Bridging the Gap in Science for Latino Students
"BIG Sci Project"

Subject/Problem

Researchers and practitioners interested in improving the teaching and learning of science at the elementary level often face stiff competition with those in the reading and mathematics curricular areas.[i] Student achievement in science is even more crucial now since many of these students could be held accountable to the standard graduation plan known as the*"4 x 4 high school graduation plan"* for Texas public education system.[ii]

In Texas, as in many other states, science is only tested once at the elementary level (Grade 5) while reading and mathematics are tested every year starting with 3rd rade. As a result, finding time or money for professional development in elementary science can be a challenge.[iii] Furthermore for Texas, the situation is additionally handicapped due to the lack of science curricular materials and teacher resources written in Spanish at the elementary levels.

The Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching (TRC)[iv] provides professional development for PreK-12 grade Texas science and mathematics teachers. This research study was conducted by the TRC with funding from in the Texas Higher Education Coordinating Board.

The *BIG Sci Project* compared the potential efficacy of two models of school-wide professional development in elementary science using a geosciences professional development programs and curriculum that focused on conceptual change across grades 2-5. The six campuses in this study had 99% Hispanic student population with a many from Spanish-language only homes. Few of the campuses had previously achieved the minimal passing level 2200, the scaled score required for the state-mandated 5th grade science standardized test.

The participating district was located less than 10 miles from the Texas/Mexico border. The majority of students traveled frequently to Mexico due to family and or businesses located across the Texas/Mexico border. A small number of students still lived in Mexico and daily crossed the Rio Grande River to attend school in the United States. Resources and materials for teaching elementary science in the district were extremely limited with nothing available in Spanish. Three weeks prior to the start of this research study, the elementary science coordinator was moved from her position as a high school reading coordinator to this administrative position for which she had no background, experience, or training as an elementary science educator.

The goal of the *Bridging the Gap in Science for Latino Students,* or *BIG Sci Project* was to:

a) determine if the professional development delivery model differentially impacts Hispanic student achievement in elementary science,

b) determine if the professional development delivery model differentially impacts teacher practice in elementary science for Hispanic students.

Design

This research study examined Hispanic student achievement and teacher practice[v] of two groups of 5th grade students from six elementary campuses in one low-socio-economic and majority Hispanic school district along the Texas/Mexico border.[vi] Campuses were randomly assigned to one of two cohorts.

The study compared two professional development (PD) delivery models. The same pedagogical instruction program, the Dynamic Professional Development System[vii] and the 5E Instructional Model[viii] were demonstrated and taught to both cohorts.

The goal of the *BIG Sci* research study was to understand and practice effective strategies for teaching the concepts required at their grade level and to understand the relationship and connections between the grades. The core group of teacher leaders intensively trained in **Cohort A: Experimental Schools (CA:Exp)** were expected to provide mentoring, support, training, and assistance *in situ* to their colleagues within their school. In short, these teachers would be resource agents for others teachers in their respective schools.[ix] **Cohort B: Control Schools (CB:Ctrl)** teachers for Grades 2 through 5 received training simultaneously.

CA:Exp attended a sustained, 4-day intense training with TRC resource support and individual teacher classroom materials to support the development of a critical mass of teachers. **CB:Ctrl** attended a typical school district style of professional development that consisted of one and a half-day training with minimal resources, follow-up, and limited shared classroom material resources.

Procedure

Researchers worked with district leaders to randomly assign the 6 elementary campuses to the experimental and control groups. Originally, 80 teachers and 6 principals representing six elementary schools were contacted by the local regional collaborative and the school district elementary science administration. An initial meeting was scheduled by the district for everyone to attend in the late fall semester during a prescheduled district in-service. During the morning session, the 57 teachers from the six campuses received information regarding the research program and an overview of the resources and materials that each campus would receive during the study. Other teachers did not attend due to two other professional development in-service trainings the district had also scheduled. One principal from **CB:Ctrl** attended the PD sessions with her campus teachers. Teachers from **CA:Exp** campuses left at noon while the **CB:Ctrl** teachers remained for the first portion of their professional development training experience. All participating teachers signed an Informed Consent Form (Appendix A).

***Cohort A: Experimental Schools* (CA:Exp)**

CA:Exp consisted of all Grade 5 teachers from the three campuses and one representative from each grade 2-4 for a total of 30 teachers. These teachers attended 4-days of professional development training over a 2-week period in January 2008. The training addressed inquiry lessons for both the nature of science and science content correlated to Texas state standards and the state elementary standardized science test (TAKS). **CA:Exp** professional development included a variety of grade-level activities in Grades 2-5 with an emphasis on the GeoSciences[x] curriculum. Training focused on the importance of vertical alignment between science concepts presented for each grade level along with the overall concept development structure across Grades 2-5. **CA:Exp** campuses included classrooms that were departmentalized for instruction (e.g. Science teachers, Math teachers, etc.), self-contained classrooms (e.g. all subjects taught by same teacher), and one campus had a Science Specialist who taught in all science lab for Grades 3 to 5.

The last day of training, each attending teacher was provided a large plastic storage box containing all of the science materials and resources necessary to conduct all lessons for the grade level contained in the geoscience curriculum. These materials included the geoscience curriculum notebook, science equipment, consumable and non-consumable materials, recommended grade-level reading books, additional Spanish-language curricular materials and resources, and a multitude of science content rich web-sites. Additionally, each campus was provided one additional box of materials for each grade level 2-4. The cost for each resource box was approximately $1,200 per grade level.

***Cohort B: Control Schools* (CB:Ctrl)**

CB:Ctrl professional development training reflected the style that frequently occurs within school districts.[xi] **CB:Ctrl** included all content area Grade 2-5 teachers from the three assigned campuses. All **CB:Ctrl** campuses were self-contained classrooms where one teacher taught all disciplines. None of these campuses had a science lab room or a Science specialist.

These teachers received one-day of training for the same geosciences curriculum and lessons within a two-grade band rather than vertical alignment across all four grade levels. Teachers from Grades 4 and 5 were grouped together as were teachers from Grades 2 and 3. Each campus was provided one plastic storage box per grade level 2-5 containing basic resources and materials. Each resource box included a copy of the geoscience curriculum notebook, science equipment, consumable and non-consumable materials and recommended grade-level reading books. The approximate cost of these resource boxes was $1,000 per grade level. None of the **CB:Ctrl** teachers received individual resource boxes or any additional science Spanish-language curriculum or web-site information.

Dynamic Professional Development System

Addressing pedagogy and rigor through science and mathematics professional development has a direct, positive influence on accountability. The TRC perceives its professional development work as part of a very dynamic system.[xii] This has been conceptualized through the Dynamic Professional Development System (DPDS). The DPDS model has received much recognition throughout the 17-year history as the basis of the TRC statewide program. Figure 1 illustrates the various components of the system: the professional development program, facilitator, and teacher - intersecting at the student level. The TRC network is cognizant and sensitive to regional and statewide social, political, and economic forces that may impact one or all parts of the system.[xiii]

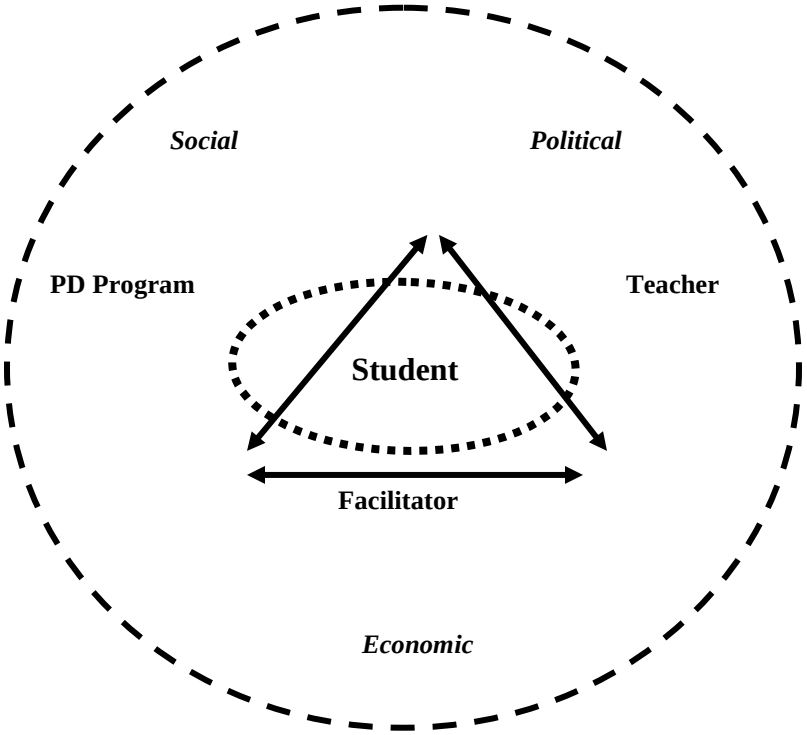
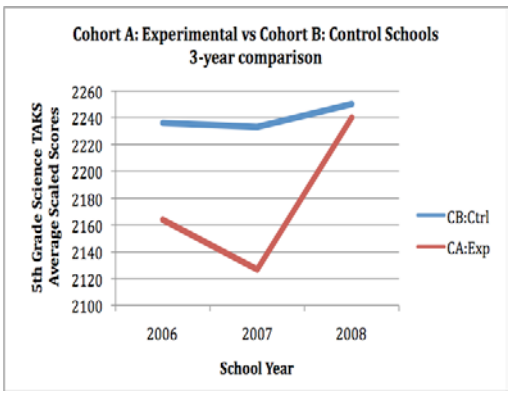


Figure 1. Dynamic Professional Development System.

Findings and Analysis

Researchers analyzed and compared the Texas Assessment of Knowledge and Skills (TAKS) 5th Grade Science scores for the 2007-08 school year at the student level for the two cohorts. The TAKS 5th Grade Science scores for years 2006 through 2008 were collected for all six campuses.



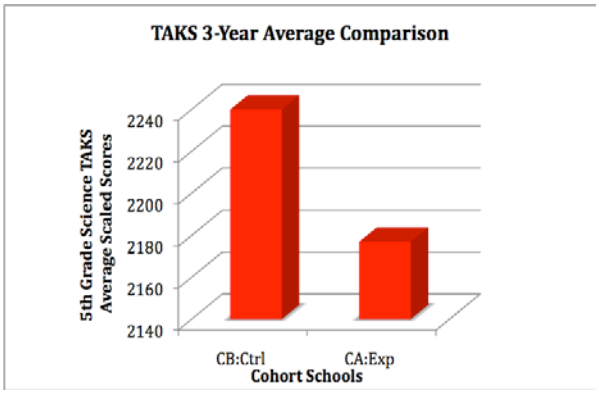


Table 1. TAKS Fifth Grade Science, Averaged Scaled Scores. English Version

Closer examination from the TAKS data alone, it was obvious that the **Cohort B: Control Campuses** (**CB:Ctrl**) started from a higher, 3-year average (Avg = 2240) than the **Cohort A: Experimental Campuses (CA:Exp)**, 3-year average (Avg = 2177). Even though the campuses were randomly assigned to a cohort for this study, there were differences in student achievement. The English version of TAKS was used because the test scores for the Spanish version were inconsistent and looked at a very small number of students (i.e. from zero to 13 each year).

The majority of student on all six campuses were proficient in English and were tested with the English versions of TAKS. The remainder of this document is based on the 5th Grade Science TAKS – English Version. See Appendix A for details regarding the Spanish Version of TAKS.

The district elementary science coordinator developed an elementary science web site for communication with all elementary teachers regarding materials, *'best practices'*, and various TAKS teaching resources. Throughout the school year during the study, she reported that elementary science teachers throughout the district used this web site extensively across the district.

Student Data

The school district provided masked, student-level 5th grade Science TAKS scores per campus. It was impossible to determine to which classroom teacher each student was assigned since not every teacher from all campuses attended the assigned Cohort training.

CA:Exp schools consisted of 209 fifth grade students with 16, 5th grade teachers and 19 teachers from grades 2 to 4 (N=35). Twelve students from the three campuses did not take the TAKS 5th Grade Science test in May 2008. The mean TAKS score was 2185 with a standard deviation of 2.46. The student-to-teacher ratio was 14 students per teacher. At one **Cohort A** campus, 1 teacher served as the "Science Lab Coordinator" and taught all of the 3rd, 4th, and 5th grade students in science lab while the classroom teachers focused on teaching science concepts.

During the 4-days of PD training anecdotal documentation for the teachers' journals were collected for qualitative analysis and direct feedback from the research team. The teachers were instructed to use their journals for reflective writing about the various strategies and science concepts presented and demonstrate how to incorporate student writing within the science curriculum. Fewer than 15% of the teacher journals showed any reflective writing. This task appeared to be difficult for the teachers to accomplish in the time allotted during PD training. Yet, during the final 2-day PD session, science journaling in their classrooms was one activity with more than 80% of the teachers reported that they started teaching to their students and were seeing high interest and motivation for writing in the classroom. 95% of the teachers reported on a science laboratory - classroom management technique they learned that had 100% success with their students. This cooperative learning and shared responsibility surprised many of the teachers by the students' reaction to this new process and the teachers reported that they saw an immediate, positive sense of personal interest and motivation for learning among their students that they had never experienced in prior years of teaching. The final 2-day PD sessions were equally engaging for the teachers learning and at the end of the training all of the teachers were requesting more PD presentations from the TRC.

CB:Ctrl consisted of 170 fifth grade students with 6 5th Grade teachers and 5 teachers from 2nd, 3rd, and 4th (N=11) who attended the 1-day professional development training. Not all of the 5th Grade teachers from each school attended training. The student-to-teacher ratio was 15 students per teacher on these campuses. Twenty-one students total from all three campuses did not take the English version of the TAKS 5th Grade Science test in May 2008. The mean TAKS scale score was 2237 with a standard deviation of 8.6. None of **Cohort B** schools had any teacher who served as a "Science Lab Coordinator." Additionally, 5 teachers from grades 2-4 and one campus administrator attended the 1-day professional development training with the 5th Grade teachers attending from her school. This was the only campus administrator who attended any of the PD sessions from all 6 campuses.

Demographic Information Comparisons

Individual data for comparison regarding Title 1 and Hispanic students showed improvements for **CA:Exp** Schools #1 and #3 (1.26% and 1.33% respectfully) while **CA: Exp** School #2 declined -5.0%. Within **CB:Ctrl** campuses, the Title 1 and Hispanic students demonstrated some improvement for Schools #2 and #3 (2.01% and 2.64% respectfully) while School #1 declined -0.3%.

Individual data for comparison regarding male and female students declined overall for male students in all three **CA:Exp**. schools (#1 = -4.2%; #2 = -4.8%; and #3 = -1.6%). Female students demonstrated improvements in **CA:Exp.** Schools #1 and #3 (2.3% and 4.8% respectfully) while **CA:Exp** School #2 declined (-5.5%).

Overall both genders in **CB:Ctrl** schools demonstrated trends towards improvement in two of the three campuses. Among male students, achievement increased

in **CB:Ctrl** Schools #2 and #3 (3.9% and 1.8% respectfully) while # 1 declined (-2.6%). Female students in all three **CB:Ctrl** schools showed improved achievement (School #1 = 1.2%; School #2 = 0.23%; and School #3 = 3.8%).

Notable 5th Grade TAKS trends

CA:Exp schools #1 and #3 and all three **CB:Ctrl** schools showed an increasing trend overall for student achievement on the 5th grade Science TAKS. **CB:Ctrl** School #1 showed minimal decline (2%) from the students 2007 TAKS scores while **CA:Exp** School #2 showed a larger decline (24%) from the prior year students' 2007 5th Grade Science TAKS scores. It may be possible this occurred when campus administrators at the **CA:Exp** School #2 instructed the teachers to *'focus instruction on Reading and Mathematics only until all the Reading and Mathematics TAKS are complete…put away the Science'.*[xiv]

Prior to this study, all three schools assigned to **Cohort B: Control Campuses** were demonstrating improved student achievement on the 5th Grade Science TAKS for 2006 and 2007. These three campuses continued improving student achievement on the 2008 Science TAKS with an 11% (**CB:Ctrl** School #1), 6% (**CB:Ctrl** School #2) and 2% (**CB:Ctrl** School#3) gain ahead of the 2007 TAKS results.

Campuses assigned to **CA:Exp**, though had varying levels of student achievement. Two campuses, **CA:Exp** School #1 (8% gain above 2007) and **CA:Exp** School #3 (3% gain above 2007) showed overall a trend towards improved student scores. Additionally the % of students who achieved "Commended" scores increased with 35% for **CA:Exp** School #1 (17% gain above 2007) and 28% for **CA:Exp** School #3 (8% gain above 2007).

Furthermore, when examining prior years of the TAKS 5th Grade Science data for all six campuses, it is important to remember that **prior** to TRC PD training, the **CB:Ctrl** schools had student achievement scores in 2007 that exceeded the **CA:Exp** schools student achievement scores by 7%.

The independent variable of professional development delivery modes (the Dynamic Professional Development System[xv] and the 5E Instructional Model[xvi]), with the predictor variables such as teacher practice, degree of lesson implementation, and degree of teacher collaboration were considered in the model. However, student achievement on the TAKS 5th Grade Science test at **CA:Exp** School #2 had 42% of the students reaching the "Met Standard" level, a loss of 23% from 2007 with 9% achieving "Commended" level, another decline of 12% from 2007. The results from **CA:Exp** School #2 were disappointing overall since the teachers were dedicated to their students' success and demonstrated high-levels of personal motivation and enthusiasm towards the TRC professional development approach and the Geoscience curricular materials. The power and influence of the campus administrator directive and the resulting impact on student achievement was clearly evident on this one campus.

Research Question and Hypothesis

The *BIG Sci Project* study was an initial attempt to address the needs of learning science among Hispanic student populations. The goal of the *Bridging the Gap in Science for Latino Students*, or *BIG Sci Project* was to:

1) Does the professional development delivery model differentially impacts Hispanic student achievement on the 5th grade science TAKS (Texas Assessment of Knowledge and Skills)?

2) Do professional development delivery models differentially impacts teacher practice in elementary science?

Hypothesis #1

$X_E = X_C = 0$: There will be a difference on Hispanic student achievement on the 5th grade science TAKS (Texas Assessment of Knowledge and Skills.

$X_E \neq X_C \neq 0$: There will be no difference on Hispanic student achievement on the 5th grade science TAKS (Texas Assessment of Knowledge and Skills.

Hypothesis #2

$X_E = X_C = 0$: There will be a difference on teacher practice in elementary science for Hispanic students learning.

$X_E \neq X_C \neq 0$: There will be no difference on teacher practice in elementary science for Hispanic students learning.

Hypothesis #1 – Student Achievement as measured by TAKS

***Research Question*: a)** Determine if the professional development delivery model differentially impacts Hispanic student achievement in elementary science.

Results: The study demonstrated that a sustained, supported, and resources professional development model for elementary science teachers improved science learning for Hispanic students. Individual data for comparison regarding both Title 1 and Hispanic students demonstrated improvements for **CA:Exp** Schools #1 and #3 (1.26% and 1.33% respectfully). Within **CB:Ctrl** campuses, the Title 1 and Hispanic students demonstrated some improvement for Schools #2 and #3 (2.01% and 2.64% respectfully)

However, **CA: Exp** School #2 demonstrated a declined by -5.0%, and **CB:Ctrl** School #1 demonstrated a declined by -0.3% when compared to the prior TAKS year.

The lackluster support from campus principals may have diminished enthusiasm of the teachers for moving forward and trying new pedagogical approaches as was evident at two schools (**CA:Exp** School #2 and **CB:Ctrl** School #1). The timing of the in-service towards the latter half of the semester and materials and resources delivered at the

end of the school year (May 2008) to many of the campuses.

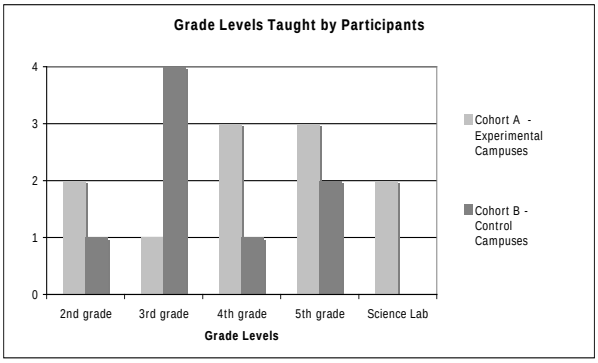
Unfortunately, the authors believe it is questionable to determine after a one-year study if the professional development delivery model differentially impacts Hispanic student achievement in elementary science. For two **CA:Exp** campuses, there was an increase in student achievement on the 2008 5th grade science TAKS, while one **CA:Exp** campus had decreased test scores. The same pattern was seen for the **CB:Ctrl** schools with two campuses demonstrating an increase in student achievement on the 2008 5th grade science TAKS and one campus with decreased test scores.

Hypothesis #2 - Survey Results – impact on teacher practice in elementary science

***Research Question*:** b) Do professional development delivery models differentially impacts teacher practice in elementary science?

The second research question answers focused on teachers' self-reporting through two online surveys. All 45 teachers were asked to complete both surveys at the end of the school year: *Collaborative Practices* (Appendix B) was available from April 7 - May 31, 2008; and *Lesson Plans Used* (Appendix C) was available from May 9 - June 10, 2008.

The *Collaborative Practices* survey had 84% response rate with 38 replies from 37 teachers and the district elementary science supervisor. The *Lesson Plans Used* survey had 51% response rate with 23 teachers replying. Teachers received 7 email reminders to complete the surveys. Both surveys were extended for longer tome periods than originally scheduled. Due to the small number of teacher respondents (**CA:Exp**, *n*= 14; **CB:Ctrl**, *n*= 8) completion of both surveys, data was combined for analysis.



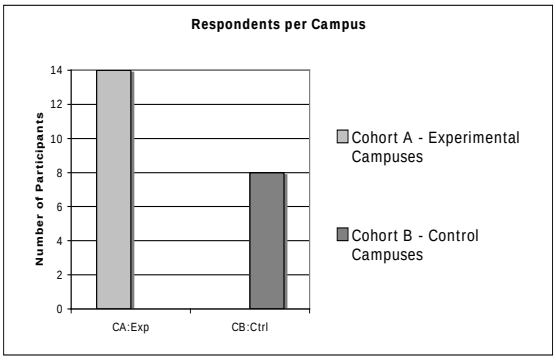


Table 2. Information about Campus Grade Levels and Teachers who completed Surveys

Collaborative Instructional Practices Survey

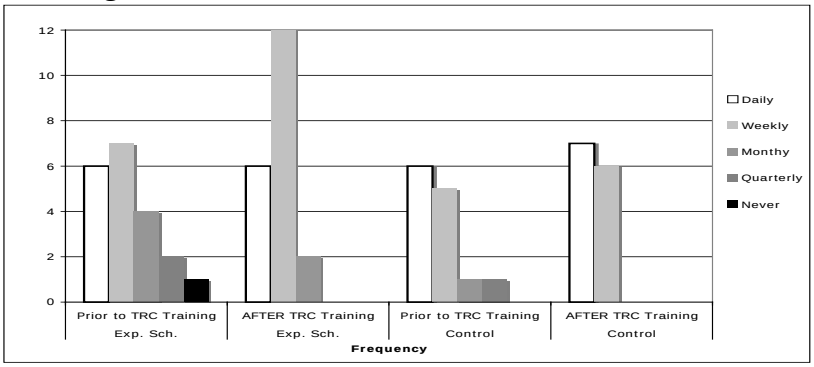
The first survey, *Collaborative Instructional Practices Survey*, focused around the teachers experiences on their campuses concerning collaboration with their grade-level colleagues, other teachers (Grades 2, 3, and 4) and among the campus administrators in

their support, or lack of support, regarding science education. This survey had double answers for questions: (1) Frequency of Collaboration Efforts and (2) Teacher Self-Report of Collaboration Efforts. The questions focused on the teachers' opinion regarding collaborative interactions prior to and after the TRC professional development training. This online survey was sent to both cohorts near the end of the academic year and after the May 2008 scheduled TAKS 5th grade science tests. 83% of the 46 teachers in the survey completed this survey. The survey questions are in Appendix B.

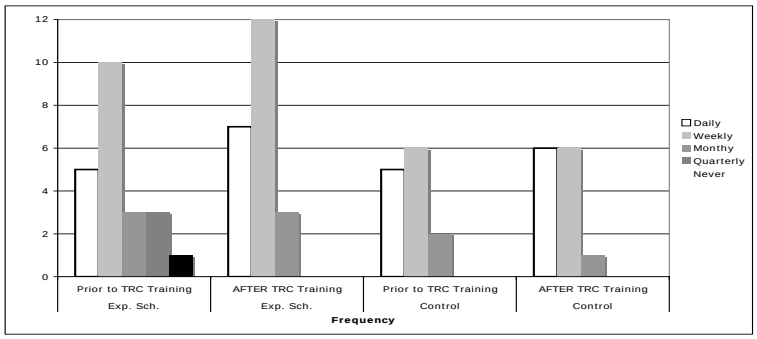
Issues regarding the lack of campus-level administration support regarding science teaching occurred in one-half of the six campuses while other campuses had complete support from campus administrators. **CA:Exp** teachers surveys show higher levels of change regarding lesson implementation and teacher collaboration after the PD training than **CB:Ctrl** teachers. Both Cohorts indicated they wanted more opportunities to learn the geoscience curriculum.

For all questions that asked about teacher attitudes toward collaborative instructional discussions with colleagues on the respective campuses prior to and after the TRC PD training experience, all campuses demonstrate positive shifts of improvement. Yet, in every question, **CA:Exp** campus responses have a wider spread of responses than those of teachers at **CB:Ctrl** campuses. After the TRC PD training experience, the teacher responses from **CA:Exp** campus cluster to the left for more frequent collaborative practices discussions with colleagues, yet a small number remain in the same response area as prior to the TRC PD training.

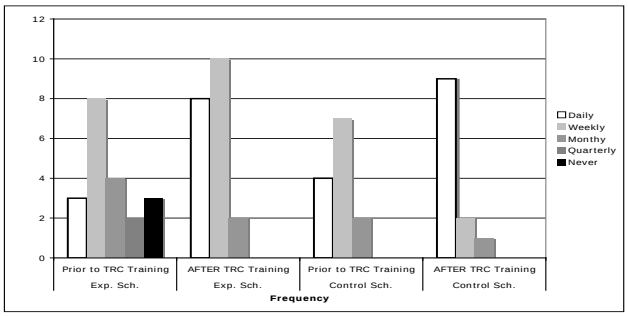
Q1: Frequency of collaborative efforts of sharing teaching strategies with **OTHER** same-grade level teachers.



Q2: Frequency of collaborative efforts of sharing teaching strategies with the **SAME** grade-level teachers.



Q3: Having science materials and supplies readily available for teaching lessons in MY CLASSROOM.



Q4: Having science materials and supplies readily available for teaching lessons in my GRADE LEVEL (sharing resources).

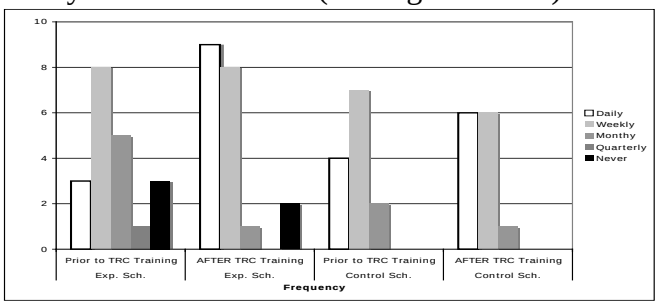
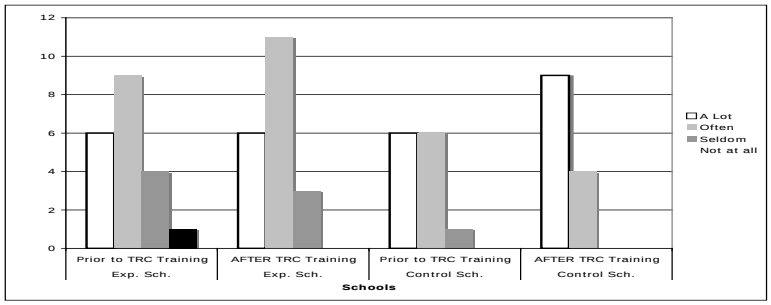


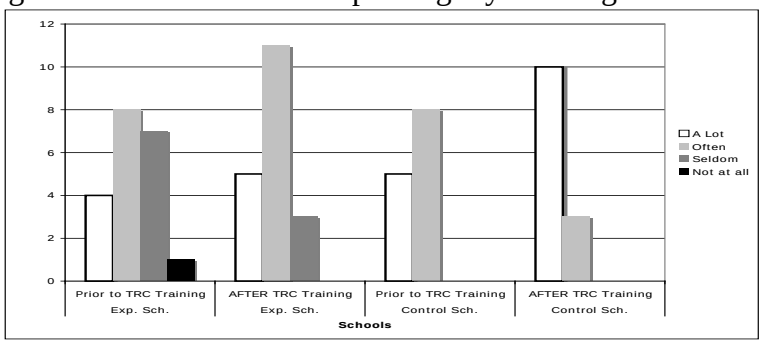
Table 4. Questions regarding frequency of Collaborative discussions on campuses. **Experimental** vs. **Control** schools

On a similar basis regarding teacher attitudes towards improvement of teaching practices on the respective campuses prior to and after the TRC PD training experience, all campuses again demonstrate improvement. Yet, in every question, **CA:Exp** campus responses have a wider spread of responses than those of teachers at **CB:Ctrl** campuses. After the TRC PD training experience, the teacher responses from **CA:Exp** campus cluster to the left for more frequent collaborative practices uses yet again a small number remain in the same response area as prior to the TRC PD training.

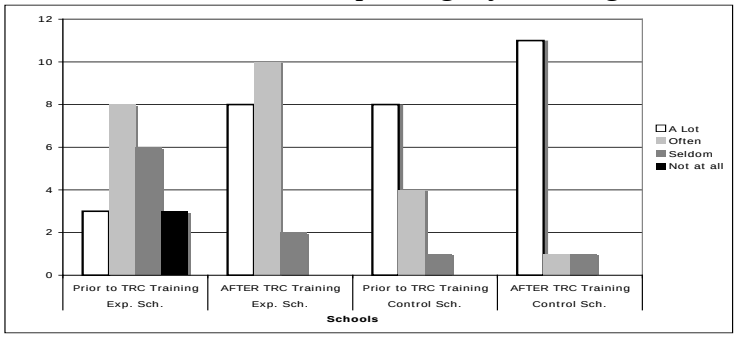
Q5: Frequency of collaborative efforts of sharing teaching strategies with **OTHER** same-grade level teachers for improving my teaching.



Q6: Frequency of collaborative efforts of sharing teaching strategies with the **SAME** grade-level teachers for improving my teaching.



Q7: Having science materials and supplies readily available for teaching lessons in MY CLASSROOM for improving my teaching.



Q8: Having science materials and supplies readily available for teaching lessons in my GRADE LEVEL (sharing resources) for improving my teaching.

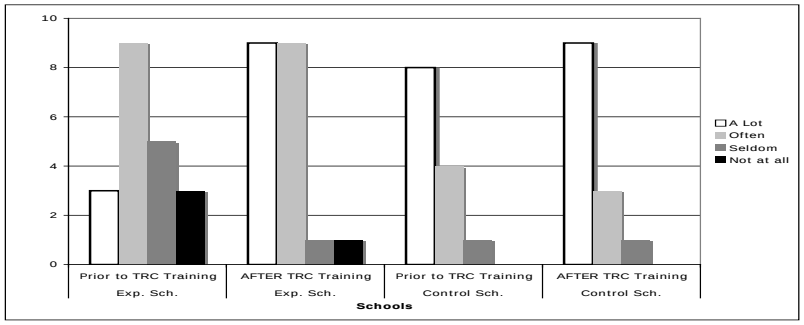


Table 5. Improvement of Teaching Practices. **Experimental** vs. **Control** schools.

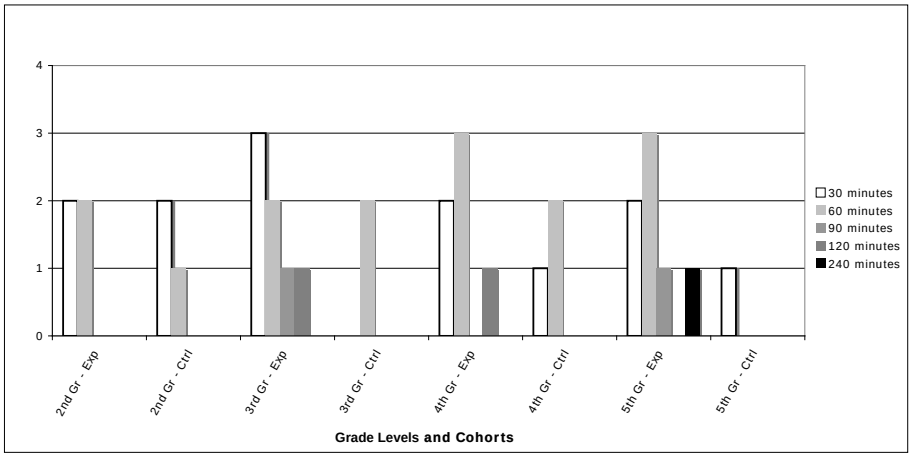
The significance of questions #5 to #8 above (collaborative discussions and improvement of teaching) can be seen as contributing to the overall 5th Grade Science TAKS scores on all six campuses. The **CA:Exp** teachers demonstrated trends towards improving the use of collaborative communication for the improvement of teaching practices while the **CB:Ctrl** teachers overall demonstrated a greater positive trends of using collaborative communications to improve teaching practices.

Lesson Plans Used

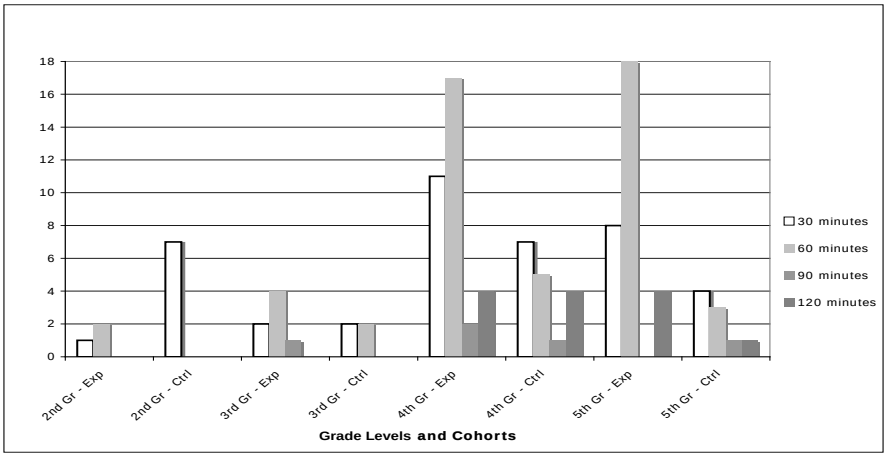
The second survey, *Lesson Plans Used,* focused on specific lessons from the geoscience curriculum used for professional development training purposes. The survey sought teachers' thoughts and data regarding which lessons were taught during the school year, how much time was spent for teaching each lesson, questions about the teachers views and opinions regarding the DPDS and 5E Instructional Model training that was used and how the teachers implemented the DPDS and 5E Model for teaching the geoscience curriculum. Additional questions asked about student reactions and / or student attention to the lessons that were observed in the classroom by the teacher. This online survey was sent in late April 2008 to both cohorts prior to the statewide early May 2008 schedule of TAKS 5th Grade Science tests. 53% of the 46 teachers in the study completed this survey.

All teachers were trained with lessons that used components of the 5E Instructional Model – Engagement, Exploration, Explain, Elaborate, and Evaluate. When examining the use of the 5E Instructional Model elements, these activities increase significantly in time, frequency, and grade level for the **CA:Exp** campuses

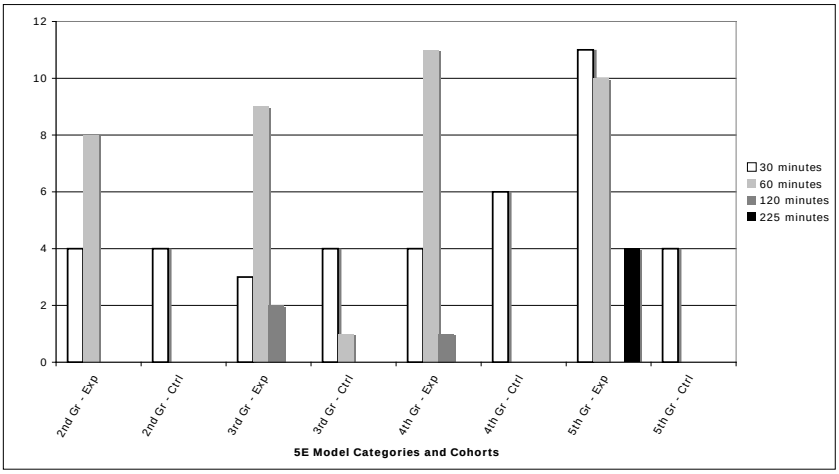
Engagement – Experimental vs. Control campuses



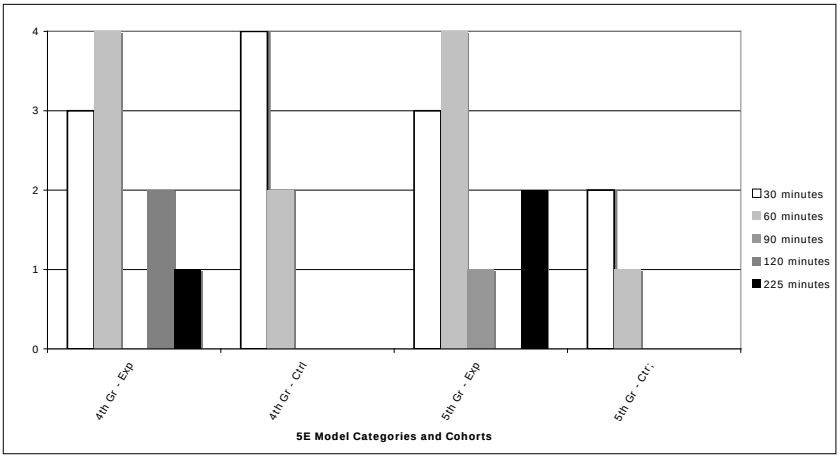
Exploration – Experimental vs. Control campuses



Explanation – Experimental vs. Control campuses



Elaborate – Experimental vs. Control campuses



Evaluate – Experimental vs. Control campuses

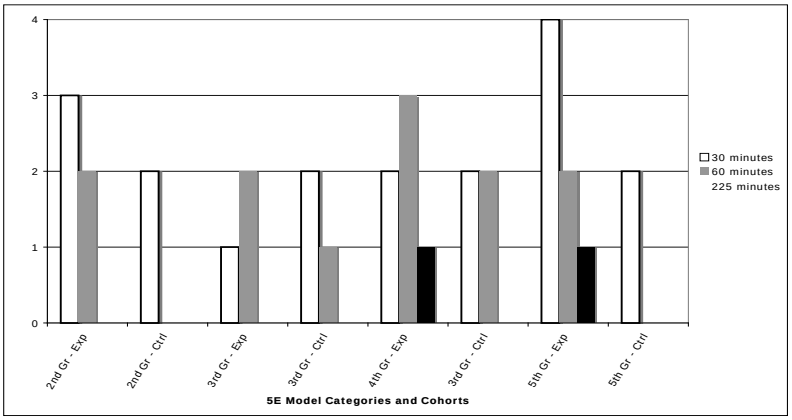


Table 3. 5E Instructional Models. **Experimental** vs. **Control**. Time spent on lessons.

Even though the results from the teachers on the **CA:Exp** campuses indicate that they spent more time practicing the 5E Instruction Model when teaching the geoscience curriculum, this new pedagogical delivery method was very new to the majority of teachers on these campuses. Since this pedagogical method was so new, the authors believed that an additional year of PD training was necessary to support full implementation of the 5E Instructional Model. Unfortunately, the district administration did not respond, or appear to support, a second year for this study.

Concerns for Spanish-language availability for Elementary Science

The lack of science materials and resources available in Spanish was a significant issue and concern among all of the teachers. When examining the **CB:Ctrl** campuses, the *'After TRC PD training'* responses nearly all shift to highly improved frequency of collaborative practices on the campuses. These results appear to be consistent with the inconsistent leadership-to-teacher practices on campuses as the 5th Grade Science TAKS test scores indicate. The **CA:Exp** campuses showed improved TAKS scores yet not as dramatic as what the TAKS scores were for the **CB:Ctrl** schools.

As indicated earlier, the **CA:Exp** campuses began with significantly lower TAKS averaged scores and after the TRC PD training, the TAKS scores on two campuses improved while one campus did not. The **CB:Ctrl** campuses started at a higher TAKS averaged scores that continued improvement on two campuses while one campus did not. Overall, student learning was improved at 80% of the campuses for all six schools and we believe a 2nd year of this study would have continued improvements for the **CA:Exp** campuses with the inclusion of the campus administrators. To make any other assessments or predictions is not possible within the limitations of this 1-year study. Additional information about the Spanish TAKS exam is in Appendix D.

Hypothesis #2 – Continued with Teacher Comments

The teachers involved in the surveys provided many personal insights about what they observed with their students, about teaching with the DPDS, the 5E Instructional Model, and the overall research study. Overall, three themes emerged from the teachers' comments: (1) Collaborative utilization on individual campuses; (2) materials and resources; (3) teachers improved learning of earth science concepts; and (4) lackluster interest from campus principals. The comment below from one teacher summarized many of the other teachers thoughts expressed from all six campuses. All teacher names are pseudonyms with minimal grammatical corrections of the comments.

> *Jane (**CA:Exp**):*
> *This research study was very effective and helpful. I learned many new, and important lessons and science concepts, as well as how to take on and teach a subject not very well liked by many economically disadvantage students in low income areas.*
>
> *Although, in areas such as where I teach it is not that the teacher can't learn, know, and execute such exciting science activities as the ones learned, but how well and disciplined are the students from these backgrounds, and how involved & supportive their parents are in their children's education. That is why I say it is not only the teacher that needs these workshops but effective and supportive "administrators [and] campus principals," that can also help out in making this research a success!*

Theme 1: Collaborative utilization on individual campuses

One question on the *Collaborative Instructional Practices Survey* asked teacher respondents to provide commentary regarding collaborative efforts on their respective campuses. This qualitative question asked respondents to *"Describe an example of collaboration among the teachers as it has occurred at your school since you have attended the TRC training."* This particular question allowed the respondent teachers to provide further information to the research team that were insightful. It was clear that the ability to discuss the lessons with colleagues, share teaching strategies, and develop new approaches for unique student populations became new standards of interactions on of these campuses.

> *Julie (**CA:Exp**): I have a closer relationship with the Science Lab teacher and I am able to understand and implement the 5E model of teaching with my students.*
>
> *Zach (**CA:Exp**): Our grade level is now trying to meet every day to plan what concept we are teaching for the week. We try to help each other with materials we need.*
>
> *Jackie (**CA:Exp**): Our grade-level teachers discussed presentations of lessons and determined the modifications that would be needed in order to serve N-LEP, LEP, and recent immigrant student and still cover all the TEKS for the grade level.*
>
> *Opal (**CA:Exp**): My class is the lowest class in the school. My partners give me extra time with our science lab teacher. So my kids get a double dosage of science when ever possible.*

*AliceBeth (**CA:Exp**): We still do not have a set curriculum at my campus. I can honestly say that I have not implemented this full program. Now, my grade level meets on a weekly basis. I shared with them many of the lessons that we completed during the in-service. We especially reflected on how journals have improved our students' vocabulary.*

*Maria Louisa (**CB:Ctrl**): The 4th Grade Teachers meet after school and during our lunch time. We discuss what worked in the science lesson and what did not. We brainstorm on ways to improve the lesson for the next teacher.*

*Jackson (**CB:Ctrl**): We have discussed and plan our daily and weekly experiments with the grade level so that we can share our ideas and expertise in certain science discoveries and lessons. Preparing materials needed to carry out fun science demonstrations has even motivated other teachers to further participate and explore, not to mention the students!*

*Amanda (**CB:Ctrl**): One example that happens now at my school, when we meet as a grade level we bring information to the table that we have learned from upper level teachers and try to use that information and integrate it into our lessons.*

*Terry (**CB:Ctrl**): During planning periods, occasionally we have discussed ways and lessons we can provide to our students to better prepare them for science state mandated tests [i.e. 5th Grade Science TAKS]. We have come to agree that there are some science resources that are still unavailable to us, such as Spanish-language resources to help meet the education of our recent immigrants.*

Theme 2: Materials & resources

A few of the teachers from both groups had mixed reactions regarding the supplies and materials that were provided to the campuses.

*Betty (**CA:Exp**): I thought that the training was great. However, our campus was very slow in receiving the materials. In fact, we have still not received everything promised to us. I don't know how the materials are supposed to help this year when we received so little so late. My students need items in Spanish and there just wasn't enough for meeting their learning needs.*[xvii]

Materials and resources delivered to many the schools was delayed until May 2008 for some campuses due to communication and technical difficulties between the local regional collaborative and the participating school district administration. See endnote #15 for additional information.

*Simon (**CA:Exp**): I feel the materials that we received for Science from the training along with the other materials were very useful. I would like to say that we received some of the materials within this past week. I just wish we would have had received the materials earlier during the year to have more time to have the students conduct more investigations.*[xviii]

*Jackson (**CB:Ctrl**): I feel much more confident in demonstrating and explaining science concepts and vocabulary.*

Theme 3: teachers improved learning of earth science concepts

Another theme among the teacher comments was their own learning of science content as they learned and taught the GeoScience curriculum.

*Pasha (**CB:Ctrl**): We meet as a grade level and discuss all the ideas and have even expanded those ideas with collaboration of every teacher in the grade level. We are more knowledgeable now about the concept of earth science and its characteristics.*

*Todd (**CB:Ctrl**): Another teacher and I were moved from second grade to fifth grade during the middle of this year. We were having a lot of difficulties teaching science as well as other subjects. After we attended the TRC we were able to work together to help our students and ourselves better understand science. We found that we learned so much about earth science that our confidence improved. We also got our department to get involved in the ideas and collaborations we had in mind. One thing we do now more often is sit during our conference time and discuss the different strategies we can all use for science concepts.*

*Julie (**CA:Exp**): I am now more aware of the science concepts and materials that are available and I feel more confident in implementing them in my teaching. I also feel more confident and enthusiastic about teaching Science with my newly gained knowledge and sharing my training and experience that I received from the TRC training to better collaborate with my colleagues in my grade level.*

*Stacie (**CA:Exp**): The collaborative has opened my mind to believe that science [concepts]can be learned in a fun and rewarding way. I'm glad I attended the training. This has been the best training that I have ever attended. Now, I meet regularly with my grade level and we plan together on activities using the 5-E model to design lessons and use the materials that were given to us from the collaborative. We implement many of the activities learned from the collaborative. We also use lessons provided to us from the binder. We used the materials from the science kit to analyze soil samples and the students really enjoyed working outdoors doing these awesome hands on activities.*

Theme 4: Lackluster interest from campus principals

Some of the teachers' comments described their feelings about their campus administrators' lack of support or interest.

*AliceBeth (**CB:Ctrl**): The reason I answered no for most of the questions is because I have not spoke to my administrator about this training. She is new to our campus and is more focused on other topics (e.g. reading and mathematics) and has not shown any interest in the type of instruction we are utilizing. I don't think she wants science at all here.*

*Betty (**CA:Exp**): It seems that there is so much concern for reading and math scores, that science is put on the back burner, even though they expect us to do well in science too. Teachers in other levels besides fifth are told to concentrate only on the tested subjects for a few weeks prior to testing. Yet in my classroom, my students use their journals daily to insert their work, draw conclusions, etc. I can see this as a positive way for reading and writing.*

We need to work more on the reflective part of the journal to help students improve their writing. It seems that there are always too many time restraints to complete this part of their journals, as we should. There is so much more to science than being limited to concentrating on only the tested subjects prior to TAKS.

*Carolina (**CA:Exp**): The district administration has given us lots of materials that were desperately needed. The only thing that we would need would be extra planning and time to observe one another on our campuses. My principal doesn't seem interested in this at all. Collaboration at my school doesn't happen very often. When we do get together as a grade level, some of the time it is successful. We plan a lesson together and we share ideas. But to be honest I can't think of the last time we met and discussed planning a science lesson or any other.*

Hypothesis #2 – Teacher practice in elementary science for Hispanic students

***Research Question* b)** Determine if the professional development delivery model differentially impacts teacher practice in elementary science for Hispanic students.

Results: Issues regarding the lackluster of campus-level administration support regarding science teaching occurred with 50% of the six campuses.

CA:Exp teachers surveys show higher levels of change regarding lesson implementation and teacher collaboration after the PD training; teacher responses showed greater diversity; the utilization of the 5E Model showed improved levels of practice by the teachers, yet there appeared to be no change for a small number of teachers who reported same responses for both prior to and after the TRC PD training.

CB:Ctrl teachers surveys show *minimal* or *no change* regarding lesson implementation and teacher collaboration after the PD training; teachers indicated *no change* regarding their use of collaborative practices and the 5E Model prior to and after the TRC PD training.

Again, it is unfortunate to report that it is inconclusive to determine after a one-year study if the professional development delivery model differentially impacts teacher practice in elementary science for Hispanic students.

Contributions

The *BIG Sci Project* study was an initial attempt to address the needs of learning science among Hispanic student populations. The goal of the *Bridging the Gap in Science for Latino Students,* or *BIG Sci Project* was to:

a) determine if the professional development delivery model differentially impacts Hispanic student achievement in elementary science,

b) determine if the professional development delivery model differentially impacts teacher practice in elementary science for Hispanic students.

Although limited to a single-year study, the information gained from the teachers provided numerous opportunities regarding insights about student achievement and teacher practice.

Other Limitations

The limitations of analysis became evident when we realized the six campuses were not evenly matched for prior years of student achievement on the 5th grade science TAKS. These limitations could be directly linked to choices and decisions made by various individuals involved who may or may not have supported the research at all due to individual values towards elementary science education.

The **CA:Exp** campuses started at a lower TAKS averaged scores. After the TRC PD training, the TAKS scores on two campuses (School #1 and School #3) improved while one campus (School #2) did not. The **CB:Ctrl** campuses started at a higher TAKS averaged scores that continued improvement on two campuses (School #2 and School #3) while one campus (School #3) did not.

Overall, an 80% improvement occurred at all six campuses in regards to student learning. The researchers believe a 2nd year of this study would demonstrate continued improvements for the **CA:Exp** campuses with the inclusion of the campus administrators. The **CA:Exp** teachers were motivated and enthusiastic with the TRC PD training, and the 4th grade students would have had 1-year of exposure and learning of both the 5E Model and collaborative educational practices for science education. To make any other assessments or predictions is not possible within the limitations of a 1-year study.

More importantly, recognizing the limitations of this 1-year study, the researchers were able to show that the study demonstrated that a sustained, supported, and resources professional development model for elementary science teachers improved science educational learning for Hispanic students in this district. Assisting teachers to become familiar with the vertical alignment of the curriculum, to focus and analyze student-learning data with the state of Texas content as described in the TEKS were crucial guidelines for appropriate lesson plans. All of these circumstances demonstrated that when individual teachers' science content knowledge and skills are addressed, there is a positive impact on student achievement in as little as one year.

Furthermore, the science education programs at all six elementary campuses encouraged and allowed teachers to learn new pedagogical strategies that combined elementary science lessons with other core areas such as student writing (e.g. journaling), reading, mathematical computations, and environmental science. The researchers believe that an additional year of PD for all participating teachers would show a dramatic improvement of student achievement on the 5th Grade Science TAKS.

The success of this research speaks well for the teacher participants because after the in-service presentations, these dedicated teachers were the individuals who worked with and supported each other as they practiced new pedagogical strategies and taught

new GeoSciences curriculum. All of the participating teachers taught science to the students in their classrooms. The researchers believe that these teachers will continue building on what they learned and ultimately, for all six campuses, the students will continue to learn science.

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[i] The following documents and research studies address issues of professional development for teachers. Loucks-Horsley, S., et al., 2003; Spillane, James P. & Karen Seashore Louis, 2002; Senge, P., 2000; Wong-Fillmore, L. & Valadez, C., 1986.

[ii] The new graduation plan legislation from the 79th Regular Session of the 2005 Texas Legislature as H.B. 2237 started in Fall 2007 for entering 9th grade students. These students are now required for achieving high school graduation 4 years of the 4 core disciplines: Science, Mathematics, Language Arts, and Social Studies / Economics (19 TAC, Part II. Texas Education Agency, §§74, Subchapter F, §74.63: Recommended High School Program. Adopted July 7, 2007).

[iii] The following research studies focus specifically on student achievement gains when teachers have sustained, consistent and content-oriented professional development experiences. Fletcher, 2004, 2006; Fletcher, et al., 2004, 2004; Meyer, et al., 2004; Tinoca, 2004; and Richardson & Placier, 2001.

[iv] TRC is an award-winning, statewide program that is housed in the Center for Science and Mathematics Education (CSME) at The University of Texas at Austin. The TRC consists of 60 P-16 partnerships to leverage the resources of universities, (Texas) Education Service Centers (ESCs), school districts, informal science providers and industry to serve science and mathematics teachers.

[v] References to writing about improving teacher practice include Senge, P., 2000. *The Fifth Dimension* and Brophy, J., & Good, T., 1986. Teacher behavior and student achievement. In M.C. Wittrock (Ed.), *Handbook of research on teaching.*

[vi] These researchers describe implementation of data-informed decision making and teacher practices for improving student learning. Cowan, D. F., 2006; Honig, M., Kahne, J., & McLaughlin, M., 2001.

[vii] Studies regarding the importance of sustained, consistent and content based professional development for elementary teachers for improving student learning. Barufaldi & Reinhartz, 2001; Barufaldi, 2007b.

[viii] The 5E Model of Instruction is described in theory and practice in Bybee, R. W., Taylor, J.A., & Gardner, A., et al. (2006). The BSCS 5E instructional model: origins, effectiveness, and applications: Executive summary.

[ix] The following research studies focus specifically on student achievement gains when teachers have sustained, consistent and content-oriented professional development experiences. Fletcher, 2006, 2004; SEDL & Charles A. Dana Center, 2005; Meyer, et al., 2004; and Tinoca, 2004; Richardson & Placier, 2001.

[x] The GeoSciences Curriculum for grades K to 8 was a project produced through many of the local regional collaboratives to address low-level TAKS scores in the earth sciences. This curriculum has been widely used throughout Texas.

[xi] References to writing about improving teacher practice include Senge, P., 2000; Sashkin, M., & Egermeier, J., 1993; Brophy, J., & Good, T., 1986.

[xii] Studies regarding the importance of sustained, consistent and content based professional development for elementary teachers for improving student learning. Barufaldi & Reinhartz, 2001; Barufaldi, 2007b.

[xiii] Information and anecdotal experiences about the importance of collaborative practices in school settings. From "A system's perspective for professional development in science and mathematics education: Texas Regional Collaboratives", a chapter in Ravid and Slater, Eds. *Collaborations in Education. (in press, 2010).*

[xiv] This quote was reported both in teachers' science journals and verbally to the TRC researchers and district elementary science coordinator during the final 2-day PD.

[xv] Studies regarding the importance of sustained, consistent and content based professional development for elementary teachers for improving student learning. Barufaldi & Reinhartz, 2001; Barufaldi, 2007b.

[xvi] The 5E Model of Instruction is described in theory and practice in Bybee, R. W., Taylor, J.A., & Gardner, A., et al. (2006). The BSCS 5E instructional model: origins, effectiveness, and applications: Executive summary.

[xvii] At the end of Cohort A – Experimental Schools 4-day training period on January 29, 2008, each attending teacher received substantial materials and resources in a plastic box containing enough supplies for a 24-student classroom to teach all grade level GeoScience curriculum. Additionally, 1 additional plastic box complete with the required materials and resources for each grade level was delivered to each Cohort A – Experimental Schools.

The additional materials purchased for the Cohort B – Control Schools, as well as the individual grade level plastic boxes for the Cohort A – Experimental Schools encountered numerous communication difficulties. These difficulties were due to unclear expectations between the local regional collaborative and the participating school district that resulted in these grade level plastic boxes for all of the participating campuses were not delivered until May 2008.

[xviii] Ibid.

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Appendix A: Informed Consent Form

APPROVED BY IRB ON: 09/24/2007 ***EXPIRES ON: 9/24/2008***

IRB# 2007-08-0008

Informed Consent to Participate in Research
The University of Texas at Austin

Consent Form and Instructions to Participants

Bridging the Gap in Science for Latino Students

You are being asked to participate in a research study **"Bridging the Gap in Science for Latino Students"** The study is being conducted by Dr. Carol Fletcher, Dr. Todd Sherron, and Ms. Linda L.G. Brown. This study is through the University of Texas Center for Collaborative Educational Research and Policy, Curriculum and Instruction Department, College of Education, of The University of Texas at Austin, 1 University Station D4900, Austin, TX 78712 campus phone (512)232-5690, email: CAROL.FLETCHER@MAIL.UTEXAS.EDU

Ms. Marsha Willis and Ms. Janette Trejo, will conduct the professional development training throughout this school year. A copy of this form will be provided to you to keep for your reference.

This study will compare two professional development delivery models to determine their impact on teacher instructional practices and student science achievement. Six elementary schools from one primarily low income, Latino majority school district in South Texas will be randomly assigned to treatment or control groups. The study contrasts a delivery model that focuses on sustained and intense training for a critical mass of teachers with one that provides a more limited amount of training for a greater number of teachers.

Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

What is the purpose of this study? The project will compare two professional development delivery models to determine their impact on teacher instructional practices and student science achievement. Six elementary schools from one primarily low income, Latino majority school district in South Texas will be randomly assigned to treatment or control groups. In short, the study contrasts a delivery model that focuses on sustained and intense training for a critical mass of teachers with one that provides a more limited amount of training for a greater number of teachers.

What will your role be throughout this research study?
All teachers will be randomly assigned to one of two teams: Cohort A and Cohort B. Each teacher will receive one type of professional development training throughout the school year. The details will be explained when the Cohorts meet individually. Your commitment will be to attend between one and four days of training throughout the 2007-08 school year, depending on the Cohort to which you have been assigned.

At the end of the school year, student achievement data will be collected through the Grade 5 TAKS for individual students and masked by the Texas Education Agency to protect student confidentiality. In addition, impact on teacher practice will be documented through the use of classroom observations and interviews with teachers and teacher supervisors. The *Science Classroom Profile*, a classroom observation instrument, will also identify the frequency of standards-based science teaching in each classroom. A *Collaborative Instructional Practices* survey may be used to determine if the degree of collaboration on each campus serves as a predictor variable in student achievement as well.

This research project will last throughout the 2007-2008 school year. Professional development training sessions will occur on Saturday's for which you will receive a stipend of $75/day for all training days. Additionally, all participating schools will receive materials to implement classroom activities worth approximately $1,000.

What are the possible benefits to you or to others?
This research study will provide professional development for elementary science teachers and is focused on the state of Texas content as described in the TEKS. It is meant to enhance the individual teachers' science knowledge and skills, along with the science education program at these elementary campuses.

If you choose to take part in this study, will it cost you anything? There are no costs to the participants who choose to take part in this study.

If you do not want to take part in this study, what other options are available to you?
Your participation in this study is entirely voluntary. You are free to refuse to be in the study, and your refusal will not influence current or future relationships with The University of Texas at Austin (and or participating sites such as AISD or any other organization.

This study has been reviewed and approved by The University of Texas at Austin Institutional Review Board. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

Thank you.

Signatures: *[Please include all of this bolded text:]*

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

Signature and printed name of person obtaining consent **Date**

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Printed Name of Subject **Date**

Signature of Subject **Date**

Signature of Principal Investigator Date

Appendix B: Collaborative Practices Survey

"Bridging the Gap in Science for Latino Students" Survey – Collaborative Instructional Practices - Part 1

I. Demographic Information (2 questions)
II. Your Opinion (5 questions)
III. Collaboration among Teachers (3 questions)
IV. Collaboration from Campus Administration (3 questions)

Consent Form and Instructions to Participants

You are invited to participate in this first survey, entitled "***Collaborative Instructional Practices Survey – Part 1***." This is the FIRST of a two-part survey, and it will ask you about your experiences concerning collaboration with your opinion, and how you perceived collaboration occurs among your colleagues (grades 2, 3, 4, and 5) and your campus administrators.

This is part of the research study that you agreed to be part of titled "Bridging the Gap in Science for Latino Students". The study is being conducted by Dr. Carol Fletcher, Dr. Todd Sherron, and Ms. Linda L.G. Brown, MA through the University of Texas Center for Collaborative Educational Research and Policy, Curriculum and Instruction Department, College of Education, of The University of Texas at Austin, 1 University Station D4900, Austin, TX 78712.

The purpose of this study is to examine two professional development delivery models and determine the impact on teacher instructional practices and student achievement.

It is estimated that it will take no longer than **20 minutes** of your time to complete the online questionnaire. If you have any questions or update your email address, please call **Linda L.G. Brown** at **(512) 797-3321 (cell phone)** or send an email to LLGBrown@gmail.com**.**

Risks to participants are considered minimal. Identification numbers associated with email addresses will be kept confidential during the data collection phase for tracking purposes only. A limited number of research team members will have access to the data during data collection. This information will be stripped from the final dataset.

Your participation in the ***Collaborative Instructional Practices Survey – Part 1*** is necessary for this research study. If you need to leave at any point, please scroll down to the end of the survey and click on the "FINISH LATER" button.

PLEASE NOTE: this survey will be open from April 9, 2008 through April 21, 2008.

This study has been reviewed and approved by The University of Texas at Austin Institutional Review Board. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

IRB Approval Number: **No. 2007-08-0008.**

An email with specific instructions to complete the ***Collaborative Instructional Practices Survey – Part 1*** will be sent to you with a coded link, similar to the one below:
[HTTP://LINK TO SURVEY URL] – ***to be provided in each individually addressed email to participant.***
The password for the survey is **[PASSWORD] –** ***to be provided in each individually addressed email to participant***

WHEN YOU HAVE COMPLETED AND SUBMITTED THE SURVEY, you will see two events:

1) Your computer will immediately go to the web-page link of the Texas Regional Collaboratives. Here you will see the numerous programs of the state-wide network you are now part of.
2) You will also receive in your email a copy of the entire survey WITH ALL OF YOUR RESPONSES. The subject line will say "**CONFIRMATION - Collaborative Instructional Practices Survey – Part 1**"

If you agree to participate please press the arrow button at the bottom right of the screen.

Thank you.
Linda L.G. Brown

Section I. Demographic Information

1. Are you Male or Female?
   - ☐ Male
   - ☐ Female

2. Please select your campus location.
   - ☐ CA:Exp School #1 Elementary
   - ☐ CA:Exp School #2 Elementary
   - ☐ CA:Exp School #3 Elementary
   - ☐ CB:Ctrl School #1 Elementary
   - ☐ CB:Ctrl School #2 Elementary
   - ☐ CB:Ctrl School #3 Elementary

NOW, PLEASE CONTINUE TO SECTION II – Your Opinion

OR you may click on the "SAVE" button and return to the Survey at a future time.

SECTION II. Your Opinion

This next section contains questions about your views and opinions regarding your experience with collaboration and your overall experiences the past 4 to 6 months. There are no right or wrong answers to any of the questions.

1. **PRIOR TO ATTENDING** the Texas Regional Collaboratives training, indicate the frequency of use and the extent you believe these activities contributed to improving your classroom teaching. *Mark (X) one box under each section.*

		Frequency of use				**Improved my teaching**				
		At least once a week	2 to 3 times a month	Once a month	A few times a year	Never	A lot	Moderately	Some-what	Not at all
		5	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**
a	Discussion with other same-grade level teachers									
b	Collaborative efforts of sharing teaching strategies with the same-grade level teachers									
c	Have science materials and supplies readily available for teaching lessons for my **classroom**									
d	Have science materials and supplies readily available for teaching lessons for my **grade level**									

2. **AFTER ATTENDING** the Texas Regional Collaboratives training, indicate the frequency of use and the extent you believe the following tasks / activity improved your classroom teaching. *Mark (X) one box under each section.*

		Frequency of use				**Improved my teaching**				
		At least once a week	2 to 3 times a month	Once a month	A few times a year	Never	A lot	Moderately	Some-what	Not at all
		5	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**
a	Discussion with other same-grade level teachers									

b	Collaborative efforts of sharing teaching strategies with the same-grade level teachers										
c	Have science materials and supplies readily available for teaching lessons for my **classroom**										
d	Have science materials and supplies readily available for teaching lessons for my **grade level**										

3. **PRIOR TO ATTENDING** the Texas Regional Collaboratives training, to what extent would you have agreed or disagreed with each of the following statements?
Mark (X) one box on each line.

		Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
		4	3	2	1
a	Campus Administrators behavior toward teachers was supportive and encouraging in implementing science instructional strategies.				
b	The level of student misbehavior in my classroom (such as noise or horseplay) prevented me teaching science.				
c	Routine duties and paperwork interfere with my job of teaching science.				
d	I could apply science instructional strategies (*5E Model for Science*) in my teaching.				
e	I was concerned about the security of my job because of the performance of my students on state tests.				
g	I was provided the materials and supplies necessary to teach science to my students.				
h	I did not feel prepared with instructional strategies for teaching science.				

4. **AFTER ATTENDING** the Texas Regional Collaboratives training, to what extent would you now agree or disagree with each of the following statements?
Mark (X) one box on each line.

		Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
		4	3	2	1
a	Campus Administrators behavior toward teachers is supportive and encouraging in implementing new science instructional strategies.				
b	The level of student misbehavior in my classroom (such as noise or horseplay) prevents me teaching science.				
c	Routine duties and paperwork interfere with my job of teaching science.				
d	I can apply science instructional strategies (*5E Model for Science*) in my teaching.				
e	I am concerned about the security of my job because of the performance of my students on state tests.				
g	I am provided the materials and supplies necessary to teach science to my students.				

h	I have changed my instructional strategies for teaching science.				

5. Did you use any of the following instructional strategies in your science teaching with your students?

Mark (X) one box on each line. If YES, please indicate frequency of use.

		No	**Yes**		**Frequency of use**				
					At least once a week	2 to 3 times a month	Once a month	A few times a year	Never
a	Introduce science content through formal presentations by using Elaboration.								
b	Pose open-ended questions to the students to encourage independent thinking.								
c	Engage the whole class in discussions.								
d	Require students to supply Evidence to support their claims.								
e	Ask students to Explain science concepts to one another.								
f	Ask students to consider alternative Explanations.								
g	Read and comment on the reflections students have written in their science journals.								
h	Use science journals for improving student writing and independent thinking.								

NOW, PLEASE CONTINUE TO SECTION III. Collaboration among teachers
OR you may click on the "SAVE" button and return to the Survey at a future time.

SECTION III. Collaboration among teachers

This section contains questions concerning your experience regarding collaboration among the teachers on your campus since your TRC training.

1. Describe "***collaboration***" among the teachers as it has occurred at your school.

Comment Box

(note: set comment box to 150 spaces and 15 lines on hosted survey web-site)

2. Since your TRC training, would you agree or disagree with each of the following statements regarding collaboration for improving instructional strategies among your colleagues? *Mark (X) one box on each line.*

Strongly Agree	Agree	Disagree	Strongly Agree
4	3	2	1

a	My colleagues were open-minded and enthusiastic to implement new methods for science instructional strategies (e.g., cooperative learning, 5E Model)				
b	I was able to share instructional strategies with my colleagues to maintain order and discipline in the science classroom.				
c	My colleagues were able to observe each other's classes as a way to improve our instructional strategies.				
d	Most of my colleagues in this school contribute actively to making decisions about science instructional strategies.				

3. Please indicate whether or not you discussed using any of the following instructional strategies when teaching science with your colleagues? If yes, please indicate the extent on a scale for 1 to 5 where 1 = little discussion and 5 = a great deal of discussion.
Mark (X) one box on each line.

		Yes	**No**	**A little 1**	**2**	**3**	**4**	**A great deal 5**
a	Introducing science content through formal presentations by using Elaboration.							
b	Posing open-ended questions to the students to encourage independent thinking.							
c	Engaging the whole class in discussions.							
d	Requiring the students to supply Evidence to support their claims.							
e	Asking the students to Explain concepts to one another.							
f	Asking the students to consider alternative Explanations.							
g	Reading and commenting on the reflections the students have written in their science journals.							
h	Using science journals for improving student writing and independent thinking.							

Please write any ADDITIONAL COMMENTS you may want to convey to the researcher here:

NOW, PLEASE CONTINUE TO SECTION IV. Collaboration from campus administration
OR you may click on the "SAVE" button and return to the Survey at a future time.

SECTION IV. Collaboration from campus administration

This section contains questions concerning your experience regarding collaboration from the campus administration (e.g. principals, assistant principals, curriculum specialists, etc.) on your campus since attending the TRC training.

1. To what extent would you agree or disagree with each of the following statements regarding collaboration by your campus administration?
Mark (X) one box on each line.

		Strongly Agree	Agree	Disagree	Strongly Disagree
		4	3	2	1
a	Administrators are open-minded and enthusiastic to implement new methods for science instructional strategies (e.g., cooperative learning, 5E Model).				
b	Administrators indicate Science TAKS scores are just as important as Reading and Math TAKS for this campus Annual Yearly Progress Report.				
c	Administrators encourage teachers to share strategies and ideas so that we help all children succeed.				
d	Administrators instructed us to ONLY teach Reading and Math for TAKS testing for this campus Annual Yearly Progress Report.				
e	Administrators arranged time so I was able to share strategies with other teachers.				
f	Administrators arranged time so that all of the teachers are able to observe each other teaching classes to improve our instruction strategies.				
g	Administrators recognize the importance of building the teachers' knowledge and understanding of the geosciences vertical alignment required across grade levels.				
h	Administrators understand the need for science materials and supplies necessary for teaching.				
i	Administrators maintain the science consumable materials required for all of the grade level material supply boxes.				

2. In COLLABORATIVE DISCUSSIONS with your campus administrators, were you able to discuss any of the following items regarding science instruction?

Mark (X) one box on each line.

		Yes	**No**
a	Introducing science content through formal presentations by using Elaboration.		
b	Posing open-ended questions to the students to encourage independent thinking.		
c	Engaging the whole class in discussions.		
d	Requiring the students to supply Evidence to support their claims.		
e	Asking the students to Explain concepts to one another.		
f	Asking the students to consider alternative Explanations.		
g	Reading and commenting on the reflections the students have written in their science journals.		
h	Using science journals for improving student writing and independent thinking.		

Comment Box

3. Please indicate your level of agreement with the following statements about the principal at your campus:

		Strongly Agree	Agree	Disagree	Strongly Disagree
		4	3	2	1
a	Encourages me to select science content & instructional strategies that address individual students' learning.				
b	Accepts the noise that comes with an active classroom.				
c	Encourages innovative instructional practices.				
d	Enhances the science program by providing me with needed materials & equipment.				
e	Provides time and encourages teachers to meet and share ideas with one another.				
f	Encourages me to observe exemplary science teachers.				
g	Encourages all teachers on this campus to make connections across disciplines.				
h	Gives me time to work with other teachers as part of my professional development plan.				
i	Encourages me to share what I have learned from the TRC training with other teachers on this campus through presenting in-service learning for other teachers.				

Please write any ADDITIONAL COMMENTS you may want to convey to the researcher here:

Thank you VERY MUCH for completing this survey for our research study. Your information is very important to us.

The second survey for this research study, "Lesson Plans Used", will be sent to you on May 9, 2008. Please click on the "END OF SURVEY" button now so that your survey is submitted to the researcher.

Sincerely, Linda L.G. Brown

Appendix C: Lesson Plans Used Survey

Bridging the Gap in Science for Latino Students

Lesson Plans Used

Part 2

I. Demographic Information (5 questions)
II. Lesson Plans Used (2 questions)
III. 5E Instructional Model (5 questions)

Consent Form and Instructions to Participants

You are invited to participate in the second survey of this research study, entitled "*Lesson Plans Used* – Part 2." This part will ask you about the lessons you used in the Changes Over Time or other curriculum

materials, the 5E instructional model, and your reflections about using this new approach to teaching science to your students.

This is the second part of the research study that you agreed to be part of titled "Bridging the Gap in Science for Latino Students". The study is being conducted by Dr. Carol Fletcher, Dr. Todd Sherron, and Ms. Linda L.G. Brown through the University of Texas Center for Collaborative Educational Research and Policy, Curriculum and Instruction Department, College of Education, of The University of Texas at Austin, 1 University Station D4900, Austin, TX 78712. For this online survey, you can contact Linda L.G. Brown at LLGBrown@gmail.com or (512) 797-3321 (cell phone).

The purpose of this study is to examine two professional development delivery models and determine the impact on teacher instructional practices and student achievement.

It is estimated that it will take no longer than **15 minutes** of your time to complete the online questionnaire. You are free to contact the researcher at the above address and phone number to discuss the survey.

Risks to participants are considered minimal. Identification numbers associated with email addresses will be kept confidential during the data collection phase for tracking purposes only. A limited number of research team members will have access to the data during data collection. This information will be stripped from the final dataset.

Your participation in the ***BIG Sci Survey – Lesson Plans Used - Part 2*** is necessary for this research study. If you need to leave at any point, please scroll down to the end of the survey and click on the "FINISH LATER" button.

PLEASE NOTE: this survey will be open from May 8, 2008 through May 22, 2008.
This study has been reviewed and approved by The University of Texas at Austin Institutional Review Board. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

IRB Approval Number: **No. 2007-08-0008.**

An email with specific instructions to complete the ***BIG Sci Survey – Lesson Plans Used - Part 2*** will be sent to you with a coded link, similar to the one below:
[HTTP://LINK TO SURVEY URL] – ***to be provided in each individually addressed email to participant.***
The password for the survey is **[PASSWORD] –** ***to be provided in each individually addressed email to participant***

WHEN YOU HAVE COMPLETED AND SUBMITTED THE SURVEY, you will see two events occur: Your computer will immediately go to the web-page link of the Texas Regional Collaboratives. Here you will see the numerous programs of the state-wide network you are now considered as to be a Cadre Member.

3) You will also receive in your email a copy of the entire survey WITH ALL OF YOUR RESPONSES. The subject line will say "CONFIRMATION - *BIG Sci Survey – Lessons Used - Part 2*"

If you agree to continue, please press the arrow button at the bottom right of the screen.

Thank you.

Linda L.G. Brown

I. Demographic Information

1. Are you Male or Female?
   - □ Male
   - □ Female

2. Please select your campus location.
   - □ CA:Exp School #1 Elementary
   - □ CA:Exp School #2 Elementary
   - □ CA:Exp School #3 Elementary
   - □ CB:Ctrl School #1 Elementary
   - □ CB:Ctrl School #2 Elementary
   - □ CB:Ctrl School #3 Elementary

3. Please select the grade level you are teaching this school year.
   - □ 2nd grade
   - □ 3rd grade
   - □ 4th grade
   - □ 5th grade
   - □ Science Lab for all grade levels
   - □ Special Education for all grade levels

4. Ethnic composition of the students in your classroom?
   - □ # ___African American
   - □ # ___Asian American
   - □ # ___Caucasian (not of Hispanic origin)
   - □ # ___Hispanic
   - □ # ___Native American
   - □ # ___Other

5. Which statement best describes the way YOUR classes at THIS school are organized? *Mark (X) only one box.*

□ You instruct several classes of different students most or all of the day in one or more subjects (*sometimes called Departmentalized Instruction*).

□ You are an elementary school teacher who teaches only one subject to different classes of students (*sometimes called an Elementary Subject Specialist*).

□ You instruct the same group of students all or most of the day in multiple subjects (*sometimes called a Self-Contained Class*).

□ You are one of two or more teachers, in the same class, at the same time, and are jointly responsible for teaching the same group of students all or most of the day (*sometimes called Team Teaching*).

□ You instruct a small number of selected students released from or in their regular classes in specific skills or to address specific needs (*sometimes called a "Pull-Out" Class or "Push-In" Instruction*).

NOW, PLEASE CONTINUE TO SECTION II – *Lessons Used*
OR you may click on the "SAVE" button and return to the Survey at a future time.

SECTION II – Lessons Used

This section contains questions concerning the Lessons Used that you have taught for your science lessons in the past 4 - 5 months.

1. Which of the lesson plans have you used in your classroom since you were introduced to the *Changes Over Time* geoscience lessons?

Mark (X) in ONE box on each table.

ENGAGEMENT

	Yes	No	Time Spent (Minutes per lesson)
2nd grade – Earth in a Bag			
3rd grade – Sticky Note Sort			
4th grade – Soil Buffet			
5th grade – Drip, Drip, Drip			

EXPLORATION

	Yes	No	Time Spent (Minutes per lesson)
2nd grade – Resource Rank			
3rd grade – Chocolate Mining			
4th grade – Activity 1: Maraca Rocks			
4th grade – Activity 2: Moving Downhill			
4th grade – Activity 3: Soil Hierarchy			
5th grade – Activity 1: Wind Erosion			
5th grade – Activity 2: Glaciers (1) ice			
5th grade – Activity 3: Glaciers (2) movement			
5th grade – Activity 4: Water Erosion			

EXPLANATION

	Yes	No	Time Spent (Minutes per lesson)
2nd grade – Using Resources			
3rd grade – Scavenger Hunt			
4th grade – Explain the Evidence			
5th grade – What's It Called?			

ELABORATION

	Yes	No	Time Spent (Minutes per lesson)
2nd grade – Using Resources			
3rd grade – What If …			
4th grade – Activity 1: Just Passing Through			
4th grade – Activity 2: Depleted			
5th grade – Activity 1: Landforms Photo Identification			
5th grade – Activity 2: Sedimentary Sandwich			

EVALUATION

	Yes	No	Time Spent (Minutes per lesson)
2nd grade – Resource Use			
3rd grade – A La Carte			
4th grade – Student Presentations of Research			
5th grade – Activity 1: Written Assessment Rubric			
5th grade – Activity 2: Landforms Photos Identification			

2. Which of the lesson plans have you used in your classroom since you learned about the *GLOBE* lessons?
   Mark (X) in ONE box on each table.

EXPLORATION

	Yes	No	Time Spent (Minutes per lesson)	Not Applicable
4th grade – Soil Horizons				
4th grade – Soil Temperature				
4th grade – Soil Characterization				
4th grade – Soil pH				
5th grade – Paleoclimates & Pollen				

ELABORATION

	Yes	No	Time Spent (Minutes per lesson)	Not Applicable
4th grade – Soil Bulk Density				
4th grade – Soil Fertility				
5th grade – Glaciers: Then & Now				
5th grade – Natural Records of Change				

Please write any ADDITIONAL COMMENTS you may want to convey to the researcher here:

NOW, PLEASE CONTINUE TO SECTION III – 5E Instructional Model
OR you may click on the "SAVE" button and return to the Survey at a future time.

SECTION III – 5E Instructional Model

This next section contains questions about your views and opinions regarding the 5E Instructional Model training you received and how you have implemented this model in your teaching.

1. **PRIOR TO ATTENDING** the Texas Regional Collaboratives training on the 5E model for teaching science, to what extent were you able to:

		Not at all	A little	Some what	Much	A great deal
		0	1	2	3	4
a	Handle a range of classroom management for science laboratory instruction?					

b	Have a knowledgeable background to teach science?					
c	Assess student learning of science concepts through alternative measures?					
d	Select and adapt science curriculum and science instructional materials?					
e	Mentor or coach other teachers for improving science education at your campus?					
f.	Use science journals to encourage student thinking and writing.					

2. **AFTER ATTENDING** the Texas Regional Collaboratives training on the 5E model for teaching science, how well are you able to:

		Very well prepared	**Well prepared**	**Somewhat prepared**	**Not at all prepared**
		4	**3**	**2**	**1**
a	Handle a range of classroom management for science laboratory instruction?				
b	Have a knowledgeable background to teach science?				
c	Assess student learning of science concepts through alternative measures?				
d	Select and adapt science curriculum and science instructional materials?				
e	Mentor or coach other teachers for improving science education at your campus?				
f.	Use science journals to encourage student thinking and writing.				

3. What kind of question(s) did you hear the students asking themselves after any ENGAGEMENT activity **you used?**
Name of Lesson _____

4. Type an example of ONE question that you used to encourage and/or focused students' attention during any **EXPLORATION** activity you used.
Name of Lesson _____

Please write any ADDITIONAL COMMENTS you may want to convey to the researcher here:

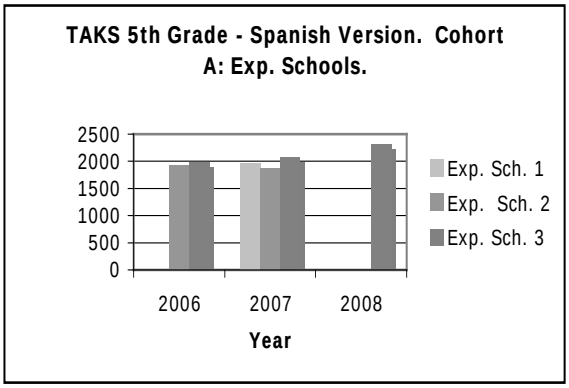
Thank you for your time in completing both surveys for this research study.
Please click on the "END OF SURVEY" button now so that your survey is submitted to the researcher.
Sincerely, Linda L.G. Brown

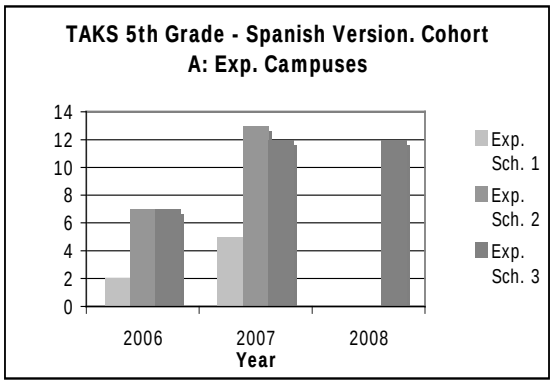
Appendix D: Spanish Version of TAKS.

Table 1. TAKS Spanish Version.

Cohort A: Experimental Campuses

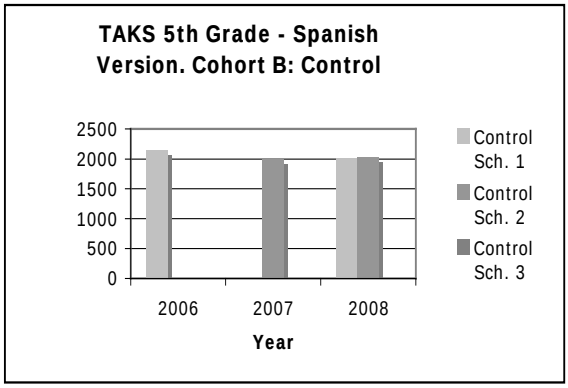
	2006 TAKS	2006 # Students	2007 TAKS	2007 # Students	2008 TAKS	2008 # Students
Exp. School 1	*Not available*	2	1955	5	*None Tested*	0
Exp. School 2	1915	7	1876	13	*None Tested*	0
Exp. School 3	1978	7	2079	12	2305	12

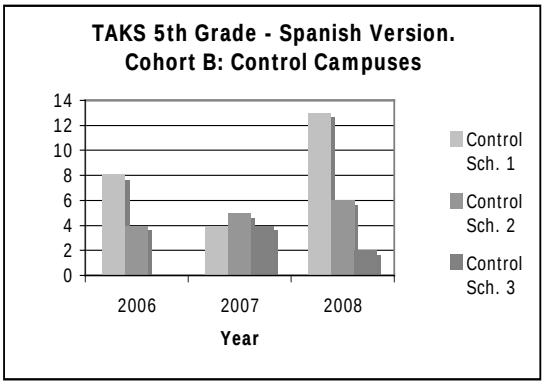




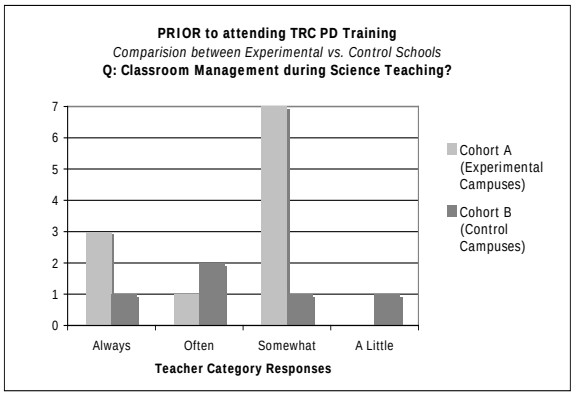
Cohort B: Control Campuses

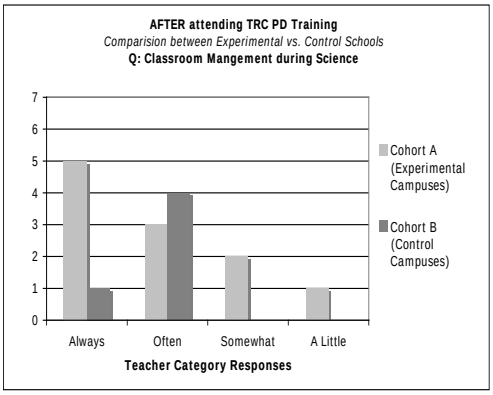
	2006 TAKS	2006 # Students	2007 TAKS	2007 # Students	2008 TAKS	2008 # Students
Control School 1	2153	8	*Not available*	4	2012	13
Control School 2	*Not available*	4	1996	5	2030	6
Control School 3	*None Tested*	0	*Not available*	4	*Not available*	2

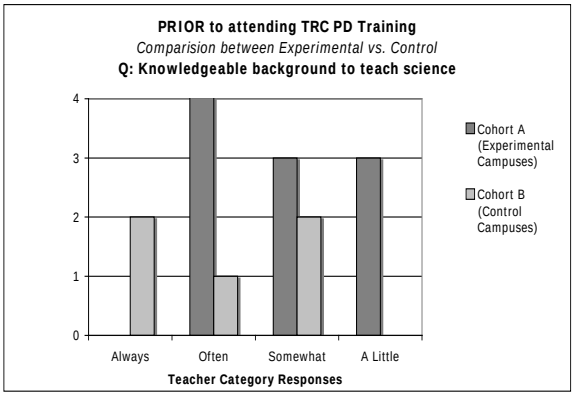


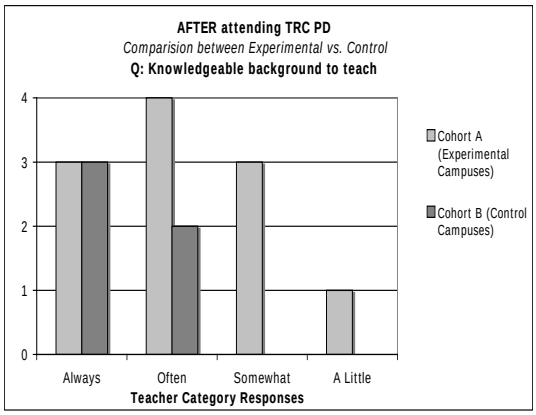


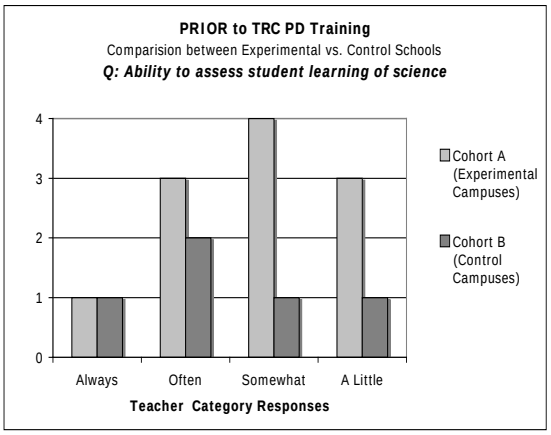
Appendix E: Other comparisons between Experimental vs. Control Schools - Prior and After TRC PD training.

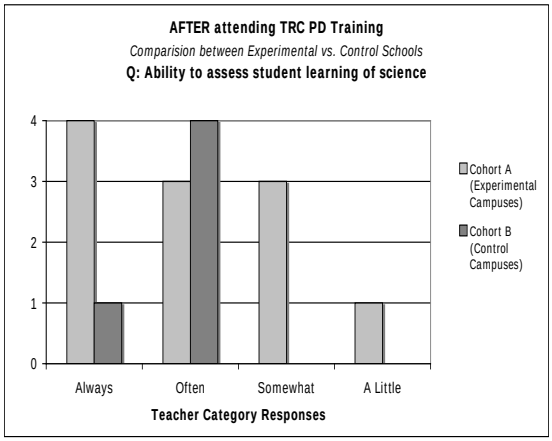

PRIOR to attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Classroom Management during Science Teaching?
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)

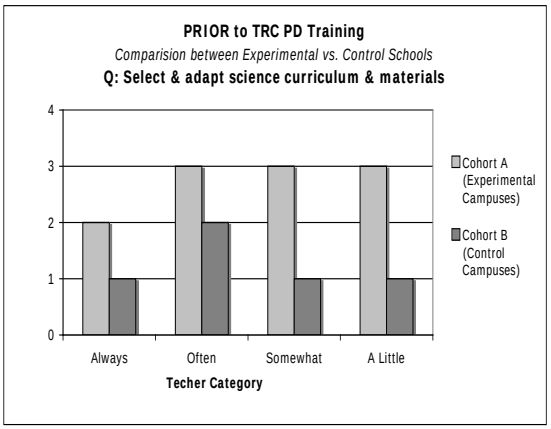

AFTER attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Classroom Mangement during Science
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)

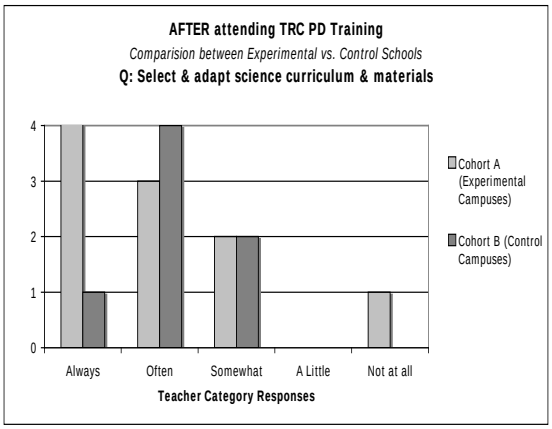

PRIOR to attending TRC PD Training
Comparision between Experimental vs. Control
Q: Knowledgeable background to teach science
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


AFTER attending TRC PD
Comparision between Experimental vs. Control
Q: Knowledgeable background to teach
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Ability to assess student learning of science
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


AFTER attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Ability to assess student learning of science
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Select & adapt science curriculum & materials
4
3
2
1
0
Always
Often
Somewhat
A Little
Techer Category
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


AFTER attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Select & adapt science curriculum & materials
4
3
2
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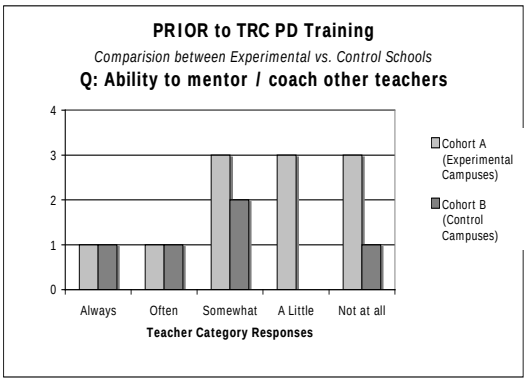
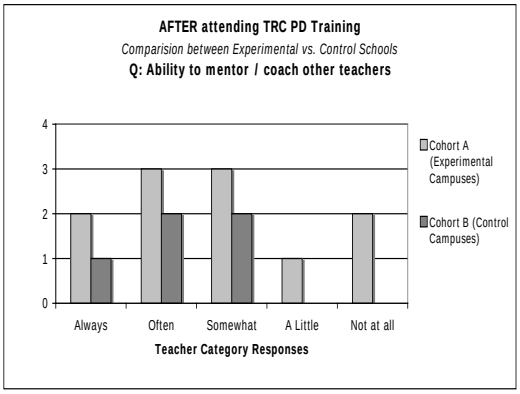
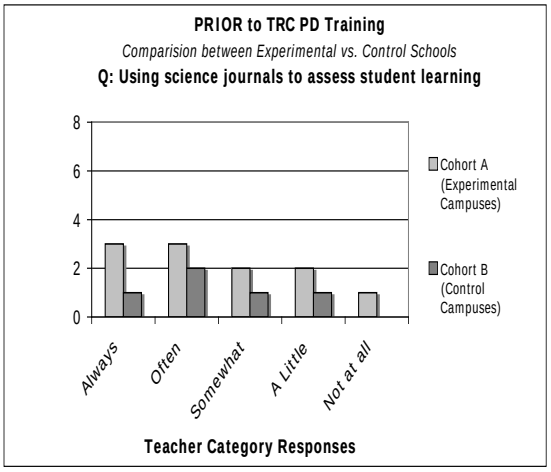
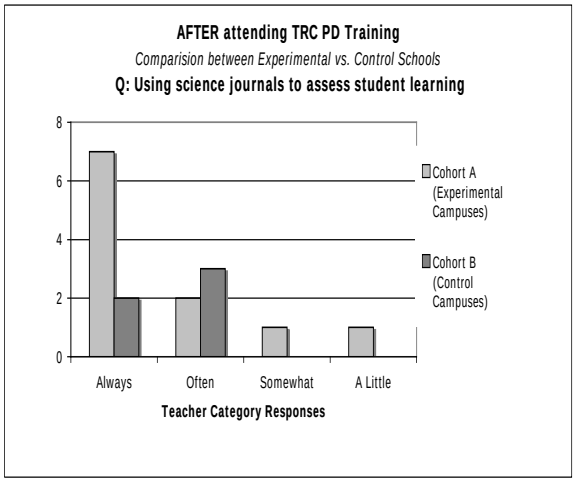
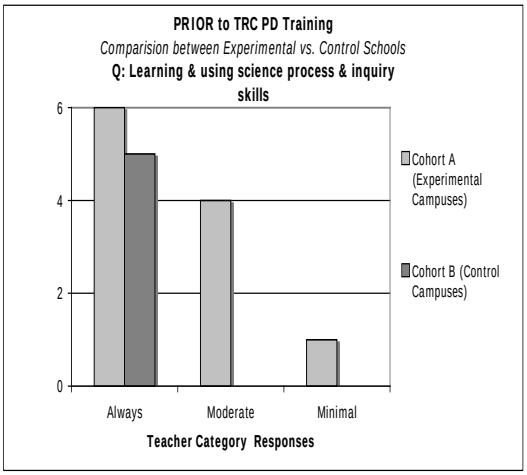
Always
Often
Somewhat
A Little
Not at all
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)

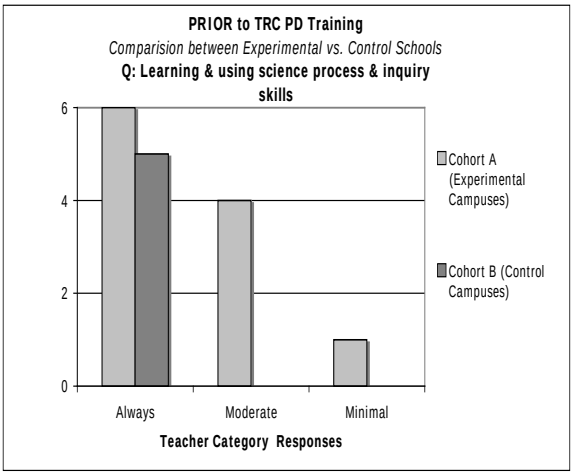

PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Ability to mentor / coach other teachers
4
3
2
1
0
Always
Often
Somewhat
A Little
Not at all
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)

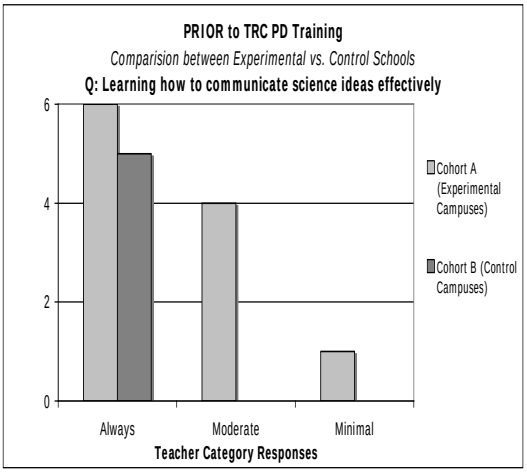

AFTER attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Ability to mentor / coach other teachers
4
3
2
1
0
Always
Often
Somewhat
A Little
Not at all
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)

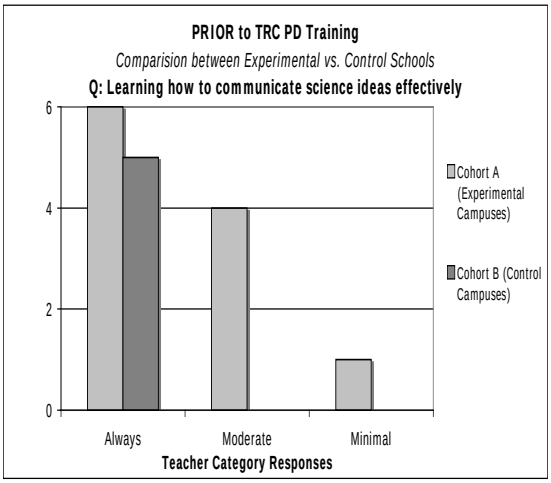

PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Using science journals to assess student learning
8
6
4
2
0
Always
Often
Somewhat
A Little
Not at all
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


AFTER attending TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Using science journals to assess student learning
8
6
4
2
0
Always
Often
Somewhat
A Little
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Learning & using science process & inquiry skills
6
4
2
0
Always
Moderate
Minimal
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Learning & using science process & inquiry skills
6
4
2
0
Always
Moderate
Minimal
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Learning how to communicate science ideas effectively
6
4
2
0
Always
Moderate
Minimal
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)


PRIOR to TRC PD Training
Comparision between Experimental vs. Control Schools
Q: Learning how to communicate science ideas effectively
6
4
2
0
Always
Moderate
Minimal
Teacher Category Responses
Cohort A (Experimental Campuses)
Cohort B (Control Campuses)