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Authentic Field Experiences: The Design of Complex Web-Based Tasks

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Abstract

For students in today's society the learning environment has been extended to provide a range of educational opportunities from excursion venues such as museums to outdoor settings such as field study centres, often supported with the use of information and communication technologies. Such contexts encourage students to engage and participate in the learning process in developing a range of skills, often associated with problem-based learning, that look at the complex relationship between evidence, ideas and the impacts on society in a range of situations. In this paper we describe the development of a web-based educational program that incorporates current knowledge of situated and authentic learning to engage students through a problem-based challenge that integrates a series of classroom-based student-centred tasks with practical field experiences.

Introduction

In a number of curriculum settings across K–12 education field experience, or fieldwork, is an essential component of associated learning opportunities that students are encouraged or expected to experience. Such experiences can enhance learning opportunities for a range of students by catering to a variety of teaching and learning styles.

When effective, fieldwork is invaluable in learning subjects such as geography, because it facilitates and enables students to:

- acquire knowledge about environments by observing, mapping and recording phenomena in the real world in a variety of places;
- understand the spatial, ecological and civics and citizenship dimensions of geographical phenomena;
- explore the geographical processes that form and transform environments;
- use different kinds of geographical tools including information technology to assist in interpretation of and decision-making about geographical phenomena;
- locate, select and organise geographical information; and
- explore different perspectives on geographical issues.

(Department of Education and Training, 2002)

Field experiences that require students to solve a complex and realistic problem, and involve processes such as direct observation, use of a variety of measuring tools, and provide teacher follow-up generally provide opportunities for enhanced understanding. However, in many cases, it is more likely that excursions and field experiences

become little more than social outings for the students where learning is disengaged and ineffective and the desired learning outcomes are not achieved. Unless students are engaged in genuine and realistic tasks and can see a connection between the relevance of the activities they complete and the data they collect, they are likely to gain little long-term effect from the field experience.

From a constructivist view of learning, one of the more effective learning situations is where the learner is immersed in the resolution of an inquiry-based task where the learner's skills in qualitative reasoning, self-questioning and reflection can be applied and developed. In a conventional classroom setting an effective teacher who can monitor a student's progress and assist the learning development through selective guidance and tutoring in reflection and reasoning skills often facilitates this process through the use of stimulating questions and focussing questions to encourage observation, analysis, comparison and interpretation. With this approach students are guided into making their own discoveries and decisions through taking greater responsibility for their own progress. Such responsibility grows from the student developing a sense of ownership of the learning task and as a consequence is actively engaged, either as an individual or as part of a group, in the resolution of the inquiry.

Within an online environment the learning dynamics change as the emphasis of the inquiry process moves from an essentially teacher-directed to a more student-centred approach where the student is given the freedom in the selection of resources from a learning environment rich in content, with the student having the opportunity to explore and learn ideas and facts that extend well beyond those found in traditional content-based curricula. The provision of multiple pathways to access information provides different perspectives on not only the information being presented but also on the interrelationships developed. With the sophisticated technologies currently available the design of learning environments which engage learners in student-centred activities that require a range of learning strategies offer considerable promise. However earlier studies (Brickell, 2004; Hung, 2002; Lajoie, Lavigne, Guerrero, & Munsie, 2001; Sheard & Lynch, 2003) into the effectiveness of learner-support strategies within computer-based learning environments have demonstrated the need for additional support systems that will assist students with the online inquiry process.

For a number of years traditional field experiences have been coordinated at Sydney Olympic Park (the Parklands) through their education program involving on-site group visitations. In recognising the potential for increased visitation, and broader learning opportunities by both the K–12 education sector and the wider community, the Sydney Olympic Park Authority sought the assistance of a range of stakeholders in developing an innovative education program that incorporates new technologies across a range of K–12 focus areas. This paper describes the development and implementation of the learning design framework that integrates these field experiences with information and communication technologies, and the design of an authentic task that facilitates onsite learning of complex geography concepts through its completion.

Background to the Project

The Sydney Olympic Park Authority — in a partnership with the NSW Department of Education, the metropolitan Catholic Education Office, Sun Microsystems and the University of Wollongong — has embarked upon the development on an innovative educational field experience program that is designed to go beyond the requirements of the traditional excursion for schools. The Parklands provide many locations and opportunities for field research by school students across the K–12 sector due to the richness and diversity of the environment within its boundaries. It is situated about ten kilometres from downtown Sydney. Prior to its colonisation in the late 18th century, the area was once occupied by a number of Aboriginal communities. Remnants of the pristine woodlands, salt marshes and mangroves remain today. Over the next two hundred years the area underwent considerable modification for industrial, commercial and residential use. When the area was designated for the 2000 Olympic Games, extensive remediation took place balanced by the addition of parklands and reserves to support the diversity of flora and fauna present. The Authority is responsible for promoting the historic, scientific, cultural and educational value of this unique mix of natural and artificial environments. The potential for a rich and varied range of educational field activities is immense, not only in exploring the physical characteristics of the area, but also its history.

The Geography excursion program to the Park had been of the traditional variety, where students would be bussed in for a day or half-day visit. Depending on the year level, the activities and data collection on the day may or may not have been related to specific curriculum outcomes, although all represented valuable geography skills development and techniques. A new approach was required, one that incorporated current knowledge of situated and authentic learning, to apply these concepts and capitalise on the opportunities afforded by the integration of the elements of the learning environment offered by the Parklands site. Specifically, an excursion program was required for students to:

- connect to the real world;
- develop expertise in accessing, evaluating and using information;
- connect the vision of real-world learning to the realization of authentic results;
- utilise interdisciplinary, problem-based learning;
- collaborate in their learning; and
- examine the experiences offered in the environment directly rather than through secondary experiences within the classroom.

In responding to this philosophy the project focussed on the development of quality learning experiences that have relevance to practices in everyday life. Such experiences require a broad range of cognitive, linguistic and social skills that extend the intellectual capabilities of the learner leading to improved student outcomes. This process reflects the proposed model for pedagogical development in the NSW education system that is fundamentally based on promoting high levels of intellectual quality, is soundly based on promoting a quality learning environment, and develops and makes explicit to students the significance of their work (Department of Education and Training, 2003).

In offering an alternative methodology to the conventional fieldwork approach, the project has drawn upon currently researched models of design in developing online learning environments. These approaches have been used to guide the development of content, learning tasks and activities, and scaffolding supports in the advancement of the ICT-mediated learning experiences for students. The field activities are situated within the context of the problem-based online learning environment that may be accessed at school, at home and at computer 'pods' situated within the Parklands while undertaking the field experience. As such the learning environment will:

- provide learners with control over their actions by placing them into contexts where data can be manipulated and interrogated;
- support learner construction of knowledge through scaffolded problem solving experiences; and
- offer learners the tools and resources to produce artefacts which represent their construction of knowledge.

Designing an Authentic Task

The design of the task was central to the learning environment. The provision of a range of powerful technology tools meant that students would be able to store, retrieve and analyse any data they collected at the excursion site, and return to it at any time for further analysis. The data could be compared to historical data of the same measures, a facility that immediately increased the learning potential of the activities. The task needed to be complex and authentic.

Elements of authentic task design (Herrington, Oliver & Reeves, 2003; Herrington, Reeves, Oliver, & Woo, 2004) were used to guide the design of the excursion task. Specifically, authentic tasks:

- have real-world relevance;
- are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity;
- comprise complex activities to be investigated by students over a sustained period of time;
- provide the opportunity for students to examine the task from different perspectives, using a variety of resources;
- provide the opportunity to collaborate;
- provide the opportunity to reflect;
- are integrated and applied across different subject areas to lead beyond domain-specific outcomes;
- are seamlessly integrated with assessment rather than separate artificial assessment removed from the nature of the activity;
- create whole polished products valuable in their own right; and
- allow competing solutions and diversity of outcome rather than a single correct response obtained by the application of rules and procedures (see Herrington et al., 2004, for full referencing of these individual characteristics).

The Parklands, specifically Narawang wetland, afforded a number of significant advantages as a place to study several key topics in the geography syllabus. To

address both the required outcomes of the syllabus and the management issues associated with the wetland three specific themes were identified for development: *Pests*, *Water Management* and *Human Interaction*. In order to focus on these two aspects, a complex task was designed to enable students to explore in depth the cause and effect relationships among these three factors. In order to engage the students in a realistic investigation a letter was written to invite them to be consultant experts to the Park, to study and advise on major problems within the ecology of the Park, among the flora and fauna, and the human interaction effects. The letter provided the context of the problem and the outcomes required if the students were to accept the offer and take up the consultancy (Figure 1).

Figure 1: Letter Inviting Students to Act as Consultants to Sydney Olympic Park

Sydney Olympic Park Authority
7 Figtree Drive
Sydney Olympic Park,
NSW 2127

Dear Consultants,

The Sydney Olympic Park Authority wish to commission you to conduct an in-depth investigation into land and water management at the Park. We have received a number of complaints from visitors and nearby residents about increasing numbers of mosquitoes in the area, rats and feral cats in the parklands and smelly ponds that are unpleasant to be near.

We are now concerned that something might be affecting the wetlands area and causing a serious imbalance in the land and water environment.

As expert geographers, you and your colleagues are best placed to determine the nature of the investigation. However, some of the issues and questions that concern us are:

- **Human interaction:** What impact are humans having on the Park? Are they contributing to the presence of introduced pests? What effect do they have on the native animals in the parklands and the ecology generally? What effect do they have on the endangered species that live in the park?
- **Water:** What is the ideal water quality in the park? Should we prioritise water for the few endangered species we have in the park, or for all users of the park, including human visitors? Can we satisfy the needs of all groups?
- **Pests:** Are there more mosquitoes breeding in the wetlands than normal? Is the situation within a normal range of variation, or is this an unusual and potentially harmful situation? Are the residents' complaints justified? What other pests have impacted on the ecology of the park? Are introduced weeds threatening native vegetation in the park?

We are commissioning you to investigate these issues, focusing specifically on pests, water and human interaction. We request from you your expert opinion of the health and future of the wetlands, and your recommendations on how land and water management should proceed.

Yours sincerely,



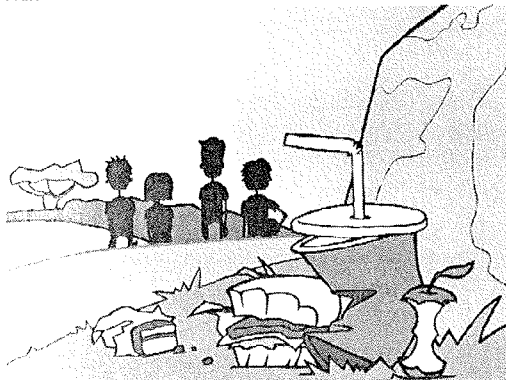
For Sydney Olympic Park Authority

The letter provides a realistic framework for investigation of physical aspects of the parklands, and for senior students, this is realistic enough. However, because the target group for this particular challenge is Year 9–10 students, it was thought that a more compelling rationale for their involvement and a more appealing introduction to the problem would be appropriate.

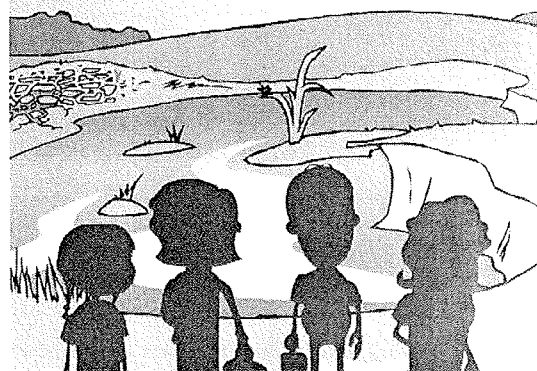
To provide this an animated introductory sequence was designed comprising three vignettes of experiences at the park. The first shows a group of young people enjoying themselves at the park, deciding what to do next, and as they walk off, they throw litter and food scraps on the ground. Later that night, a rat emerges to eat the remains of their food (Figure 2a). In the second vignette, a family approaches a pond in the park with their picnic lunch, only to be deterred by the smell and the appearance of the water. They quickly walk away to try to find somewhere else to have their picnic (Figure 2b). In the third vignette, mosquitos approach a house near the park and cause problems for a sleeping baby and a family enjoying a barbecue with friends (Figure 2c). In the last scene, a meeting is taking place at the Sydney Olympic Park Authority offices. The Director is complaining to the others about the increased number of complaint letters that they have received, and they discuss the possible causes. They decide they need a thorough investigation into the pests in the park, water management and the impact on humans, and that they need expert Geographers to do the job. The scene then dissolves to the letter of invitation to the students (Figure 1).

Figure 2: Scenes from the Introduction to the Geography Challenge

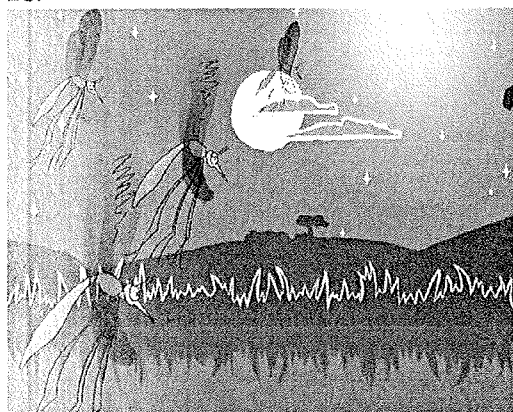
2a.



2b.



2c.



2d.



The introductory sequence is important in setting an authentic context for the investigations that students will do before, during and after their visit to the Park. It clearly introduces the parameters of the task, and students know that they must create recommendations on what needs to be done to address the problems. Any data collection is now firmly embedded in the quest to solve the problem, and students work collaboratively to produce a realistic report with recommendations as an accomplished product.

Design Process

The design process required that these underlying guiding principles be embedded in the design model being used and also provide a reference point for evaluation of the design model. The design model used, shown in Figure 3, represents an iterative design process and is based on a well tested model (Harper & Hedberg, 1997; Hedberg, 1993) developed around a student-centered task driven design drawn from a constructivist view of learning.

The model represents a three-phase process, referenced back to the guiding principles for this project at each phase of the design process.

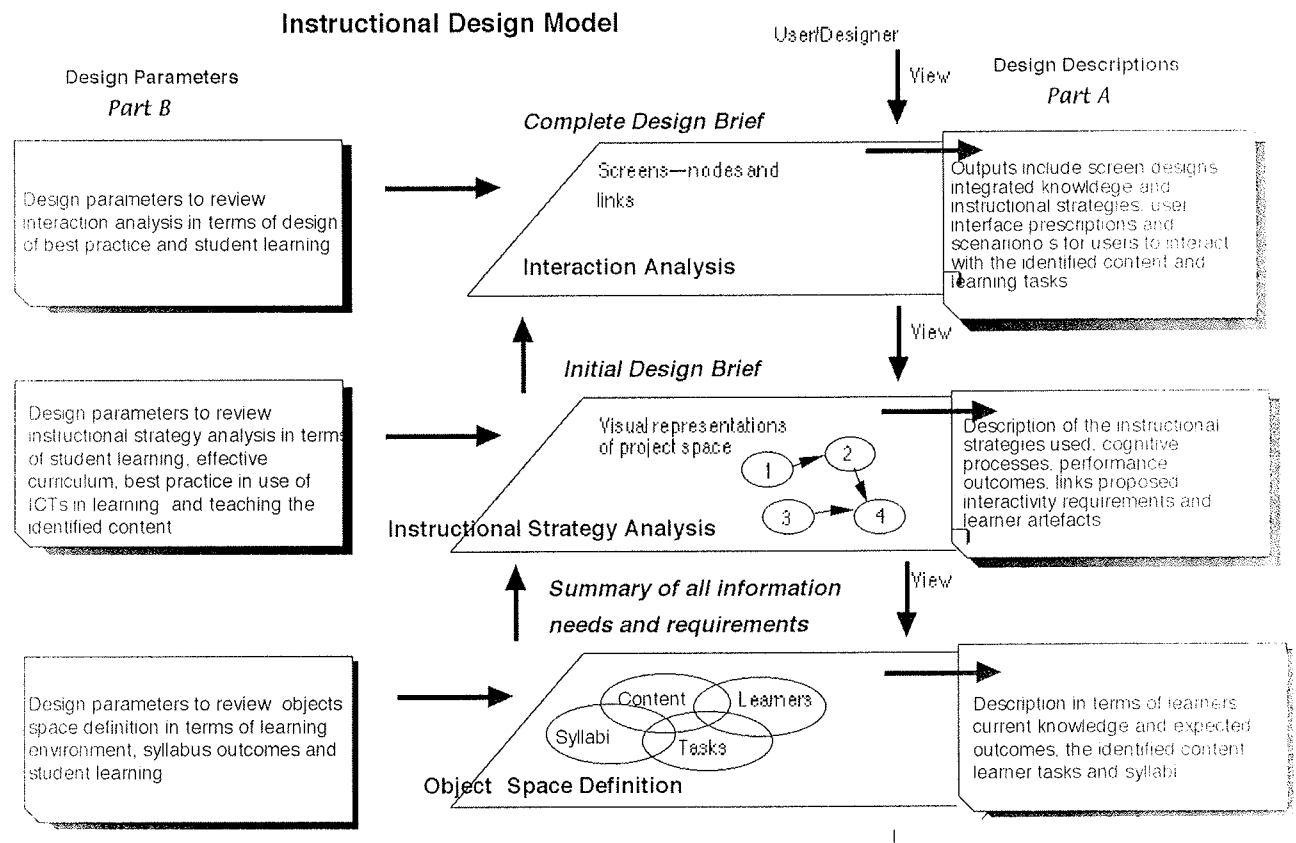
Phase one, Part A takes the basic information derived from a content review of the site, the learning challenges that can be structured around that content, the target audience for the challenges and the related syllabus outcomes and converts these into a description of the project space — the information which is to be included in the materials, how it is structured, what the target audience understands about the information and how it might be structured for the audience. A structuring device for this project would be a concept map of the challenges and subtasks and links that are to be included in the project.

Phase two, Part A presents a review of the basic description and a linking of the elements through an appropriate instructional or presentation strategy. It also seeks to identify metaphors that help both the design team and the final presentation of the information structure. The outcome of the second phase would be a formal description such as a design brief, including learner interactions and artifacts. The detail would enable understanding of the underlying knowledge structures and the ways it is proposed to link them conceptually and intuitively.

The third phase, *Phase three, Part A*, is a further pass at the same material, this time with the express goal of linking the design ideas into a potential interaction structure. One output of this phase would be an interactive mock-up of the learner interactions to illustrate not only static display of information but also the graphical and visual metaphors used to create understandable links. The information included in this prototype may include visual, motion, static graphics, sound and data landscapes as appropriate to the concept under development.

In each of the three phases a review process — *Phase one Part B; Phase two Part B; Phase three, Part B* — allows a referencing of the outputs back to the underlying guiding principles for the project to ensure the principles are integral to the design.

Figure 3: Design Model Developed from Hedberg



Implementation of Design Process

The Geography Challenge is designed to engage students over a 4–6 week period that incorporates a pre-visit phase, a fieldwork phase and a post-visit phase and is structured around a problem-based approach to learning. The design elements of the challenge are illustrated in Figure 4.

During the pre-visit phase students begin to develop a better understanding of the problem and related issues involved in managing the Narawang wetland, through interaction with a series of online tasks that are accessible in each step of the process (Figure 5), before choosing a theme for investigation. These tasks provide opportunities to develop a greater awareness of the interactions and impacts involved in managing the Narawang wetland as well as a better understanding of the artefacts and tools needed to improve their skills as geographers. Information is revealed through a range of ‘hot links’, roll-overs and disclosure triangles. Students have the opportunity to work collaboratively in a group or individually as they investigate their chosen theme. Data collected can be saved (either individually or as group data) to allocated folders in a database and reviewed at a later time.

Figure 4: Theoretical Design Elements

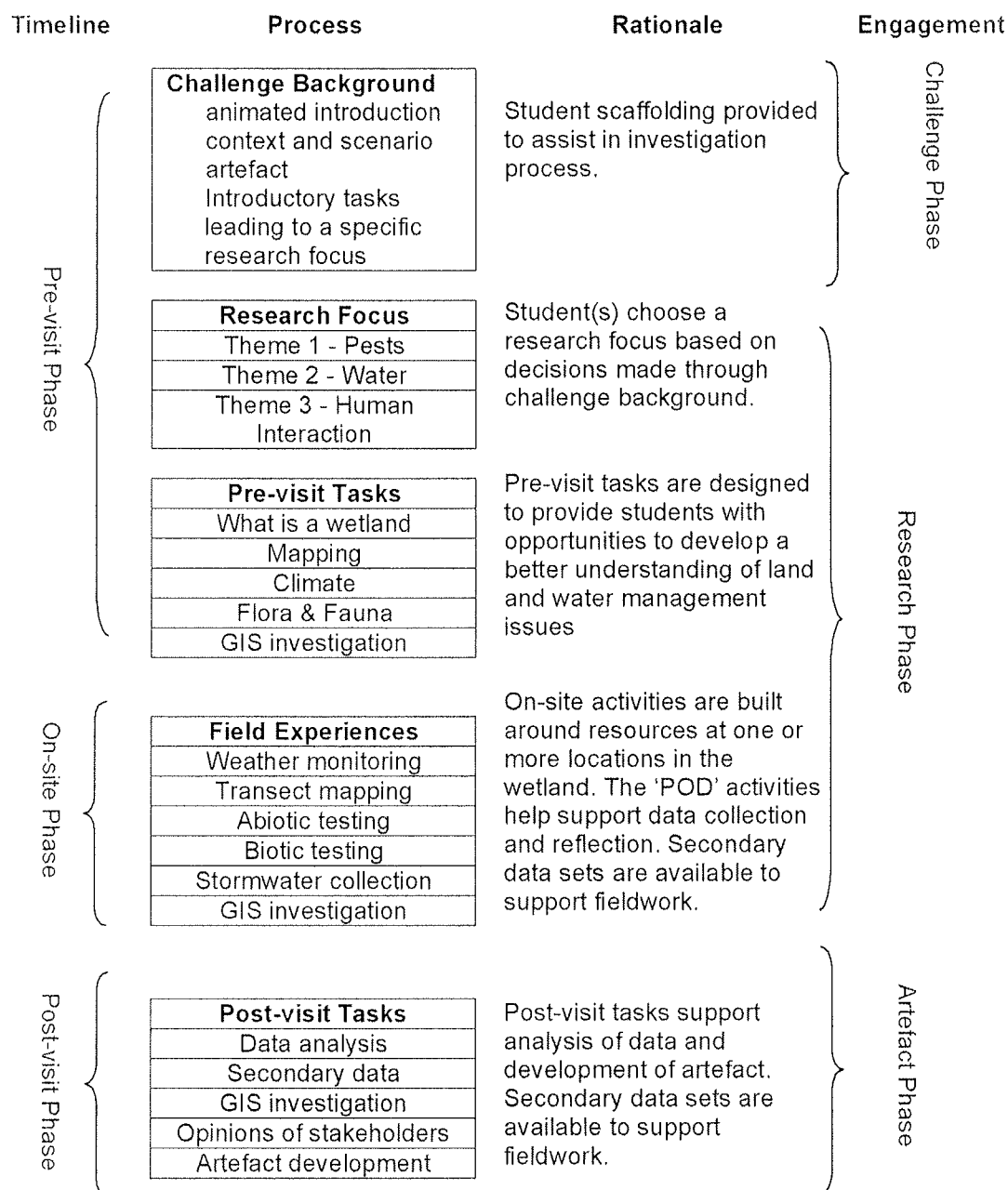


Figure 5: Understanding the Problem

The screenshot displays the 'Geography Challenge' website. At the top, there is a navigation bar with 'Group: Kangaroos' and 'User: White Grouse'. Below this is a progress indicator with steps 1 through 8, where step 1 is highlighted. The main header reads 'Step 1: Understanding the problem'. A sidebar on the left contains a list of topics: Stakeholders, Research Action Plan, Sustainability, Social Justice, and Equity. The main content area is titled 'Tasks' and includes an introduction to the problem, a list of pre-visit tasks, and a section titled 'What is a wetland?' which defines wetlands and lists related topics like Mapping, Climate, Flora and fauna, History, Stakeholder roles, and Geographic Information System.

Geography Challenge Group: Kangaroos | User: White Grouse | Log out

Introduction **1** 2 3 4 5 6 7 8

Step 1: Understanding the problem

Tasks Resources Your notes R.A.P. Our challenge Help

Step 1

Understanding the problem

The problem your group has been asked to investigate is a complex one with many issues. There are many stakeholders who are affected by these issues.

Stakeholders

Understanding the problem is the first step in developing your Research Action Plan (R.A.P.). What is a Research Action Plan?

Research Action Plan

In developing your report you need to consider how the management of the wetlands should proceed.

Sustainability

Social Justice

Equity

Don't start by looking at the Tasks available.

Information in the **Resources** folder may help you with the Tasks.

Use **Your notes** to help develop your ideas.

Tasks

To help understand the problem you need to develop your background knowledge.

Completing the following pre-visit tasks will help in developing your awareness of the land and water management associated with Narawang Wetland.

Once you have a better understanding of the problem you and your research team will need to decide on which one of the management issues you will investigate.

What is a wetland?

Wetlands are areas where water generally covers the soil for varying periods of time during the year. This task will help you understand the importance of wetlands and some of the management issues associated with them.

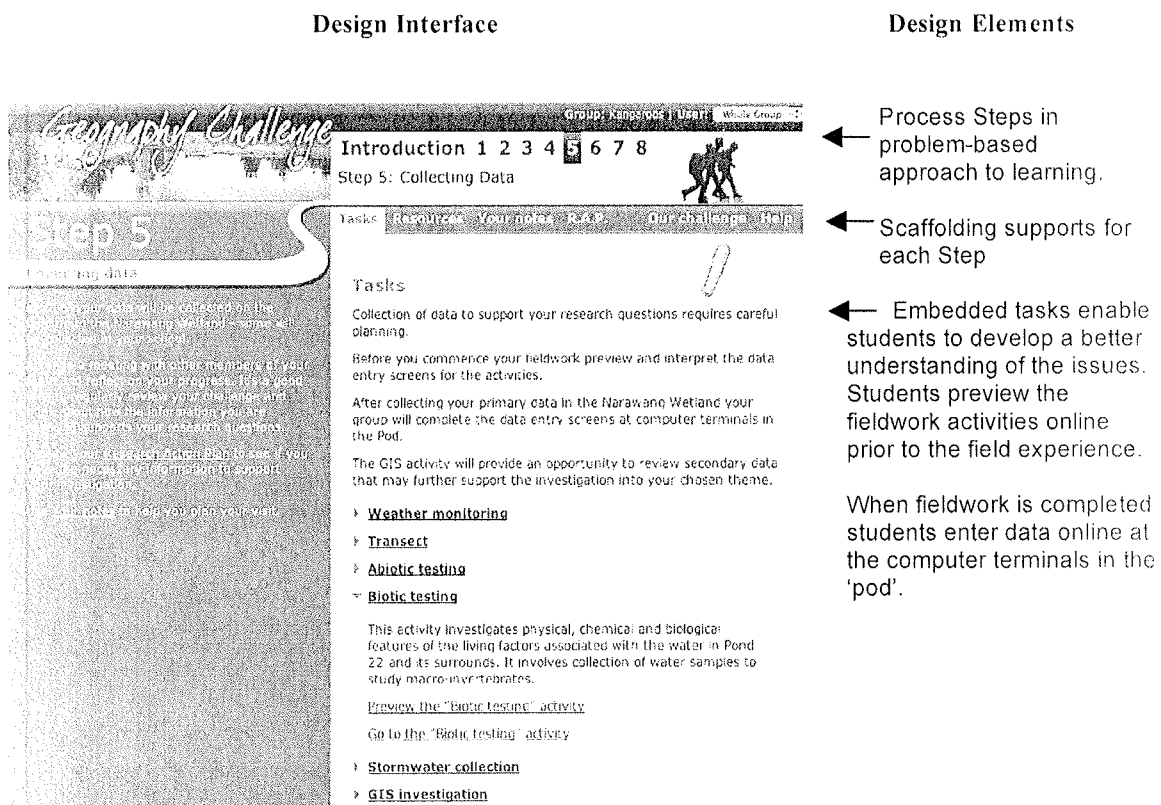
[Go to "What is a wetland" task](#)

- ▶ **Mapping**
- ▶ **Climate**
- ▶ **Flora and fauna**
- ▶ **History**
- ▶ **Stakeholder roles**
- ▶ **Geographic Information System - an overview**

In the fieldwork phase, students complete a series of activities at the Narawang wetland that relate specifically to the themes of the overall challenge (Figure 6). During this on-site phase data collected through the use of field-based tools, in the form of physical, chemical and biological measurements, photographs, video, audio and diagrams, are collated and later recorded on computers situated in an onsite 'pod' that has been specifically designed to facilitate the continued use of the online environment. All members of the investigative team (the class) can view data entry from each of the student groups. This data will be collated over time and become a source of secondary data for the Authority.

On returning to school, during the post-visit phase, students work towards developing a response to the challenge they originally accepted. They analyse data collected, both during the pre-visit phase and the field experience phase, review available secondary data through the online geographic information system (GIS) and relate this information to the specific theme under investigation. Before developing their artefact they are required to review the opinions of stakeholders to gain a better understanding of the varying opinions that may have a bearing on their final decision making processes.

Figure 6: Design Interface of the 'Geography Challenge'



Research Agenda

Reeves and Hedberg (2003) have suggested that at least six types of evaluation are appropriate to an interactive learning system such as the Sydney Olympic Park Geography Challenge. *Reviewing the project concept* is the first type of evaluation, and one that is done in the very early stages of any project. This was completed by conducting a thorough literature review to inform the development team of learning strategies and approaches appropriate to fieldwork, and to provide information on any existing systems with similar focus and intent. The second type of evaluation that is relevant is a *Needs Assessment*. This was systematically conducted to ensure that the excursion program was needed and would complement a range of educational focus areas in the key learning areas (KLAs).

Formative evaluation of the project has occurred consistently and frequently at each stage of the project. Expert reviews have been conducted at both alpha and beta stages using the expertise of the education systems (both State and Catholic) who were represented on the Education Design Team of the project. Curriculum experts from the faculty of Education at the University were also consulted, as were expert geography teachers (Brickell, Herrington, & Harper, 2005a). Experts reviewed both paper-based plans as well as beta products, as each component of the learning environment was developed. User testing was conducted with students from the target group (Year 9–10) in both one-to-one consultation, and with whole geography class

participation, where observation and focus group data was obtained (Brickell, Herrington, & Harper, 2005b).

Further *Effectiveness*, *Impact* and *Maintenance* evaluation will be conducted as the challenge is fully implemented and established as a learning program.

Conclusion

Fieldwork experiences are an important learning tool across K–12 education in many discipline areas. They provide opportunities for direct observation, data collection, and data analysis and are fundamental to basic research in these areas. However traditional approaches to fieldwork are often teacher-centred with few opportunities for active student participation. As a consequence, for many students, the desired learning outcomes are not achieved and the fieldwork experience considered ineffective.

This online project has been developed to incorporate fieldwork into a realistic challenge that reflects problems experienced in the ‘real world’ and introduces the topic to students in an engaging and motivating manner. Student interaction with the range of classroom tasks and fieldwork activities are designed, not only to develop their skills as geographers but also, to engage them in an authentic problem-based learning environment. Initial testing of the design has received favourable feedback from both students and teachers.

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