication and the likelihood of attendance at Family Science Night, although one

of the seven students fit into the Low Communication Frequency category.

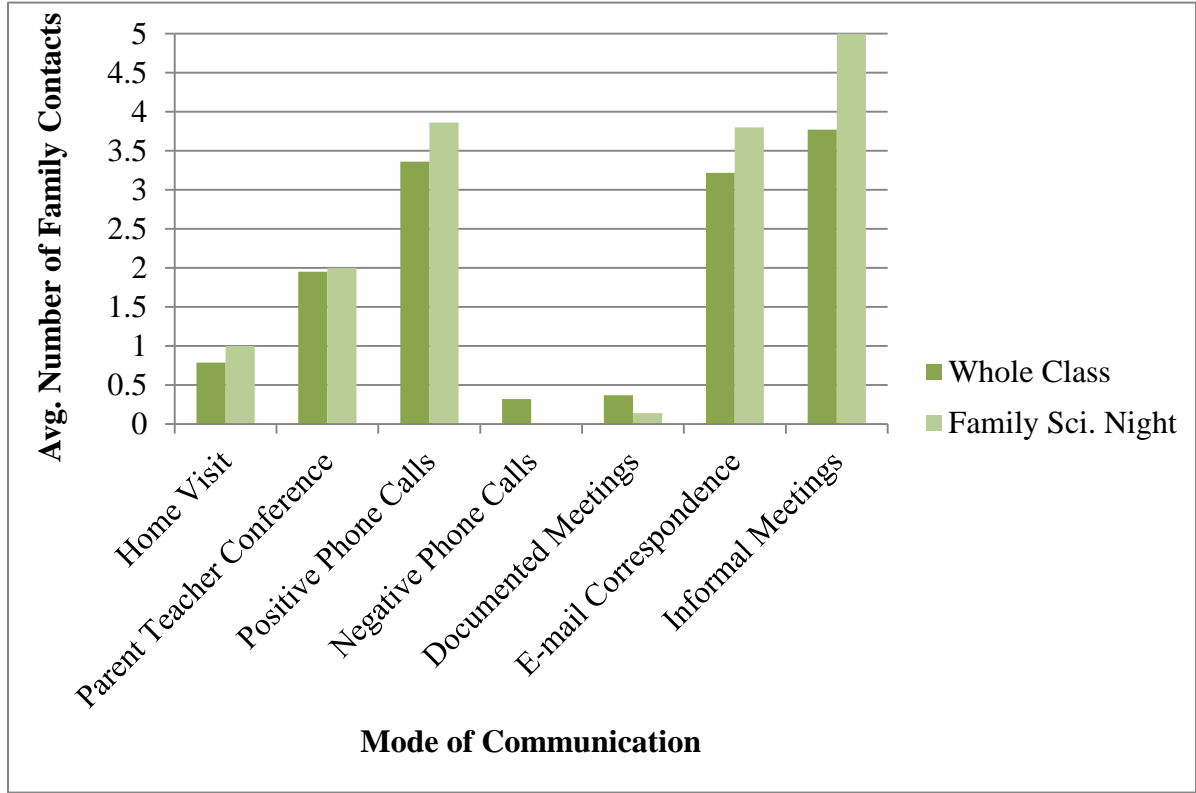


Figure 15. Correlation between contact frequency and family science night attendance (whole class $n=19$, family sci. night $n=7$).

INTERPRETATION AND CONCLUSION

This action research-based classroom project focused mainly on communication between parents and the teacher. When examining student changes in attitude and performance, and parent involvement, a pattern of connection emerged. When parents communicated more frequently with the school, student attitudes and performance showed a more positive trend than the results for students whose families were less frequently in contact.

On the Draw a Scientist Test, students showed marked changes in their understanding of scientist and their work. The drawings became much more specific in

relation to science discipline. I could really see their interest in physics and astronomy in the post treatment assessment. These drawings also contained significantly more signs of technology, like computers and telescopes. As in other assessments, communication frequency and positive change went hand-in-hand. Students whose families were in more frequent communication showed four times the increase compared to students whose families were in the low frequency communication group.

It's worth noting that student science attitudes were never negative to begin with. The initial Test of Science Related Attitudes showed 98% of students in agreement that science is valuable. Some of this enthusiasm might be explained by the unique variety of learners since 45% were receiving either Title One or Special Education services. Of the remaining students, 100% were enrolled in a reading class for bright and gifted readers.

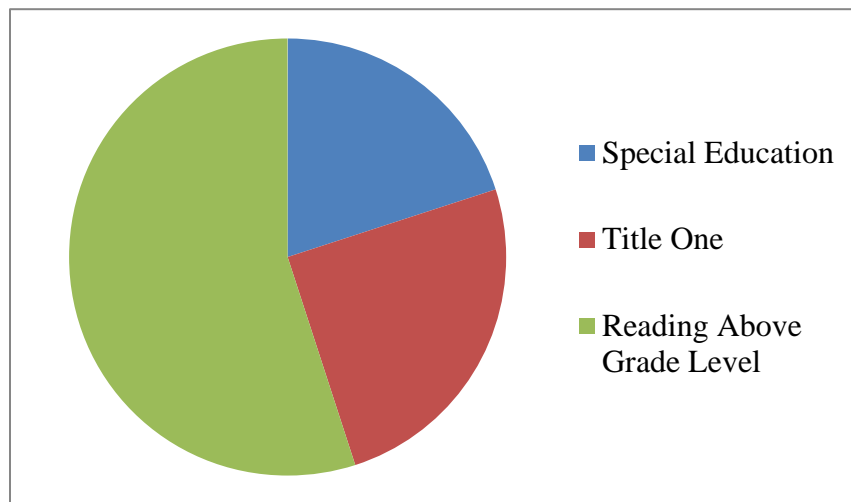


Figure 16. Students receiving academic intervention, ($N=20$).

Every student in the class received intervention specific to his or her exceptionality. This targeted learning environment across subject areas could explain, in part, that persistent continuity of positive attitudes on the TOSRA. The down side of this situation came in timing. For every intervention there must be time to execute it. Sadly, this often meant

missing science. The four students receiving Special education services missed at least part of science every day, and the four students in Title One missed at least one science class every week. When attitudes on the TOSRA did show a decrease, frustration over missing science class as a factor.

Student work and grades reflected an increasing ability to think and work in an inquiry learning environment in the science classroom. When families were in more frequent communication with the school, students maintained a higher level of performance throughout the study. At the beginning of the school year, most of each class was spent in hands-on lab work, with less time set aside for data recording or science notebook work. As the rigor of class increased, students who already missed class for Title One or Special Education were struggling more to keep up with their peers and the perceived change in work load. Combined with a fairly predictable third quarter grades slump, this frustration was reflected in their grades. It held especially true for those whose families communicated less often.

Because of the design of this study, and home visits that happened before the first day of school, a baseline of parent involvement could not be established. Later in the treatment there was a clear indication that parents who communicated more were more likely to attend Family Science Night. I had not anticipated that the wide range of communication frequency would be caused by the families themselves. This clear gap between the highest and lowest frequency of communication was generated not by my treatment, but by parents responding to the treatment's notes, calls, visits, and other outreach. Several parents also made the effort to initiate communication.

VALUE

The results of my study were not as remarkable as I had hoped. I had imagined that I'd have a room full of ten year olds just waiting to pursue careers in science because their parents believed in them, and I hoped to be a small part in that. This study structured a platform to help launch them in that direction. Where previously I used my instincts and intuition to make decisions about communication and curriculum, I have been able to examine my practices and efforts in an objective, data driven setting.

Changes in student attitudes and performance were subtle and consistent. But how can I know that these changes occurred because of this treatment as opposed to being the result of the way I teach science? Would those parents in the high frequency contact group have provided more support for their student's success without the treatment? Baseline data in the Parent Survey was likely to have been influenced by the teacher home visit which occurred before the first day of school. If I were to redesign the study, I might begin by keeping data on a control class. One class, my homeroom, has a lot of energy devoted to family communication, and I could gather data from the other class where their primary communication comes from another teacher.

Since parent attitudes showed a greater change than student attitudes, maybe an increased focus on student communication would be beneficial. Using student science journals as a place for academic one-on-one dialogue and individual conferencing might cause greater change in the students than the change reflected after the focus on family communication.

Previous research showed that students need support from school and from home to make decisions about the future (Lee & Bowen, 2006). The data from my study did not show that my efforts at building a culture of communication between families and school created a huge shift. What did happen was remarkable just the same. Families got to know what happens in their students' lives a little more, students were involved in science in a way they may not have been before, and there are two Frenchtown fourth graders who want to pursue science as a future. Someday, when I need a good veterinarian for my ailing livestock, or I am reading an article about astrophysics, I fully expect to see familiar names come up in my searches.

Students at this age have so much enthusiasm and optimism. I have to believe that any efforts made toward helping them to see a future with many opportunities greater than a closed paper mill are worthy tasks. Prior to embarking on this process, I made a point to stay in touch with my classroom families as much as I could. Because of this action research based intervention, I found out that creating a system that is structured, and reflecting frequently on the results of my efforts can guide me in adapting my approach to both curriculum and communication. The parents and students in my classroom now have a much clearer picture of what is happening in our classroom, and I have a data supported system that will guide my efforts to strengthen bonds between my students and my school. I'll see more of those opportunities in the future because of my work with this action-research based classroom intervention. My fourth grade families have been exposed to science in new ways that I had never tried before. They had the chance to engage in what could be a foundation for science studies beyond high school. Maybe these families and their students will be just a little more aware of the world

around them, more willing to see innovation and exploration as the stuff of science, the stuff of possibility. Since I first set foot in my own classroom, it has been my highest goal to help students see themselves differently; see themselves as constantly changing and growing. I am so glad I've had that chance myself, to transform my approach to communication with my classroom families, and to see a transformation in myself.

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APPENDICES

APPENDIX A

ADAPTED TEST OF SCIENCE RELATED ATTITUDES

Appendix A

NAME: _____

Test of Science Related Attitudes (TOSRA)
(Fraser, 1981)

Directions:

This test contains a number of statements about science. You will be asked what you think about these statements. There are no “right” or “wrong” answers. Your opinion is what is wanted.

For each statement, draw a circle around the specific numeric value corresponding to how you feel about each statement. Please circle only ONE value per statement.

- 5 = Strongly Agree (SA)
 4 = Agree (A)
 3 = Uncertain (U)
 2 = Disagree (D)
 1 = Strongly Disagree (SD)

Statement	SA	A	U	D	SD
1. I would prefer to find out why something happens by doing an experiment than by being told.	5	4	3	2	1
2. Science lessons are fun.	5	4	3	2	1
3. I would like to belong to a science club.	5	4	3	2	1
4. When I leave school, I would like to work with people who make discoveries in science.	5	4	3	2	1
5. I would prefer to do experiments rather than to read about them.	5	4	3	2	1
6. School should have more science lessons each week.	5	4	3	2	1
7. I would like to be given a science book or a piece of science equipment as a present.	5	4	3	2	1
8. Working in a science laboratory would be interesting.	5	4	3	2	1
9. I would prefer to do my own experiments than to find out information from a teacher.	5	4	3	2	1
10. Science is one of the most interesting school subjects.	5	4	3	2	1
11. I would like to do science experiments at home.	5	4	3	2	1
12. I would like to teach science when I leave school.	5	4	3	2	1

Statement	SA	A	U	D	SD
13. I would rather solve a problem by doing and experiment than be told the answer.	5	4	3	2	1
14. I really enjoy going to science lessons.	5	4	3	2	1
15. A job as a scientist would be interesting.	5	4	3	2	1
16. I would prefer to do an experiment on a topic than to read about it in science magazines.	5	4	3	2	1
17. I look forward to science lessons.	5	4	3	2	1
18. I would enjoy visiting a science museum on the weekend.	5	4	3	2	1
19. I would like to be a scientist when I leave school.	5	4	3	2	1
20. If you met a scientist, he/she would probably look like anyone else you might meet.	5	4	3	2	1

APPENDIX B

DRAW A SCIENTIST TEST EVALUATION

Appendix B

<u>Draw-A-Scientist Test</u>			
Standard Images	No Indication (0)	Some Indication (1)	Great Indication (2)
Lab Coat			
Eyeglasses or Goggles			
Facial Hair			
<u>Symbols of Research</u>			
test tubes			
flasks			
microscope			
Bunsen burner			
experimental animals			
other			
<u>Symbols of Knowledge</u>			
books			
filing cabinets			
other			
<u>Signs of Technology (Products of Science)</u>			
solutions in glassware			
machines			
other			

Captions (formula, equations, taxonomy)			
Male			
Signs/Labeling			
Pencils/pens in pocket			
Unkempt Appearance			
Alternative Images	No Indication	Some Indication	Great Indication
Sinister (mad scientist, violence, etc)			
Eccentric appearance (nerd)			
Neutral			
Positive (smiles, positive captions)			
Female			
Science Discipline		Total	

<http://www.jdenuno.com/Resume%20Web/DAST.htm#SCORE>

APPENDIX C

FORMAL STUDENT INTERVIEW QUESTIONS

Appendix C

Formal Student Interview Questions

1. What do you think about Fourth Grade so far? Tell me a little about how it is different from your other grades.
2. Tell me some things you are curious about. They don't have to be school related.
3. What are some of your thoughts about science and scientists? How have they changed over time?
4. Do you think you might want to study science as an adult?
5. What has your experience of science been like in school so far?
6. How much time do you spend learning about science and topics related to science outside of school?
7. How much do you and your family talk about science and science related topics?
8. What other thoughts do you have about science?

APPENDIX D

PARENT SURVEY

NAME: _____
Parent Survey

- 5 = Strongly Agree (SA)
 4 = Agree (A)
 3 = Uncertain (U)
 2 = Disagree (D)
 1 = Strongly Disagree (SD)

Statement	SA	A	U	D	SD
1. My student is successful at school.	5	4	3	2	1
2. The school stays in close contact with me about my student.	5	4	3	2	1
3. It is easy to contact my child's teacher when I have questions.	5	4	3	2	1
4. I am kept informed of what my child is learning.	5	4	3	2	1
5. My child enjoys school.	5	4	3	2	1
6. My child would prefer to find out why something happens by doing an experiment than by being told.	5	4	3	2	1
7. My child enjoys watching science programs on TV at home.	5	4	3	2	1
8. When my child leaves school, he/she would probably like to work with people who make discoveries in science.	5	4	3	2	1
9. My child is curious about the world in which we live.	5	4	3	2	1
10. School should have more science lessons each week.	5	4	3	2	1
11. My child would like to be given a science book or a piece of science equipment as a present.	5	4	3	2	1
12. My child would like a job in a science laboratory after leaving school.	5	4	3	2	1
13. My child would like to do science experiments at home.	5	4	3	2	1
14. My child looks forward to science lessons.	5	4	3	2	1
15. My child would enjoy visiting a science museum on the weekend.	5	4	3	2	1
16. It is better to be told scientific facts than to find them out from experiments.	5	4	3	2	1

APPENDIX E

JOURNAL RUBRIC

Appendix E
Journal Rubric

	Attitud e	Homewor k Completed	Organizatio n	Illustratio n	Tables/Graph s	Narrativ e
Layne						
Luc						
Uliah						
Vivian						
Libby						
Frannie						
Marissa						
Chase						
Isaac						
Madison						
Dawson						
Jesse						
Kaiden						
Annie						
Wiley						
Kiera						

- 5 = Exceeded Expectations
 4 = Met all Expectations
 3 = Partially Completed Requirements
 2 = Some Work Begun
 1 = No Evidence

APPENDIX F

FAMILY CONTACT LEDGER

Family Contact Ledger

Student Name	Parent Names	Phone	Parent e-mail	Pos/Neg	Pos/Neg	Pos/Neg	Pos/Neg
1		626-1111	Parent@email.com				
2		626-1111	Parent@email.com				
3		626-1111	Parent@email.com				
4		626-1111	Parent@email.com				
5		626-1111	Parent@email.com				
6		626-1111	Parent@email.com				
7		626-1111	Parent@email.com				
8		626-1111	Parent@email.com				
9		626-1111	Parent@email.com				
10		626-1111	Parent@email.com				
11		626-1111	Parent@email.com				
12		626-1111	Parent@email.com				
13		626-1111	Parent@email.com				
14		626-1111	Parent@email.com				
15		626-1111	Parent@email.com				
16		626-1111	Parent@email.com				
17		626-1111	Parent@email.com				
18		626-1111	Parent@email.com				
19		626-1111	Parent@email.com				

APPENDIX G

STUDENT JOURNAL PROMPTS

Student Journal Reflective Questions

What was the most important science idea you learned from this investigation?

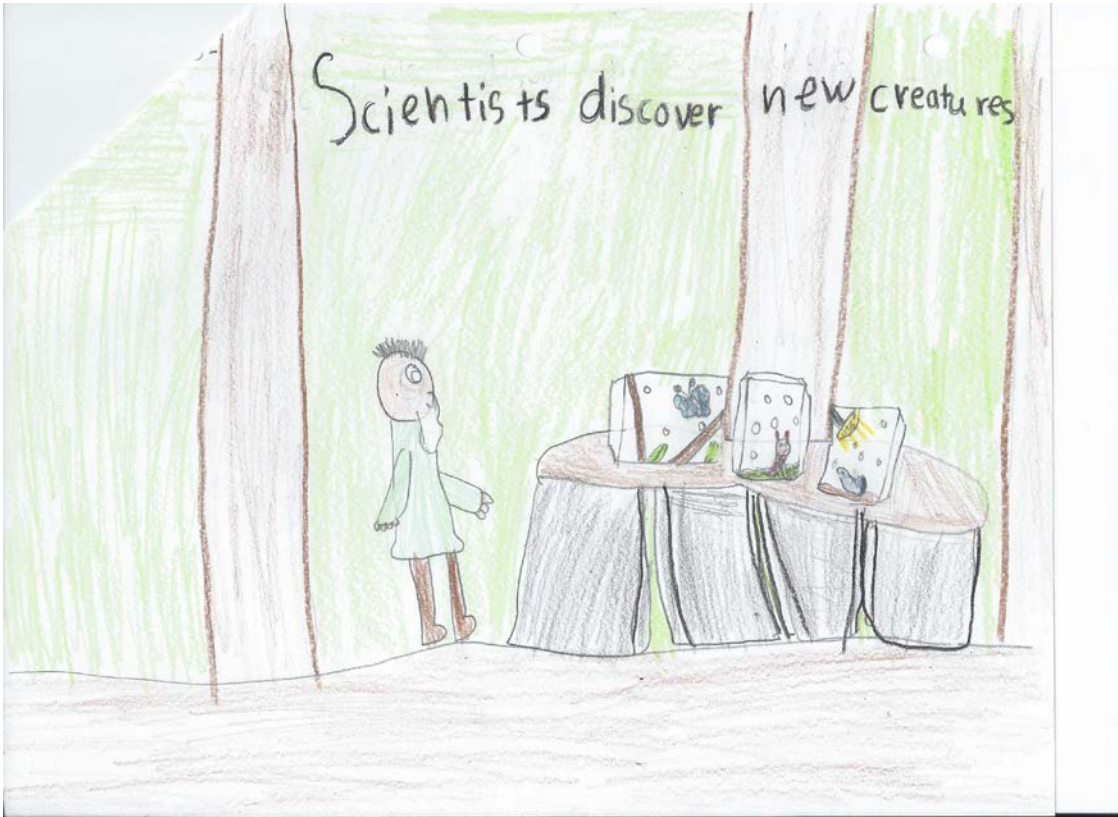
Describe how this knowledge might be useful to you outside our classroom.

What questions do you have for Mrs. Murphy about what we worked on today?

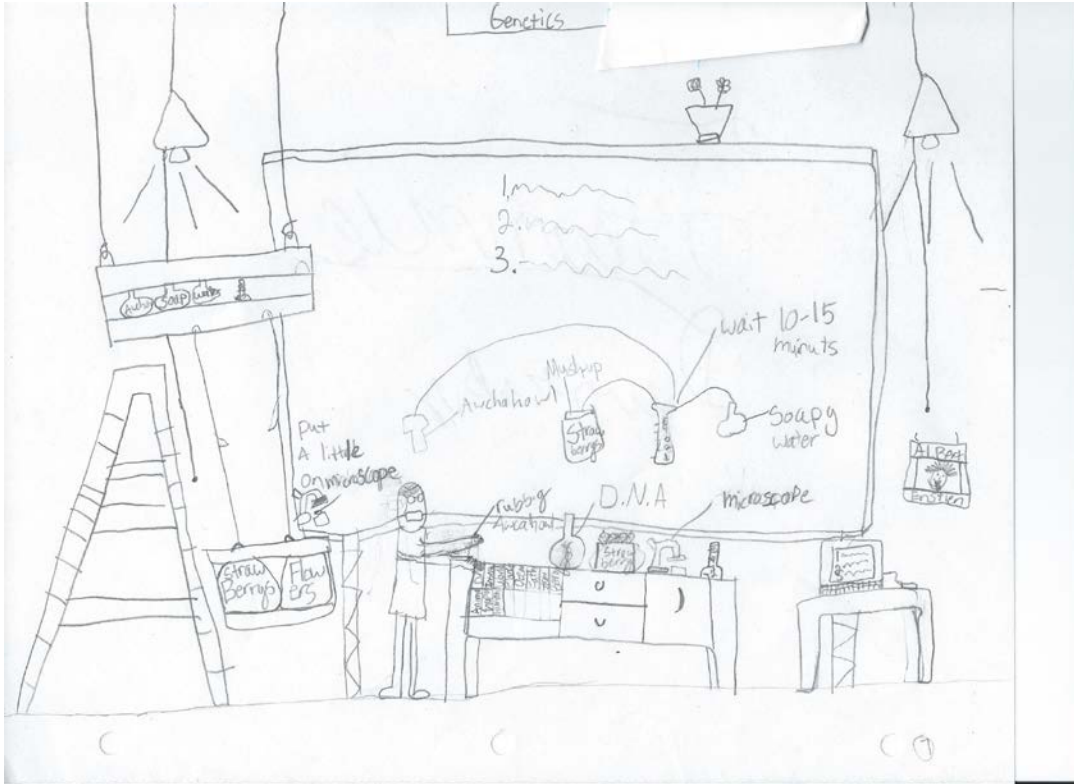
APPENDIX H

PRE AND POST-TREATMENT DRAW A SCIENTIST TESTS
STUDENT NUMBER 4

Pre-Treatment Draw A Scientist Test Student Number 4



Post Treatment Draw A Scientist Test Student Number 4



APPENDIX I

BEGINNING OF SCHOOL HOME VISIT LETTER

Beginning of School Home Visit Letter

August 22, 2011

Welcome to 4M!

My name is Mrs. Murphy and I am soooo lucky to have you in our class! I hope you have had a SMASHING summer and you are rested, relaxed, and ready to rev-up for your greatest school year EVER.

Maybe you'd like to know some fascinating Mrs. M. trivia. I was born in Washington and lived in sixteen different homes before I was twenty years old. I camped nearly every weekend this summer. I am the oldest kid in my family. I love to learn so much that I am back in school as a student right now. At home I have one husband, two sons, one turtle, and two parakeets. I don't like cantaloupe. I am a very good listener and my smile takes-up my whole face. I have a huge heart.

There are so many things I want to know about YOU! What are you most looking forward to about fourth grade? What is one thing you would like to see your first day of school? What keeps you busy? What makes you grin? Do you laugh as loudly as I do? (I forgot to tell you. I am a LOUD laugher.) I NEED the answers to these important questions about you. And I want to meet you and your family. I will be giving you a phone call very soon to invite myself to your front porch! I know it sounds crazy but I just can't wait so long to meet you. Hopefully my goofy schedule will fit for your family and I can come to your house for a few minutes one day before school starts. You and your family are really important to me and to our school.

Fourth grade is going to be awesome! We do a lot of Science. Math rocks. We'll read some unforgettable books. You get to choose your seats at lunch. You will learn a ton about our Montana Tribes and people. All the fourth grade teachers are *amazing*. And **WE HAVE THE MOST FANTASTIC CLASS ON THE PLANET!!!!**

Have fun these next two weeks. I am really looking forward to meeting you and beginning a terrific year of hard work and great fun.

Sincerely,

p.s. I get lost easily, so please give me VERY good directions to your house? Please? (I would very much like to make it home to my family!)