



NITARP Alignment with Common Core Literacy and Mathematics Standards



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Abstract

NASA/IPAC Teacher Archival Research Program (NITARP) is an authentic research experience that partners teachers and students from around the country to participate in data extraction and analysis with a mentor astronomer from the Spitzer Science Center. The goal of the research is to determine a relationship between luminosity and temperature of Type I Seyfert galaxies between redshifts of 0.1 and 0.8 using data from the Sloan Digital Sky Survey and Galaxy Evolution Explorer archives. Members of this group participated in weekly teleconferences, a trip to Caltech and Google Hangouts to communicate and analyze data. This program meets Common Core standards in Mathematics for modeling, statistics and probability, and in English Language Arts for collaboration, and presenting. This is evident in data extraction, manipulation of data/variables, analysis of trend lines, and communication, all of which are integral parts of the research conducted with this project. The NITARP program is an optimal teaching tool for meeting national common core standards.



Common Core is a national educational initiative to promote student learning with clear standards and skills for parents and teachers. Educators around the country collaborated to determine a set of core standards designed to meet the needs for a successful student for future college and careers. Currently they have been adapted by over 45 states and are pushed to be adapted into current curriculum. Standards are divided into two Categories: Mathematics and English Language Arts Standards. These standards are interdisciplinary and span across all courses and curricula. Authentic research opportunities coincide directly with these national standards.



Figure 1 - Participants in the Color Magnitude for Seyferts or (CMSY) team. Teachers from around the country and astronomer from JPL.

NITARP Experience

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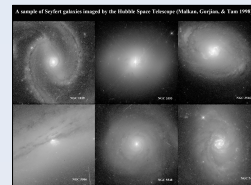


Figure 2 - Examples of Seyfert galaxies where accretion onto a supermassive black hole generates energy at the cores of galaxies

Common Core Alignment Standards

Common Core Mathematics

High School - Linear Modeling

CCSS.Math.Content.HSF-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
CCSS.Math.Content.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.
CCSS.Math.Content.HSF-LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.

Common Core Mathematics

High School - Interpreting Categorical & Quantitative Data

CCSS.Math.Content.HSS-ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Common Core English Language Arts Standards

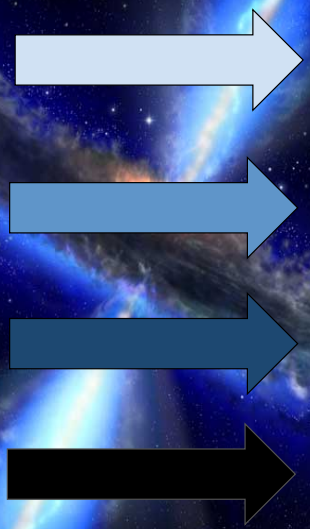
Speaking & Listening Grade 11-12 - Collaboration

CCSS.ELA-Literacy.SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Common Core English Language Arts Standards

Speaking & Listening Grade 11-12 - Presenting

CCSS.ELA-Literacy.SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.



NITARP Experience

Students use archived astronomical data relating to Seyfert galaxies. They participated in plotting relationships, analyzing data and developing conclusions to solve the problem: Can Seyfert galaxies use similar modeling techniques as stars?

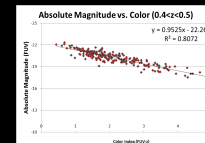


Figure 3 - Example of a plot created during the research process

Students generated several linear plots during this study to validate scientific conclusions. Consideration of dataset shape, spread and outliers are made to justify findings.



Figure 4 - Students participating in group collaboration at Caltech in July 2013.

Students participated in several small group discussions with other high school students. In addition, students collaborated with teachers and students from around the country in a large group setting with a JPL Astronomer.

Students will participate in presenting their results at the American Astronomical Society meeting. In addition, students present at their local high schools and other community presentations such as Board of Education meetings and "Astronomy Nights"



Figure 5 - Example of students presenting at a national meeting.

Education through Experience

This NITARP project has immersed students and teachers in authentic research which promotes and demands the mastery of several Common Core Mathematics and English Language Arts Standards. The benefits will not end with the students directly involved in this project. By teaching teachers to use the immense NASA astronomical archives, NITARP promotes continued research in the classroom with new questions and new students each year, expanding and enhancing experiences that are naturally aligned with national standards of education.

1. Photo Reference: <http://nitarp.ipac.caltech.edu/team/48-CM4Seyferts-Gorjian>
2. Photo Reference: http://imagine.gsfc.nasa.gov/docs/science/know_12/active_galaxies.htm
3. Photo Reference: <http://www.corestandards.org/Math/Content/MD/>
4. Photo reference: <http://cees10.phys.uk.ac.uk/astr162/lect/active/seifert.html>

