

# Authentic Research in the Classroom: NITARP Teachers Connect Astronomy with NGSS

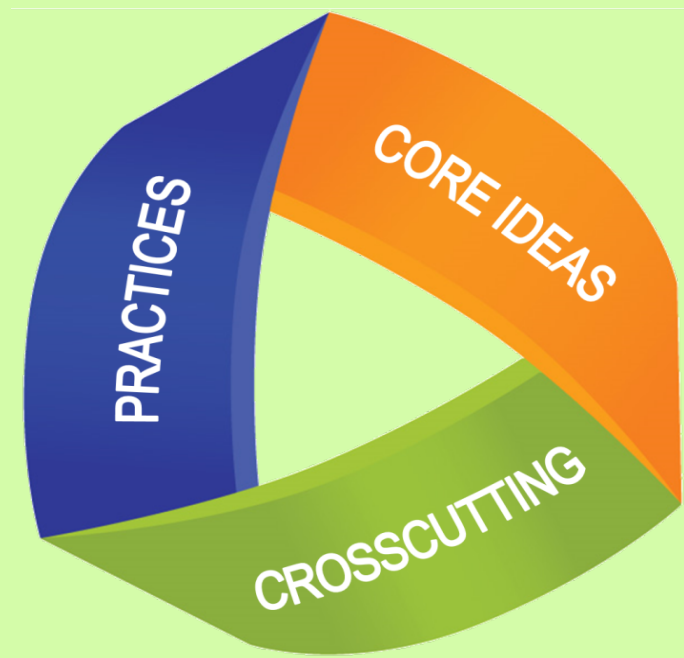


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## 1. Authentic Research in the NGSS



Of the three dimensions highlighted in the Next Generation Science Standards (NGSS), the **practices** are most applicable to NITARP.

The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems.

### Relevant NGSS standards:

**High School:** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

**Middle School:** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

## 2. Overarching Research Question

*Can we develop a predictive optical and near-infrared color- magnitude diagram for type I Active Galactic Nuclei?*

## 3. Research-Based Teaching Strategies

### 21st century skills:

**Communication**-- students practice communicating ideas, comparing theories, developing reasoned explanations and defending positions based on evidence.

**Collaboration**--students will work together in teams to gather and evaluate data.

**Flexibility and Adaptability**-- students will be able to share their ideas on the universe and revise those ideas when provided accurate scientific information.

**Productivity and Accountability**-- students will be able to describe the real world applications inherent in solving astronomy problems, provide examples, and formulate scientifically reasoned solutions.

## 4. Student Engagement

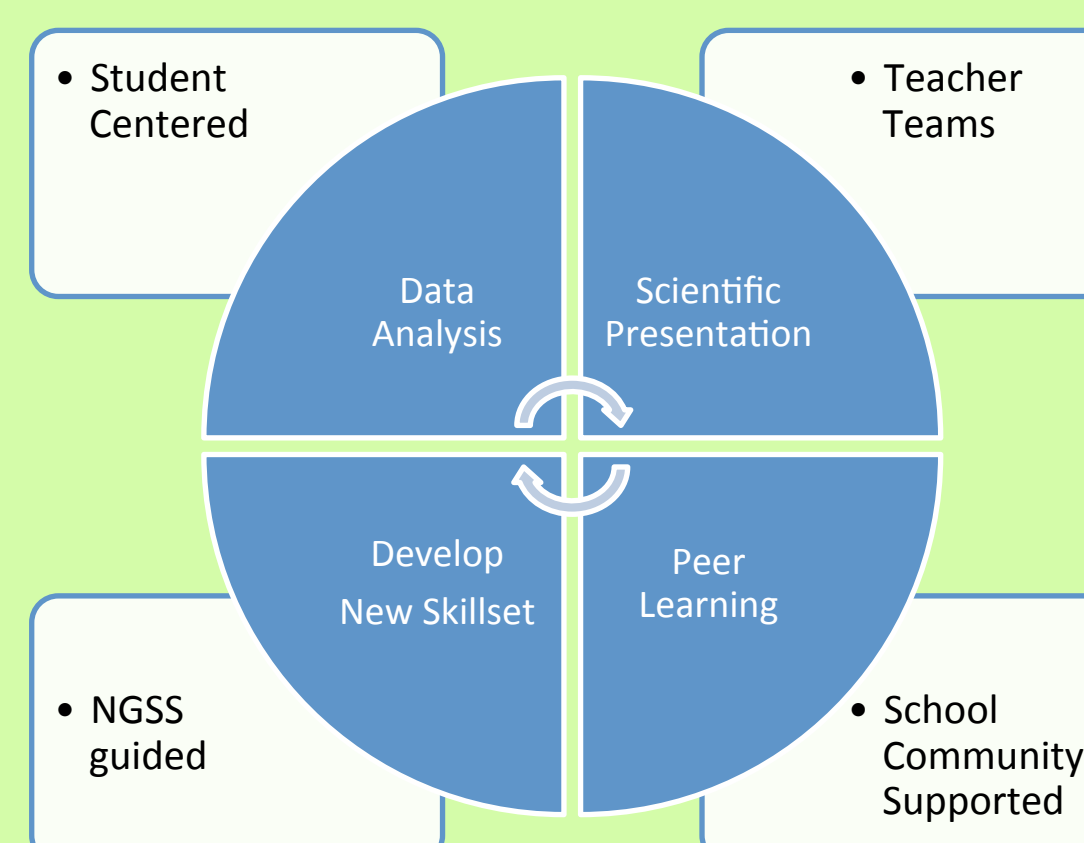
Students have a unique learning experience:

- Working with real data
- Learning from astronomers
- Collaborating with schools from around the country
- Gaining data analysis skills and content knowledge



## 5. School Community Engagement

Students directly served: 4-8 at each school site.  
Students indirectly served: 120 at each school site.



NITARP has several complementary stakeholders

**Participation in NITARP resulted in continual growth for the teachers.**

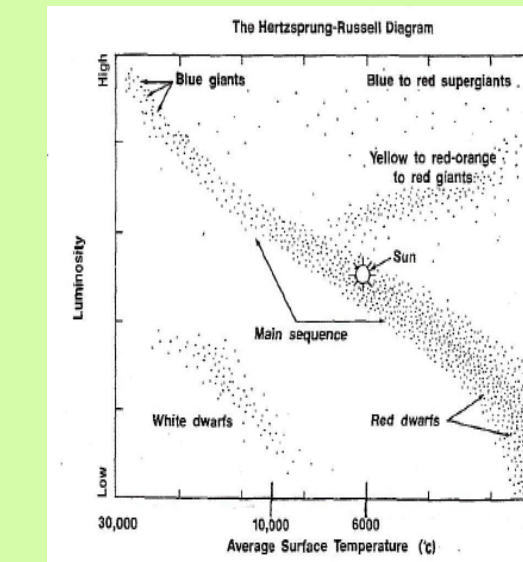
Ms. Young gave a NITARP workshop to 25 teachers at Ridgway Christian School. Her students also did a presentation on their NITARP work.

Ms. Pruet's students presented their work at the Bright STaRS session at the fall American Geophysical Union (AGU) meeting.

Inspired by his NITARP work, Mr. Palmer attended the Sloan Digital Sky Survey Plates for Education Workshop.

Mr. Gibbs, along with two other NITARP teachers, presented their NITARP experiences at the National Science Teachers Association regional meeting in Portland, OR in October 2013.

## 6. Models of Classroom Incorporation



Spring	Summer	Fall
1. Weekly background assignments that included readings and problem sets geared towards the team research question. All work done remotely via google drive <b>(teacher creating background assignments for students).</b>  2. Lunch and weekend meetings to understand data and work, in real time, on research <b>(teacher and students learning together).</b>	1. Week long crash course in astronomy prior to traveling to Pasadena.  2. Email correspondence with students.  3. Met with students 1-2 hours a week reviewing Astronomy, excel and the basics of measuring photometric data using Image J.  4. One week in Pasadena, learning content and how to work in Excel. Toured facilities.	1. Continued work on team data. On average, students work 1-2 hours a week.  2. Students create their own scientific posters.  3. Students and teachers present data at AAS.  4. A student is using the LADDT data to do a science fair project on 'outlier AGN'S' and will be competing at both the regional and state level with the project.

## 7. Conclusions

NITARP provides educators with an opportunity to develop a deep understanding of the content and skills required for astronomy research. It lays the foundation for authentic research in the classroom, in alignment with the NGSS.

## 8. Acknowledgement

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