Impact of and Lessons Learned from NITARP, the NASA/IPAC Teacher Archive Research Project

http://nitarp.ipac.caltech.edu/

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ABSTRACT: NITARP, the NASA/IPAC Teacher Archive Research Program, gets teachers involved in authentic astronomical research. We partner small groups of educators with a mentor professional astronomer for a year-long original research project. The teams echo the entire research process, from writing a proposal, to doing the research, to presenting the results at an American Astronomical Society (AAS) meeting. The program runs January through January. Applications are available annually in May and due in September. The educators' experiences color their teaching for years to come, influencing 100s of students per teacher. This program differs from other programs that we know of that get real astronomy data into the classroom in that: (a) Each team works on an original, unique project. There are no canned labs here! (b) Each team presents their results in posters at the AAS, in science sessions (not just outreach sessions). The posters are distributed throughout the meeting, in amongst other researchers' work; the participants are not "given a free pass" because they are educators and students. (c) The 'product' is the scientific result, not any sort of curriculum packet. The teachers adapt their project and their experiences to fit in their classroom environment, and we change the way they think about science and scientists. More information: http://nitarp.ipac.caltech.edu/

MAIN PROGRAM COMPONENTS

- Group of 3-4 educators plus a mentor teacher (who has been through program before) teamed with a scientist mentor; work to develop a science research project, do it, write it up, present it – all within 13 months!
- Teachers (& scientist mentors) attend a *start-up workshop* at a winter AAS (most recent: Jan 2013).
  - Learn about their science, their tools, how AAS meetings work, how astronomers present results. (We pay for teacher travel.)
- Team works remotely to write a proposal. (most recent: March 2013.)
  - Must use data housed at IPAC: Spitzer, IRSA, NED, and/or NStED.
  - Use telecons, internet-based resources such as our wiki, etc.
  - Proposal is reviewed! Rewite proposal, if necessary, in response.
- Meet for *4 days at IPAC* to work on the data (now: Summer 2013).
  - Funding permitting, each teacher brings ≤2 students to this visit; students must be heavily involved in the project. (We pay for teacher/student travel; they may bring up to 2 more on own $.)
  - (Work remotely before and afterwards, using online resources.)
- *Present results* of the project in AAS posters (next: Jan 2014).
  - At least 2 posters per team: Science and Education.
  - Funding permitting, each teacher brings ≤2 students we pay for; they may bring up to 2 more students.
- Educators serve as NASA & NITARP ambassadors.
  - 12 hours' worth of professional development workshops, talks, etc.
- Serve as mentorsto the rest of the NITARP community of teachers and students. Now have 80 teachers who are/have been through the program, and they want to do more!

Challenges (a.k.a. lessons learned the hard way)

- **Finding the right teachers**. Have to be savvy educators, astronomers, but not yet done research.
- **Finding the right scientists**. Need to be patient! Need to help come up with project that can be done within 13 months by people who largely do not program; there need to be multiple 'exit points' such that something substantial can be presented at the AAS no matter what happens.
- **Getting all the travel logistics sorted out**. Teachers bringing kids who are not their own, on long trips. Government travel rules require some outlay of cash; stress on teachers!
- **Working remotely across time zones**. Scientists do this all the time; teachers do not. Use email, NITARP wiki. School email often broken. NITARP teams need regular (weekly or biweekly) telecons to work.
- **Software installation**. Use common or free software; some schools put severe limitations on installing software.
- **Keeping it all together**. Program is long. Between summer visit, through the start of year chaos in September, there is braindrain. Just go through it all again in the Fall – sticks better!
- **Finding funding**! We are too science-y for outreach proposal calls and too outreach-y for science proposal calls. Currently funded largely out of discretionary money. You can subsidize a team starting at $20-$30K!
- **Closing the loop**. Getting teachers to tell us what they did to "share the wealth" after their intensive participation year.
- **Sustaining a community** of trained educators. Now have 80 educators who want more, more, more. Have started a "continuing education" series of web-based tutorials for 2013.
- **Measuring this experience**. This is a complex program, and requires careful and labor-intensive evaluation. Each team, each year, is unique. Impact of program may be felt most intensively 6, 12, 18+ months after intensive year is done. Have embarked on careful study of 2013 teams.

← The NITARP delegation to the 2013 winter American Astronomical Society (AAS) meeting in Long Beach, CA – consists of the 2012 class fnishing up (teachers +students) and the 2013 class starting up (teachers)

- **OUR GOAL** is to give teachers an *authentic research experience such that they understand more about how science really works*.
- **WE USE** *real astronomical data* from archives housed at IPAC (ground- and space-based missions and surveys; primarily but not only infrared). And each team does a *new* project.
- **WE SELECT** teachers from a national competitive application process; 4 times as many people applied as we had advertised spots for 2012, and 5 times as many applied for 2013. Ideal applicants are already familiar with the basics of astronomy (e.g., what is a magnitude) and quantitative measures of astronomical data (e.g., what is a FITS file), but have not yet done research. Most of our educators are high school teachers, but also 8th grade, community college, & informal educators participate.
- No school would hire a football coach who had never played the game, and yet most science teachers have never done real scientific research. ***Our model works, and should be extendable to other sciences.***

BY THE NUMBERS…Since 2005, we have had 38 science posters, 40 education posters, and 8 refereed journal articles come out of NITARP work. 80 teachers have participated, from 33 states. ~200 different students (gr 7-13) have travelled to AAS and/or Caltech.

IMPACT SNAPSHOT : Based on a survey conducted in 2013 of 40 alumni spanning 2005-2013 (~50% of alumni, so multiply numbers by ~2 to approximate net impact)…:

- ~181 student trips.
- ~752 students at home who didn't travel but worked on aspects of the project (avg ~20 per educator).
- ~3650 students worked with on smaller aspects of the project (avg ~100 per educator).
- ~6500 students benefited from skills/resources the educator learned about via NITARP (avg ~183 per teacher).
- ~10700 students taught by NITARP educators PER YEAR. (Research in other fields suggests that simply being taught by a science teacher who has done real research makes an impact on the students' learning; Silverstein et al. 2009, Science, 326, 440.)
- ~2150 other educators reached with NITARP information, everything from "scientists are normal" through working with them on data (avg ~60 per teacher).
- Schools with NITARP teachers are 70% public/30% private.
- Schools with NITARP teachers have between 0-65% of students on free/reduced lunch; we are not just reaching elite students.

This program has opened many doors for all of us. It has been the greatest experience in my life and my students' lives.

The NITARP program ranks at the top of the dozens of professional development programs in which I have participated.

As a result of this program...my life has been altered forever. I will never be the same educator I was before.

My NITARP experience is giving me opportunities to teach/engage with students/parents/community members in ways that I would not be able to otherwise.

My NITARP experience made my science department realize that we need to bring the use of real data into our curriculum. [..Because of NITARP,] I am now working with my dept. chair to bring a research component into all our science classes.

[Because of NITARP,] I now design lessons with the goal of getting students to do more of their own searching for answers, instead of being "handed" that information by teachers in lecture or power point presentations. It is so much more exciting.

As a result of this program, I am inspired to include real data in my astronomy course.[..]My focus on incorporating real science into my classroom has inspired other teachers in my department to do the same, and generally improved the level of science teaching at my school.

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