

Early Engagement – Tertiary Success: Sustainability Meets Statistics and STEM

9 February 2017 to 31 March 2018

Associate Professor Peter Howley

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Modifications: Changed to meet WCAG 2.0 accessibility requirements.
Alternate text inserted for all images. Minor typographical errors corrected.

Higher Education Participation and Partnerships Programme (HEPPP)

2016 National Priorities Pool FINAL REPORT

Early Engagement – Tertiary Success: Sustainability Meets Statistics and STEM

9 February 2017 to 31 March 2018

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In accordance with the Conditions of Grant, you must submit to the Department a Final Report (Clause 6.1 of Part A) and an Acquittal Report (clause 6.4 of Part A).

To meet this obligation, please submit:

- the completed **Final Report** template, in Word and PDF
- the completed and signed **Declaration** form, in PDF
- the completed **Acquittal Report** template, in Excel and PDF.

All documents must be submitted to equity@education.gov.au by **31 December 2017**.

If you require additional guidance or clarification, please contact us at equity@education.gov.au.

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1. PROJECT SUMMARY (Conditions of Grant, clause 2.2 of Part A)

As per clause 2,2, of Part A, the project required the team to:

Develop and implement project-based learning activities to engage students and teachers from low socio-economic status (SES), regional and remote schools in Dubbo, Griffith and Broken Hill. These project-based learning activities will focus on environmental sustainability and understanding and applying statistics and the sciences. The project will support students to work collaboratively and to develop analytical and data-based decision-making skills.

The project included the combined services and involvement of:

- academics across three principal fields of focus (statistics, environmental sustainability, indigenous peoples);
- project officer and assistants;
- 85 teachers and principals from 26 schools across four remote NSW locations (Broken Hill, Dubbo, Griffith, Orange) and surrounding areas, having a combined total of 10,702 students (423 indigenous), of which 435 interacted directly with the project team members during school visits;
- team of external digital media consultants.

Objectives

Indicate the extent to which the Project Objectives specified in clause 3 of Part A of the Conditions of Grant were met. Where obligations established in the Conditions of Grant were not met, please identify these and provide an explanation of circumstances and consequences.

Table 1: Project objectives

IDENTIFIED OBJECTIVE	EXTENT TO WHICH THE OBJECTIVE WAS MET
Deliver project-based learning activities, and supporting resources, for low SES, rural and remote school students which develop scientific and statistical understanding of sustainable energies, enabling them to pursue and succeed in higher education	Completed The research team visited low SES, rural and remote schools in Dubbo, Broken Hill, Griffith and Orange, and presented hands-on workshops for teachers (off-site) and students (on-site (in schools)). Workshops described and promoted project-based learning activities and supporting resources including the National Schools Poster Competition www.ssaipostercomp.info , Electric Vehicles www.hunterevfestival.net/mini-ev-prize-team-entry-2017.html and other aspects of sustainability as examples of potential investigations for student projects, along with the importance of coding, engineering and technology, the Science and Engineering Challenge and scholarships supporting Indigenous and those with educational disadvantage

IDENTIFIED OBJECTIVE	EXTENT TO WHICH THE OBJECTIVE WAS MET
	<p>(UoN's Ma-Morley scholarships) www.newcastle.edu.au/scholarships/ma-and-morley-scholarship-program/about. The team was able to share pathways to University and inspire teachers and students towards Statistics, Sustainability, STEM and University aspirations through the activities. Participants developed their own investigations, engaging with and even building their own electric vehicles from kits.</p>
<p>Increase student interest, attitudes and aspirations, as well as those of their families and teachers, towards their ability to achieve and succeed in higher education and science</p>	<p>Completed and ongoing.</p> <p>Teachers and students welcomed our attendance and significantly have participated in the National Schools Poster Competition – contributing to a record number of entries from 356 teams, and 955 students nationally.</p> <p>Results of project evaluation identify positive improvements in teacher and student interest, attitudes and aspirations. Additionally the ATSI group showed even greater increases. Results are summarised in later sections of the report below.</p> <p>Families of students have since applied for University of Newcastle Ma-Morley scholarships we promoted during our visits.</p>

Project Activities, Milestones and Key Performance Indicators

Below, please specify whether:

- all project Activities specified in Schedule 1 of the Conditions of Grant were completed
- all Project Milestones specified in Schedule 1 of the Conditions of Grant were completed
- all Key Performance Indicators specified in Schedule 1 of the Conditions of Grant were met.

Where obligations established in the Conditions of Grant were not met, identify these and provide an explanation of circumstances and consequences.

Table 2: Project activities, milestones and KPIs

TIME FRAME	MILESTONES AND ACTIVITIES	KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Nov 2016 – Dec 2016	1.1 Establishment of groundwork for Sustainability, Statistics & STEM (SSS) program.	1.1.1 Appointment of a Project Officer with the knowledge, skills and experience to successfully deliver the Project.	Completed
		1.1.2 Application for ethics approval is submitted to the University of	Completed – delayed timing.

TIME FRAME	MILESTONES AND ACTIVITIES	KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
		Newcastle in sufficient time for approval to be granted by 31 December 2016.	Additional levels of ethics approvals were required (SERAP, NEAF). This had a snowball effect, delaying ensuing timing of milestone completions, but they were still met.
		1.1.3 Drafting of: <ul style="list-style-type: none"> • video concepts and storyboards; • concepts for supporting documentation (including instructions and web content); and • project website concept. 	Completed
		1.1.4 Solar electric vehicle kits purchased.	Completed
		1.1.5 Agreement to participate in the SSS project from primary and secondary schools in the following regions: <ul style="list-style-type: none"> • Broken Hill (target - min.8; >1200 students); • Dubbo (target - min.10; >1600 students); and • Griffith (target - min.8; >1200 students). 	Completed An additional location (Orange) included to compensate for school issues regarding scheduling the event such that all could attend. Contacted 916 schools. Participation from 85 teachers and principals from 26 schools across four remote NSW locations (Broken Hill, Dubbo, Griffith, Orange) and surrounding areas, having a combined total of 10,702 students (423 indigenous), of which 435 interacted directly with the project team members (visited and ran workshops at 8 schools), the remainder via their teachers who attended project team workshops.
		1.1.6 Secure and confidential student participation identifying system developed.	Completed
		1.1.7 Evaluation strategy developed, with an emphasis on measuring changes in the aspiration of participating students to pursue careers in SSS.	Completed
		1.1.8 Survey instrument selected, refined and tested in-house.	Completed
		1.1.9 Project website for wider dissemination of videos and associated resources established.	Completed Project website at http://www.tomfarrellinstitute.org/sustainability-meets-statistics-and-stem.html
		1.1.10 Mechanics of incorporating the poster competition into the SSS project- based activities established.	Completed
Feb 2017 –	2.1 Project Team delivery of the	2.1.1 Delivery of the SSS project-based activity (solar electric vehicles) to	26 schools representing over 10,000 students participated, via 8 individual

TIME FRAME	MILESTONES AND ACTIVITIES	KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Apr 2017	SSS project-based activity.	students at the Broken Hill, Dubbo and Griffith sites. Expected delivery to over 3000 students in total.	school visits and teacher attendance at workshops.
		2.1.2 All participating students and teachers surveyed for attitudes to SSS and for career aspirations prior to the commencement of the SSS project-based activity.	Completed
		2.1.3 All participating students and teachers surveyed for attitudes to SSS and for career aspirations after the SSS project-based activity. <ul style="list-style-type: none"> Expected over 800 responses based on 25 per cent response rate, with 30 per cent improvement in attitudes. 	Completed – lower response than desired, however, the mean improvements in interest/attitudes towards SSS were as high as a 99% (reflecting a doubling of interest/attitude towards SSS) for students, and 70% for teachers (particularly with respect to their feeling of connection with, and support by, Universities and the development of valuable activities for students).
Apr 2017 – Jul 2017	3.1 Video production and distribution.	3.1.1 Four videos of the SSS project-based activity are created, providing information to students and teachers on: <ul style="list-style-type: none"> how to make a solar electric vehicle; how to incorporate the use of statistics into the posters they design for the competition; careers in SSS; and the educational power of the SSS activity. 	Completed Videos freely available at http://www.tomfarrellinstitute.org/sustainability-meets-statistics-and-stem.html and https://www.ssaipostercomp.info/resources.html Completing additional videos re careers with expected completion date in June 2018.
		3.1.2 Videos and other teaching materials are distributed to all schools in the SSS program regions.	Completed
		3.1.3 Feedback (surrounding the value of the activity to inspire both the teachers and students) from teachers is collected and analysed.	Completed Results identify mean improvements in attitudes towards SSS were as high as a 99% (reflecting a doubling of interest/attitude towards SSS) for students, and 70% for teachers (particularly with respect to their feeling of connection with, and support by, Universities and the development of valuable activities for students).

TIME FRAME	MILESTONES AND ACTIVITIES	KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Jun 2017 – Jul 2017	4.1 Repeat of the SSS project-based activity.	4.1.1 Schools successfully deliver the SSS project-based activity without the assistance of the Project Team. <ul style="list-style-type: none"> Expect minimum 50 per cent of students to engage in repeated activity. 	Completed
		4.1.2 Individual students prepare posters on their solar electric vehicle builds and modifications for the poster competition under the supervision of their teachers.	Completed
		4.1.3 Student and teacher surveys completed (for the third time) following the second intervention, to assess retention of improved attitudes and career aspirations.	<p>Third survey deliberately not completed.</p> <p>Delay in ethics approvals and consequent availability of schools postponed delivery of the activity and thus prohibited third survey.</p> <p>At time of ethics approvals, decision was made to run pre- and post-intervention surveys and not a third survey. The mean improvements in interest/attitudes towards SSS were as high as a 99% (reflecting a doubling of interest/attitude towards SSS) for students, and 70% for teachers (particularly with respect to their feeling of connection with, and support by, Universities and the development of valuable activities for students).</p>
	4.2 National dissemination of Project methods, resources and outcomes.	4.2 Team member to attend Mathematics Education Research Group of Australia conference to promote the Project outcomes and disseminate information about the resources to the teaching community.	Completed, and additional promotion at Australian Association of Mathematics Teachers conference. More forthcoming in 2018 – including publications of activity and results, and conference attendance.
Jul 2017 – Aug 2017	5.1 Assessment of outcomes from first and second SSS project-based activities.	5.1.1 Surveys are assessed for evidence of aspirational change as a result of the SSS activity.	<p>Completed</p> <p>Mean improvements in interest/attitudes towards SSS were as high as a 99% (reflecting a doubling of interest/attitude towards SSS) for students, and 70% for teachers (particularly with respect to their feeling of connection with, and support by, Universities and the development of valuable activities for students).</p>
Aug 2017 –	6.1 Final evaluation.	6.1.1 Preparation of publications and reports, including: <ul style="list-style-type: none"> draft journal articles and draft 	Completed

TIME FRAME	MILESTONES AND ACTIVITIES	KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Sept 2017		<p>conference papers on the Project and its outcomes, with a view to guiding future outreach activity; and</p> <ul style="list-style-type: none"> reports on the Project, including how to access and utilise the SSS program resources, for distribution to regional schools, including through the NSW Aboriginal Education Consultative Group (AECG). 	Draft journal articles, and accepted conference paper. Dissemination to AECG to occur mid-2018.
	6.2 Plan for continuing self-delivery of the SSS program by regional schools.	6.2.1 Plan for continuing self-delivery of the SSS program by schools in 2018 is generated and disseminated to all schools in the regions visited and beyond through AECG.	<p>Completed.</p> <p>Further dissemination through AECG ongoing – results of analyses to complement dissemination (evidence to support value of the resources), following publication of articles mid-2018.</p>
		6.2.2 Completion of the marketing and advisory strategy for wider dissemination of the SSS program in remote and Aboriginal communities, and the wider education and outreach audience.	Completed, and ongoing. Reports distributed to schools. Presentations at conferences. Promotion via national society newsletters, school networks.
Oct 2017 – Dec 2017	7.1 Poster competition: submissions and evaluations.	<p>7.1.1 Submissions received from schools.</p> <p>7.1.2 Submissions evaluated and prizes awarded.</p> <p>7.1.3 Winning posters promoted online.</p>	<p>Completed.</p> <p>Certificates provided for all participants and winning posters (and Honourable Mentions) from Dubbo South Public School (which we attended) – see https://www.ssaipostercomp.info/winners.html</p>
	7.2 Dissemination of Project outcomes.	<p>7.2.1 A Project Team member attends and applies to present at the Australian Association for Environmental Education conference.</p> <p>7.2.2 Submission of reports and draft publications as specified in 6.1.1.</p>	Completed – although substitute conference (Australian Association of Mathematics Teachers) due to timing. Abstract accepted for International Journal of Innovation in Science and Mathematics Education (IJ-ISME) special issue on supporting Indigenous student engagement with STEM in higher education.
	7.3 Final Report and Acquittal Report.	7.3 Final Report and Acquittal Report are submitted to the Department of Education and Training by 31 December 2017.	Completed, after permitted extension to 31 March 2018

Highlights and Issues

Provide a summary of highlights and achievements arising from your project (maximum half page).

- Exceptional feedback from teachers and students
 - Personally during workshops and school visits
 - Via anonymous surveys, E.g., comparisons revealed mean scores (on 7-point scale) surrounding interest/attitudes to Statistics, Sustainability and STEM, and feelings of connection with and support from Universities improved by as much as 70% for teachers and 99% for students.
- 15 Ma-Morley scholarship applications (supporting University enrolment for those from Indigenous and Educational Disadvantage backgrounds) from the areas we visited. The University didn't otherwise promote the scholarships in these areas.
- Provided a solution (as teachers commented) for teachers who wanted to connect their students with national and inspiring STEM activities without associated exorbitant expenses of having to travel to participate.
 - Teachers commented on the expenses associated with many other activities and the required efforts surrounding travel in order to participate that prevented their wider involvement, having to be selective in what opportunities they could provide students – and how our project solved this; enabling students to participate and deliver their efforts to a real audience.
- Creation of resources and videos to engage students and teachers in project-based learning that addresses key national curriculum outcomes (including all general capabilities, cross curriculum priorities).
- Fostered interdisciplinary and cross-University collaboration – the team won the 2017 University Faculty of Science's Collaboration Excellence Award.

Did the project lead to implementable outcomes? What changes will result at your institution/nationally? How is research being translated into practice? Are there activities resulting from this project that will be continued?

The initiative brought together academics from disparate fields and areas of the University, developing additional synergies from previously individually existing endeavours. The team won the 2017 Faculty of Science's Collaboration Excellence Award.

The national poster competition (one of the key project-based learning activities underpinning and uniting the collaborative project research), which combined specifically with environmental sustainability in this project and focussed on low SES and remote areas, won the 2017 International Statistical Institute's Best Cooperative Project Award. Lead investigator Howley has since been invited to present and publish on this initiative and be guest editor of an international education journal – this project will feature in these avenues of dissemination. The national competition will continue annually, and the environmental sustainability examples (which include electric vehicle and mushroom kits) will continue to provide a source of inspiration for teachers and students via links to the project website and related materials. Schools will be directed to such materials via the National Schools Poster Competition website <https://www.ssaipostercomp.info/>.

In practical terms, this supports teachers' abilities to fulfil national curriculum requirements, including the 7 General Capabilities and Cross-curriculum priorities for students. The resources and initiative will be used to develop key future workforce skills in students (including but not limited to STEM, creativity, investigation, collaboration) by connecting the usually disparately taught aspects within the classroom and engaging students through these activities proven to be of interest to them.

Significantly, the team is developing further conference and journal publications surrounding the initiative. These include one for the International Conference on Teaching Statistics (for which Howley is an invited speaker, with abstract accepted) and the International Journal of Innovation in Science and Mathematics Education (IJ-ISME) special issue on supporting Indigenous student engagement with STEM in higher education (abstract has been accepted).

Did you undertake an evaluation of your project?

Yes No

Please summarise the findings and attach the evaluation report.

Surveys of students and teachers were conducted both prior to our 'intervention' (the project) and after in order to consider the relative changes in interest, attitude and aspiration/connection with Statistics, Sustainability, STEM and tertiary education. The pre and post surveys for each of the students and teachers are attached. They contained a series of statements to which students/teachers would indicate their level of agreement (from 1 very strongly disagree, through to 7 very strongly agree).

Key results:

Students:

Aspects surrounding awareness and interest in:

- Statistics, and involvement in activities relating to the field, increased by 60 – 99%.
- Sustainability and the value of Statistics to Sustainability, increased by 30 – 45%

Feelings of their ability to contribute to Science and Sustainability, interest in solving global problems and of their ideas being heard increased by about 30%.

Increases were realised across all students. Noticeably, the sizes of the increases were greater for ATSI students across most aspects, as the following table exemplifies:

Increase in the mean rating of:	Non ATSI	ATSI
Enjoyment in learning Statistics	85%	176%
Interest in future projects involving Statistics	37%	111%
Ability to give examples of careers in Statistics	64%	110%
Ability to give examples of careers in Environmental Science	36%	64%
Ability to see how Statistics and Environmental Science are valuable to on another	36%	86%

Teachers:

Aspects surrounding feelings of connection with and support from Universities increased by about 40 - 60%.

Involvement, and confidence in connecting students, with valuable practice and aspects surrounding student enthusiasm in projects surrounding statistics and sustainability increased by about 30 - 50%.

Across all aspects tested, both student and teachers responded more positively after our project than before. Some relative (percentage) changes weren't as large as the above since the 'pre-intervention' mean scores were already quite high and thus the relative percentage improvement was smaller in magnitude. However, they all increased post intervention.

Where applicable, indicate number of the following resulting from this project:

Student contacts	>10,000
Journal (or other publication) submissions	1 drafted + 2 being developed for mid-2018
Conference Presentations	3
Websites developed	1 http://www.tomfarrellinstitute.org/sustainability-meets-statistics-and-stem.html
Educational or marketing campaigns	1
Community organisations engaged	4
Schools engaged	26
Teachers engaged	85
Parental/family contacts	Not measured, but we know 15 applied for scholarships, and at least 85 completed the survey consent forms

Optional - If you included transformational/behavioural change KPIs in your EOI, please summarise outcomes here:

30 per cent improvement in attitudes: Achieved and exceeded. Dependent on the measure in focus, improvements ranged from about 30 up to 99 per cent, and by as much as 176% for ATSI students.

Describe any issues that occurred during the year and any mitigation strategies you implemented.

Ethics approvals (including SERAP and NEAF) at multiple levels were required and produced delays in being able to run surveys and thus physically attend schools; we needed to run pre-intervention surveys prior to the 'intervention' (attending schools). Staff commitments, safety of travel times and significantly the increasing unavailability of schools to participate (with no fixed dates possible) resulted, after ethics approvals were received, in our visits to schools (delivery of activity – including workshops for teachers and students presenting activities) in the proposed Feb-April delivery timeframe being delayed to August. Many schools were less able to commit as the year progressed.

We mitigated these issues through the following:

- reducing the number of surveys (originally three) to two (pre- and post-visits)
- including additional assistants to address the increasingly tight timeframe to still complete all aspects of the project
- bringing on board an undergraduate student (Management of Renewable Energy) from Germany who had recently arrived in Australia, as part of his work-integrated learning experience, to assist in lieu of staff member unavailable to travel
- including additional location (Orange) to the original three proposed (Broken Hill, Griffith, Dubbo) and visited them all, to increase reach

2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 (b)-(e) of Part A)

List the titles of any published reports, pamphlets or other documentation produced in the course of the Project and attach them to this Final Report.

Table 3: Additional materials produced over the course of the project

TYPE	AUTHOR	DATE OF PUBLICATION	PUBLICATION DETAILS
E.g. Journal article; conference paper; website; pamphlet, etc.			<p>Conference presentation:</p> <ul style="list-style-type: none"> You gotta teach it, so it may as well be fun, AAMT, 11-13 July, Canberra Resources Promoting Statistical Threshold Concepts, and Addressing Statistical Anxiety and Apathy, MERGA40, 2-6 July 2017, Melbourne <p>Conference paper (part of ongoing dissemination beyond the project): (2018) <i>Uniting Primary, Secondary & Tertiary Education, Industry and Statistics</i>, ICOTS10, 8-13 July 2018, Kyoto, Japan</p>
Website			http://www.tomfarrellinstitute.org/sustainability-meets-statistics-and-stem.html
Report on school visits			http://www.tomfarrellinstitute.org/sustainability-meets-statistics-and-stem.html
Online evaluation forms (surveys)			Attached

3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4 (a)-(d), clause 6.5 (a)-(b) of Part A)

Have you fully expended the Grant Funds provided under the Conditions of Grant?

Yes No

If the answer is No, please specify:

- *the amount of funds remaining: \$2822.94*
- *the reason for this underspend: conference travel was less than anticipated. We would welcome being permitted to retain this amount to support our efforts towards further dissemination of resources during 2018, but also understand if this is not possible (and will still endeavour to continue to disseminate widely).*

Ensure that the completed Acquittal Report template is signed by an appropriate university officer and attached to this Final Report.

**IMPORTANT NOTICE - Unspent 2016 National Priorities Pool Grant Funds*

- *Grant recipients must fully expend these 2016 National Priorities Pool funds in the project period for which the grant is made and report on this expenditure to the Commonwealth, including the amount of any unspent funds.*
- *If a provider fails to spend the full amount granted it in respect of a year, the unspent funds may be recovered by the Commonwealth.*

DECLARATION

I declare that:

- I am authorised by the university to sign this Declaration on its behalf, and
- to the best of my knowledge, the information that I have provided in the **Final Report** and **Acquittal Report** for the HEPPP 2016 National Priorities Pool project: *Early Engagement – Tertiary success: Sustainability meets Statistics and STEM* is true, correct and accurate in all particulars.

I understand that:

- The provision of false or misleading information or the making of false or misleading statements to the Commonwealth is a serious offence under the *Criminal Code Act 1995 (Cth)*.
- If any actual or potential conflict of interest arises, I must notify the Commonwealth immediately in writing of the facts giving rise to the actual or potential conflict of interest and to take such steps as the Commonwealth may require so as to resolve or otherwise deal with any conflict of interest that may arise.

I agree to publication of the Final Report on the Department of Education and Training website, once accepted by the department.

Title

Name

Position Chief Executive Officer (Vice-Chancellor)

Signature