Current Results and Future Directions of the Pulsar Search Collaboratory

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BACKGROUND

In the summer of 2007, the Green Bank Telescope was shut down for a track replacement. We used this extended maintenance period to carry out a search for new pulsars: we collected data as the sky drifted overhead. We received 1500+ hours of observing time and collected 130 terabytes of data! With the help of scientists and staff at NRAO and WVU, high school students from **nine states** are searching this data looking for new pulsars!

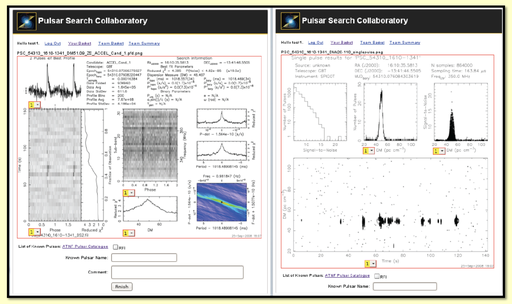

The GBT compared to the Washington Monument

Goals of the PSC

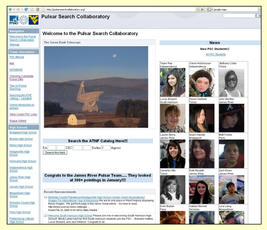
- Advance high school science teachers' and students' understanding of the nature of science and the relationship between science and technology.
- Prepare teachers to implement authentic research with students.
- Promote student use of information technologies.
- Increase student interest in and awareness of STEM career pathways.
- Contribute to the field.

Participants (2008-2010):

- 9 States, 32 teachers, 260 students
- 170 active PSC students
- 30% student retention from years 1 and 2



PSC Data (Prepfold (left) and single pulse diagnostic plots)



PSC website is a "Google Site"--allows collaboration, and communication between students, teachers and staff.


A Research Team at the Green Bank Telescope, Shay Bloxton in front, Lucas Bolyard standing-July, 2009. Lucas and Shay have made confirmed discoveries as PSC members.

THE PROGRAM

Summer Residential Institutes at NRAO in Green Bank.

•10 Day teacher institute: Become experts in pulsar astronomy, use the GBT, analyze pulsar data as you work with professional astronomers.

•6 day Student Research Institute: Teacher select 2-3 students from their school to join them. Teachers assist in training the students.

Classroom. Teachers and student leaders introduce the PSC to their classes and implement hands-on activities. Students will then be invited to join the PSC school team. PSC teams conduct original research by analyzing data from the GBT with the expectation of discovering new pulsars and characterizing changes in previously-known pulsars.

Online Resources. We use Elluminate Live! to conduct online classes for teachers and students as well as pulsar follow up observing sessions. Online classes provide background content on topics such as the EM spectrum, life cycle of a star, properties of pulsars etc. Follow-up observations occur when students have flagged promising candidates.. The PSC Website is a Google Site. The Database is custom designed.

Annual 2.5 -day Capstone Seminar at WVU. Students who are active PSC members and meet all requirements are invited to the Capstone Seminar at WVU. There they:

- present their research,
- hear talks by professional astronomers,
- tour the STEM colleges within the University
- Teachers and School Counselors attend as well. **NEW Teachers attend seminar day.**

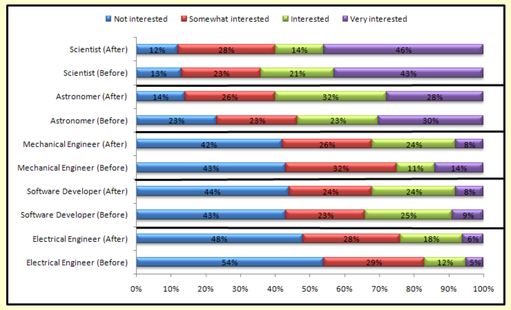
Additional Benefits. Both teachers and students may receive graduate and undergraduate credit, respectively, for their participation in PSC. Room/Board are free.
Teachers receive $100/day stipend, and educational materials.

RESULTS

PSC increases Interest in STEM Careers:

	Pre-Institute		Post-Institute		Paired One-sided t	p <
	Mean	Std Dev	Mean	Std Dev		
Scientist	2.92	0.98	3.19	0.94	2.94	0.0030
Electrical Engineer	1.86	1.03	2.59	1.01	5.30	0.0000
Software Developer	2.05	1.00	2.30	0.97	2.31	0.0150
Mechanical Engineer	2.03	1.07	2.19	1.15	0.85	0.2007

Students participating in PSC Leadership /Institutes

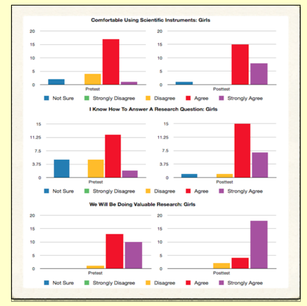


Students participating in PSC during academic year.

PSC increases Scientific Self Efficacy in Girls.

As a result of the PSC, girls:

- are more comfortable using scientific instruments;
- know how to answer a research question;
- see themselves as valuable members of a team;
- believe they will be doing valuable research.



Student Understanding of Scientific Inquiry

Items showing significant pre/post gains	PRETEST		POSTTEST		Paired-t p < 0.05
	Mean	SD	Mean	SD	
Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well, because scientists tend to accept the theory that is favored by more expert scientists.	2.8	1.1	2.5	1.0	YES p < .0318
The values and expectations of the culture determine what science is conducted, interpreted, and accepted.	3.7	0.7	3.3	1.0	YES p < .0137
Scientific theories will be gradually refined or modified as experimental techniques/instruments improve.	4.0	0.5	4.3	0.5	YES P < 0.0183
Scientists' observations of the same events may be different because the scientists' prior knowledge may affect their observations.	3.6	0.8	4.0	0.5	YES p < 0.0052
Scientists with similar background knowledge are trained to make similar observations of the same events.	2.9	0.9	3.4	0.8	YES p < 0.0147
Scientists may use different methods to investigate, but all results will eventually be verified or confirmed by using the scientific method.	3.3	0.9	3.7	0.8	YES p < 0.0099
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QUESTIONS FOR THE FUTURE

Can We Expand the program?

- Less face-to-face time with teachers and students (current contact = up to 18 days for teachers, 6+ days for students)
- Increase number of scientist mentors
- Improve online presence

PSC-West.

Experiment involving 8 Milwaukee/Chicago teachers

- 4 online intro lessons.
- 2.5 day face-to-face workshop at Yerkes Observatory 10/2010.
- Utilizes UWM faculty.
- No student leaders.
- Results: Teachers felt the workshop pace and duration was clear and appropriate,. They were able to master the diagnostic skills needed for pulsar research. However, so far, only 50% of teachers have formed PSC student teams.

For More Information: www.pulsarsearchcollaboratory.org
www.gb.nrao.edu/epo/psc.shtml

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http://www.nsf.gov