Authentic Astronomy Research Experiences for Teachers: The NASA/IPAC Teacher Archive Research Program (NITARP)

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 educators incorporate the experience into their classrooms and share their experience with other teachers. The program runs January through January. Applications are available annually in May and due in September. The teams echo the entire research process, from writing a proposal, to doing the research, to writing up and presenting the results at an American Astronomical Society (AAS) meeting. 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. This poster describes the program, highlighting some of our lessons learned in partnering scientists and educators for original astronomy research projects since 2005. More information: http://nitarp.ipac.caltech.edu/

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

- **OUR GOAL** is to give teachers an *authentic research experience*.
- **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.***

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 program, 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).
  - Workshop includes intro to project, tools, etc.
  - Learn about how AAS meetings work, how people present results.
  - Start to define project that addresses a current astronomical problem.
  - (We pay for teacher travel.)
- Team works remotely to write a proposal. (next: due 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 (next: Summer 2013).
  - Each team decides on a mutually acceptable date.
  - 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.
- Teachers serve as NASA & NITARP ambassadors.
  - 12 hours' worth of professional development workshops, talks, etc.
- Teachers report back to us all the cool stuff accomplished in connection with this project. (Covers a wide range of results!)
- Teachers serve as mentor teachers to the rest of the NITARP community of teachers and students. Now have ~80 teachers who have been through the program, and almost uniformly they want to do more; they don't want to stop!

"I thought that was cool that you could be involved with astronomy and still be learning new things about it every day." (student)

"The students [from the year prior to mine] did a great job of explaining to me what it was like to really collaborate as scientists and how helpful it was to work as a team to learn new things."

"This [is] the absolute best learning experience in my career as a teacher!"

"Astronomy involves a lot more than I thought it did. I am now extremely interested in doing research. I think I learned what the scientific process is all about." (student)

"I feel like a popcorn kernel that has just burst open!" (teacher)

"I did not anticipate how much the astronomers would trust us right away. I felt more like a colleague than a student." (teacher)

"Of all the professional development programs in which I have been involved, NITARP continues to rank among the top few."

Since 2005, 80+ educators from 31 states have participated, 109+ students (from gr 7-13) visited IPAC and/or attended AAS meetings, 70+ AAS posters have been presented, & 5 refereed articles have appeared in major astronomy journals.

"This taught me a valuable lesson about the nature of astronomy as well as all sciences: no matter how much we observe and discover, there will always be more questions."

"Overall, this project has seriously been one of the best things I've ever done and made me feel like a real part of an adult community of highly intelligent people." (student)

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.

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