

Learning for sustainability:

The role and impact of Outdoor and Environmental Education Centres

Roy Ballantyne and Jan Packer



THE UNIVERSITY
OF QUEENSLAND

Acknowledgements

This project was undertaken with the support of an ARC Linkage Grant, with Industry Partner Education Queensland. We are grateful to the research assistants who contributed to the data collection: Michele Leiminer, Petra Skoien, and Mark Crome. We also acknowledge the contribution of Cam Mackenzie, Noeleen Rowntree and Ron Tooth, who have been closely involved in all stages of the project planning and implementation.

First published in Australia in 2008 by the University of Queensland, School of Tourism

Copyright University of Queensland 2008

ISBN 9781864999129

All photographs courtesy of Education Queensland Outdoor and Environmental Education Centres.

Learning for sustainability:

The role and impact of Outdoor and Environmental Education Centres

Table of Contents

Executive Summary	3
Chapter 1 Project Aims and Background.....	6
Chapter 2 Method.....	7
2.1 Overview of Stage 1 (2005).....	7
2.2 Overview of Stage 2 (2006).....	7
2.3 Stage 2 Data collection methods.....	7
Chapter 3 Results from Stage 1.....	9
3.1 The destination model	9
3.2 The expert/advisor model	10
3.3 The partnership model.....	10
3.4 Stage 1 Conclusions.....	11
Chapter 4 Results from Stage 2.....	12
4.1 Range of pedagogies used in target programs	12
4.2 Program Observations	12
4.3 Student Interviews - Initial learning events	16
4.4 Student interviews - Follow-up learning events	19
4.5 Teacher interviews.....	21
4.6 Evidence of subsequent environmental actions	25
Chapter 5 Conclusions	26
5.1 Pedagogies that facilitate student learning for sustainability.....	26
5.2 Impacts on the nature and quality of student learning for sustainability	28
Chapter 6 Recommendations	29
References.....	30
Appendix A: Examples of reported Learning Events	31
Appendix B: Data Collection Instruments	34

List of Tables

Table 1. Participating programs 7

Table 2. Categorisation of program components by mode of delivery 13

Table 3. Mode of delivery by school level..... 13

Table 4. Mode of delivery by day/residential..... 14

Table 5. Average frequency of observation of learning indicators (1-4 scale) 14

Table 6. Average (observed) engagement for each mode of delivery (1-4 scale)..... 15

Table 7. Average learning events per exposed student for each mode of delivery 17

Table 8. Average learning events per exposed student at follow-up, for each mode of delivery..... 20

Table 9. Subsequent Actions 25

Table 10. Pedagogies that facilitate learning for sustainability 26

Executive Summary

Aims

This project was designed to improve our understanding of the role and impact of nature-based environmental learning experiences, identify factors that facilitate learning for sustainability, and develop empirically-based principles to support Outdoor and Environmental Education Centres (O&EECs) in providing effective education for sustainability. The project builds on previous research which identified productive pedagogies (effective teaching strategies) in classroom contexts, and extends these to incorporate additional pedagogies that are effective in *supporting learning in natural environments*.

Method

The project was conducted in two stages, with data collection for Stage 1 in 2005; data collection for Stage 2 in 2006; and data analysis and report writing in 2007. In Stage 1, 23 O&EEC principals were surveyed regarding their centre's aims, perceived roles, clientele, pedagogies, partnership approaches and expected learning outcomes using a combination of telephone interviews, on-line questionnaires and document collection. In Stage 2, in-depth data were collected from 199 students, 23 classroom teachers and 16 O&EEC teachers who had participated in twelve O&EEC programs across Queensland. The selected programs included metropolitan and regional locations; programs for primary and secondary students; residential and day programs.

Key Findings: Stage 1

O&EEC principals envisaged three types of roles for their Centres: conducting short-term or one-off programs for students (destination model); modelling sustainable practice (expert/advisor model); and engaging in long-term, whole-school approaches (partnership model). These three models are seen as a hierarchy of responses, each building on and extending the one before, rather than as three discrete approaches. Most of the programs offered by O&EECs are based on the destination model of service provision, whereby programs are confined within the boundaries of the Centre, which students 'visit' for a short period. Principals recognise the limitations of this approach and envisage a broader role for O&EECs that includes promoting and advocating for environmental education; developing the professional capacity of classroom teachers to integrate environmental education into the school curriculum; and developing whole-school partnerships to ensure the continuity of environmental learning experiences in all aspects of school life. These broader roles do not negate the need for 'destination'-type programs, but rather build upon and extend the outcomes already being achieved in this way. In order to move forward with such a vision, it is necessary to document the outcomes being achieved by destination-type programs, and identify the program elements, pedagogies and partnership approaches that are most effective in facilitating student learning for sustainability. These were the aims of Stage 2 of this research.

Key Findings: Stage 2

Although the twelve target programs varied widely in their environmental context (e.g., forest, river and marine environments), there were some important commonalities in the ways in which programs were delivered. Eight major modes of delivery were identified: field investigation; teacher presentation; interpreted walks; discussion or debate; drama or story; games or play; reflective responses; and worksheets. Programs for Primary classes used a broader range of delivery modes than those for Secondary classes. In particular, Primary programs were more likely to include drama or story, games or play, and reflective responses, while programs for upper Secondary classes had a strong focus on teacher presentations. Field investigations were well-represented across all class levels.

Observer ratings of student engagement in learning during each program indicated that (a) engagement declined as the age of the students increased, (b) field investigation and story/drama were the most highly engaging modes of delivery and teacher presentation and worksheets were the least engaging; and (c) Primary students were highly engaged in teacher presentations, but Secondary students were disengaged.

Student interviews were conducted immediately after each program, in order to measure what they could report having learned. Students each reported an average of 6 different learning events, of which 3.3 related to new knowledge; 0.6 related to changes in the way they felt; and 2.1 related to changes in what they would like to do for the environment. All students reported at least one learning event, the highest number reported was 16, and 60% of students reported 6 or more events. Students in residential programs reported significantly more learning events (average of 7.0) than those in day programs (average of 5.8).

Students were asked which parts of the program they had learned the particular items they reported. The modes of delivery that produced the highest learning outcomes were “reflective responses” (averaging 2.6 learning events per student) and “field investigations” (averaging 1.9). There was some variation in the impact of different modes of delivery on knowledge, attitudes and behaviour. Reflective responses, field investigations and interpreted walks were important for knowledge and behaviour change; worksheets, stories, and teacher presentations were important in conveying knowledge; reflective response was the only mode of delivery to impact on attitude change.

When asked to indicate what it was that helped them to learn or change, students identified that 49% of all learning was *experience-based* (including what I saw, what I did, what I felt, what I experienced, listening to nature, creative and reflective responses); 31% was *teacher-directed* (including the teacher, other adults, stories and printed information); and 20% occurred through a combination of both. Attitude and behaviour change in particular were more likely to occur through experience-based methods. Teacher presentation, discussion and worksheets elicited mostly teacher-directed learning; reflective responses, stories, interpreted walks and field investigations elicited mostly experience-based learning. The teacher-directed modes of delivery were observed to be the least engaging.

Follow-up student interviews were conducted approximately three months after each program. A total of 173 students were interviewed, and each reported an average of 5.3 different learning events. Although the total numbers of learning events reported had decreased slightly over time, the proportions of knowledge, attitudes and behaviours remained the same, indicating that no one type was more susceptible to loss over time than another. All students reported at least one learning event, the highest number reported was 13, and 60% of students reported 4 or more events. Primary students reported significantly more learning events than Secondary students, and students in residential programs reported nearly 50% more learning events (average of 7.2) than those in day programs (average of 4.8). The most successful techniques for encouraging knowledge, attitude and behaviour change were reflective responses and field investigations.

Interviews with classroom and O&EEC teachers were conducted immediately after each program, and classroom teachers were interviewed again approximately three months after the program. Two aspects emerged which teachers considered had the greatest impact on student environmental learning: learning by doing (exploring, investigating, collecting data, and learning new skills) and being in the environment (seeing its beauty, seeing the effects of drought or human activity, visualising the issues, grasping the scale and importance of the problems, being outdoors). Teachers of the residential programs noted the impact of having an extended period with students, as it enabled them to develop a deeper rapport and to understand and cater for students’ individual needs and interests.

Emotional engagement was seen as a vital part of the environmental learning process, and a necessary motivator for behaviour change and further learning. It was generally agreed that the major role of O&EEC programs should be to develop an emotional connection with the environment, which ideally would lead to deeper cognitive engagement both in the Centre and back in the classroom.

Both classroom and centre teachers affirmed the value of close partnerships, which enabled classroom teachers to access the expertise and resources of the O&EEC, and enabled O&EEC staff to become part of the school community and culture. Some teachers felt there was a need for more O&EECs in order to provide greater opportunities for access to these resources at the local level.

Conclusions

The findings outlined in this report are conceptualised in relation to the “productive pedagogies” developed for formal classroom teaching. In this regard, a fifth category, *Experience-Based Learning*, has been identified, which encapsulates the unique pedagogies that are the specialty of Outdoor and Environmental Education Centres, and that are most effective in facilitating learning in the natural environment. The components of this fifth category include:

- Learning by doing (Are students actively involved in hands on exploration and investigation?)
- Being in the environment (Are students encouraged to experience and appreciate the special characteristics of the natural environment?)
- Real life learning (Are learning activities based on real places, real issues, and authentic tasks?)
- Sensory engagement (Are opportunities provided to explore the environment using all five senses?)
- Local context (Are students encouraged to explore and investigate environmental problems and issues in “their own backyard”?)

Experience-based learning is particularly important in addressing attitudes and behaviours, and its effects are longer-lasting than those that result from teacher-directed learning.

Recommendations

On the basis of the research findings, the following recommendations are made:

1. That the research be disseminated and shared across all O&EECs, districts, regions and within central office of Education Queensland.
2. That the research findings be used to review current Education Queensland approaches to sustainability as contained in the MACER report and other relevant curriculum documents.
3. That a professional development package be developed for use by O&EECs around the fifth pedagogy that (a) identifies effective modes of delivery for experienced based learning; (b) is based on a set of best practice fifth pedagogy principles; and (c) can provide professional development to centre staff and partner schools.
4. That the fifth pedagogy be promoted as a powerful means of delivering Education Queensland priorities in the areas of: Essential Learnings, Ways of Working and What State Schools Value – Active and Informed Citizens for a Sustainable World.
5. That schools be assisted to use O&EECs to deepen their pedagogical approaches and embrace experienced based learning models that will help them develop deep learning approaches in local contexts.
6. That further ARC Linkage research be undertaken to identify and explore the qualities, characteristics, applications and impacts of the fifth pedagogy, thus further contributing to the improvement of teaching and learning for sustainability in Queensland schools.

Chapter 1 Project Aims and Background

The project aimed to:

- Describe, document and examine a range of pedagogies and school-centre partnership arrangements used by O&EECs to facilitate student learning for sustainability;
- Measure the impact of O&EECs program elements, pedagogies and partnership approaches on the nature and quality of student learning for sustainability;
- Identify the program elements, pedagogies and partnership approaches that facilitate student learning for sustainability;
- Produce a set of ‘best practice’ principles in relation to program elements, pedagogies and partnership approaches, to enable O&EECs to optimise student learning for sustainability.

Environmental education research strongly suggests that learning experiences *in the natural environment* are extremely important in developing students’ environmental knowledge, attitudes and responsible actions (Ballantyne & Uzzell, 1994; Ballantyne Connell & Fien, 1998; Ballantyne, Fien & Packer, 2001a, 2001b; Ballantyne & Packer, 2002; Bogner, 1998; Lai, 1999; Rickinson, 2001; Tanner, 2001). For example, Palmer’s (1999) research with 1259 students in nine countries including Australia found that direct experiences with nature had far more impact on subsequent involvement in pro-environmental activities than did formal education. Dettmann-Easler and Pease’s (1999) review of research suggests that environmental education that is solely school-based is only moderately successful, and that the best approach for teaching environmental concepts and awareness is to incorporate outdoor activities. Learning experiences in natural environments have been associated with increased levels of student motivation and achievement (Battersby, 1999), as well as a greater likelihood that learning will be transferred to situations that students encounter outside of the school environment (Ballantyne, Fien & Packer, 2001b).

In Queensland, the State education authority (Education Queensland) has embraced the philosophy of ‘real world’ environmental instruction by establishing twenty-five Outdoor and Environmental Education Centres (O&EECs) throughout the State. These centres complement school programs and provide students with the opportunity to study particular aspects of the sustainability of the environment in which centres are located. Because the Centres are located in a range of different environments (including forest, beach, outback, estuarine and freshwater), they enhance students’ understanding of various environmental systems and address a broad range of environmental issues, including the use of land, water, mineral and energy resources. They thus offer a diverse range of environmental education programs, incorporating many different pedagogical approaches. Programs include day and residential programs, programs targeting different content areas and age groups, and programs employing drama, environmental investigations, didactic presentations, nature experiences and emotional appeals. O&EECs have a crucial role to play within the environmental education field because they provide the personal nature-based experiences that have been identified as critical for the formation of pro-environmental attitudes, and are in a prime position to build positive and productive relationships between school students, the local community and the natural environment.

This project builds on previous research conducted in classroom contexts that has identified twenty “productive pedagogies” or classroom strategies that teachers can use to focus instruction and improve student outcomes (Education Queensland, 2002). It was designed to identify specific program elements or pedagogies that are most effective in bringing about desired learning outcomes **in the context of learning in natural environments**.

Chapter 2 Method

2.1 Overview of Stage 1 (2005)

Principals of 23 of the 25 O&EECs in Queensland were surveyed regarding their centre's aims, perceived roles, clientele, pedagogies, partnership approaches and expected learning outcomes using a combination of telephone interviews, on-line questionnaires and document collection. The interviews were transcribed and analysed and the findings published in an academic paper (Ballantyne and Packer, 2006). A database of the survey responses is available.

2.2 Overview of Stage 2 (2006)

Twelve O&EEC programs from eight Centres were selected in collaboration with O&EEC principals for participation in Stage 2 of the project in 2006. These included Centres from both metropolitan and regional locations; programs for primary and secondary students; and both residential and day programs. A total of 199 students (102 males; 97 females), 23 classroom teachers and 18 Centre staff were interviewed and 16 classes attending the twelve programs in eight different locations across Queensland were observed (see Table 1). The number of classes and students able to be included in the project was limited by (a) the number of class groups participating in the target programs during the data collection period; and (b) the number of students whose parents had signed and returned participant consent forms.

Table 1. Participating programs

Centre	Program	Day/Res	Level	Classes	Students
Bunyaville	1. Parliament of Birds	Day	Primary	2 x Gr 5	43
	2. Corymbia Quest	Day	Primary	2 x Gr 7	25
Pullenvale	3. Hoodwinked	Day	Primary	1 x Gr 5	20
	4. Wander Way of the Water	Day	Primary	1 x Gr 7	18
Barambah	5. Catchment Crawl	Residential	Primary	1 x Gr 5	14
Holloway's Beach	6. Mixed program	Residential	Primary	1 x Gr 7	14
Toohey Forest	7. Quadrant Studies	Day	Secondary	1 x Gr 11-12	5
	8. Freshwater Studies	Day	Secondary	1 x Gr 8	7
Boyne Island	9. Gladstone Harbour Sustainability	Residential	Secondary	Gr 11-12	9
Nudgee Beach	10. Human Impact	Day	Secondary	2 x Gr 8	21
	11. Catchment Story	Day	Primary	2 x Gr 6-7	16
Stanley River	12. Bunya to Bay	Residential	Secondary	Gr 9-10	7
8 Centres	12 programs	8 Day 4 Res	7 Primary 5 Sec	16 groups	199

2.3 Stage 2 Data collection methods

Student Observation Schedule (SOS)

Participating students were observed during each of the 12 selected outdoor and environmental education programs and their patterns of behaviour were recorded using an observation schedule designed for the purpose.

Environmental Learning Outcomes Survey (ELOS) - Student interviews

The Environmental Learning Outcomes Survey (Ballantyne, Packer and Everett, 2005)¹ was developed for use in this project. Participating students were interviewed using this instrument

¹ Published in the Australian Journal of Environmental Education, vol 21, pp 89-100.

immediately following the program, and again three months after participating in the program. The ELOS is a structured interview schedule designed to measure students' conceptual learning, emotional responses, attitudinal change and behavioural intentions as a result of participating in an O&EEC program.

O&EEC staff interviews

Principals and teachers involved in the delivery of each of the 12 selected O&EEC programs were interviewed regarding the impact of different aspects of the program, pedagogies and partnership approaches on student learning for sustainability.

Teacher interviews

Classroom teachers whose classes attended the 12 selected O&EEC programs were interviewed regarding the impact of different aspects of the program, pedagogies and partnership approaches on student learning for sustainability. Three month post-visit follow-up interviews were also conducted with classroom teachers regarding the extent to which the programs had been integrated with subsequent classroom activities, and their impact on longer term learning outcomes.

These instruments are included in Appendix B.



Target programs represented a range of locations throughout Queensland

Chapter 3 Results from Stage 1²

The roles that principals envisaged for their Centres fell into three main categories:

1. Conducting short-term or one-off programs for students (destination model)
2. Modelling sustainable practice (expert/advisor model)
3. Engaging in long-term, whole-school approaches (partnership model).

These three models are seen as a hierarchy of responses, each building on and extending the one before, rather than as three discrete approaches. At the base level is the destination model, where students come in to the Centre for on-site programs. At the second level is the expert-advisor model, where Centre staff make their expertise available to classroom teachers, in order to extend the Centre's influence beyond their site-specific programs. At the third level is the partnership model, where Centres and whole school communities work together in the long term.

3.1 The destination model

O&EECs provide environmental education experiences at a site or Centre removed from the everyday school or classroom environment. O&EEC principals widely agreed that their Centres offer a specialised service to schools that complements and enhances the school curriculum. This specialised service includes both their unique location in the environment and the specialised expertise of their staff. Many programs are designed thematically around the environments surrounding the Centres (e.g., coastal and marine studies, dry forest studies, rainforest habitats, dry/arid climate studies, studies of built environment, sustainable land uses and practices). The settings in which O&EECs are located, the facilities they offer, and their specialist staff expertise, enable students to participate in learning activities that they are unable to experience at school, such as residential camps, wilderness treks, reef and marine studies.



Because of their unique locations and staff expertise, O&EECs provide experiences that are not available within a school setting.

² These results have been published in the journal article “Promoting learning for sustainability: Principals’ perceptions of the role of Outdoor and Environmental Education Centres” (Ballantyne and Packer, 2006).

Centre programs are usually developed in conjunction with curriculum requirements to meet the needs of client schools. An inventory of environmental education programs of the 23 O&EECs in this study lists some 340 programs across the State. There is variation in the duration of the site-based component of programs, which may range from a few hours to extended camps, field trips and trekking up to two or three weeks.

The destination model appears to have some advantages that would be difficult to replicate within the school environment. Hands-on pedagogical approaches, supported by staff with an intimate knowledge of the specific local environment provide learning opportunities that are different from the everyday classroom routine, and so have a special appeal to a broad range of students. There are, however, a number of disadvantages associated with this approach, including the cost of travel to and from the Centre, the pressure caused by large student numbers accessing limited resources, and the short-term nature of Centre programs.

3.2 The expert/advisor model

Many of the principals interviewed said that Centres were exemplars or models of sustainable practices in terms of building design and facilities. Such practices included, for example, their use of solar power and waste water management systems, and their attention to recycling, composting, and energy efficient practices. Centre facilities, design and practices are often an integral part of the environmental education learning program. Principals also indicated that through their involvement in the planning and delivery of O&EEC programs, classroom teachers gain the skills to develop and implement environmental education programs when they return to their schools.

The main advantage of the expert/advisor model then is in equipping and empowering classroom teachers to take students' learning a step beyond what can be achieved at the Centre. Thus students can be encouraged to apply what they have learned, and to integrate their understanding across different content areas. In this way, the effectiveness of Centre programs can be significantly enhanced and extended.

3.3 The partnership model

Principals' responses about the role of O&EECs reflected the emerging trend away from "stand alone" programs, and towards approaches that are integrated with the school curriculum. In other words, the on-site program is one component of a much broader experience. Adopting a collaborative approach to planning was seen by a number of principals as a key factor in developing Centre-school partnerships. These principals talked about the importance of Centres and schools having a shared understanding, a shared vision, a shared responsibility for program implementation, and being "on the same wavelength". Some principals also envisaged an outreach role for their Centres, involving long-term partnerships with whole school communities. From this perspective, O&EEC programs provide a point of entry, rather than a final destination, and the most important role that the Centre can play is to leverage change within whole school communities. This involves building a long-term two-way relationship between Centres and Schools. Adopting this role is seen as an extension of, rather than an alternative to the destination and expert/adviser models.



O&EEC programs provide a point of entry, leading to long-term partnerships between Centres and whole school communities

3.4 Stage 1 Conclusions

Most of the programs offered by O&EECs are based on the destination model of service provision, whereby programs are confined within the boundaries of the Centre, which students ‘visit’ for a short period. Although this model has been very successful, principals recognise the limitations of this approach. They envisage a broader role for O&EECs that includes promoting and advocating for environmental education; developing the professional capacity of classroom teachers to integrate environmental education into the school curriculum; and developing whole-school partnerships to ensure the continuity of environmental learning experiences in all aspects of school life. Adopting these roles will enable Outdoor and Environmental Education Centres to address some of the challenges they face in providing programs that are effective in bringing about student environmental learning, while at the same time contributing to a wider school awareness and action in relation to environmental sustainability. These broader roles do not negate the need for ‘destination’-type programs, but rather build upon and extend the outcomes already being achieved in this way. In order to move forward with such a vision, it is necessary to document the outcomes being achieved by destination-type programs, and identify the program elements, pedagogies and partnership approaches that are most effective in facilitating student learning for sustainability. These were the aims of Stage 2 of this research.

Chapter 4 Results from Stage 2

4.1 Range of pedagogies used in target programs

The 12 target programs were rated according to the extent to which they incorporated each of the 20 productive pedagogies identified in earlier research in classroom contexts. All four categories of productive pedagogies were well-represented. The following 13 of the 20 productive pedagogies were observed to be present in at least 50% of programs, with those in bold present in at least 75%.

Intellectual Quality

- Higher order thinking skills
- Substantive conversation
- Knowledge as problematic

Supportive learning environment

- **Social support**
- **Academic engagement**
- Self-regulation

Recognition of difference

- Inclusivity
- Group identity
- **Active citizenship**

Connectedness

- **Connectedness to the world**
- **Problem-based curriculum**
- Knowledge integration
- Background knowledge

4.2 Program Observations

Program components

Each of the 12 programs was divided into components, according to the major modes of delivery used throughout the program. The number of components per program ranged from two to thirteen.

The Stage 1 study in 2005, which collected information regarding 117 programs across 16 Centres, identified the major modes of delivery as:

- Field investigation
- Presentation
- Interpreted Walk³
- Discussion or debate

³ It should be noted that interpreted walks often included discussion, explanation or investigation

- Drama or story
- Physical activity
- Games or play
- Creative or reflective responses
- Worksheets

With the exception of “physical activity”, these codes were used to categorise the observed program components in the target programs. Table 2 compares these observation results with the principals’ reports from the Stage 1 survey.

Table 2. Categorisation of program components by mode of delivery

	% of all programs (from Stage 1 survey)	% of target programs (from observation)
Field investigation	52	75 (9 programs)
Presentation	51	50 (6 programs)
Interpreted walk	33	83 (10 programs)
Discussion or debate	30	67 (8 programs)
Drama or story	23	50 (6 programs)
Games or play	21	17 (2 programs)
Creative/reflective responses	20	17 (2 programs)
Worksheets	15	8 (1 program)

Use of the different modes of delivery differed significantly according to the school level of the participating classes ($\chi^2 (14) = 54.92$, $p < .001$), as indicated in Table 3.

Table 3. Mode of delivery by school level

	Primary	Lower Sec	Upper Sec
Field investigation	xx	xx	xx
Teacher presentation	x	x	xxx
Interpreted walk	x	xx	x
Discussion or debate	x	x	x
Drama or story	xx		
Games or play	x		
Creative/reflective responses	x		
Worksheets		xx	

(xxx = over 50% of program components; xx = 20-50%; x = 1-19%)

Programs for Primary classes used a broader range of delivery modes than those for Secondary classes. In particular, Primary programs were more likely to include drama or story, games or play, and creative or reflective responses. Programs for upper Secondary classes had a strong focus on teacher presentations. Field investigations were well-represented across all class levels. Day vs residential programs also showed different patterns of use of the different modes of delivery ($\chi^2 (7) = 24.84$, $p = .001$), as indicated in Table 4.

Table 4. Mode of delivery by day/residential

	Day	Residential
Field investigation	xx	xx
Teacher presentation	x	xx
Interpreted walk	x	x
Discussion or debate	x	xx
Drama or story	x	x
Games or play	x	
Creative/reflective responses	x	
Worksheets	x	

(xxx = over 50% of program components; xx = 20-50%; x = 1-19%)

Student engagement

Eight different indicators of student engagement in learning were observed as students participated in each component of the program, and each was rated on a 4 point scale according to their frequency:

- Sharing learning with peers and experts
- Making links and transferring ideas and skills
- Initiating and showing responsibility for learning
- Purposefully manipulating objects and ideas
- Showing confidence in personal learning abilities
- Actively involved in learning
- Responding to new information or evidence
- Disengagement

The average ratings for each of these indicators, as observed over all 12 programs, are reported in Table 5, in descending order of frequency.

Table 5. Average frequency of observation of learning indicators (1-4 scale)

Indicator of learning	Ave rating
Actively involved in learning	3.0
Showing confidence in personal learning abilities	2.6
Sharing learning with peers and experts	2.4
Responding to new information or evidence	2.4
Making links and transferring ideas and skills	2.4
Purposefully manipulating objects and ideas	2.1
Initiating and showing responsibility for own learning	2.1
Disengagement (off-task behaviour)	1.4

An average engagement score was calculated for each program component using the rating for each of the eight indicators with disengagement reverse scored. These average scores are reported in Table 6 in descending order of engagement.



Mostly, students were actively engaged in learning

Table 6. Average (observed) engagement for each mode of delivery (1-4 scale)

Mode of delivery	Total no of components	Average engagement
High engagement		
Field investigation	21	3.0
Story or Drama	11	3.0
Moderate engagement		
Interpreted walk	13	2.7
Reflective response	8	2.7
Game/play	3	2.6
Group discussion	15	2.5
Low engagement		
Teacher presentation	13	1.6
Worksheets	4	1.6
Total	89	2.6

This ordering was consistent across most of the individual indicators of engagement with only a few exceptions. Notably, the category “reflective response” was highly engaging in terms of active involvement and “games/play” was high in terms of sharing learning and manipulating objects/ideas.

Only four of the modes of delivery were present across all school levels (Field investigation, Teacher Presentation, Interpreted Walk and Discussion). Despite a general trend for engagement to decline as the age of the students increased, it was clear that Field Investigation was highly engaging for all levels of student. The largest differences between school levels were found in relation to Teacher Presentation, with Primary students being highly engaged and Secondary Students disengaged.

The difference between day and residential programs in average student engagement (2.7 and 2.3 respectively) was not statistically significant.

4.3 Student Interviews - Initial learning events

Immediately after participating in the program, students were interviewed using the Environmental Learning Outcomes Survey (ELOS). They were asked to describe:

- What they learned about caring for the environment (Knowledge)
- How they had changed the way they felt about the environment (Attitudes)
- How what they learned would change what they do for the environment (Behaviour)

For each of these learning events, they were also asked to indicate where they were when it occurred, what it was that helped them learn or change, and how they felt when they were learning.

Number and types of learning events

A total of 199 students were interviewed, and each reported an average of 6 different learning events. Of these, 54% (or an average of 3.3 events) related to new knowledge (including knowledge of what they *could do* to help the environment); 10% (or an average of 0.6 events) related to changes in the way they felt; and 35% (or an average of 2.1 events) related to changes in what they would or would like to do for the environment. All students reported at least one learning event, the highest number reported was 16, and 60% of students reported 6 or more events.

Primary students reported marginally more learning events than Secondary students (6.1 vs 5.8) but this was not a statistically significant difference. There were no significant differences between Primary and Secondary students in the proportions of Knowledge, Attitude and Behaviour changes. Female students reported significantly more learning events (average of 6.4) than males (average of 5.7), $t(197) = 2.28, p < .05$, and were more likely to report changes in attitudes than males ($\chi^2(2) = 7.73, p < .05$). Students in residential programs reported significantly more learning events (average of 7.0) than those in day programs (average of 5.8), $t(197) = 3.49, p < .001$, although the proportions of Knowledge, Attitude and Behaviour changes were roughly equal.

Modes of delivery and learning events

Although students were asked to indicate in which parts of the program they had learned the particular items they reported, it was difficult to make connections between modes of delivery and learning outcomes because there was so much variation in the way different modes of delivery were applied across the programs. One mode of delivery that did stand out as producing higher than average learning outcomes, across Knowledge, Attitudes and Behaviour, was “Reflective response” (averaging 2.6 learning events per exposed⁴ student). Unfortunately, however, it was only offered in two programs. “Field investigations” were the second most successful mode (after reflective response), again across Knowledge, Attitudes and Behaviour (averaging 1.9 learning events per exposed student). Table 7 lists the 8 modes of delivery in order of effectiveness in relation to immediate learning outcomes. It also indicates the range of effectiveness across different programs.

There was some variation in the impact of different modes of delivery on Knowledge, Attitudes and Behaviour. Reflective response, field investigations and interpreted walks were important for Knowledge and Behaviour Change; worksheets, stories, and teacher presentation were important in conveying Knowledge; reflective response was the only mode of delivery to have a real impact on attitude change.

⁴ An exposed student is one who attended a program where this mode of delivery was offered.

Table 7. Average learning events per exposed student for each mode of delivery

Mode of delivery	Range across programs	Average LE/student
High effectiveness		
Reflective response	2.1 – 3.1	2.6
Moderate effectiveness		
Field investigation	0.1 – 3.4	1.9
Interpreted walk	0.2 – 2.1	1.0
Low effectiveness		
Group discussion	0.0 – 2.2	0.6
Worksheets	0.6 – 0.6	0.6
Story or Drama	0.1 – 2.2	0.6
Teacher presentation	0.0 – 3.4	0.5
Game/play	0.0 – 3.1	0.4

Feelings associated with learning events

Students were asked to report the feelings that were associated with each learning event. These feelings were coded according to their direction (positive vs negative) and their intensity (high vs low) giving four possible codes, as follows:

- Low positive (e.g., happy, calm) 36% of responses
- Low negative (e.g., felt nothing, bored) 5% of responses
- High positive (e.g., interested, surprised) 43% of responses
- High negative (e.g., sad, angry) 16% of responses



Thus students mostly reported positive feelings, the most commonly cited being “happy”, “interested” and “surprised” which together accounted for 59% of responses. New knowledge was most commonly associated with interest and surprise, while attitude and behaviour change were most commonly associated with feeling happy. The most common negative emotions, “sad”, “angry” and “afraid” were strongly associated with changes in knowledge rather than attitudes and behaviours. Females were more likely to report high intensity emotions than males. In particular, the low negative emotions (e.g., felt nothing, bored) were much more likely to be reported by males than females.

New knowledge is often accompanied by feelings of interest and surprise

How students learned

For each learning event, students were asked to indicate what it was that helped them to learn or change. Their responses were coded as either **teacher-directed learning** (including the teacher, other adults, stories and printed information) or **experience-based learning** (including what I saw, what I did, what I felt, what I experienced, listening to nature, creative and reflective responses). Students identified that 49% of all learning events were learned through experience; 31% through teachers; and 20% through a combination of both.



Experience-based learning draws on what students see, hear, do and feel

Because students were asked both where they had experienced each learning event and what it was that helped them learn or change, links were able to be made between the different modes of delivery and how students learned. The different modes of delivery varied significantly according to whether they elicited teacher-directed or experience-based learning ($\chi^2 (14) = 139.55$, $p < .001$). Teacher presentation, discussion and worksheets elicited mostly teacher-directed learning; reflective responses, stories, interpreted walks and field investigations elicited mostly experience-based learning. Referral back to Table 6 indicates that the modes of delivery associated with teacher-directed learning were observed to be the least engaging.

Although learning of Knowledge, Attitudes and Behaviour were all more likely to be experience-based than teacher-directed, attitude and behaviour change were particularly experience-based ($\chi^2 (4) = 45.03$, $p < .001$).

Teacher-directed learning was more likely to be associated with low negative emotions (e.g., felt nothing, bored) than experience-based learning; and experience-based learning was more likely to be

associated with low positive emotions (e.g., feeling happy, calm) than teacher-directed learning. They were equally likely to be associated with high negative (e.g., feeling sad, angry) and high positive (e.g., feeling interested, surprised) emotions.

There was no difference between males and females in the extent to which they reported teacher-directed vs experience-based learning. Primary students were more likely to report experience-based learning and Secondary students were more likely to report teacher-directed learning ($\chi^2(2) = 21.41$, $p < .001$). Day students were more likely to report experience-based learning and residential students were more likely to report teacher-directed learning ($\chi^2(2) = 33.97$, $p < .001$).

4.4 Student interviews - Follow-up learning events

Approximately three months after participating in the program, students were interviewed again using the Environmental Learning Outcomes Survey (ELOS). They were asked to describe what they had learned about caring for the environment (Knowledge); how they had changed the way they felt about the environment (Attitudes); and how what they learned would change what they do for the environment (Behaviour).

Number and types of (long-term) learning events

A total of 173 students were interviewed, and each reported an average of 5.3 different learning events. Of these, 54% (or an average of 2.8 events) related to new knowledge; 11% (or an average of 0.6 events) related to changes in the way they felt; and 35% (or an average of 1.8 events) related to changes in what they would do for the environment. Thus although the total numbers of learning events reported had decreased slightly over time, the proportions of knowledge, attitudes and behaviours remained the same, indicating that no one type was more susceptible to loss over time than another. All students reported at least one learning event, the highest number reported was 13, and 60% of students reported 4 or more events.

Primary students reported significantly more learning events than Secondary students (5.5 vs 4.5), $t(171) = 2.05$, $p = .04$. There were no significant differences between Primary and Secondary students in the proportions of Knowledge, Attitude and Behaviour changes. Female students reported marginally more learning events (average of 5.5) than males (average of 5.1), and again were more likely to report changes in attitudes and less likely to report items of new knowledge than males ($\chi^2(2) = 9.51$, $p = .009$). Students in residential programs reported nearly 50% more learning events (average of 7.2) than those in day programs (average of 4.8), $t(167) = 5.07$, $p < .001$, although the proportions of Knowledge, Attitude and Behaviour changes were much the same.

Modes of delivery and (long-term) learning events

Again “reflective response” stood out as the mode of delivery that produced the highest learning outcomes, across Knowledge, Attitudes and Behaviour, averaging 2.4 learning events per exposed student (see Table 8). Reflective response and field investigations were the most successful techniques for bringing about behaviour change.

Table 8. Average learning events per exposed student at follow-up, for each mode of delivery

Mode of delivery	Average LE/student Immediate post-vist	Average LE/student At follow-up
High effectiveness		
Reflective response	2.6	2.4
Moderate effectiveness		
Field investigation	1.9	1.1
Low effectiveness		
Interpreted walk	1.0	0.7
Teacher presentation	0.5	0.7
Story or Drama	0.6	0.5
Group discussion	0.6	0.4
Worksheets	0.6	0.3
Game/play	0.4	0.2

Feelings associated with learning events

Students were again asked to report the feelings that were associated with each learning event. The proportions of each type of emotion were almost identical to those reported immediately after the program. Again, knowledge was most commonly associated with interest and surprise, while attitude and behaviour change were most commonly associated with feeling happy.

How students learned

Again, students were asked to indicate what it was that helped them to learn or change. Students identified that 57% of all follow-up learning events had been learned through experience; 23% through teachers; and 20% through a combination of both (compared with 49%; 31%; and 20% respectively of initial learning events). Thus it would appear that experience-based learning is longer-lasting than teacher-directed learning. The graph in Figure 1 lends credence to the old adage about remembering more of what we do and see than what we hear. The pattern was similar across Knowledge, Attitudes and Behaviour.

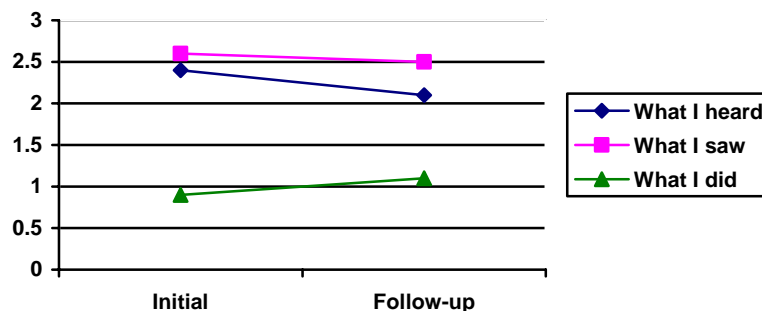


Figure 1. Learning events per student according to how they reported having learned

Females were more likely to report experience-based learning at follow-up than males ($\chi^2 (2) = 7.06$, $p < .03$). There was no difference between Primary and Secondary students. Again, day students were more likely to report experience-based learning and residential students were more likely to report teacher-directed learning ($\chi^2 (2) = 7.18$, $p = .03$).

4.5 Teacher interviews

A total of 23 classroom teachers (14 Primary; 9 Secondary; between 1 and 4 for each program) and 16 O&EEC teachers (between 1 and 3 for each program) were interviewed on completion of the program; 18 of the classroom teachers (10 Primary; 8 Secondary; between 1 and 3 for each program) were interviewed again 3 months after the program. Teachers were asked to reflect on the aspects of the program that they felt had the greatest impact on student environmental learning; the extent to which student learning was influenced by emotional engagement and/or information and explanation of the topic; and the importance of the school-centre partnership in achieving student learning for sustainability.

Teaching strategies and pedagogies that have the greatest impact on student learning

Classroom and centre teachers were asked to indicate what teaching strategies, pedagogies, or other aspects of the program they considered had the greatest impact on student environmental learning for sustainability. Two aspects emerged as being the most widely recognised, important characteristics of the participating programs; *Learning by Doing* and *Being in the Environment*. These were each mentioned by over 50% of teachers. While these were important for both Primary and Secondary classes, *Learning by Doing* was more frequently mentioned by Primary teachers and *Being in the Environment* was more frequently mentioned by Secondary teachers.

Learning by doing. Teachers often used the words “hands on” to describe the aspects of the program they considered had the greatest impacts on student learning. This included exploring, investigating, collecting data, and learning new skills.



Teachers consider ‘hands on’ learning to be one of the most powerful aspects of O&EEC programs

Being in the environment. Actually being *in* the environment – seeing its beauty, seeing the effects of drought or human activity – had an impact on students, according to their teachers. Seeing the environment helped students to visualise and understand the issues and to grasp the scale and importance of the problems. Just being outdoors and out of the classroom had an impact on student learning according to some teachers.



Being in the environment is an important part of the learning experience

Another six aspects emerged as being moderately important aspects of the participating programs. These were mentioned by 20-40% of teachers:

Important to both Primary and Secondary teachers:

- *Real Life Learning*
- *Integration with Classwork*
- *Higher Order Thinking*

Important mainly to Primary teachers:

- *Local Context*
- *Making Personal Connections*
- *Sensory Engagement*

Real Life Learning. A number of teachers used the words “real life” to describe aspects of the program that impacted on student learning. This included being in a “real” place, responding to “real life situations”, and undertaking “real life tasks”. According to one Centre teacher, “everything we do is real”.

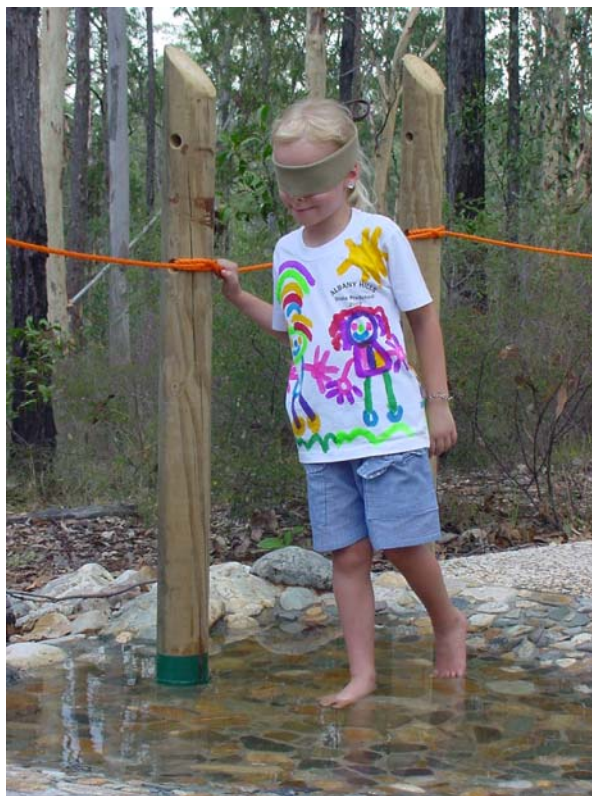
Integration with Classwork. Teachers felt that being able to connect aspects of the program with classroom activities impacted on student learning. In particular, they referred to the importance of post-visit activities in reinforcing and deconstructing what students had seen and experienced in the field.

Higher Order Thinking. A number of the programs were seen to draw on students' higher order thinking skills such as asking questions, comparing different perspectives, creating meaning, drawing conclusions, and developing opinions and values.

Local Context. When schools were located relatively close to the EEC, teachers felt being in their local area had an impact on student learning. A number used the term "their own backyard" to indicate the heightened meaning and relevance that this gave to the students' involvement the program, making them a stakeholder in environmental issues. Even when the school was some distance from the EEC, the skills and approaches learned at the EEC could be applied in the local area as a post-visit activity.

Making Personal Connections. Aspects of the programs that helped students, especially Primary students, make connections between their own experience and the messages being conveyed, were considered to impact on student learning. These included, for example, story and drama, as well as group discussion designed to draw out personal experiences.

Sensory Engagement. Primary teachers in particular felt that being able to see, hear, touch, smell and "live the experience" was important for students.



Engaging all the senses provides a powerful experience for young students

Other aspects that were mentioned by fewer than 10% of the teachers included the use of relevant themes; engaging curiosity; appealing to different styles of learning; providing a social experience (important for Secondary students); having a sense of purpose; focussing on environmental action; and allowing students to take some ownership and control. Teachers of the residential programs noted the impact of having an extended period with students, as it enabled them to develop a deeper rapport and to understand and cater for students' individual needs and interests.

Emotional engagement and information/explanation

Teachers were asked about the importance of both emotional engagement and information/explanation in influencing students' learning for sustainability. Emotional engagement was seen as a vital part of the environmental learning process, and a necessary motivator for behaviour change: "You need to be emotionally engaged to change what you do". Emotional engagement was also seen to be important in making learning more personal, giving students a sense of purpose and meaning and helping them to feel part of a larger issue. Teachers felt that once students felt passionate about the topic, they would then be more open to information, and in fact often asked questions to obtain it. Some teachers also saw the need for some preparatory information. They felt that information could be provided at school before and more importantly after the program, and that the role of the program should be to develop the emotional engagement. Information could also be provided as the students needed it at relevant points in the program. As one teacher put it: "Open the door with emotions then go through the door with analysis."

The passion, sincerity and commitment of the presenter was also considered important as these people often became environmental role models for the students.

The importance of school-EEC partnerships

Both classroom and centre teachers affirmed the value of close partnerships:

- *It's the foundation of being able to get the best out of kids and us* (classroom teacher)
- *I don't know how a school can operate without this kind of partnership* (classroom teacher)
- *The classroom teacher and the environmental education teacher bounce off each other... we can soon tell when a class has not engaged in the topic* (centre teacher)
- *Pre-visit contact between the school and the centre is essential... constant communication back and forth enables joint ownership of the learning outcomes* (centre teacher)
- *Results are always better when the hard yards are done at school* (centre teacher)

Classroom teachers in particular explained that partnerships had enabled them to:

Learn new teaching skills

- *Have changed the way I teach*
- *It helps us to understand what and why we have to achieve certain things*
- *Seeing how the techniques can be used*
- *Given us confidence to develop on our own*
- *Take the philosophies from them and work them ourselves*

Access O&EEC expertise and resources

- *We desperately need them and their expertise*
- *Their knowledge and expertise – they can give depth of knowledge of a particular area*
- *I feel comfortable to approach them to use their expertise*
- *Experts to contact*
- *Schools can't afford the equipment*
- *Shared resources are important*
- *Easy availability of support through resources and advice*
- *Mutual outreach – staff from each visiting each other*

Some teachers felt there was a need for more O&EECs:

- *Could develop greater opportunities for access and more O&EECs – neighbourhood centres because a lot of schools aren't resourced*

- *EEC included into a cluster of schools*
- *EQ should continue to have these centres and even more*

The teachers' understanding of an ideal partnership included O&EEC staff providing professional development programs in the schools, acting as role models for teachers, being involved in planning units, and sharing resources; and classroom teachers working to integrate classroom tasks with the O&EEC programs, building a long-term relationship with O&EEC staff, and considering the O&EEC team a part of the school community. Communication was seen as the most important aspect of an ideal partnership and classroom teachers needed to feel comfortable in approaching O&EEC staff for help. Once a good partnership between a school and an EEC was established, it became an ongoing part of the school culture: *"It's a cycle – it just flows and keeps going"*.

4.6 Evidence of subsequent environmental actions

Three months after the program, classroom teachers reported the following evidence of environmental actions their students had taken since their involvement in the program:

Table 9. Subsequent Actions

Centre	Program	Subsequent Action
Bunyaville	1. Parliament of Birds	Parents reported they took what they knew home; developed personal action plans; one student suggested writing a letter to MP
	2. Corymbia Quest	Students are more aware and influencing their families; have made comments about looking after environment; small steps are making an impact
Pullenvale	3. Hoodwinked	Walking club started litter patrol; started birdwatching; raising money; visited websites eg WWF, sponsoring animal
	4. Wander Way of the Water	Fund-raising ; recycling
Barambah	5. Catchment Crawl	One student reported cleaning up after fishing trip so it wouldn't get in the waterways; students feel they are making a difference
Holloway's Beach	6. Mixed program	Good discussions about environment in class
Toohey Forest	7. Quadrat Studies	Worked on assessment items
	8. Freshwater Studies	Class won competition to stop rubbish going in stormwater drains; sustainable living challenge
Boyne Island	9. Gladstone Harbour Sustainability	Students careful to keep baby mullet alive; comfortable to pass on knowledge
Nudgee Beach	10. Human Impact	Students took interest in local issue, asked teacher about it on playground duty
	11. Catchment Story	Students interested in environment, established an environmental duty roster – go out and clean up; mentioned animals seen in trip
Stanley River	12. Bunya to Bay	Students talk to their friends about the environment; confidence to contribute an opinion; improvement in collective responsibility for litter in school grounds; increased concern re waste of water

Chapter 5 Conclusions

5.1 Pedagogies that facilitate student learning for sustainability

The findings of this research may be conceptualised in relation to the 20 “productive pedagogies” developed for formal classroom teaching (noting that the term “Supportive classroom environment” is replaced with “Supportive learning environment”). Table 10 compares the original set of 20 productive pedagogies (Education Queensland 2002) with those identified as most important by O&EEC principals (Stage 1), those observed most frequently in the 12 target programs (Stage 2) and those identified among the strategies that participating teachers considered most effective (Stage 2).

Table 10. Pedagogies that facilitate learning for sustainability

Original productive pedagogies (Education Queensland 2002)	Principal’s (Stage 1) ratings of productive pedagogies ^a	Observed (Stage 2) frequencies in 12 target programs ^b	Teachers’ perceptions of effective strategies (Stage 2 interviews) ^c
1. Intellectual Quality			
Higher order thinking skills	*	*	*
Deep knowledge	*	*	-
Deep understanding	*	*	-
Substantive conversation	**	**	-
Knowledge as problematic	*	*	-
Metalanguage	-	-	-
2. Supportive learning environment			
Student direction	*	-	-
Social support	**	***	-
Academic engagement	***	**	-
Explicit performance criteria	-	-	-
Self-regulation	**	*	-
3. Recognition of difference			
Cultural knowledge	*	*	-
Inclusivity	**	**	-
Narrative	-	-	-
Group identity	*	**	-
Active citizenship	**	***	-
4. Connectedness			
Knowledge integration	*	**	*
Background knowledge	*	**	-
Connectedness to the world	***	***	*
Problem-based curriculum	**	***	-
5. Experience-based learning (NEW Fifth Pedagogy)			
Learning by doing			***
Being in the Environment			***
Real Life Learning			**
Sensory Engagement			*
Local Context			*

Note: Shading indicates level of importance for O&EECs

^a Mean ratings on a 1-7 scale; *** = 6.0-7.0; ** = 5.0-5.9; * = 4.0-4.9

^b Mean ratings on a 1-5 scale; *** = 4.4-5.0; ** = 3.7-4.3; * = 3.0-3.6

^c Mentioned by *** = more than 50% of teachers; ** = 30-49%; * = 10-29%

Based on this information, it is suggested that the four major categories (Intellectual Quality; Supportive learning environment; Recognition of difference; and Connectedness) are all applicable to

the Outdoor and Environmental Education context, but items within these categories are given different emphasis than in classroom contexts. A fifth category, **Experience-Based Learning**, is also identified, which encapsulates the unique pedagogies that are the specialty of Outdoor and Environmental Education Centres.

1. Intellectual Quality

Higher order thinking skills, Substantive conversation and Knowledge as problematic were observed in over 50% of the programs. These related particularly to the critical examination and discussion of ideas and examination of alternative perspectives on environmental issues.

2. Supportive learning environment

Social support, Academic engagement and Self-regulation were observed in over 50% of programs. They reflect learning experiences that are cooperative, engaging and intrinsically motivating.

3. Recognition of difference

Inclusivity, Group identity and Active citizenship were observed in over 50% of the programs. Environmental issues provide abundant opportunities to discuss citizenship issues, while field experiences provide opportunities to build a sense of community that includes all students.

4. Connectedness

Connectedness to the world and Problem-based curriculum were observed in all 12 programs. Knowledge integration and Background knowledge were observed in over 50% of the programs. These components also include the ideas of Integration with classwork and Making personal connections, which were mentioned by teachers as having an important impact on student learning. Environmental issues are by definition real world public problems, and environmental education programs explicitly aim to help students “connect” with these problems, and explore possible solutions. Knowledge integration occurs not only across subject areas, but ideally across contexts (School and EEC). Background knowledge includes not only links with students’ prior knowledge, but also their prior experiences, and their relationship with their environment.

5. Experience-based learning

The findings indicated that 69% of all learning events that students reported immediately after participating in an O&EEC program had been learned through experience-based methods, or a combination of experience-based and teacher-directed methods. When learning events reported three months later were considered, this percentage rose to 77%. Experience-based methods were particularly important in relation to attitude and behaviour change.

The components of experience-based learning include:

- Learning by doing (Are students actively involved in hands on exploration and investigation?)
- Being in the environment (Are students encouraged to experience and appreciate the special characteristics of the natural environment?)
- Real life learning (Are learning activities based on real places, real issues, and authentic tasks?)
- Sensory engagement (Are opportunities provided to explore the environment using all five senses?)
- Local context (Are students encouraged to explore and investigate environmental problems and issues in “their own backyard”?)

These components were identified by both students and classroom teachers as those that had the greatest impact on student learning.

5.2 Impacts on the nature and quality of student learning for sustainability

The research has demonstrated that O&EEC programs have a significant impact on the students who attend, their class teachers, and whole school communities.

Impact on students

Students who attend an O&EEC program typically come away with an average of six learning events, three of which relate to new items of knowledge, and three to changes in attitudes and behaviours. Even three months after participating in the program, students could still recall an average of 5 learning events.

As noted above, the unique strength of O&EEC programs is the opportunity to engage in experience-based learning. Experience-based learning is particularly important in addressing attitudes and behaviours, and its effects are longer-lasting than those that result from teacher-directed learning.

Impact on teachers

Teachers who attended an O&EEC program with their students often reported learning new skills that changed the way they taught in the classroom. Teachers reported the greatest benefits when O&EEC programs were well-integrated with classwork. Teachers who returned to the O&EEC year after year were able to streamline this process as they knew what to expect from the program, how to prepare students for it, and how to reinforce student learning after the program.

Teachers appreciated being able to access the resources and expertise of their local O&EEC. A number of teachers indicated the need for more O&EECs in order to (a) allow students to participate in activities in their local area; and (b) improve the accessibility of O&EEC programs.

Impact on whole school communities

There were some examples of whole school communities who had developed long-term partnerships with O&EECs. These partnerships then became an ongoing part of the school culture.



Experience-based learning, the fifth pedagogy, encapsulates the unique strategies that are the specialty of Outdoor and Environmental Education Centres

Chapter 6 Recommendations

The following recommendations are made in the light of the research findings:

Recommendation 1

That the research be disseminated and shared across all O&EEC's, districts, regions and within central office of Education Queensland.

Recommendation 2

That the research findings be used to review current Education Queensland approaches to sustainability as contained in the MACER report and other relevant curriculum documents.

Recommendation 3

That a professional development package be developed for use by O&EEC's around the fifth pedagogy that: –

- identifies effective modes of delivery for experienced based learning
- is based on a set of best practice fifth pedagogy principles
- can provide professional development to centre staff and partner schools

Recommendation 4

That the fifth pedagogy be promoted as a powerful means of delivering Education Queensland priorities in the areas of: Essential Learnings, Ways of Working and What State Schools Value – Active and Informed Citizens for a Sustainable World.

Recommendation 5

That schools be assisted to use O&EEC's to deepen their pedagogical approaches and embrace experienced based learning models that will help them develop deep learning approaches in local contexts.

Recommendation 6

That further ARC Linkage research be undertaken to identify and explore the qualities, characteristics, applications and impacts of the fifth pedagogy, thus further contributing to the improvement of teaching and learning for sustainability in Queensland schools.

References

- Ballantyne, R. and Uzzell, D. (1994). A checklist for the critical evaluation of informal environmental learning experiences. *International Journal of Environmental Education and Information*, 13(2), 111-124.
- Ballantyne, R., Connell, S. and Fein, J. (1998). Students as catalysts of environmental change: A framework for researching intergenerational influence through environmental education, *Environmental Education Research*, 4(3), 285-298.
- Ballantyne, R., Fein, J. and Packer, J. (2001a). Programme effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *Journal of Environmental Education*, 32(4), 8-15.
- Ballantyne, R., Fein, J. and Packer, J. (2001b). School environmental education programme impacts upon student and family learning: A case study analysis. *Environmental Education Research*, 7(1), 23-37.
- Ballantyne, R. and Packer, J. (2002). Nature-based excursions: School students' perceptions of learning in natural environments. *International Research in Geographical and Environmental Education*, 11(3), 218-236.
- Ballantyne, R. and Packer, J. (2006). Promoting learning for sustainability: Principals' perceptions of the role of Outdoor and Environmental Education Centres. *Australian Journal of Environmental Education*, 22 (1), 15-30.
- Ballantyne, R., Packer, J., and Everett, M. (2005) Measuring environmental education program impacts and learning in the field: using an action research cycle to develop a tool for use with young students, *Australian Journal of Environmental Education*, 21, 89-100.
- Battersby, J. (1999). Does environmental education have 'Street Credibility' and the potential to reduce pupil disaffection within and beyond their school curriculum? *Cambridge Journal of Education*, 29(3), 447-459.
- Bogner, F.X. (1998). The influence of short-term outdoor ecology education on long-term variables of environmental perspective. *Journal of Environmental Education*, 29(4), 17-29.
- Dettmann-Easler, D. & Pease, J.L. (1999). Evaluating the effectiveness of residential environmental education programmes in fostering positive attitudes towards wildlife. *Journal of Environmental Education*, 13(1), 33-39.
- Education Queensland (2002). *Productive Pedagogies: Classroom reflection manual*. Brisbane, Queensland: The State of Queensland (Department of Education).
- Lai, K.C. (1999). Freedom to learn: A study of the experiences of secondary school teachers and students in a geography field trip. *International Research in Geographical and Environmental Education*, 8(3), 239-255.
- Palmer, J.A. (1999). Research matters: A call for the application of empirical evidence to the task of improving the quality and impact of environmental education. *Cambridge Journal of Education*, 29(3), 379-395.
- Rickinson, M. (2001). Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research*, 7(3), 207-320.
- Tanner, C.K. (2001). Into the woods, wetlands and prairies. *Educational Leadership*, April, 64-66.

Appendix A: Examples of reported Learning Events

Examples of Knowledge-Related Learning Events

(What are some of the things you learned about caring for the environment during your visit?)

If you don't look after the environment, plants and animals will die.

If you kill the birds they won't be there to listen to.

People try to hunt wildlife - and the way to stop them is to convince them that their habitat is very important.

The environment is not always going to be there - we need to care for it.

The air was fresh at the creek.

The trees were old, big and green because people haven't cut them down.

Now I know how much we can affect the environment

We should keep our pets on leashes if in the forest - they can attack birds.

Put rubbish in bins - animals think it's their food.

Feral animals kill birds.

Birds collect hair for nesting.

If we cut down trees there are not enough homes for birds.

Don't bring horses into the forest - manure - chemicals spread - seeds spread of non-native grasses.

Birds are becoming endangered because of people.

I know that if I litter, the environment will change.

I learnt more about birds. I never knew it would be so hard for birds to live with feral animals.

Ponds have good quality water - even though there is a drought – we need to keep those ponds.

Low levels of salt is good for a healthy pond.

Trees are important because they can slow down the flow of water – affect the banks – need to look after trees.

Litter can get washed down into ponds then the ocean - animals think it's food and may die.

Importance of trees to hold the soil and stop it going in waterways.

If you cut down one tree it can destroy a whole ecosystem.

To know that everything is important and connected. Taking one thing out can make a big difference.

I never knew the forest would stay around for hundreds of years.

I used to think the environment was to look at, and now I know it's there for a reason to save us.

If you have evidence of someone hurting the environment you should tell somebody.

How indigenous people cared for the environment like part of the family.

Water sinks straight into sandstone.

How all the species are needed to keep the environment sustained.

There are different zones, and different trees live in earth - can see how the whole ecosystem works.

Litter will destroy the environment - animals get caught in it.

I learnt different names of trees, their sensitivity, if they like water and tree names.

The quality of water is important for animals to survive.

Learnt there's lots of animals in mangroves

You can kill the mangroves by suffocating it.

I used to throw scraps out the window - I've learnt it can kill birds by choking them.

Ways to save water.

Plastic gets stuck in turtles' bodies.

Coal needs to be kept moist so coal dust doesn't blow on residential people.

Water temperature has a negative impact on biodiversity.

Toadfish help clean the sea.

Crabs need us to not pollute the sand because that's where they live.
Septic systems can overflow and get into the water system.
It is possible to build bridges without clearing mangroves.

Examples of Attitude-Related Learning Events

(Have you changed the way you feel about the environment as a result of your visit? If so, how have you changed?)

Probably made me feel more about the environment.
I care about it more than before.
I feel more careful about the environment.
I want to look after the forest more.
I've always felt quite a lot about the environment. Feel more about it now.
I used to think birds were just birds, now I think they're special.
It is worth keeping these forests so serene, nice and peaceful.
Preciousness of trees.
Now I want to help it a lot more or help save it.
I want to follow my sister who got the school award for recycling.
I feel more protective of the environment.
I felt connected to others who protect the environment - a bunch of people to support you - felt you could do something not just sit there.
Important to connect to nature - to preserve the beauty.
The experience of relaxing in the environment - you wouldn't know if you didn't experience it.
I cared for it more and I did a drawing of some rocks and trees.
I felt like I was nowhere - like all my troubles were gone. It felt amazing - can't really describe it.
It motivated me - I've always had the dream of making the world a better place – it inspired me.
You want the whole world to hear that we want the forest to stay there.
You have to experience the forest to get the passion to save the environment.
The way I care for the environment. I've changed – I won't do things I shouldn't do.
A different way of looking at things - not just a tree - more thoughts about a tree when you look at it.
Be mindful of the environment - towards animals.
Feelings about environment are stronger now.
Will do my best to help out.
My whole life has changed because of this trip. I feel different and want to help the environment.
My feeling towards everything, making me treasure every drop of water.
I feel like I can and should do more.

Examples of Behaviour-Related Learning Events

(Do you think what you learned from your visit will change what you do for the environment? If yes, what do you think you will do?)

Don't cut down trees.
I won't throw things at birds.
Pick up garbage at school.
Now I'll recycle more .
Use less water.
Use less electricity.
Organise a bush walk so people understand.
Planting more trees.
Composting.

Turn off lights when not using them.
I've stopped eating outside because a lot of the things I've eaten are packaged.
I can tell others about the environment - so they know what's right.
Being legal with crabs and fish.
Keep sticks in my yard for birds.
Plant food for birds.
When I'm playing I make sure I don't stand on living things (plants and animals).
I keep my cats in at night.
Don't bring horses into the forest.
Try to get my parents to plant less water-using trees in the front garden.
Volunteer to help pick up stuff/rubbish on beach - picking up litter everywhere.
Help out environment groups.
I convinced Mum to buy green bags.
I convinced Dad to wash the car on grass.
Turn light off.
When I'm older drive a car less, and walk more.
Not chase birds.
Not step on bugs on ground if I see them - leave them alone.
Use more natural energy.
Use both sides of paper to write on.
Nag my mum to buy efficient light bulbs.
I might become a landscaper who looks after environment.
Don't carve in trees or cut them down.
I won't feed the animals - it might be a dangerous food.
Turn my light off when I leave room.
Don't keep undersized fish.
Not kick the creek bank.
It might be something as small as picking up rubbish but it all helps.
Trying to encourage family and friends as well as my own school to help the environment.

Appendix B: Data Collection Instruments

Student Observation Schedule (SOS)

Environmental Learning Outcomes Survey (ELOS) - Student interviews

Teacher interview Schedule

Follow-up Classroom Teacher Interview Schedule

STUDENT OBSERVATION SCHEDULE

Centre/Program: _____ Class: _____ Researcher: _____ Date: _____

Program component	Observed student behaviours (including comments and questions)	Frequency of Engagement code (1-4)
		S : 1 2 3 4 L : 1 2 3 4 I : 1 2 3 4 M : 1 2 3 4 C : 1 2 3 4 A : 1 2 3 4 R : 1 2 3 4 D : 1 2 3 4
		S : 1 2 3 4 L : 1 2 3 4 I : 1 2 3 4 M : 1 2 3 4 C : 1 2 3 4 A : 1 2 3 4 R : 1 2 3 4 D : 1 2 3 4
		S : 1 2 3 4 L : 1 2 3 4 I : 1 2 3 4 M : 1 2 3 4 C : 1 2 3 4 A : 1 2 3 4 R : 1 2 3 4 D : 1 2 3 4

Engagement in Learning Behaviours (adapted from Griffin, 1999)

- S Sharing** learning with peers and experts (talking & pointing; asking each other questions; pulling others to show them something; talking & listening; talking to adults or experts)
- L Making links** and transferring ideas and skills (comparing objects and ideas; comparing/referring to previous experiences)
- I Initiating** and showing responsibility for their own learning (knowing what they want to look for; making choices; deciding where and when to move; initiating engagement in learning)
- M Purposefully manipulating** objects and ideas (handling objects or specimens with care, interest, purpose; using hands-on activities as intended)
- C Showing confidence** in personal learning abilities (seeking out information; explaining to peers; reading to peers)
- A Actively** involved in learning (standing and looking/reading; persevering with a task; exhibiting curiosity & interest; absorbed, close, concentrated examination)
- R Responding** to new information or evidence (evidence of changing views; evidence of discovering new ideas)
- D Disengagement** (off-task behaviour; lack of attention; disinterest)

Frequency codes: 1=rarely; 2=sometimes; 3=most of the time; 4=all of the time

Program Pedagogy Characteristics	Example / comment
Higher-order thinking –uses operations such as synthesising, hypothesising, analysing and evaluating.	
Deep knowledge - covers the content area in great depth or detail.	
Deep understanding - Students’ responses provide evidence of depth of understanding of concepts or ideas.	
Substantive conversation - incorporates sustained dialogue between students, and between teachers and students to create or negotiate understanding.	
Knowledge as problematic - Students critique and question ideas and knowledge.	
Metalanguage - focuses on aspects of language, grammar or technical vocabulary.	
Knowledge integration - integrates a range of subject areas.	
Background knowledge - attempts to connect with students’ background knowledge.	
Connectedness to the world - has a connection to real-life contexts or concerns.	
Problem-based curriculum - focuses on identifying and solving intellectual and/or real-world problems.	
Student direction –allows students to play a part in deciding specific activities or outcomes of the program.	
Social support - activities characterised by atmosphere of mutual respect and support among teachers and students.	
Academic engagement - Students are engaged and on task during the program.	
Explicit quality performance criteria - There are explicit criteria for judging student performance and/or learning.	
Self-regulation –Students are responsible for regulating their own behaviour during the program.	
Cultural knowledges - Non-dominant cultural knowledges are recognised and valued.	
Inclusivity - attempts are made to increase participation of students of different backgrounds and abilities.	
Narrative - style of teaching is principally narrative (using story) rather than expository (giving information).	
Group identity - builds a sense of community and identity.	
Active citizenship - encourages active citizenship.	
Ownership - attempts to demonstrate the personal importance of environmental issues.	
Empowerment –conveys an expectation that students can make a positive difference in relation to the environment.	
Environmental investigation - focuses on identifying and investigating environmental issues.	
Action skills building - builds the skills needed to actively participate in resolving environmental issues.	
Cooperative learning - Students work together to accomplish shared learning goals.	
Creative thinking - Students’ responses indicate they have made new connections or recognized new possibilities.	
Emotional engagement - Students are engaged emotionally during the program.	
Range of learning styles - incorporates a variety of teaching strategies to accommodate students’ individual styles.	
Metacognition - encourages students to think about their own learning processes.	
Reflection - provides students with opportunities to carefully consider lessons learned in terms of their future behaviour.	

Scale: 1=not at all characteristic of the program, 2=very little, 3=to some extent, 4=quite a bit, 5=very characteristic of the program

ENVIRONMENTAL LEARNING OUTCOMES SURVEY

Centre: _____ Focus of program: _____	
Student name: _____	Year level: _____ School: _____ Gender: Male <input type="checkbox"/> Female <input type="checkbox"/>
Teachers/s: _____	Researcher: _____ Date: _____

A. Knowledge

A1. What are some of the things you learned about caring for the environment during your visit?	A2. Where were you when you learned this? (Program components)	A3. What was it that helped you learn? [prompts: something... the teacher said; you did; you saw; a story you heard; talking to friends]	A4. Feelings (1-12)

A2 codes: 1=pond; 2=forest; 3= story; 4: tree

A3 codes: 1=listening to a story; 2= listening to an adult or teacher; 3=talking to a friend; 4=discussing with a small group; 5=seeing something in the environment; 6= doing something in the environment; 7=experiencing the environment

A4 Which one of these words best describes how you were feeling when you learned [heard, saw, did, said] this? [show flashcards to students]

A4 codes: LP 1=happy 2= calm 3=relaxed; HP 4=excited 5=interested 6=surprised; LN 7=nothing 8=bored 9=disinterested; HN 10=afraid; 11=angry; 12=sad

LP = Low intensity/Positive; HP = High intensity/Positive; LN = Low intensity/Negative; HN = High intensity/Negative

B. Attitudes

B1 Have you changed the way you feel about the environment as a result of your visit? If so, how have you changed?	B2. Was there a particular part of the visit that made you change how you feel? Where was it?	B3. What was it that made you change? [something...the teacher said; you saw; you did; a story you heard; talking to friends]	B4. Feelings (1-12)

C. Behavioural intentions

C1. Do you think what you learned from your visit will change what you do for the environment? If yes, what do you think you will do?	C2. Where were you when learned this?	C3. What was it that made you think about doing something about the environment? [something...the teacher said; you saw; you did; a story you heard; talking to friends]	C4. Feelings (1-12)

B & C2 codes: 1=pond; 2=forest; 3= story; 4: tree; 5=the overall program

B & C3 codes: 1=listening to a story; 2= listening to an adult or teacher; 3=talking to a friend; 4=discussing with a small group; 5=seeing something in the environment; 6= doing something in the environment; 7=experiencing the environment; 8=the overall program

B4. Which one of these words best describes how you were feeling when you learned [heard, saw, did, said] this? [show students flashcards]

C4. Which one of these words best describes how you were feeling when you thought about doing something for the environment? [show students flashcards]

C4 codes: LP 1=happy 2= calm 3=relaxed; HP 4=excited 5=interested 6=surprised; LN 7=nothing 8=bored 9=disinterested; HN 10=afraid; 11=angry; 12=sad

LP = Low intensity/Positive; HP = High intensity/Positive; LN = Low intensity/Negative; HN = High intensity/Negative

TEACHER INTERVIEW SCHEDULE

Centre: _____	Focus of program: _____		
Year level: _____	School: _____	Gender: Male <input type="checkbox"/>	Female <input type="checkbox"/>
Teacher: _____	Researcher: _____	Date: _____	

1. From your perspective, what aspects of the program have the most impact on student environmental learning for sustainability? Why?
2. What teaching strategies or pedagogies have the most impact on student environmental learning for sustainability?
3. To what extent is student learning for sustainability influenced by emotional engagement with the topic?
4. To what extent is student learning for sustainability influenced by the degree of information and explanation of the Environmental topic?

5. Are there any aspects you'd change next time to improve student learning?

6. How important is a partnership between the school and the O&EEC in achieving student learning for sustainability?

7. What is your understanding of a good partnership between the school and the O&EEC?

8. What difficulties are there in achieving a good partnership between the school and the centre?

FOLLOW-UP CLASSROOM TEACHER INTERVIEW SCHEDULE

Centre: _____	Focus of program: _____		
Year level: _____	School: _____	Gender: Male <input type="checkbox"/>	Female <input type="checkbox"/>
Teacher: _____	Researcher: _____	Date: _____	

1. How was the O&EEC program connected to work you were doing with students in the classroom?

2. To what extent did the O&EEC program activities connect to classroom activities you planned?

3. Have you built on student learning during their field visit? If so, how?

4. How did you integrate concurrent and subsequent classroom activities with the O&EEC program?

5. How did the O&EEC program contribute to student learning outcomes in the work you were doing in the classroom at the time?

6. Are there longer term learning outcomes you expected the O&EEC program to contribute to? Are they occurring?

7. Have students evidenced any actions for the environment since their field trip visit?

8. Did you plan collaboratively with O&EEC staff for student learning outcomes? If so, what aspects did you plan together? Do you consider that collaborative planning improved student outcomes?

9. Are there any aspects you'd change next time to improve student learning?