



# Spitzer Space Telescope Research Program for Teachers and Students

## Program Impact Summary

### 2005 – 2009



The Spitzer Space Telescope Research Program for Teachers and Students is a joint project of the Spitzer Science Center (SSC) and the National Optical Astronomy Observatory (NOAO), providing teachers and students with authentic science experiences using observing time on the Spitzer Space Telescope. This program has as its goals the fundamental NASA goals of inspiring and motivating students to pursue careers in science, technology, engineering, and mathematics as well as to engage the public in shaping and sharing the experience of exploration and discovery. Through the program teams of teachers and students are provided with unique opportunities to observe with the Spitzer Space Telescope and work with Spitzer archival data. Once the observations are complete, the research team, made up of students, teachers, and a mentor scientist, meet to complete the data analysis. Through various forums and media the teams present their findings to others throughout the scientific community, as well as the general public.



A total of 32 teachers have received training and participated in research projects. The teachers include Jeff Adkins - CA, John Blackwell - NH, Karen Borders - WA, Howard Chun - RI, Lauren Chapple - MI, Harlan Devore - NC, Velvet Dowdy - KY, Cris DeWolf - MI, Peter Guastella - NY, Rosa Hemphill - OR, Ardis Herrold - MI, Chelen Johnson - MN, Virginia Jones - ID, Susan Kelly - NY, Thomas Loughran - IN, Tony Maranto - NH, Chris Martin - AZ, David McDonald - MT, Jeff Paradis - NY, Vincent Pereira - NY, Peter Pitman - MN, Steve Rapp - VA, Theresa Roelofsen - NJ, John Schaefers - PA, Babs Sepulveda - CA, Linda Stefaniak - NJ, Tim Spuck - PA, Dwight Taylor - AK, Jen Tetler - WA, Beth Thomas - MT, Cynthia Weehler - TX, and Lynne Zielinski - IL.

**News Audience Nearly 6 MILLION People**



Oil City kids chalk up some out-of-this-world discoveries

Education in the stars



Thanks to many front-page news articles, and radio/TV broadcasts, stories about the Spitzer Space Telescope, and teacher/student research have reached a potential audience of 5,831,742. According to current records there have been 48 newspaper articles, 37 radio broadcasts, 14 magazine/newsletter articles, two TV broadcasts, and numerous Internet articles across the United States reporting on various aspects of teacher and student involvement. Some of the media outlets include:

- Pasadena Star News
- KSTX Texas Public Radio
- Stockton Record
- Fayetteville Observer
- South Bend Tribune
- Society of Physics Students News
- Contra Costa Times
- Discovery Bay Press
- ASP Mercury Magazine
- NASA News

**Spitzer Teachers/Students Deliver Nearly 200 Presentations - Reach Over 14,000**



For the past five years the 32 teachers involved in the Spitzer Space Telescope Research Program for Teachers and Students have been sharing their experience with other educators, amateur astronomers, and members of the general public. These presentations have taken place in their local areas, as well as in the state, national, and international arena. Some examples of forum locations include:

- American Astronomical Society meetings
- National Science Teachers Association conferences
- State Science Teachers conferences
- Christa McAuliffe Planetarium
- Carnegie Science Center
- GHOU Conference in France
- INTEL Science Fair

**High School Students using Spitzer Data/Research Receive Regional and International Science Awards**

Students involved in the Spitzer program have been motivated to enter their research at science fairs across the Country. As Oil City High School student Matt Walentosky put it, "The Spitzer Program helped me find my life's passion." Like Matt, other's are finding their passion too.

To date, 79 high school students have visited the Spitzer Science Center to conduct research or attended AAS meetings to present their findings, over 1200 students have used Spitzer data in the classroom, and about 105 students feel the program has influenced them to pursue careers in science. Of these 105 high school students, 45 of them have chosen careers in astronomy/space science.

And they're not just talking about science, they're doing it. Forty-two students involved in the project have entered science fairs across the United States, and they are bringing home top prizes. Some of the awards to date include:

**Deer Valley High School, CA - Teacher Jeff Adkins - Student Brielle Hinckley won 3rd place at the 2006 Contra Costa**

County Science and Engineering Fair, 2nd place from Mt. Diablo Astronomical Society, \$750 scholarship from Chevron, Thomas Travagli and Alekzandir Morton won 1st place at the Contra Costa County Science and Engineering Fair 2007, medallion from Yale Science and Engineering Association, 1st place Contra Costa County Science and Engineering fair 2008, 1st place California State Science Fair 2008, \$1000 Chevron scholarship (each) and \$100 from Mirant Corp; John Michael Santiago won 4th place in Physical Science at Contra Costa County Science and Engineering Fair 2007; Ame Bartlebaugh won 3rd place and \$100 from Mirant Corp. at the 2009 Contra Costa County Science and Engineering Fair

**Grosse Pointe North High School, MI – Teacher Ardis Herrold** - Student Zackery Schroeder presented research at the Junior Science and Humanities Symposium, the Southeast Michigan Science Fair, and at the Intel International Science Fair in Albuquerque, New Mexico.

**Manhasset High School, NY – Teacher Peter Guastella** - Students Ashley Peter, Will Wassmer and Rose Haber won 3rd place at the Rohm Haas Invitational Science Fair and High Honors at the Long Island Science Congress. AJ Scaramucci, Nick DiPreta won Honorable Mention at Long Island Science and Engineering Fair and Honorable mention at Rohm Haas.

**Mecosta-Osceola Intermediate School District, MI – Teacher Cris DeWolf** - Students Justin Boerma, Stephen Brock, Trevor DeWolf won Regional Science & Engineering Fair Top Team Award and the Michigan Earth Science Teachers Association Award of Excellence in Earth & Space Science.

**Oil City Area High School, PA – Teacher Tim Spuck** - Student Danielle Yeager won first place at 2008 Pittsburgh Regional Science & Engineering Fair in the Engineering/Robotics Senior Division; Matt Walentosky - 2008 Pittsburgh Regional Science & Engineering Fair where he was awarded \$12,500 annual scholarship, an Honorable Mention by the US Army, and was one of only three people selected to move on to the International Science Fair, 2008 International Science & Engineering Fair 2nd Place in the Physics and Astronomy Division and the American Astronomical Society

Sponsors Award; Nick Kelley - 2008 Pittsburgh Regional Science & Engineering Fair - First Place in Earth/Space/Environment Senior Division, Carnegie Science "Best of Show" Award Senior Division; Matt Walentosky - Semifinalist in the Intel Science Talent Search 2009; Jennifer Butchart - 2009 Pittsburgh Regional Science & Engineering Fair where she was awarded 1st place Earth/Space/Environment Senior Division, Best of Show Award from the US Army, Migliuolo Family Sponsors Award, and was one of only three people selected to move on to the International Science Fair, 2009 International Science & Engineering Fair 4th Place in the Physics and Astronomy Division and an Honorable Mention from the American Association of Physics Teachers; Rachele Siegel - 2009 Pittsburgh Regional Science & Engineering Fair where she won an Achievement Scholarship totaling \$8,000 from Waynesburg University, and the Mu Alpha Theta Award from the National Mathematics Honor Society for the most challenging, original, thorough and creative investigation.

**Oregon Episcopal School, OR – Teacher Rosa Hemphill** - Student Emily Petroff won the 2007 Aardvark Science Expo, the Army Exceptional Project, First Place Physics & Astronomy, Best of Fair Physical Science and the Priscilla and Bart Bok Award, a 2nd Place Award at the 2007-2008 Siemens Competition in Math, Science, & Technology and Emily was a Semifinalist at the 2008 Aardvark Science Expo and 1st Place in Physics. BunRon Chen and Isaac Horenblas won the 2007 Aardvark Science Expo Honorable Mention in Chemistry. Opher Kornfeld won 3rd Place in Physics at the 2008. Aardvark Science Expo.

**Eleven Major Research Projects and 33 Poster Presentations Made**

**11 Major Research Projects**

- Star Formation in Lynds Dark Nebulae
- Spitzer Light Curve of Z Cha
- IRAC Monitoring of NGC 4051 for Interday Variability
- Spitzer Light Curve of WZ Sge
- Star Formation in High Redshift

- Clusters with Spitzer
- Young Stars in IC 2118
- Observing Iron Stars with Spitzer
- Intergalactic Star Formation in Tidal Dwarf Galaxies of M81
- AGN Spectral Energy Distributions of GLAST Telescope Network Program Objects
- The Supermassive Black Hole in Arp102B
- Detecting Brown Dwarfs in Interacting Cataclysmic Binaries

**33 Scientific Posters Presented**

- Identifying T-Tauri Stars Using Small-scale Optical Telescopes
- Star Formation in Lynds Dark Nebulae
- Spitzer 3.6 and 5.8 micron Monitoring of the Seyfert 1 NGC 4051
- Z Chamaeleontis: The Return of Dark Matter
- Classroom Applications of Cataclysmic Variable Z Cha
- Spitzer - Hot & Colorful Student Activities
- New Components in Accretion Disks: Evolution of the Lightcurve in WZ Sge
- Research-based Astronomy in the Secondary Classroom: Lessons Developed for Investigating YSOs Using APT, Excel, MaxImDL, and MOPEX
- Spitzer Space Telescope Research Program for Teachers and Students: Using Spitzer Data to Teach About Active Galactic Nuclei
- The Spitzer Space Telescope Research Program for Teachers and Students: Overview
- The Spitzer Space Telescope Research Program for Teachers and Students: The Wiki
- Resolved Galaxies in the Spitzer Survey of the Taurus Molecular Cloud
- WZ Sge: The Dark Matter in Accretion Disks
- Adapting Observations of WZ Sge Made With the Spitzer Space Telescope for Use in the Classroom
- Education with Infrared Astronomy and Spitzer
- Establishing a School-based Research Community (SRC) for Astronomy
- Student Exploration of Star Formation Rate in Three High-Redshift Galaxy Clusters: a NOAO/Spitzer EPO Project

## Teacher Comments and Student Stories

- Galaxy Clusters: The Local Effects on Star Synthesis
- Variation in Star Formation Rate From Galaxy Cluster Center for cl1037
- Observations of S5 0716+714 With the Spitzer Space Telescope and Ground Based Telescopes
- Multiwavelength Observations of Tidally Induced Star Formation in the M81 Group
- Spitzer Space Telescope Research Program for Teachers and Students: Using Spitzer data in your classroom with (relatively) simple software
- Spitzer Observations of YSO's in the Witch Head Nebula (IC 2118)
- Spitzer Space Telescope Research Program for Teachers and Students: Young Stars in the Witch Head Nebula (IC 2118)
- Spitzer Observations of Young Stars in the Witch Head Nebula (IC 2118)
- AGN Spectral Energy Diagrams of GLAST Global Telescope Network Object 4C29.45
- Using Space Telescopes Observations in a Classroom Setting
- Mid-Infrared Properties of ARP
- Eclipsing Binary Light Curves: A Sequence of Activities to Support Secondary Student Research
- Lessons Using Polars in the Science Classroom
- Spitzer Research Program for Teachers

## Science Research Papers Published to Date

S. Guieu, L. M. Rebull, J. R. Stauffer, F. J. Vrba, A. Noriega-Crespo, T. Spuck, T. Roelofsen Moody, B. Sepulveda, C. Weehler, A. Maranto, D. M. Cole, N. Flagey, R. Laher, B. Penprase, S. Ramirez, S. Stolovy, *Spitzer Observations of IC 2118*, 2010, AJ, submitted

S. B. Howell, D. W. Hoard, C. Brinkworth, S. Kafka, M. J. Walentosky, Frederick M. Walter, and T. A. Rector, *Dark Matter" in Accretion Disks*, 2008 ApJ 685, 418-427.

S. B. Howell, C. Brinkworth, D. W. Hoard, Stefanie Wachter, Thomas Harrison, Howard Chun, Beth Thomas, Linda Stefaniak, David R. Ciardi, Paula Szkody,

and Gerard van Belle, *First Spitzer Space Telescope Observations of Magnetic Cataclysmic Variables: Evidence of Excess Emission at 3-8  $\mu\text{m}$* , July 2006, ApJ 646 No 1 L65-L68

Rebull, L. M.; Stauffer, J. R.; Spuck, T. S.; Maranto, A. R.; Roelofsen, T. E.; Sepulveda, B.; Weehler, C. R., *Spitzer Observations of Young Stars in the Witch Head Nebula (IC 2118)*, 2006, IAUS, 237, 199

### Articles Published in the 2009 Research Based Science Education Journal:

*Identifying T Tauri Stars Using Small Optical Telescopes* by Jennifer Butchart, Oil City Area Senior High School, Oil City, PA, Teacher: Mr. Tim Spuck, pages 24-32.

*Investigating Star Formation in Lynds Cloud 981* by Rachele M. Siegel Oil City Area Senior High School, Oil City, PA, Teacher: Tim Spuck, pages 33-45.

*Star Formation in Isolated Dark Nebulae: YSOs in LDN 981* by Justin Boerma, Stephen Brock, and Trevor DeWolf Chippewa Hills High School, Remus, MI, Teacher: Cris DeWolf – pages 46-56.

### Articles Published in the 2007 Research Based Science Education Journal:

*Spectral Analysis of Blazar S5 0716+714 using Spitzer Infrared Space Telescope and New Mexico Skies Telescopes* by Alekzandir Morton, Manutej Mulaveesala and Thomas Travagli, Deer Valley High School, Antioch, CA (Teacher Jeff Adkins) - pages 49 - 56

*Galaxy Clusters: The Local Effects on Star Synthesis* by Zachary Schroeder, Gross Pointe North High School (Teacher Ardis Herrold) - pages 66-79

*Star Formation Rate in Three High-Redshift Galaxy Clusters: A Contribution to the Study of Galactic Evolution* by Vinay Patel and Matt Pellegrino, Saint Joseph's High School, South Bend, IN (Teacher Thomas Loughran) - pages 80-94

### Articles Published in the 2006 Research Based Science Education Journal:

*Micro-Variability of 4c29.45 using the Spitzer Space Telescope, and Ground Based Telescopes* by Brielle Hinckley, Deer Valley High School, Antioch, CA (Teacher Jeff Adkins) - pages 12-21

**Jeff Adkins (CA)** - Our students won the California State Science Fair (1st place) with a Spitzer project. As a result of this and other projects, our district supported the development of a space academy at our school. The space academy is set to expand in the next year into a full-blown science academy supporting research based science education at our school with me as the director. I'm going to have more influence at the district level because of it. My students, Thomas Travagli and Alekzandir Morton, were told by Michelle Thaller that they may be the only high school students who ever wrote a Spitzer proposal (possibly even any space telescope proposal) and had it accepted. Ultimately it was a follow-up to an earlier project and attached to a previous proposal, but they did almost all the work and it was their original idea. One student, Brielle Hinckley, was my first Spitzer Student. She said the work was the hardest thing she'd ever done and she "hated math." Now she's the manager of a flight school and working on her pilot's license. At least three former Spitzer Students are going into astronomy and astrophysics as careers in various ways. Others are involved in more peripheral ways or at least tried out the major before switching to some area they found more appealing.

We have also increased support from our local astronomical society and from our district because of the Spitzer work. I got a research lab for my research students, an office to run the program, and it looks like we may take over an old manufacturing lab.

Personally being able to work on the Spitzer project has been a tremendous boost to me. I never thought I'd ever have a chance to participate in an active space mission. Now I can say I worked on one proposal, and my students worked on one as well. I cannot express how much inspiration I've derived from the opportunity and am very grateful for it.

**John Blackwell (NH)** - An interesting anecdote to share would be about one of my students a few years ago who worked with the Spitzer data we collected as part of our project. She was interested in high-energy astronomy (X Rays) but then learned about the importance of multi-

wavelength study and how the IR data could be helpful in so many ways. She then began tapping into the other available data sets from past Spitzer projects for an excellent senior project involving IR studies of star forming HII regions. This is all from a student who thought she was "bad at science" at the start. She went on to Colby College and took their astronomy course. The teacher immediately asked her to be a teaching assistant! Another of my students said that they now understand that scientists are people too, and that they don't all wear white lab coat every day!

Being a part of the Spitzer project has been most rewarding as a teacher and as a scientist. Working alongside professional astronomers allows unique insight into the world of long-term astronomical research for both my students and myself. It adds to the reality of research, that it takes planning, time, perseverance and patience.

**Kareen Borders (WA)** - Students and teachers alike have been tremendously motivated by the Spitzer program. We have now given two Spitzer/Infrared Astronomy workshops for teachers. One was held in Washington State and the other in Puerto Rico. Both were well attended with over 25 teachers attending each workshop. Evaluations were overwhelming positive and indicate that these teachers will take back their learning to their students.

We have also intentionally engaged students in Spitzer. Dr. Michelle Thaller has been to our school twice and amazed our students with the relevance of infrared astronomy. Students in 6th, 7th, and 8th grade are participating in a variety of electromagnetic investigations that range from the use of ultraviolet beads (effectiveness of sunscreen) to partnering with the fire department in demonstrations of infrared cameras.

**Cris L. DeWolf (PA)** - My wife heard this from one of my student's former teachers. "I never would have thought that he would ever be this successful as a student! (In reference to his being part of the team that won team competition in our regional ISEF). Going to the Intel ISEF in Reno is quite an accomplishment for him, considering how his behavior affected his performance in my 4th grade class."

The Spitzer Teacher Program has opened another door for both my stu-

dents and I. Having research project possibilities beyond what we had normally done in the biological sciences is a fantastic opportunity for other students in my classes to experience the successes that others have had in Biology. Astronomy is now the most popular of our elective Earth & Space Science courses, with at least 2 sections being offered (full sections!) each school year. I do not think that either the students or the administration in my district would support astronomy in our high school to the level they do if it were not for my involvement in programs like Spitzer, THEMIS-GEONS Ambassadors, TLRBSE, and now the Heliophysics Educator Ambassadors program. My students and I are indeed fortunate that these opportunities exist.

**Peter Guastella (NY)** - Three of Manhasset's Spitzer students are staying actively involved in Astronomy. Ashley Peter is attending Kopernick Astronomy Camp this summer and Willy Wassmer is attending astronomy camp at Alfred University. Rose Haber is using her knowledge to start a spectrographic survey of light polluted skies. Each of these students will be Juniors this year and are eager to further develop their astronomy knowledge. The group presented their Spitzer research that continued to look at archival data for new YSO's in other Lynds Clouds. Their research took a 3rd place award at one fair and a High Honors award at a second fair. For myself, my knowledge and love of Astronomy continue to grow. I attended John Blackwell's Phillips Exeter Conference last month and will be working at McDonald Observatory on the Monet Project later this month.

**Ardis Herrold (MI)** - One of my students worked on a Spitzer project, presented it and won the Detroit area science fair and was offered a four year full academic scholarship to Wayne State University (Detroit). He is currently enrolled there as a junior in chemical engineering. The Spitzer experience on his resume also contributed to him accepting an REU opportunity this summer.

Also, one of the participants in one of my infrared workshops was a brand new teacher. She came along with another teacher and got the opportunity to network with and meet many of the Earth science teachers in our area. This served as a starting point for her to become more

involved in the MI Earth Science Teachers Association (MESTA), where she has continued to become more involved not only with her own learning but with helping to conduct more teacher in-service opportunities. Another participant in one of my workshops/talks also became involved both with TLRBSE and as a Spitzer teacher.

**Chelen Johnson (MN)** - After her initial involvement with the Spitzer program, one of my students has become so excited about science that she is spending over eight weeks conducting research full-time at a nearby environmental study site. She is also leading a new group of Spitzer astronomy researchers at our school.

The Spitzer teacher program has re-invigorated my research interests. Helping students work with authentic data is a fascinating process to watch as they experience "real science" through trials and tribulations.

**Susan Kelly (NY)** - As a result of being a participant in the Spitzer Space Telescope Research Program for Teachers and Students I acquired a stronger background in the research application of infrared astronomy. This experience resulted in the development of classroom activities that helped students to recognize the value of acquiring infrared data, as well as better understand light beyond the observable range. Because of my involvement in the project, I have been assigned to develop an elective course entitled Introduction to Science Research next year.

**Chris Martin (AZ)** - I teach at a school with 300 students. 50% of the students have special needs and many are at risk. Science with Spitzer is dynamic and life changing. Few of my students will go to university, but those that do tell me that they take and enjoy astronomy courses. Most of my students struggle to get their high school diploma. The school counselor tells parents that wood-shop and science are the main motivators at our school.

Several of my at-risk students stay after school to work on Spitzer projects for credit recovery. This motivates them to come to school and take science. Students from the after school program used a 61" telescope this summer, collecting 500 images of a white dwarf that will be analyzed by next year's students.

Working with the Spitzer program has enabled me to offer my special needs students cutting edge science projects.

**Dave McDonald (MT)** - My involvement with the Spitzer program has been great for both my students and I. A number of my students working with me on the Spitzer data have gone into science degrees in college and one is in the NASA Inspire program and currently is doing research with nanotubes.

**Vincent Pereira (NY)** - A student of mine, Mr. Redwan Saleh, who I took to the SSC to work on the Spitzer Project, had this to say when he graduated: "Thank you for the opportunities you gave me to work alongside other great students and scientists at Caltech. These are things that I will never forget."

There are two ways to look at a star: one is through the lens of a telescope and the other is through the "lens" of an equation. Through my involvement in the Spitzer project I have demonstrated to my students how mathematical modeling coupled with telescopic observations can be used to unravel the mysteries of nature.

**Peter Pitman (MN)** - Bryant Richardson was a junior when he enrolled in my Advanced Topics in Astronomy course at White Bear Lake Area High School in the spring of 2008. I was so impressed by his methodical, conscientious approach to his work that I invited Bryant to participate that summer in a research study with astronomers and teachers at the Spitzer Science Center at the California Institute of Technology. Bryant became a leader and an integral part of the research team that presented their research results and data at the American Astronomical Society's annual meeting the following January in Long Beach, California. Bryant applied to and was accepted to the class of 2013 at Embry-Riddle Aeronautical University in Daytona Beach, Florida. When the admission committee was notified of Bryant's successes in the Spitzer Space Telescope Research Program for Teachers and Students, he was deemed a high academic scholar and was given a scholarship to attend the University. He begins his academic study in the fall of 2009.

I have fully integrated the Spitzer studies on Variability of Galaxies and Interacting Cataclysmic Binaries into

the Advanced Topics in Astronomy Course at White Bear Lake Area High School. Given the opportunity to participate in the Spitzer Space Telescope Research Program for Teachers and Students has afforded me the opportunity to present a facet of Astronomy not possible without my involvement in the program. The number of students involved in Astronomy Research has increased dramatically in the past 24 months, with several of my graduating seniors considering careers in the Space Sciences or Engineering.

**Tim Spuck (PA)** - The Spitzer Space Telescope Research Program for Teachers and Students is truly a flagship educational mission for NASA. All the components are there. You have kids and their teachers engaged in authentic scientific research. You have scientists, teachers, and students collaborating together to unravel the mysteries of the universe. And you have students and teachers reporting their findings at a professional scientific forum. This is the cycle of science that is often talked about in education circles, but rarely practiced.

Here in Oil City this program has facilitated an entire movement. There's a group of kids running around school and they are simply called, "The Spitzer Kids." But that title carries a great deal of respect and admiration among their peers. These kids work hard to earn that title, and it has had a huge impact. Oil City is a small rural school and is among the 10 poorest school districts in the state of Pennsylvania. Over the past three years we have had 6 students from this small school go on to college for careers in astronomy or space science education. Other students have gone on to pursue careers in other areas of science, and most have used their Spitzer experience to secure significant scholarship awards. Using their Spitzer research these students have won regional, national, and international awards and recognition. The Spitzer Space Telescope Research Program for Teachers has had a profound impact on the students at Oil City as well as the entire community. We here at Oil City want to thank NASA, NOAO, and all the people that have made this incredible experience possible.

**Beth Thomas (MT)** - Being involved in the Spitzer Teacher program has provided me with new tools, skills, and perspec-

tives to share with my students as they discover their world. My hope is, this in turn will inspire and motivate students to want to pursue careers in science and mathematics. Personally, I have learned so much and have enjoyed the process and opportunity to work with scientists, teachers, and students from around the country to use and apply authentic data in unique research projects.

**Cindy Weehler (TX)** - I had a student who had missed a lot of days her junior year, but she said being involved with Spitzer motivated her to come every day. The difference between her junior year (many absences for her Chemistry class) and senior year, when she took my Science Research and Design class was phenomenal. She didn't miss a day.

In addition, my work with Spitzer and subsequent presentations played a major role in the state of Texas adopting astronomy as a high school science course.

The Spitzer Teacher Research Program was a huge challenge for me. Like in college years before, I had to stretch my brain to learn new things and it completely rejuvenated me. I worked hard and felt hugely rewarded with new skills. It's a good reminder that our students are doing that too.

**Important Note on the Data:** The Spitzer Space Telescope Research Program for Teachers and Students Program began in 2005 and ended in 2009. The Impact Summary was completed by analyzing historical records, and conducting interviews and surveys after the program had ended in May 2009. Only 24 of the 32 teachers involved returned a completed survey. Due to the data limitations, it is likely that the numbers presented here are significantly less than the actual numbers, and as a result the impact may be significantly broader.

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