The Bioastronomy program: ‘Life in the Solar System?’

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Abstract
Examining contextual learning is important in the Science Stages 4-5 Syllabus because it is central to the framework with which Science teachers provide for learning in Science. Within the framework associated with Astrobiology, all of the Prescribed Focus Areas (PFAs) can be covered at some point. In particular, the PFAs dealing with ‘Applications and Uses of Science’, ‘Implications for Society and the Environment and Current Issues’, and ‘Research and Development’ can be easily addressed.

Significant parts of the domain of knowledge can also be covered using Astrobiology as a context in both Stage 4 and 5, including content from ‘Models, Theories and Laws’, ‘Interactions’ and ‘Systems and Structures’.

In terms of skills, the context of Astrobiology can be used to address a range of areas. These areas include investigations, information processing, creativity and imagination, and teamwork.

The context of Astrobiology can also be used to promote positive values and attitudes about Science in general. This is because it deals not only with ‘leading edge’ Science but has links to popular film and television entertainment to which students are familiar. Furthermore, the study of Astrobiology poses some of the most important questions asked of humans, including, “What is the origin of life?” and, “Is there life beyond Earth?” The possible answers to these questions generate interest and excitement in school students.

This project aims to produce curriculum materials which have a principal focus on Stage 4 Science. It is anticipated that the materials produced will address a variety of cross curriculum areas and have liberal references to Australian scientific endeavours in Astrobiology and associated fields.

Biography
Craig Brown has 21 years experience in the NSW Teaching Service. He has been both a part time TAFE teacher and lecturer in both Science and Computing Education methods at the University of Western Sydney, Macarthur and Bankstown campuses. From 1998 to 2002 he was the Science Coordinator at Lucas Heights Community School. He is both an experienced HSC Advice Line teacher for Biology and Senior Science and is a Senior Marker for HSC Biology.

In 2002 he was a NASA sponsored teacher at the Fulbright/Astronomical conference for his work in Bioastronomy education in NSW. Currently, Craig Brown is a DEPUTY principal in a large K-12 state school and is an Honorary Science Teaching Fellow with the University of Sydney.
The Bioastronomy program, ‘Life in the Solar System?’ is a contextualised Stage 4 Science unit originally based on the concept of an exemplary program produced by a team of teachers in conjunction with DET and the University of Western Sydney, Macarthur in 1998. This unit has been gradually developed over the last 5 years to cater specifically for the local candidature at Lucas Heights Community School and to reflect current exemplary practice in terms of mandatory DET policy and BOS requirements. In the last year the unit has undergone radical changes with the impetus provided by the Honorary Science Teaching Fellowship at the University of Sydney.

As a result of an association with Bioastronomy educators attached to NASA, SETI and other space based organisations, including the Mars Society in Australia, it has been possible to draw the best elements of Bioastronomy into one unit of work for Australian students. This has been further enriched by the opportunity to work as an Honorary Science Teaching Fellow with the University of Sydney. The unit has now been developed to a point where it is a genuine example of a ‘cutting edge’ contextualised Science program. It has the flexibility for student self-paced or teacher directed progression. The activities embedded throughout the unit are original and emphasise skills such as literacy, information research and presentation, design and construction, and technology. The assessment strategies in the unit are standards based and allow for both formative and summative assessment means.

“Life in The Solar System?” has the ‘cutting edge’ Science of Bioastronomy at its core. It allows students to explore recent discoveries and research in this field and builds a brief history of Bioastronomy, leading up to current day research and developments and proposed future developments by organisations such as NASA and the Mars Society. As the program’s context progresses, it attempts to make links between some of the most inspiring questions of humanity; such as, “Is there life beyond Earth?” “What is the origin of life?” and the Science that students study at school. The program addresses a range of Science Education issues from the effects of Science on society and the environment to investigations, problem solving and the acquisition of knowledge.

The vehicle for this program is principally a PowerPoint multimedia file which incorporates the latest graphics and animations available and links to web sites where students can further explore the unit at their own pace. At designated points in the program, students undertake tasks or ‘Missions’. The Missions focus on specific, sequentially devised skills in literacy, investigations and research and design. Students are able to complete most Missions individually, in pairs or larger groups.

‘Life in the Solar System’ uses computer-based technologies as a means of achieving the unit’s outcomes. The program and its resources can be accommodated in one CD-ROM to facilitate flexibility in teacher-designed delivery to students. The files are ‘education friendly’ because they are both PC and Macintosh compatible and mostly use Microsoft software that is found in all state schools and in many independent schools. (Note: The program Inspiration which is also cross platform is desirable but not essential for the unit to be implemented.)

An important feature of the program is the assessment of the unit’s outcomes in a standards framework. Tasks are both formative and summative. They link directly to seven broad outcomes within the NSW Stage 4/5 Science Syllabus document and both students and teachers are supplied with explicit assessment criteria for each task. Task assessment is always subsequent to opportunities for students to acquire and practise skills and teachers are supplied with a complete and comprehensive set of answers and marking guidelines for all tasks.

The unit’s impact on student learning has not been formally assessed or measured except for general and informal feedback from staff and students. Overall, staff feedback was positive. Teachers found the context stimulating but noted that despite exposure to this context in the past, the ‘radical’ changes described before required extra initial preparation with the materials provided in the unit of
work. This problem was somewhat overcome in subsequent classes by the provision of sample answers and marking guidelines and professional dialogue with class teachers.

Students generally found the approach to this unit on space science very different to traditional space units covered in primary school but the responses were favourable overall. Students showed a good understanding of the knowledge, skills and concepts covered but generally struggled with the connections between Science, society and the environment. Whether the materials for this Mission need further refinement or the concepts are beyond the cognitive development of the students in the pilot project need further investigation. Students also commented favorably on the blend of theory and the variety of practical tasks covered. They also responded well to the inclusion of more formative assessment tasks despite the presence of an end of topic test. On this point, teachers were pleased that assessment tasks were strategically placed in the unit to facilitate the coverage of all report outcomes within the school report schedule. Teachers also reported favourable on the fact that sample answers and guidelines were supplied as examples of working in a standards based style framework.

The original brief of this fellowship was to begin a web-based set of teaching materials on Bioastronomy. Despite the fact that the project is not web based at this point and that it requires further field testing and refinement, it is a complete teaching resource package which could possible be used in its current state in the vast majority of secondary schools in NSW with substantial positive outcomes in terms of student learning. Future directions of this project may include some form of substantial field testing with quantitative evaluation, development of optional Missions and homework activities to support the in class Missions.

**Sample Activities:**
Mission sample 10 and the associated teaching program