



An Authentic Research Experience in an Astronomy Education Professional Development Program: An Analysis of 8 Years of Data on the NASA/IPAC Teacher Archive Research Program (NITARP)



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Background: The NASA/IPAC Teacher Archive Research Program (NITARP) partners small groups of educators with a research astronomer for a year-long authentic research project. This program aligns well with the characteristics of high-quality professional development (PD) programs and has worked with a total of 103 educators since 2005. In this poster, we explore surveys obtained from 74 different educators, at up to four waypoints during the course of 13 months, incorporating data from the class of 2010 through the class of 2017. This work illuminates what benefits the program brings to its participants, and serves as a model for similar PD programs in other STEM subjects. NITARP support is provided by the NASA ADAP program.

Why do teachers participate?
NITARP asks a lot of its participants (many hours over a year); we don't pay salary, only trip costs. **What motivates teachers to participate in NITARP? Does this change over the NITARP year? And, how can we help them when they get frustrated?**
We mapped what educators tell us onto a continuum ranging from **more inward-focused to more outward-focused**.

Look at responses. Encode responses as inward (colleagues, self) and outward (students, teachers). Some responses missing or short; others are long. Counting encoded words ameliorates long/short response inequality.

- A NITARP Year**
- September 2017: Participants selected from nationwide application process.
 - January 2018: Participants attend 'NITARP Bootcamp' and the Winter AAS. Teams meet, start working.
 - Spring 2018: Teams work remotely, write proposal; proposal reviewed, teams respond, proposal finalized. Teams start on projects.
 - Summer 2018: Teams (including students) come out to Caltech for 4 days to do intensive work on project.
 - Fall 2018: Teams finish up project, submit 2 AAS abstracts (1 science, 1 education).
 - January 2019: Teams (including students) present results at Winter AAS.
 - Surveys are collected at 4 'waypoints': (1) pre-first AAS, (2) post-first AAS, (3) post-Summer visit, (4) post-second AAS. Have surveys from 74 educators in 8 classes. 70% HS, 81% public schools, 57% women.

OUTWARD: teaching goals, student benefits (helping students learn or with research projects, share experiences with other educators)

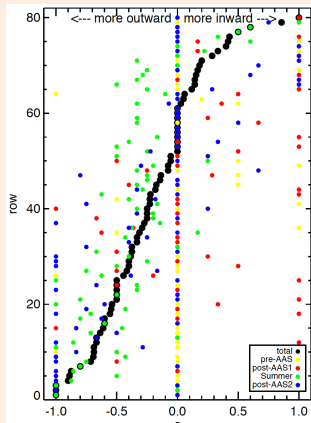


INWARD: personal learning (new science, new skills, finding like-minded educators, building networks)

It was most rewarding to watch my students gain confidence in science and to shed some self-doubt. -- educator, 2013 class; OUTWARD

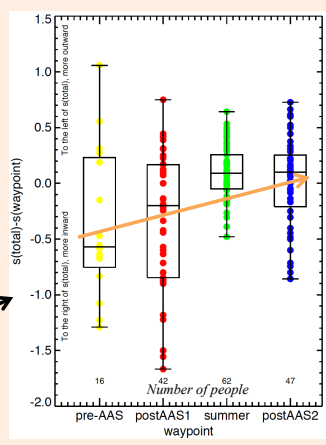
...expand my ability to offer exciting and meaningful educational opportunities to students in my classes [...] in my own school, and [...] in many secondary schools in my geographic area. -- educator, 2017 class; OUTWARD

The best thing [...] was watching how much my students' learning had evolved over time. So much of what we have done [...] had a really steep learning curve, and it was really great to see them [master it] -- educator, 2012 class; OUTWARD



Any time I can meet with other educators who teach what I teach, I benefit. Having the opportunity to get new ideas from my peers and discuss projects, activities, and strategies helps me to grow... -- educator, 2011 class; INWARD

...connecting with working scientists and networking with other colleagues has immeasurable value. -- educator, 2012 class; INWARD



- What are the major outcomes of NITARP?**
- Understanding the nature of science:** 47% self-report some change, 27% report major changes in understanding.
 - Teamwork:** half the teachers list it as the most important thing about the trips. Science is collaboration and sharing; teachers build those skills. NITARP alumni = community of practice. We have historically underestimated the importance of teamwork!
 - Skills to be an astronomer:** collaboration (30%), also patience, persistence, creativity.
 - Comfort with the unknown:** at least ~40% describe being more confident in tackling complex projects where they don't know all the answers or even exactly how to get there.
 - Student empathy:** Remembering what it is like to be overwhelmed.
 - Research community:** Maintaining linkages to astronomy community. Alumni returning to AAS. Collaborations among alumni.
 - Professional growth:** 80% report wanting to learn/grow. We had a significant role in major career changes of at least ~12% of alumni; some report "life changing."
 - More/better science in classrooms:** At least 60% tell us that they are including richer, more authentic science activities in their classrooms.

NITARP is both highly intensive and selective; participants are highly motivated. **No value judgment** on inward/outward focus; it just reflects more of what motivates them to be here. NITARP has had more outward-focused educators than inward-focused, though there is a bias against the extremes on either end of the continuum. Moreover, **teachers change over time**. They start the year focused on their own gains (affected by application process; "T" in NITARP is teachers!). *Post-AAS#1:* getting excited, meeting last year's teachers/students, sharing with own students. *Summer:* working with team (teachers+students) intensively, with a common goal. *Post-AAS#2:* team (teachers+students) sharing results with community (astronomers, home). Thinking about integrating experience into own classes.



What now? What should we do with this information? We ask a lot of our educators. We can see that some struggle during the year, and we haven't always known how to help them best. Someone inward-focused will be less motivated by pointing out their students' achievements; someone outward-focused may need to be reminded to step back from their students and learn themselves. Will this affect team formation? Probably not: (a) we usually don't know the people well enough when forming teams; and (b) other factors (time zone, environment such as urban/rural, etc.) are typically more important when forming teams. Our application has open-ended questions focused on personal gain; this may discourage those who are more outward-focused, and thus may ultimately affect teacher selection; we need to revisit the wording of our application questions. In terms of outcomes, we are having an impact in ways we didn't realize! We will continue to foster community.

The content discussed here is incorporated into two submitted papers to PRPER. Drop me an email if you want to know when they're accepted! rebull@ipac.caltech.edu