

Healing the Swan: Integrating Science

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Introduction

The Healing the Swan project integrated science lessons into real-life concerns about the Swan River as well as into other learning areas in the curriculum. This project was a component of a broader investigation entitled *SOS: Science of Sustainability*, previously reported in SCIOS (Lewis, Baudains and Mansfield, 2008). *SOS* explored student engagement and learning in science and other learning areas. *SOS* was supported by an Australian Schools Innovation in Science, Technology and Mathematics (ASISTM) grant which involved six Western Australian schools (independent and government, primary and secondary) working together collaboratively, in partnership with tertiary institutions, government and non-government organisations.

Project Purpose

To improve student engagement and learning outcomes, a course examining the sustainability of the Swan River was developed, with outcomes in Science, Society and Environment, Technology, Mathematics, the Arts and English. The course aimed to provide opportunities for deep learning in a real life context, richly resourced through partnerships and curriculum integration. Students involved in the program ranged from Years 4-9 and came from state and independent schools, in geographically disparate suburbs of the metropolitan area of Perth. Partners in the project included Nyungah Circle of Elders and Swan Coastal Plains elders, Ribbons of Blue officers, the Swan River Trust, the Water Corporation, volunteers from the Eric Singelton Bird Sanctuary, representatives from the Point Fraser rehabilitation project, local councils along the Swan River and staff at Whiteman Park.

Healing the Swan Program

The *Healing the Swan* project was implemented during 2007. It consisted of six phases:

- Program planning – undertaken in Terms 1 & 2, with ongoing modifications during the whole project, as required by student and partner input.
- Focus lessons – these lessons were undertaken in Term 3 at the participating schools, prior to on-site investigations. A series of thirteen lessons were prepared covering topics including indigenous history in the Swan Valley, white/indigenous conflict, mapping skills, riparian planting, visual site assessment and assessing water quality.
- Field excursions – three days of student field trips along the Swan River were conducted in early Term 4. The first site visit explored the upper reaches of the Swan River – Walyunga, Middle Swan and Midland. Students used visual assessment, water monitoring, listening and observation skills to develop a profile of each location. The second excursion covered the middle reaches of the river – Guildford, Bayswater and East Perth. The last site visit explored the lower reaches of the

Swan River – Perth, Mosman Park and Fremantle.

- Post-excursion learning activities – involved the application of learning and understandings to interpret river transects and water quality data. Information was compiled into a report to show the health/ill health of the river system and discussion of sustainability and future conservation of the river. This was completed by the end of Term 4.
- Student and teacher surveys – were conducted at the end of Term 4 to determine outcomes of the *Healing the Swan* project.
- Showcasing learning – occurred in late Term 4 at the Groundwater Festival, held at Whiteman Park, in the Shire of Swan.

Outcomes

Four key outcomes of the *Healing the Swan* project can be identified: Enhanced student engagement, improved knowledge and skills of students, the ability to engage in a new discourse about the sustainability of the river and the benefits of working in co-operative partnerships in real life teaching-learning contexts.

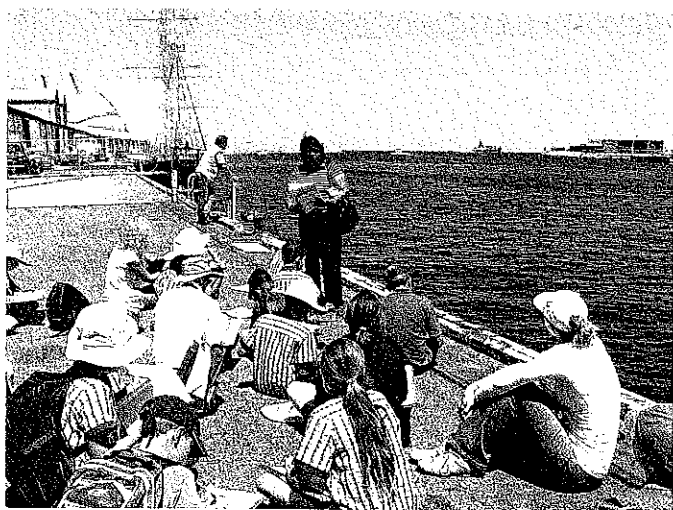
Enhanced engagement – Students enjoyed learning about the history, science and technology of river management from indigenous elders and other experts, and participating in the water quality monitoring activities. This enhanced engagement was reflected in student feedback about the highlights of the *Healing the Swan* walk, which included “*learning aboriginal stories*” (Year 5), “*eating bush tucker, testing water and finding bugs*” (Year 6) and “*it felt good to do the same work as the scientists do when they study the river*” (Year 4). Clearly the students expressed positive feelings of engagement in the excursion activities.

The students also reported improved attitudes and understandings towards caring for the environment. One Year 8 student said her attitudes to water and sustainability had changed “*dramatically because I didn't know how sick the water was ... I am going to plant trees!*” Other typical comments about changed attitudes referred to “*much shorter showers*” (Year 5) and “*I have talked to people about things that are affecting it [the river] and I have planted trees and reeds*” (Year 4). Finally, students reported greater interest in undertaking further science studies. For example, one student stated:

“I learnt about chemicals and gases that affect the ecosystem ... I now know that there are a lot of scientific tools out there and I know that chemistry can be heaps of fun because not only can you solve things – its thinking and having fun at the same time. When I grow up I now want to be a scientist and I want to study chemistry” (Year 4).



Students, teachers, mentors and scientists discussing the management of the Swan River at the Point Fraser rehabilitation site.



Students and teachers on the Fremantle wharf learning about changes to the mouth of the Swan River from an Indigenous mentor.

Improved knowledge and skills – Students learnt how to draw transects of the river, conduct visual site assessments and undertake water quality monitoring activities (macroinvertebrate investigations and the 'fab 4' – temperature, pH, salinity and turbidity assessments). Students illustrated their improved knowledge as a result of participating in the project in their excursion reports, for example:

"I learnt that the Swan River needs healing. I never knew about things like the Riparian Zone before. I learnt that trees are important to river health ... People shouldn't litter the river because it effects fish. Farm animals should not be near the river because they damage the environment and cause nutrients to wash into the river after the rains" (Year 4).

Students also stated that their understandings of ecosystems had developed:

"I am amazed at the degree of erosion at the Guildford site and I now understand how complex the care of the river ecosystem is" (Year 7).

The development of both knowledge and skills was another important outcome for many students:

"Some of the new knowledge and understandings I have gained include viewing all the different kinds of shores around the Swan River, learning about the micro-invertebrates ... testing the pH,

salinity and all the different things and looking at the different types of damage the Swan has endured" (Year 8).

A Year 9 student reflected the quest for deep learning through close questioning of guest experts during the *Healing the Swan* walk (Day 2, Point Fraser rehabilitation development). The student enquired *"How do the bacteria and microbes in the soil reduce the pollution impact of petrochemicals and other such pollutants?"* This student continued to ask probing questions on how the process worked and his enhanced awareness and depth of engagement in the subject is a good example of the effectiveness of the project. Similar learning attributes developed for many of the students who participated in the excursion.

Teacher statements from their post-excursion surveys supported the above student evidence for improved knowledge and skills developed by the students in this authentic learning context. For example, one teacher stated *"The students have applied their knowledge and skills to new and novel tasks"*. Teachers also acknowledged the broader skills students had developed that would be relevant in a range of situations: *"Some students have shown transference of knowledge and new attitudes to home and community situations"*. A third key point that teachers raised was that students' skills in scientific inquiry had dramatically improved through engagement with this project:

"The students valued the opportunity to conduct in depth scientific enquiries with appropriate technical equipment and their ability to use proper scientific procedure was greatly improved".

This teacher feedback provides additional evidence substantiating the claim of improved student knowledge and skills resulting from participation in the *Healing the Swan* project.



Investigating water temperature.

Ability to engage in a new discourse about the sustainability of the river – Students showcased their learning in various formats, such as written reports, diagrams, critical questioning, photographs and dramatic performance. They also displayed improved communication skills when they shared their knowledge and understandings about the Swan River with other participants at the Groundwater Festival.



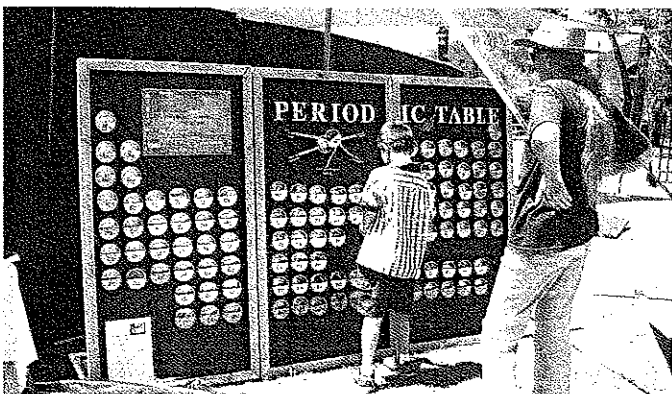
Students conducting pH, salinity and turbidity assessments.



Students examining macroinvertebrates in a sample of river water.



Students at the Groundwater Festival explaining the Healing the Swan project to a teacher.



Student at the Groundwater Festival investigating the elements of the Periodic Table in the context of heavy metal pollution in water.

Benefit of partnerships – Students experienced insight into the tasks undertaken by real scientists, while teachers gained specific knowledge and technical support from different experts involved in the project. Teacher feedback in the post-excursion survey illustrated improved student outcomes and enhanced professional development provided by the numerous partnerships in the project. Specifically, teachers mentioned the benefits for students having to understand, interpret and make decisions based on the complementary and conflicting views of a number of stakeholders:

"Having opportunities to listen to and question key stakeholders who held different views, empowered students to be confident to ask meaningful questions and make up their own ideas about issues"

Evidently the collaboration with stakeholders also contributed to innovative learning:

"Close collaboration with stakeholders enabled innovative learning activities to be undertaken and successfully implemented"

Teachers reflected that their own knowledge and skills had improved through participation in the project too: *"The project facilitated improved teacher knowledge and skills in science"*.

Furthermore, the opportunity to collaborate closely with project partners who had expert knowledge in particular aspects of the river ecosystem provided teachers with new understandings and approaches to teaching their students. This benefit of partnerships is illustrated by one teacher's post-excursion survey comment:

"New understandings from Healing the Swan include using vegetation and evaluation matrixes to analyse the health of a water system ... Using the idea of a journey to measure the health of a length of water"

Clearly, participation with different project partners enabled teachers to extend their own knowledge and understandings, which then informed their teaching.

Partnerships with local Indigenous mentors was another key feature of the project. Teachers articulated the advantages and insights obtained from working with Indigenous mentors in the context of an integrated curriculum program:

"The approach taken to examining issues of sustainability (scientific, historical and cultural awareness of Aboriginal issues) was a new and broader approach that gave ... greater knowledge and understandings."

The links across the curriculum, between the Science and Society and Environment learning areas, were highlighted by the Healing the Swan project. This is clearly illustrated in one teacher's post-survey response:

"The importance of recognising cultural issues in planning and management of water catchment areas, became an area of great learning for me and I believe all concerned – staff and students. The present failure to acknowledge Aboriginal heritage and sites along the Swan River and its foreshore area, was poignantly

illustrated by the representatives of the elders of the Swan coastal plain and Swan River Native Title Holders."

These teacher comments support the finding that enhanced understandings of Indigenous perspectives concerning the care of the river were achieved.

Collaborative partnerships also developed between the six schools involved in the *Healing the Swan* project. This collaboration involved sharing knowledge and skills amongst the participating teachers, sharing learning resources and school bus transport to the various locations on the river. Teachers also reported that they developed new teaching resources and "... have shared with staff my new understandings, for example, terms, processes, using equipment, organising a big 3-day excursion, contacts, etc." This shared knowledge has been used by other teachers. It is therefore evident that the project highlighted many benefits to be gained from working in collaborative, co-operative partnerships in a teaching-learning setting.

Other *Healing the Swan* project information and outcomes may be viewed on the whole- of-project SOS website: <http://scienceofsustainability.net> For access to the teaching-learning materials developed for this project, the blog facilities on this website may be employed.

Conclusion

The *Healing the Swan* project was effective in improving student learning outcomes. Evidence was obtained that indicated enhanced student engagement, improved knowledge, skills and understandings about river management and the ability to engage in a new discourse about the sustainability of the river. Schools worked in partnership with each other and experts

from tertiary institutions, government and non-government organisations. This was found to positively contribute to student learning. In conclusion, the *Healing the Swan* project, set in a real life, hands-on context, provided a rich and enjoyable learning experience with deep learning.



The Groundwater Festival banners showcasing the work of the six schools in the Healing the Swan project.

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Reference

Lewis, E., Baudains, C. M. & Mansfield, C. (2008). Making waves: Engaging science projects, *SCIOS*, 44(2), 18-19.

ASTA Award Winners

Congratulations to Elaine Horne, Robyn Groves and Leon Deluil who recently received awards from the Australian Science Teachers Association

