Evaluation of a tertiary sustainability experiential learning program

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4 1 **Evaluation of a tertiary sustainability experiential learning program**

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31 27

Abstract

Purpose: This paper describes the development, promotion and evaluation of SLED, the *Sustainability Learning Experience Database*, a university-curated database of sustainability experiences to augment formal student learning. Its purpose was to encourage students to participate in experiential learning, to facilitate students' critical appraisal of programs ostensibly designed to create sustainability, and to thus develop students' sustainability self-efficacy and employability.

Design: Fifty-five sustainability experiences were curated and placed into the SLED database which was promoted to students in nine subjects. Supporting materials designed to assist critical evaluation, reflection on experiences and to build student employability were also developed. A comprehensive mixed-methods evaluation of the program was conducted.

Findings: Quantitative evaluation revealed some change in environmental behaviours, depth of critical sustainability thinking, and graduate attributes. Qualitative evaluation revealed that students see the value of a university-curated database of experiences and provided ideas for improvements to the database. It also revealed examples of higher order learning facilitated by SLED.

Research limitations: Recruitment and attrition of research subjects, common challenges in pedagogical research, were experienced. 'Opt-out' is one response to this but it comes with ethical challenges.

Value: This exploratory study demonstrates the potential of SLED to build students' sustainability efficacy and suggests ways in which it and similar programs can be developed for improved student and sustainability outcomes. Namely, 1) use of an online platform closely associated with existing learning management systems, 2) higher level institutional stewardship, 3) closer curriculum integration and 4) close partnering with credentialing programs.

Key Words:

experiential learning, sustainability, tertiary education, pedagogy, work integrated learning, program evaluation

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4 Introduction

5 The impetus for the research described in this article is the nexus of three complex ecological

6 and pedagogical problems:

7

- the existential threat to civilization due to climate change;
- declining student engagement in tertiary education; and
- the notion that education, in its broadest sense, is not merely instrumental but is critical

10 to an individual's *Bildung*; the journey to enlightenment through education that builds

11 personal efficacy (Fung, 2017).

12 The article assesses the merit of a modest response to these inter-related issues: a program that

13 integrates authentic sustainability-based experiences, located outside of the academy,

14 tangentially to a suite of subjects. The program is the development, implementation, and

15 importantly, an evaluation, of the *Sustainability Learning Experience Database* (SLED), a

16 database of experiences for students. In short, students were encouraged to participate in

17 experiences (described below), and challenged to think critically about possible solutions to

18 contemporary ecological crises, thus simultaneously promoting engagement. The paper begins

19 by addressing the ways the program speaks to both that most wicked problem of all, the

20 Anthropocene, and contemporary pedagogy. It then provides a description of the rationale for

21 the database, an explanation of its delivery, and critically, an evaluation of its success. The paper

22 closes with proposed improvements for increasing engagement with this and similar programs,

23 and thus, with sustainability more broadly.

3

1 Within the multiple crises that characterize the Anthropocene, any solution must help to
2 facilitate sustainability and thus ameliorate the tragedy of the commons (Hardin, 1968) that is
3 unfolding. It is sufficient to state that,

4 ... sustainability concerns cannot be adequately comprehended or tackled without
5 thinking in terms of interrelationships, and the requirement for interdisciplinary
6 approaches and new ways of thinking, working and researching (Sclater, 2018).

7 Environmentally-aware and empowered students are potentially the greatest agents of change
8 for long-term protection of the environment (Erhabor and Don, 2016). Yet students'
9 understanding of sustainability appears to be limited by their past and present disciplinarily-
10 defined studies, resulting in a lack of integrated understanding (Fisher and McAdams, 2015).
11 Barrett et al. (2017) posit that, for transformative learning to occur - that which can be used to
12 move society to a truly sustainable state - students must be sensitized to the rich and complex
13 connections that characterise sustainability (Filho et al., 2018). This would facilitate an
14 epistemological shift from an anthropocentric, dualistic view of 'humans versus nature', towards
15 appreciation of the interdependent relationships essential for survival that are, for example,
16 typically reflected in traditional (Indigenous) knowledge.

17 This project focuses on experiential learning in the tertiary sector to facilitate transformative
18 learning, and acknowledges that here, another crisis exists; the contemporary crisis of learner
19 engagement (Zepke and Leach, 2010). Full engagement in sustainability is a psychological
20 investment in learning. It is not characterised by instrumental success in the form of good
21 grades, but by students taking an intrinsic interest in the content about sustainability and
22 incorporating it into their lives to make change (Sinatra et al., 2015). The Australian 2017 Quality
23 Indicators for Learning and Teaching survey of student experience revealed that learner
24 engagement scored significantly lower than any other measure (QILT, 2017). Unsurprisingly, the
25 quest for meaningful student engagement has become something of a 'holy grail' for
26 pedagogically-minded tertiary educators (Northedge et al., 2017). Numerous solutions have
27 been proposed, with Oliver and Jorre de St Jorre (2018) highlighting experiential learning,
28 broadly defined as *students learning through experience*, as an important pedagogy for

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3 1 increasing engagement (Zepke and Leach, 2010). Kolb and Kolb (2005) state that with increased
4 2 engagement comes a deeper and more critical understanding of academic content; a vital first
5 3 step towards taking effective action. But experiential learning also helps to build self-efficacy -
6 4 that is confidence, capability and agency - a key disposition for successfully striving to achieve
7 5 sustainability-related goals (Bandura, 1997, Podger et al., 2010) as well as broader academic and
8 6 career objectives.

9
10 7 Listing graduate attributes is one thing; achieving them is quite another (Oliver and Jorre de St
11 8 Jorre, 2018). While most universities aim for students to become active learners and global
12 9 citizens, it is often unclear which pedagogies effectively facilitate this. Thus, despite the interest,
13 10 the standard approaches for building graduates' attributes, usually focused on classroom
14 11 teaching, have produced mixed results (Lertpratchya et al., 2017). Here again, experiential
15 12 learning shows promise for its ability to prepare students to respond to Anthropocene
16 13 challenges.

17
18 14 Current literature abounds with theories of how experiential learning works to encourage
19 15 students to become engaged citizens (Heinrich et al., 2015). The most essential component is
20 16 participation in *concrete experiences*, activities or direct interactions with the environment or
21 17 community. Ely (2018) states that rooting ideas in action or 'learning by doing' environmental
22 18 behaviours invests the actor and creates meaning, which helps 'test', critically reflect upon, and
23 19 make sense of abstract concepts (Goralnik et al., 2018). Hence, experiential learning provides
24 20 opportunities to apply academic content to complex or *wicked* 'real-world' problems, providing
25 21 students with the opportunity to work across discipline boundaries, and to gain understanding
26 22 of community contexts and systemic factors (del Baldo and Baldarelli, 2017). In doing so,
27 23 experiential learning may assist in refining career goals and developing graduate employability
28 24 attributes including critical thinking, problem solving skills, communication, teamwork,
29 25 leadership and activating cognitive learning (Thiry et al., 2011), group building and personal
30 26 development (Goralnik and Nelson, 2017), as well as developing practical skills (Parr and Horn,
31 27 2006).

1 Well-designed experiential learning can thus serve a variety of purposes in undergraduate
2 curricula: creating 'cognitive apprenticeship environments' (Brown et al., 1989), a fertile ground
3 for situated cognition. This enables deep learning of knowledge and skills, as well as positive
4 affect and increased efficacy about environmental challenges. Indeed, Morris (2019) has
5 explicitly emphasized that four aspects must be activated to build confidence as a citizen
6 scholar: contextually-rich concrete experience, critical reflective observation, context-specific
7 abstract conceptualization and pragmatic active experimentation.

8 Despite the numerous positives of concrete experiences, they are still just one part of a
9 complete experiential learning process. As described above, activating the remaining
10 components of a reflective cycle Kolb & Kolb (2005) is also highly valuable. Thus, there remains
11 an important role for the teacher/facilitator in the briefing and debriefing processes.

12 The University of Melbourne, like many others, facilitates experiential opportunities in the form
13 of work-integrated learning (WIL); fully-integrated internships for under- and post-graduate
14 students studying professional degrees like law and medicine. These are known to equip
15 students with job-ready skills that bridge the gap between academia and employment.
16 However, there is currently no university-endorsed, co-curricular program that facilitates
17 specifically *sustainability*-based and transformative experiential learning (Filho et al., 2018),
18 even though it is common for students in environmentally-focused subjects to express a desire
19 to 'get involved'.

20 Aims

21 The aim of this paper is to describe an exploratory study which developed, trialed, and evaluated
22 the Sustainability Learning Experience Database (SLED); a pilot, supra-faculty sustainability-
23 based experiential learning program intended to increase students' engagement and to enhance
24 their sustainability behaviours, attitudes, critical thinking and broader graduate attributes. The
25 specific aims of the research were to investigate students' take up of SLED, and the effect of
26 students' participation in SLED activities on their learning, behaviours, critical evaluation skills
27 and employability.

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1 Overview of evaluation program

2 Program evaluation is an important part of sustainability education. It is only through integrated

3 evaluation – i.e., planned at the initiation of, and integrated throughout a project – that

4 knowledge about ‘what works’ can be created. Given the similarities between programs

5 intended to improve health and those intended to increase sustainability (Heimlich and Ardoin,

6 2008), evaluation of SLED was informed by the health promotion and community development

7 literature (c.f. Green and Kreuter (2005), Friedman (2005)). This recognises that: 1) intending to

8 carry out a project does not necessarily mean that it will be implemented successfully and 2)

9 implementation does not equate to benefit. Consistent with these, three key aspects of SLED

10 were evaluated:

11 1. Outputs (reported in Methods): the extent to which implementation was achieved;

12 measured by attainment of setting up the database, curating experiences, establishing the

13 empirical evaluation program and promoting the database.

14 2. Impacts: the extent to which students were aware of and used the SLED database, the

15 ease of database use, and whether there was an increase in time spent doing experiences.

16 3. Outcomes: the extent to which students’ critical skills in evaluating sustainability, their

17 ‘sustainability efficacy’, and their level of participation as active global citizens changed.

18 Outputs were measured against project milestones. Impacts were measured using data from

19 the SLED platform. Both impacts and outcomes were measured quantitatively using baseline

20 (pre) and evaluation (post) participant surveys, and qualitatively in a group interview (University

21 of Melbourne Ethics Application 1851130.1). These are described in detail in ‘Empirical

22 evaluation’. Data from the *Extramural* and *LiCA* systems (explained below), anecdotal evidence

23 from subject coordinators’, and student assessment metadata were also used.

7

Method

Establishment, promotion and integration of SLED

The first task was to identify a platform suitable for hosting the sustainability learning experience database (SLED); one that was: (i) accessible to students in a range of subjects at the university, (ii) inexpensive to acquire and operate, and (iii) user-friendly. After investigating the cost and capabilities of two commercial packages for work-integrated learning (WIL) ([Sonia](#) and [InPlace](#)), it was decided that *Extramural*, an existing system customized for the University's Veterinary School for managing WIL placements, would be used.

Next, the database was populated with a variety of sustainability-based learning experiences suitable for students. Sustainability was broadly defined, consistent with the three pillars paradigm; the economic, social and environmental dimensions (Griggs et al., 2013). Fifty-five local and regional experiences were curated through sustainability networks, suggestions from subject coordinators, and internet searching. Levels of autonomy ranged from site visits in which students could participate during their own time, to self-guided tours, through to supervised volunteer work by an external organisation. Partnering organisations ranged from community-based ecological restoration projects, to health and social equity organisations, to social enterprises with an environmental or social equity focus. Some experiences required only a couple of hours to complete; others, several days' or weeks' commitment. To enable students to find experiences that matched their interests, experiences were categorised by both Lowe et al.'s (2015) Liveability Domains – policy areas which have been shown to have high consistency with the concept 'sustainability' – and the Sustainable Development Goals (UNDP et al., 2016) towards which they were ostensibly working.

Using on-campus networks plus some cold-calling, the project was piloted in nine undergraduate subjects from different faculties that integrated sustainability into their curricula (see Table 1 shows the number of students enrolled in each of the nine partnering subjects and the number and percentage that accessed SLED).

1). Each had a coordinator supportive of SLED who allowed some class time for promotion and
2 evaluation (discussed below). In this exploratory pilot, SLED was provided as an optional, co-
3 curricular add-on rather than integrated into assessment.

4 SLED was promoted in semesters 1 and 2 via launch announcements in lectures and subjects'
5 online learning management system (LMS). A [20-minute 'pre-departure' video](#) was also
6 prepared and published on subjects' LMS. Its purpose was fourfold: to promote SLED, to attune
7 students to the contested nature and definitions of sustainability, to teach skills for critically
8 reflecting on experiences (Eaton et al., 2017), and to help students understand and articulate
9 the career benefits of participation.

10 LiCA is the University's *Leaders in Communities Award*, an optional program which formally
11 recognises co-curricular experiences (such as volunteer work) on a student's transcript
12 (University of Melbourne, 2018a). It provides official university accreditation of volunteer
13 leadership activities, which research suggests can increase students' confidence in their
14 prospects and differentiate prospective graduate employees (Saito and Pham, 2019). LiCA was
15 seen to complement SLED for the additional incentive to engage in sustainability experiences it
16 provided and so was heavily promoted during the pilot.

17 With reference to the method of integrated program evaluation that was used, the project team
18 assessed the delivery of SLED *outputs*, and therefore implementation, as successful.

19 **Empirical evaluation methods**

20 *Survey*

21 A survey to evaluate the impact and outcomes of SLED was conducted using Qualtrics and a
22 simple repeated measures design, whereby students were surveyed prior to launch of the
23 database ('baseline survey') and again at the end of each semester ('evaluation survey'). The
24 survey included six *impact* measures. These measured students',

- 25 • awareness of SLED ('aware' or 'not aware'),
- 26 • hours spent doing experiences,

- 1 • opinion of system usability (/100),
- 2 • opinion of the number and diversity of experiences (/100),
- 3 • opinion of the relevance of experiences to their subjects (/100), and
- 4 • opinion of the relevance of experiences to their interests (/100).

Students are familiar with their work being graded out of 100, where a score greater than 50/100 would be deemed satisfactory. The same assumption was used when analysing the scores that students gave to these aspects of SLED.

The survey also included four *outcome* measures that the literature associates with effective experiential learning:

- environmental behaviours using questions developed by Heeren et al. (2016),
- sustainability attitudes, using a revised version of the New Ecological Paradigm (Anderson, 2012, Zhu and Lu, 2017),
- ability to critically evaluate what 'sustainability' means using Bloom's (1971) taxonomy, and
- attainment of the University of Melbourne's (2018b) graduate attributes.

These measures quantify some of the factors in the knowledge-to-action continuum in which an improvement is associated with greater self-efficacy to act sustainably. An increase in scores from baseline to evaluation was therefore understood to signify some success in achieving the project's aims.

To maximise the response rate, students were given 12 minutes of class time to complete the survey. The university's learning management system (LMS) was also used to remind students to complete the survey. Because of attrition (discussed below), basic analyses were used to compare baseline and evaluation scores, plus the evaluation scores for two groups (described below).

1
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3 1 *Group interview*
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6 2 Students were invited, via a question in the survey (above) and via the LMS, to participate in a
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8 3 group interview to evaluate the impacts and outcomes of SLED. After experiencing challenges
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10 4 recruiting students for the interviews, individual invitations were sent by email. The group
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12 5 interview was conducted during study week of semester 2, after students had a chance to
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14 6 participate in some SLED experiences. Four students attended and were asked about their
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16 7 experiences using *Extramural* (for impact evaluation) and the value of doing sustainability
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18 8 experiences (for outcome evaluation). The interviews were audio recorded with students'
19
20 9 consent. Interviews were transcribed, then analysed using NVivo 12.

21
22 10 The first stage of analysis involved reading the transcript while simultaneously listening to the
23
24 11 recording. NVivo12 was then used to code the data using thematic analysis (Daly et al., 1997) to
25
26 12 understand interviewees' perceptions of the themes of interest. Analysis was performed using
27
28 13 a four-stage, 'collect, qualify, verify and synthesise' process. The first stage identified and
29
30 14 collated data into themes about SLED's impacts and outcomes e.g., its ease and extent of use
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32 15 (impacts), and the effect of participation in experiences on environmental behaviours and
33
34 16 attitudes, higher order learning and the benefit of experiences for developing career goals and
35
36 17 increasing employability (outcomes).

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38 18 The second stage separated positively from negatively framed phrases by coding them into sub-
39
40 19 nodes within the parent node. For example, phrases that described positive critical evaluation
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42 20 of experiences were coded separately from those that described negative evaluation.

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44 21 Thirdly, a second coder verified the coding undertaken. If there were differences of opinion, the
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46 22 data were discussed and a decision to either recode, 'code-on' or keep the coding 'as is' was
47
48 23 made. Consistent with the intentions of qualitative research, this served to verify interpretations
49
50 24 rather than quantify data (Pidgeon and Henwood, 2004). Finally, synthesis and a summary of
51
52 25 key nodes was compiled. However, the low number of participants meant that qualitative data
53
54 26 were most useful for illustrating key issues identified from the quantitative data.

Results

Impact

SLED's impact was assessed using data from the survey, the interview and from *Extramural*. It was assessed as the extent to which students were aware of and used the database, their opinions of database usability, change in time spent doing experiences, and their opinions of the relevance of experiences.

Awareness of and participation in SLED

Table 1 shows the number of students enrolled in each of the nine partnering subjects and the number and percentage that accessed SLED.

Table 1: The nine 2018 subjects involved in the SLED pilot showing the level of study, the number of students enrolled and the percentage that accessed SLED (data from *Extramural*).

* Subject name	Undergraduate level of study	Students enrolled	Percentage of students that accessed SLED
Semester 1, 2018			
<i>Natural Environments</i>	1	317	3
<i>Reshaping Environments</i>	1	71	14
<i>Ecological History of Humanity</i>	1	133	<1
<i>Forest Systems</i>	3	38	5
Semester 2, 2018			
<i>Sustainability in Developing Communities</i>	1	36	39
<i>Contested Resources</i>	2	40	35
<i>Fire in the Australian landscape</i>	2	63	24
<i>Integrated Landscape Analysis</i>	3	36	42
<i>Professional Practice for Agriculture</i>	3	130	13

	864	12
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*Further information on each subject is available via <https://handbook.unimelb.edu.au/search>

Table 1 shows that of the 864 students enrolled in SLED-partnering subjects, 12% accessed SLED. There was marked variability in students' access between subjects; from <1% to 42%. Of the students that accessed SLED, 19% (20 students) also registered with LiCA, suggesting an intention to seek university accreditation for volunteer work undertaken.

Of all students enrolled, 299 (34%) participated in the baseline survey, and 121 (14%) participated in the evaluation survey. The evaluation survey participation rate was lower than hoped due to reduced attendance at the end of semesters when a range of demands compete for students' time, such that likely, only the more-engaged students participated. The baseline survey revealed that prior to SLED, 26% of students were already doing a sustainability learning experience. The evaluation survey, which was implemented eight months after SLED had been running, showed that 69 (57%) of students were aware of SLED and 35 (29%) were not aware (104 respondents), while participation in experiences rose to 37%. In the interview, several stated that finding time in their busy ('hectic' (Interviewee 1)) schedules was a challenge and mentioned the value of being able to search and select SLED entries according to the time commitment required.

Students' perception of SLED's usability

Table 2 shows how students in the baseline and evaluation surveys rated the *Extramural* interface and experiences (out of 100) against four criteria: usability, number and diversity of experiences listed, relevance of experiences to subjects and relevance of experiences to their interests.

Table 2: Students' rating of the SLED database and the experiences therein.

SLED attribute and possible score	Number of respondents	Mean rating (/100)	Standard deviation
Platform (<i>Extramural</i>) usability (/100)	43	63.4	26.5
Number & diversity of experiences (/100)	49	61.8	22.9
Relevance to my subjects (/100)	44	69.6	21.8
Relevance to my interests (/100)	40	70.6	22.7

Only 4.6 - 5.7% of the 864 students who were exposed to SLED answered these questions. Nevertheless, Table 2 shows that for the students that answered, the average scores for SLED fell between 61 and 71 out of 100, suggesting that while the *Extramural* interface and the experiences themselves were satisfactory, further investigation on how they might be improved should be conducted.

In the group interview, several students noted SLED's value as a resource, for example,

It's the idea that us, and others, we want to help out, but we don't feel like we have the ability to. Whereas something like this really helps because it's a connecting tool.

In emphasising the benefits, one interview participant noted that even for subjects that had a field trip, there was value in also doing a SLED experience because they felt they had 'hit a ceiling' and 'written all there was to say' about the field site. This view was supported by survey data which indicated that SLED contained a good amount and variety of experiences, relevant to students' interests. Interview participants also made suggestions for improvements. For example, students were sometimes unclear how SLED worked with subjects and one student stated that more promotion and explanation of how SLED integrates with LiCA was needed. Because of the University's substantial international student population, several suggested including more international experiences.

Time spent and relevance of experiences

An independent-samples t-test was used to compare the impact of SLED, from baseline to evaluation, on the average number of hours students spent doing experiences. It showed an

1 increase of 6.4 hours, which was not significant (baseline; $M = 16.0$, $SD = 27.1$, evaluation; $M =$
2 22.4 , $SD = 24.9$; $t(236) = -1.49$, $p = 0.14$), but may have been caused by the low evaluation
3 response rate for this question (baseline $n=191$, evaluation $n=47$).

4 Students participated in experiences with environmental organisations such as a local
5 indigenous nursery, Climate for Change, The Regent Honeyeater Project, Australian Wildlife
6 Conservancy and EcoKnights, as well as social enterprises including Engineers without Borders,
7 RoboGals and the Cambodian Rural Development Team. Notably, in the survey, very few
8 students provided information on how they found and chose an experience. Of those that did,
9 two cited SLED as the source. Other frequently cited sources were 'word of mouth' and 'because
10 participation was required by a subject', thus indicating some lack of awareness of the
11 distinction between co- and intra-curricular activities.

12 The results showed that intrinsic rather than extrinsic reasons for participating in an experience
13 dominated (Ryan and Deci, 2000), with 'improving skills' ($n=22$) and the desire 'to make a
14 difference' ($n=21$) among the top three reasons. In comparison, only 3 students selected
15 'because my friend participated' and 11 selected 'because participation was required'. From the
16 nine optional reasons for choosing a particular experience, students selected 'convenience'
17 (e.g., 'at a location close to home or University', 'if the time commitment matched my
18 availability') most frequently. Under 'other reasons', students mentioned 'because the
19 organisation's activities were consistent with Christian ethics', because they 'were a member as
20 a youth and wanted to 'give back' to the organisation' and because 'family members also
21 volunteered with that organisation'. Such data are useful for refining the process by which
22 additional experiences are selected for SLED.

23 Analyses of students' responses to key assessment tasks provided additional evidence of SLED's
24 value. For example, in the subject *Integrated Landscape Analysis*, there was a measurable
25 increase in student interest in experiential learning compared to previous years: In 2016, no
26 student mentioned volunteer experiences in their Goal Setting hurdle task. However, this
27 number increased to 2 in 2017 and to 13 in 2018, and several of these explicitly mentioned doing
28 experiences that they had found through SLED.

1 Outcomes

2 As with impacts, success in achieving the outcomes of SLED was evaluated using both survey
3 and interview data. Survey data scores were normally distributed, so the first four tests were
4 independent samples t-tests to enable simple comparison of mean scores for students' self-
5 reported *environmental behaviours, environmental attitudes, depth of sustainability thinking,*
6 and attainment of *graduate attributes* from baseline to evaluation. The results of these analyses
7 are shown in Table 3.

8 Table 3: Summary of baseline and evaluation survey results for key outcomes.

Measure name and highest possible score	Baseline			Evaluation			t-test
	n	$\bar{x}$	SD	n	$\bar{x}$	SD	
Environmental behaviours (/100)	156	69.2	13.5	73	73.2	13.8	-2.1 *
Environmental attitudes (/5)	220	4.0	0.59	98	4.1	0.61	ns
Sustainability thinking (/5)	220	3.6	0.58	98	3.9	0.59	-3.6 *
Graduate attributes (/5)	220	3.9	0.04	98	4.1	0.06	-2.1 *

9
10 Notes: Levene's test showed equal variances for all tests. 'n' denotes the number of students who
11 contributed data to the question, $\bar{x}$ denotes mean score, SD is the standard deviation, 'ns' denotes not
12 significant, and * is a $p < 0.05$ (two-tailed tests).

13 Table 3 shows a change in the means for all four measures, and a statistically significant
14 improvement in three measures: environmental behaviours, depth of sustainability thinking,
15 and attainment of graduate attributes. These results suggest that SLED was successful in having
16 some impact on students' involvement in both operational and epistemological sustainability,
17 showing promise for achieving the project's intended outcomes.

18 *Pedagogical benefits of participation*

19 A sub-set of the evaluation survey data was also analysed - using independent samples t-tests -
20 to determine if, among only the more engaged students (i.e., those completing the evaluation

survey), participation in an experience was associated with higher outcome scores. These results are shown in Table 4.

Table 4: Comparison of mean scores between ‘engaged’ students (i.e. evaluation data only), who participated in a sustainability experience and those who did not.

Measure name and highest possible score	Evaluation data						t-test
	No participation			Participation			
	n	$\bar{x}$	SD	n	$\bar{x}$	SD	
Environmental behaviours (/100)	46	71.0	15.1	27	77.0	10.2	-2.1 *
Environmental attitudes (/5)	61	4.1	0.67	37	4.1	0.48	ns
Sustainability thinking (/5)	61	3.8	0.61	37	4.0	0.55	ns
Graduate attributes (/5)	61	4.0	0.63	37	4.1	0.57	ns

Notes: Levene’s test did not show equal variances for all tests. ‘n’ denotes the number of students who contributed data to the question, $\bar{x}$ denotes mean score, SD is the standard deviation, ‘ns’ denotes not significant, and * is a $p < 0.05$ (two tailed).

Table 4 shows only marginal changes between the mean scores for *sustainability thinking* and *graduate attributes* but a statistically significant increase in *environmental behaviours*. Nevertheless, these results lend support to the idea that participation in experiential learning, even among the most engaged students, has some benefits, indicating that SLED shows promise as a means for achieving the project aims.

Exemplifying the benefits, when students were asked, in the group interview, whether they thought that the activities in which they participated could have been done more sustainably, one student stated,

I feel like it was, really at the point where I know enough to identify a few things that might have been sub-standard, but I'm not really sure if I can think of how you would go about improving that.

1 This example exhibits higher order learning consistent with Bloom's (1971) description of
2 'evaluation'. It displays a degree of critical analysis to identify an inadequacy, albeit without the
3 confidence yet to synthesise and propose a solution.

4 Another student, also exhibiting an ability to 'evaluate', described the value they gained from
5 applying academic theory to practical experience with the Australian Wildlife Conservancy.
6 During this experience, they set up and monitored the effects of feral animal exclusion zones on
7 native vegetation using positivist methods as opposed to a 'systems' approach (Capra and Luisi,
8 2014). Afterwards, they exhibited skills in 'evaluation' when reflecting on the suitability of
9 conventional methods for dealing with complexity,

10 *The way that they would talk about it, was that this (trying to control for myriad random variables)*
11 *was a really good thing ... And it probably makes sense to try and make it as repeatable as possible.*
12 *But a different, ['systems'] approach was something I thought about.*

13 Significantly, one student stated that Malaysian NGOs do not have a very strong voice with the
14 government. This student wanted to understand how the NGO he volunteered for worked, and
15 to help it to be more influential,

16 *They've done all the environmental stuff but for me it's not very sustainable, so it can be improved.*

17 This student thus exhibited a desire to move to the highest order of learning; 'synthesis' in
18 Bloom's (1971) taxonomy. That is, to first understand, then to critically analyse, and finally to
19 propose a solution to a real-world problem. Specifically, the student went on to state that to
20 them, sustainability was about more than just the environment, and that the organisation also
21 needed to learn how to work with the government for the betterment of society. Furthermore,
22 they stated that their idea to put this into practice came directly from a subject on sustainable
23 development at university. As such, they made a clear link between theory learnt in class, and
24 its application to a real-world problem during experiential learning.

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1 Career benefits of participation in SLED

2 Two interviewees stated that SLED experiences provided them with valuable skills that would
3 be relevant for the workplace,

4 *I also felt like I was not doing enough just by being in Uni and learning about it, [and] a person I*
5 *talked to, she mentioned how it [Climate for Change] helped her speaking skills, so that's*
6 *something I was hoping to develop as well.*

7 *I'm still in second year so I really want to get as much experience as I possibly can. ... and then*
8 *actually trying to apply it in real life ... to try and help make a difference ... but also understand*
9 *that you need skills to make a difference and that's what SLED helps [with].*

10 This sentiment is echoed, albeit in a more relaxed manner, by another student. They stated
11 simply that sustainability experiences provided a meaningful break from study,

12 *The main reason is like halfway through the semester it was nice to put my books away for a bit*
13 *and go out and do something. It's easier to do that when it's career [-related].*

14 Discussion

15 This evaluation of the SLED pilot shows that the program has achieved some important
16 successes, thus contributing to the literature on what works to create a successful experiential
17 learning program. It evaluated student awareness and uptake of SLED by assessing impacts,
18 which showed that the platform and range of experiences in SLED were satisfactory, while also
19 providing useful ideas for improving these. The study also evaluated the effect of participation
20 in SLED experiences through the measurement of outcomes, which showed that SLED could be
21 judged successful at helping students to move along the knowledge-to-action continuum
22 towards self-efficacy in relation to sustainability, perhaps enabling them to actively respond to
23 the climate crisis. This conclusion is evidenced by the self-reported and significant increases in
24 students' environmental behaviours, sustainability thinking and graduate attributes after
25 exposure to SLED; and the significant increase in environmental behaviour scores among the
26 students that participated in an experience compared to those that did not. Importantly, the

1 integrated evaluation method, borrowed from health promotion, provided insights into the way
2 that future iterations of SLED and similar programs might be improved, thus demonstrating the
3 value of such an approach. However, the results must be considered in the context of the
4 project's limitations.

5 Chief among these is that participation in evaluation was voluntary and this affected recruitment
6 (only 34% of all eligible students participated in the baseline survey, and only four students
7 attended the interview) and resulted in some attrition (59% of participants dropped out
8 between baseline and evaluation). These are known challenges in research on tertiary students
9 (Vadeboncoeur et al., 2017), and while they do impact the results, the current study is
10 nevertheless useful for its exploratory value. To create more certainty in results, evaluations of
11 SLED and other, similar programs could employ interviews conducted in class time, research
12 designs that employ incentives, opt-out methods, or even participation for course credit, thus
13 recruiting a larger sample for greater statistical power (Padilla-Walker et al., 2005). The
14 downside is that such methods come with their own, particularly ethical, challenges and can
15 produce unreliable data.

16 An implication of the low response rate is self-selection bias, i.e., that compared to baseline,
17 those who completed the evaluation survey (conducted in the final weeks of semester) or
18 participated in the interview did so because they are already more engaged. This could have
19 created a confounding factor, skewing the results in favour of SLED. This limitation is partly
20 surmounted by using just the evaluation data to compare students who participated in a
21 sustainability experience with those who did not (Table 4). These analyses showed that
22 participation in a SLED experience is associated with a significant increase in the mean score for
23 environmental behaviours, suggesting that even among 'engaged' students, participation in
24 SLED can be beneficial.

25 Astin (1984) suggests that engagement occurs on a continuum with students who are already
26 engaged in sustainability (and therefore seeking out and participating in experiences) at one end
27 of the continuum and students who are far less likely to participate in such experiences at the

1 other end. As stated, it is possible that the SLED pilot and particularly its evaluation,
2 inadvertently targeted students who were already more engaged (A. in Figure 1), and that to
3 target the students that would benefit most (B. in Figure 1), improvements in a future 'SLED
4 version 2.0' will need to be made.

5
6 Figure 1: Promotion of the SLED pilot likely targeted already-engaged students (A) so a future
7 version and delivery of SLED should target students lower on the engagement continuum (B).

8 The results, and the literature, point to several complementary ways in which engagement with
9 SLED might be created and then capitalized on for achieving greater student sustainability
10 efficacy. These are 1) use of a tailor-made online platform that is closely associated with the
11 LMS, 2) high level institutional stewardship and endorsement of the program, 3) closer
12 curriculum integration and 4) a close partnering with credentialing programs. Each would help
13 to make experiential learning and its benefits more legible and is expanded upon below.

14 Tertiary students regularly use and are often considered to be adept at familiarization with web-
15 based tools, platforms and databases (Brown and Czerniewicz, 2010). Awareness of this
16 adeptness contributed to the decision to use the lower-cost, university-designed *Extramural* to
17 host SLED, rather than (for example) Sonia or InPlace. Nevertheless, the evidence also shows

1 that disengagement can occur when students navigate away from familiar platforms
2 (Hollenbeck et al., 2011). As a response to this, rather than being separately hosted, a
3 sustainability experiential learning program should be incorporated into the institution's LMS
4 using the same look and feel, to help maintain engagement when navigating between
5 tools/databases. This becomes more feasible as learning management systems such as
6 BlackBoard and Canvas incorporate increased capability and intuition.

7 In regard to endorsement, research on both safe (Dills et al., 2016) and sustainable (Dyer and
8 Dyer, 2017) campuses shows that the success of institutional cultural change programs depends
9 on centralized endorsement and stewardship which create legitimacy, facilitate integration and
10 ensure program continuity. Offering a curated list of experiences like SLED is a form of
11 endorsement. However, because sustainability is now understood to sit well beyond the
12 environment disciplines, incorporating domains such as economics, justice and public health,
13 programs such as SLED should have supra-faculty, e.g. chancellery-level support. Such a move
14 should be accompanied by sufficient funding and the appointment of a champion, such as a pro-
15 vice chancellor, who can demonstrate commitment to the program, motivate others to 'buy in,'
16 and provide guidance for implementation (Hendy and Barlow, 2012). Such an elevation is
17 appropriate given the pressing nature of climate change and the fact that most universities now
18 have a sustainability charter or similar document which articulates a leadership role in
19 responding to Anthropocene challenges.

20 Regarding curricular integration, experiential learning that is co-curricular is valuable for
21 providing students with authentic opportunities to reflect upon and test their thinking about
22 sustainability, unbound by the pressure of performing for academic success (Jackson, 2011).
23 However, as this research shows, engagement in experiential learning seems more attractive to
24 students who are already engaged, whereas one of the main purposes of SLED is to encourage
25 the less-engaged students to participate. Therefore, curriculum integration, rather than SLED
26 being an optional add-on, is an option for compelling engagement with experimental learning.
27 It would require close cooperation with subject coordinators, and some adjustment to
28 curriculum and assessment. But depending on the subject, integration is certainly feasible and

could be via pre-departure briefings, assessed reflective writing, project or evaluation reports and debriefing exercises. Indeed, there are many cases of successful integration of both sustainability and experiential learning into curricula (c.f. Austin and Rust (2015), Lambrechts et al. (2013)) and so future work should synthesise and apply such lessons to SLED.

The final opportunity for increasing engagement with SLED is to capitalize on ‘meso-credentialing’, a term coined here to describe the credentialing of co-curricular activities that enables students to differentiate themselves in the minds of prospective employers. *Micro-credentialing* is typically used to demonstrate the attainment of core competencies like occupational health and safety, data management, or intellectual property and is often ‘gamified’ via online training and *digital badges* (Coleman, 2018). It works on the principle that credentialing should be granular (or ‘stackable’), because the skills are utilitarian, discrete and interlocking. At the next higher level, *meso-credentialing* of ‘soft’ or experientially-built skills that cannot be taught via online training yet may not be covered in a degree (Busby, 2015) - exactly the types of skills that SLED aims to build - may be a way to induce engagement with SLED and similar programs. Indeed, this was why SLED, principally a curation program, partnered with LiCA, effectively a co-curricular meso-accreditation program. Evaluation of SLED showed that 20 students registered with LiCA, indicating that students see value in using meso-accreditation for differentiation (Hall-Ellis, 2016). SLED, and programs like it, should therefore capitalize on opportunities to engage that meso-credentialing presents, by working with existing campus programs or incorporating new ones.

Conclusions

This pilot implementation and exploratory evaluation of SLED makes important contributions to the literature on experiential learning. It indicates that more engaged students will undertake co-curricular experiences for their pedagogical and employability benefits, while less engaged students are likely to need the benefits more explicitly demonstrated, suggesting a need for better integration, including with curricula. The findings also showed that students value the ‘university curation’ that SLED provided, as it takes some of the guesswork out of identifying a

1 worthwhile experience and acts as a form of endorsement. Thus, the importance of the
2 institution performing this role should not be underestimated. Meso-credentialing is another
3 way universities can strategically value-add to motivate the less-engaged students, i.e. those
4 unaware or unconvinced of the intrinsic benefits of participation. Universities stand to gain
5 much from understanding their influential role in co-curricular experimental learning and from
6 capitalizing on the opportunities it provides, particularly the opportunity to increase student
7 engagement.

8 Despite the methodological limitations, evaluation showed that the implementation of SLED
9 was associated with some significant improvement in environmental behaviours, sustainability
10 thinking, and graduate attributes. These are results which can be built upon to increase both
11 engagement in university and sustainability-related studies, and to raise graduates' efficacy to
12 act for sustainability. The scale and impact of Anthropocene challenges are not to be
13 underestimated. Co-curricular sustainability experiential learning can play a small but valuable
14 part in building students' confidence to understand and respond to them, to the benefit of global
15 health and wellbeing.

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