

What's the hook to engage students in secondary science?

Project title: *Bringing Deep Space into the Classroom*

Lead organisation: *Macquarie University, Department of Physics*

It's a question frequently posed in science education: 'What's going to excite students to more fully engage in science?' Quentin Parker believes one strategy is astronomy, coupled with innovative, cutting-edge technology. Astronomy often has tremendous pulling power among young and old students alike so the potential for student access to a robotic, powerful, professional class, internet-controlled telescope had great potential.

The Macquarie University Department of Physics, together with Swinburne University, provided support and expertise to ten cluster schools – six in NSW and four in Victoria – involved in the ASISTM project, *Bringing Deep Space into the Classroom*. The project provided exciting experiences for secondary students involved in using astronomy for a real purpose.

The project's broad aims

The project aimed to encourage high school students to engage with science and technology by providing direct access to professional astronomical telescopes – the Faulkes Telescopes.

A critical aspect of the project was to develop new skills and expertise in the cluster teachers. As well as improving content knowledge, the aim was to assist teachers in locating, accessing, modifying and developing learning activities for students using the Faulkes Telescopes through teacher professional development and mentoring.

Part of the project's success was in creating cross-curricular synergies and establishing international linkages as a means of extracting maximum learning benefits in a globally connected world.

As a project legacy a valuable resource pack will be made available to participating schools and other interested parties which includes details on the manner in which students engage with, and learn from, the new technologies available to them via their use of the Faulkes Telescopes and the data generated by it.

Main features of the project

- Provision of teacher professional development in the areas of science and technology related to astronomy
- Two Teacher Associates to support and mentor schools and assist the data assessment and analysis phase

- A competitive process undertaken by cluster schools to submit a request for observing time on the Faulkes Telescope
- Access for students to a world-class research tool (the Faulkes Telescopes)
- Provision of a CD-ROM containing astronomical software packages for use in assessing and analysing the project data together with support documentation
- Development of a separate ASISTM Faulkes self-moderated (Moodle) website for managing the project
- A dedicated website for the project.

Engaging students in a scientifically rigorous process

Highly qualified Teacher Associates provided students involved in the project with guidance about the possible targets to observe and research. Each school submitted specific observing proposals to the Faulkes Telescope (moderated by the project team) to acquire new data for their special target objects which they had selected to study.

With the help of the TAs, support astronomers and enthusiastic teachers, students designed the projects they would like to investigate, applied for telescope time and analysed their data in exactly the same way a professional astronomer would pursue their research. This enhances the study of astronomy for students and introduces them to the scientific process in a real and tangible context.

Quentin explained that the project uses an approach that reflects actual scientific practice. 'Schools had to explain why they wanted to take the images and what they were going to do with them; it wasn't enough just creating a pretty picture, though this is often a lovely by-product.'

What does a typical school project look like?

A request for Faulkes Telescope time involved schools in:

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| <p>Choosing a research topic</p> <ul style="list-style-type: none"> ▪ Student interest ▪ Year level ▪ Time available ▪ Writing a proposal |
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Getting the images

- Locating object coordinates
- Object visibility
- Exposure time
- Phase of Moon

One project contributed to the effort of monitoring asteroid motion. The project involved twenty-five Year 7 students across 6 x 50 minute periods. The proposal for Faulkes Telescope time focused on obtaining accurate positions of two asteroids classed as Near Earth Objects. Students used Astrometrica software to locate and obtain an accurate position for the asteroid and Iris software to generate colour images and show the movement of the asteroid. Students appreciated using science for a purpose, as one student commented: *'I can't believe I have contributed to real life science.'*

Another project aimed to help students grasp the scale of our universe and understand it as a dynamic system. Images of three galaxies were obtained using the Faulkes Telescope. A WebQuest was used to introduce students to star formation, galaxies, and the universe in general. Following step-by-step instructions students used Iris to create colour images of three pairs of galaxies colliding.

They discovered areas of star formation and observed the effects of tidal interactions between the colliding galaxies by completing a series of open-ended questions. Using step-by-step instructions students used Iris to measure the apparent diameter of the galaxies, and performed calculations to measure their actual size. The Faulkes images were integral to the project. One student commented: *'I loved that we got to look at real galaxies.'*

Working with real astronomers

A key facet of ASISTM projects is the use of Teacher Associates to work with students and provide a mentoring role. In this project the Teacher Associates were astronomers Dr Milorad Stupar, who worked with the NSW cluster schools and Dr Lisa Germany, who worked with the Victorian cluster schools. Teacher Associates were sourced from Macquarie University and Swinburne University of Technology.

The Teacher Associates were pro-active in visiting individual schools and interacting closely with both teachers and students at each step of the project. They encouraged participating schools to focus on the project and submit a request for time on the Faulkes Telescope. They were involved in the workshops, assessing the applications and providing feedback on both the proposal process and the reporting process. They assisted cluster schools with the data assessment and analysis phase.

As astronomers they were able to provide practical support and advice from a position of deep knowledge and understanding of the subject matter and practicalities.

Major challenges faced

It became evident that many teachers experienced difficulties in accommodating this project into tightly-packed schedules and the curriculum. Teachers were able to address this by confining the time to a limited number of periods and developing innovative ways to provide students with the necessary background by using learning tools such as a WebQuest.

It was also clear and anticipated that the success of the project in any school was significantly correlated with the confidence and competence of the science teacher in both astronomy content and the technological ICT challenges. Unsurprisingly, teacher professional development was identified as the key area that needed to be addressed if such educational opportunities are to be maximised.

Learning from the project

Quentin explained that a good team is absolutely essential. The team, led by Quentin, included the Teacher Associates and an astronomy Masters student, Lesa Moore, as the project administrator. They all played an integral role in successfully achieving the project aims.

Where to from here?

The post-project assessment process involves teacher interviews and student questionnaires for the purposes of gathering and collating reactions to the project from students and teachers involved. Data analysis and result interpretation will contribute to the final report, legacy materials and recommendations.

Quentin and his team believe strongly in the merits of the Faulkes Telescope project. They are submitting an ARC Linkage Industry Grant for three years, 2009-2011, to build on the lessons and ideas for science pedagogy and teacher professional development that have come out of this ASISTM project. It will again use the hook of astronomy and the Faulkes Telescope to engage students with science.

Project resources

A dedicated project website contains materials developed for the project and includes links to relevant software available freely for downloading.

<http://www.physics.mq.edu.au/astronomy/asistm/index.html>

Further information

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