

Attracting and retaining young professionals in horticulture

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Almond
Banana

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Summary

Attracting and Retaining Young Professionals in Horticulture

The Project Objectives:

1. Expand the learnings from the Riverland to Southern Queensland
2. Focus the program on meeting specific needs of the almond and banana industries
3. Support young people during university to increase engagement with horticulture industries.

The project will focus on innovation in Southern Australia by developing and strengthening the current Almond industry focused work program (other horticultural industries are stakeholders). The Southern Queensland work will mirror the strategy used successfully in Southern Australia by commencing work with the banana industry.

The project activities:

The Primary Industry Centre for Science Education (PICSE) is a proven national collaboration between universities, regional primary industries, national R&D Corporations, national agribusiness, regional research institutes, local community organisations, schools and State Government Departments. PICSE is designed to attract an increased supply of high-quality, young people into science-based primary industries and their supporting businesses through engagement with students during school years and early university. Through its program, PICSE attracts students into tertiary science and increases the number of skilled professionals in science-based primary industries.

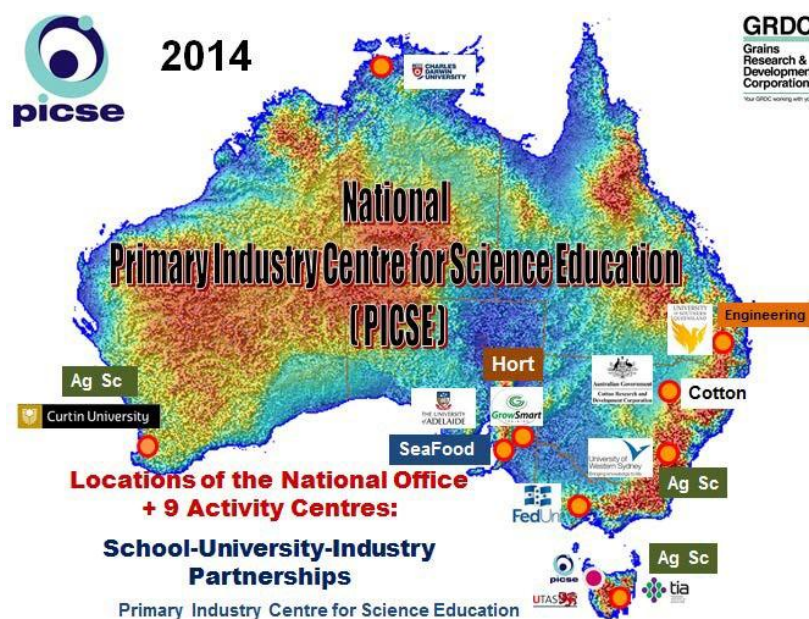


Figure 1: 2014 PICSE Activity Centre locations

The Core Activities of the PICSE program are: Science Class Engagement including the Science Engineering Investigation Awards (SEIAs); Industry Placement Scholarships (Camps, Industry Placement (IPS) and Reporting Back Sessions (RBS)); Science for Growth Awards (SGAs); Teacher Professional Development (PD); creating teacher resources; communications; and Industry Internships (IIs).

Across this project implementation, a number of changes to the PICSE program impacted on the Activity centers location and national engagement data. The two largest impacts being the lack of federal funding and significant personnel changes, including the retirement of the National Director and significant alterations to the senior management team. The funding issue led to the rapid closure of four Activity Centres early 2013 (Sunshine Coast University, Charles Sturt University, University of Western Australia and University of New England). However in 2014, eight Activity Centres currently operate: Curtin University, University of Adelaide, GrowSmart (Riverlands), Federation University, University of Western Sydney, Cotton Activity Centre, University of Southern Queensland and Charles Darwin University (refer to Figure 1).

The project shared a breadth of 'horticultural stories to tell' across the nation by the PICSE Science Education Officers (SEOs), with secondary science students and teacher and undergraduate students. It also produced and distributed teaching resources (online and hardcopy) made available for use by teachers nationally, with a strong horticultural focus. Through the enhanced links with a wide variety of horticulture industry partners, it ensured students and teachers are exposed to a variety of R&D technologies that are cutting edge. This reinforced the concept of how new technologies can be linked to profitable production and demonstrated the value chain from food production into a food product, that is healthy and nutritious. The enhanced PICSE integrated activity model represents good value for investors and partners as participants continue to provide solid evidence of its impact on their perception of the breadth and depth of career pathways available within agriculture and science.

Keywords

PICSE; Primary Industry Centre for Science Education; Riverland; students; workforce capacity; professional development; science education officer; university; teacher resource; industry placement

Introduction

Horticultural industries have flagged the need to attract bright young professional personnel into their industries, both today and more so into the future. This need was noted in industry strategic plans i.e. the Almond Industry (Objective 4 and Skills Strategy), the Banana Industry (Objective 3 and Strategy 3.1) and the Citrus Industry (declining research capacity). It was also reported in a 'Strategy to attract young people into horticulture', Coutts, Casey and Stone, March 2004 for the National Horticultural Research Network through HAL. This report was the catalyst for the establishment of the HAL/PICSE GrowSmart human capacity project established in the Riverland (SA) in 2006. It was reinforced during a PICSE briefing requested by the National Horticultural Research Network in May 2011.

The program in the Riverland (SA) has been part of the PICSE national program that occurs in all states that focuses on the wider agri-foods and fibre industry. The concept was to expand and focus the program on key horticultural industries in the Riverland region, then into specified sub-tropical banana industry regions in southern Queensland. This expansion built on the evaluated HG08018 project to continue to deliver the current program to attract bright young people. PICSE does this by engaging direct with students in the classroom using case studies of real careers in the agri-foods industries that are linked to the school science curriculum. Science teachers participate in accredited teacher professional development programs to see for themselves horticultural professional careers in action (so they can use these exemplars in their daily teaching of science courses). It uses industry placements where handpicked bright students are placed with trained and committed employers to 'tell the story'. Additional exemplar based teaching resources are created for wider distribution to additional teachers. The Science Education Officer (SEO) also links with other PICSE partner universities, who provide a mentoring role, as well as tracking students through their studies. The current PICSE GrowSmart (SA) program engaged with a range of horticultural industries in SA and collaborated with University of Adelaide Science Education Officer (SEO), part funded by this project, which consolidated the activities undertaken and supported the geographic expansion in South Australia.

A second Science Education Officer based in Southern Queensland was partly funded by this project, and collaborated with the South Australian SEO's to extend the systems successfully used in the horticultural industries in SA to support expansion of this work into the banana industry. This was managed and supported by the PICSE National Office. An additional element of the process has been to 'support and mentor students through their university studies', to assist their engagement with horticultural industries and maintain strong continued engagement with the primary industry sector. This ensured that the students had the capacity to work in a horticultural industry in areas of interest, for example, in pest and disease control.

Through the activity participation between Science Education Officers at these and other Activity centres located in each state, a national exposure was provided to schools and students. In each of the Activity Centres, the SEOs developed industry liaison group with the relevant, local horticulture industries, with focus on the almonds industry in South Australia and with Bananas Industry in Queensland. However, during this project, operating Activity Centres changed and consequentially the partnerships with industry partners also changed. 2013 saw

the closure of the University of Tasmania and Sunshine Coast University Activity Centres. However in 2014, new Activity Centres commenced at Charles Darwin University, in the Northern Territory, as well as Federation University (three campuses state-wide) Victoria, with funding gained from the Australian Mathematics and Science Partnership Program (AMSPP). Despite these changes, teachers' and students programs undertaken within the 2014 calendar year have seen increased national student engagement with the horticultural area.

Methodology

The PICSE Activity Centres has promoted the career opportunities for those partner horticultural industries with teachers, students and first year university students. The Science Education Officers (SEOs) have partnered with various industries, schools and students to develop appropriate industry placements for PICSE students.

The annual program has involved the integrated engagement activities of:

- a) Science-based class presentations by the Science Education Officer (SEO) where students are exposed to cutting-edge scientific research and the exciting opportunities for horticultural graduates in their region, with examples of the application of science in local horticultural industries.
- b) A two-day program of teacher professional development for teachers in each Activity Centre, to illustrate the connection between the science taught in class and the science used locally in horticultural industries and Research and Development organisations.
- c) Student scholarships to five-day industry science induction camps for selected Year 11-12 students in December, involving in-depth consideration of career and research opportunities for horticultural graduates. Postgraduate students from local research institutions and scientists working in local primary industries provide assistance and input at these camps.
- d) A five-day student industry placement for scholarship students with scientists/researchers in specific local industries. The placement matches as closely as possible the student's aptitude and inclination. At the end of the placement, students provide a report to other scholarship students, industry mentors, university personnel and to parents.
- e) Production of science teaching resources that integrate into school science curricula and use practical, horticultural industry examples. Each year different themes being chosen, relating to different science subjects and linked to industry applications.
- f) The planning and management of a Science and Engineering Investigation Awards program that targets local horticultural industries.

A summary of the PICSE programs for 2013 and 2014 for individual Activity centres activities are listed below.

Activity Centre Program Calendars for 2013

University of Adelaide program of activities planned for 2013-2014 Date	Adelaide Uni PICSE Activity
May to September	Year 11 and 12 Class presentations
May to August	SEIA class visits
June	Reference Committee Meeting 1
July	Industry Placement Scholarship 2012/13 reunion
8 to 15 August	University Open Day
10 to 18 August	National Science Week
13 August	SACE Research Project Expo
24th October	Reference Committee Meeting
9 & 10 December	Teacher Professional Development
2 to 6 December	Industry Placement Scholarship Camp
9 to 20 December	Industry placements
6 to 24 January 2014	Industry placements
10 February 2014	Reporting back session

Cotton RDC program of activities planned for 2013-2014 Date	Cotton PICSE Activity
April to September	Class presentations
4th August	University Southern Queensland Open day
4 June	Farmfest Field Day
5 to 6 June	PIEF Agriculture Teacher conference
7 to 10 July	CONASTA 62 –Canberra
16 to 24 August	National Science Week
14 August	SEIA Awards –Wagga Wagga
29 August	SEIA Awards – Narrabri
30 September to 4 October	International ICASE conference presentation
22 November	Gateway Schools Agribusiness presentation
4 to 5 December	Teacher Professional Development
15 to 19 December	Industry Placement Scholarship Camp
13 to 24 January 2014	Industry Placements
5 February 2014	Industry Placement Reporting Back Session

Curtin University program of activities planned for 2013-2014 Date	Curtin PICSE Activity
14 May to 18 August	Year 11 and 12 Class presentations
6 June	Reference Committee Meeting 1
12 July	Industry Placement Scholarship 2012/13 reunion
4 August	Curtin University Open day
10 to 18 August	National Science Week
30 September to 4 October	Industry Placement Scholarship Camp
24 October	Reference Committee Meeting 2
14 & 15 November	Teacher Professional Development
2to 20 December	Industry placements
12 to 7December	The Science Experience with Engineering
6 to 23 January 2014	Industry placements
30 January 2014	Reporting back session

University of Southern Queensland (USQ) program of activities planned for 2013-2014 Date	USQ PICSE Activity
April to August	Class presentations
15 March	Reference Committee Meeting 1
9 August	Science and Engineering Investigation Awards- USQ
14 November	PICSE USQ Reference Committee Meeting 2
2-6 December	Industry Placement Camp
9-10 December	Teacher Professional Development -USQ
13-18 or 20-25 January 2014	Industry Placements
5 February 2014	Industry Placement Reporting Back Session

University of Tasmania program of activities planned for 2013-2014 Date	UTAS PICSE Activity
7 May 2013	Reference Committee Meeting 1
12 July 2013	IPS Reunion
22 July 2013	Teacher Professional Development
22 August 2013	SEIA Awards- Hobart
25 August 2013	UTAS Open Day
28 August 2013	SEIA Awards- Launceston
5 September 2013	SEIA Awards- Burnie
22 October 2013	Reference Committee Meeting 2

25 October 2013	Teacher Professional Development
2 to 6 December 2013	Industry Placement Camp
16 to 20 December 2013	Industry Placements
6 to 24 January 2014	Industry Placements
29 January 2014	Reporting Back Session

Activity Centre Program Calendars for 2014

University of Adelaide program of activities planned for 2014-2015 Date	Adelaide Uni/GrowSmart PICSE Activity
March 2014	SEO present at the Bachelor of Food Science and Nutrition Camp - promoted on social media
May to September	Year 11 & 12 Class presentations
May to August	SEIA Class visits
17 June	Reference Committee Meeting 1
12th July	Industry Placement Scholarship 2012/13 reunion
6 July to 9 July	CONASTA 63 - Adelaide
14 to 18 July	Teacher Internship
9 to 15 August	University Open day
13 to 14 August	SACE Research Project Expo
16 to 24 August	National Science Week
20 August	SEIA Loxton
21 August	SEIA Tanunda
22 August	SEIA Golden Grove
8 September	Grand Final SEIA Royal Adelaide Show
21 October	Reference Committee Meeting 2
24 to 28 November	5 day Industry Placement Scholarship Camp
8 to 9 December	Teacher Professional Development
8 to 19 December	10 Day Junior Science Camp
15 to 19 December	Industry placements
12 to 23 January 2015	Industry Placements
16 February 2015	Reporting Back Session
16 to 20 February 2015	Undergraduate Internships

Charles Darwin University program of activities planned for 2014-2015 Date	CDU PICSE Activity
1 February to 31 March	Meetings with organisations and schools
15 March to 31 June	Class presentations
7 April	Reference Committee Meeting 1
18 June	SEIA Teacher Professional Development
6 to 9 July	CONASTA 63
15 to 18 July	Industry Placement Scholarship Camp
15 August	Science and Engineering Investigation Awards
16 to 24 August	National Science Week
11 to 12 September	Teacher Professional Development
29 September to 3 October	5-day Industry Placements
18 November	Reference Committee Meeting 2
26 November	Reporting Back Session
1 December	Teacher Professional Development
24 January 2015	Teacher Professional Development

Cotton RDC program of activities planned for 2014-2015 Date	Cotton PICSE Activity
20 to 24 January	Teacher Internship

10 to 14 February	Undergraduate Internship
10 March to September	Class presentations
13 March	Gateway Schools Agribusiness presentation
5 to 9 May	Undergraduate Internship
26 to 28 June	PICSE/ RUN Ag & Enviro. Teacher Professional Development at UNE
4 to 6 June	Tamworth Careers Expo
6 to 9 July	CONASTA 63
24 July	Workforce Committee meeting
1 August	Farming Futures Fair
5 to 7 August	Australian Cotton Conference
17 August	University Southern Queensland Open day
16 to 24 August	National Science Week
19 August	SEIA Awards – Wagga Wagga
28 August	SEIA Awards – Narrabri
17 September	Cotton Workforce Committee meeting
10 November to 12 December	Undergraduate Internships
1 to 5 December	Industry Placement Scholarship Camp
8 to 9 December	Teacher Professional Development
8 to 12 December	Teacher Internships
5 to 23 January 2015	Industry Placements
11 February 2015	Reporting Back Session

Curtin University program of activities planned for 2014-2015 Date	Curtin Uni PICSE Activity
5 to 25 September	Year 11 and 12 Class presentations
22 May	Reference Committee Meeting 1
3 August	Curtin University Open day
16 to 24 August	National Science Week
5 to 25 September	Year 11 and 12 Class presentations
23 October	Reference Committee Meeting 2
24 October	BEES day Biology, Environment & Earth Science Expo at TAFE
13 November	Science and Engineering Investigation Awards
4 to 5 December	Teacher Professional Development
15 to 19 December	Industry Placement Scholarship Camp
December/January tbc	Teacher & Undergraduate Industry Internship
5 to 23 January 2015	Industry Placements
29 January 2015	Reporting Back Session

Federation University Australia program of activities planned for 2014-2015 Date	Fed Uni PICSE Activity
11 March	Reference Committee Meeting 1
February to October	Year 11 and 12 Class presentations
8 to 9 May	Teacher Professional Development – Mt Helen campus
22 to 23 May	Food Fibre Careers Conference in Dunkeld
30 June to 4 July	Industry Placement Scholarship Camp
7 to 11 July	Industry Placements
6 August	Afghanistan Farmers presentation
16 to 24 August	National Science Week
20 August	SEIA Awards - Ballarat
29 September to 3 October	Teacher Industry Internship
29 September to 3 October	Undergraduate Industry Internship

24 September	Presentation Primary Skills Victoria AGM Melbourne
23 October	Reference Committee Meeting 2
24 October	Reporting Back Session
28 October	SEIA Awards - Horsham
28 November	STAVCON Teacher conference
4 to 5 December	Teacher Professional Development
8 to 12 December	Teacher and Undergraduate Internships
12 to 23 January 2015	Industry Placements

University of Southern Queensland program of activities planned for 2014-2015 Date	USQ PICSE Activity
March to August	Class presentations
10 March	Reference Committee Meeting 1
7 August	Science and Engineering Investigation Awards
2 to 3 September	AgShow Toowoomba
12 November	Reference Committee Meeting 2
1 to 5 December	Industry Placement Scholarship Camp
9 to 10 December	Teacher Professional Development
8 to 12 December	Undergraduate Internships
8 to 12 December	Teacher Internships
8 to 19 December, 12 to 23 January 2015	Industry Placements
11 February 2015	Industry Placement Reporting Back Session

University of Western Sydney program of activities planned for 2014-2015 Date	UWS PICSE Activity
February to October	School visits
6 to 10 January	Teacher Industry Internships (x2)
21 February	UWS Koori school engagement day
20 to 24 January	Undergraduate Industry Internship
Ongoing - Monthly	Agriculture Teachers' network meetings
12 March	Reference Committee Meeting 1
18 March	Crawford Fund Forum
12 to 24 April	Sydney Royal Easter Show: Food Farm; Career zone and Junior Young Farmers Challenge
10 to 12 April	Year 10 Camp - Youth Advocate Forum
2 May	Year 11 & 12 student - iSteer & Unischool steers
3 to 4 May	UWS Open Day
4 to 6 June	Tamworth Careers Expo
30 June to 4 July	Industry Placement Scholarship Camp
14 October	Jamison Agriculture Science Fair
26 October	Western Sydney Parklands- Food security workshops
17 October	Teacher Professional Development in conjunction with RAS & Sydney Olympic Park Authority
October	Youth Eco Summit
1 to 2 November	The Land's Farming Small Areas Expo
26 November	Teacher Professional Development
28 November	Industry Reporting Back Session
August to October	Undergraduate Industry Internship (x10)
16-20 December 2013	Industry Placements
6 to 24 January 2014	Industry Placements

Outputs

Throughout the all aspect of engagement with schools, university and industries, PICSE SEO's are required to develop and thorough understanding of the relevant local requirements and contexts that can be integrated into stimulating school presentations and outreach events.

The initial school enragement aspect of the PICSE program is the delivery of a 20 minute PowerPoint presentation by the Science Education Officer, to university bound science students (Yr 11/12) in their chemistry or biology classes with the teacher present. The focus of this presentation is the career opportunities that primary industry and research organisations can provide young people of today. Examples of slide information discussed with senior classes are shown in **APPENDIX 1**

Engagement with schools in 2012 engagement saw PICSE SEO's speak to around 3200 school students in schools across the nation, however decreased to 1365 in 2013 across the Activity Centres (primarily due to the closure of four centres in early 2013). However, 2014 has seen the University of Western Sydney, Charles Darwin University and Federation University commence as Activity Centres and school presentation numbers are increasing. 2014 school engagement has seen PICSE SEO's speak to over 9100 school students, in 207 classes, in over 125 school schools across the nation. Additional to the in-class engagement has been SEO's presentations and interactions with students and teachers at university open days, student experience days and research expos, as well as industry sponsored careers expos and events.

Program highlights have been:

- Presentation by Jane Wightman to the 2013 Australian Banana Growers Congress of a YouTube clip by PICSE student,
- Article Attracting and retaining young professionals in horticulture, reported in http://www.horticulture.com.au/librarymanager/libs/14/Hortlink_autumn_2013.pdf . **APPENDIX 2**
- Research update presentation by Dr Jay Anderson at the October SEO professional development forum and recorded presentation can be viewed at <https://usqdirect.usq.edu.au/usq/items/a9f9e374-1e92-41b0-9052-9b985cb8d06d/1/index.html>
- Presentation by GrowSmart manager, Mr Trevor Noble at the October SEO Forum in Toowoomba and recorded presentation can be viewed at: <https://usqdirect.usq.edu.au/usq/items/a9f9e374-1e92-41b0-9052-9b985cb8d06d/1/index.html>
- Tour and presentation of the Maroochydore Research Station by Dr Mike Smith, Senior Principal Scientist with Queensland Department of Agriculture, Fisheries and Forestry (DAFF) for the 2012 SEO Forum. Mike elaborated on the new Banana Plant Protection Program & research of 'Panama Disease' one of the biggest problems for lady finger growers. It affects banana bunch weight, size & shape therefore decreasing the percentage of marketable fruit. Mike is part of a team of scientists who are currently conducting banana trials at Duranbah, Queensland, planting 24 different varieties to determine which are most suited to Queensland sub-tropical dimate. **APPENDIX 3**
- Presentation by Dr Michelle Wirthensohn from Almonds Australia and University of Adelaide at the 2014

October SEO forum

- Presentation by Stuart Burgess, HAL Industry Services Manager, at the 2011 SEO Forum in Hobart, provided background information regarding HAL structure, purpose and research as well as detail information on Strawberry research **APPENDIX 4**
- Student reports presented as part of the Industry Placement Scholarships (IPS). Students attend a wide range of horticultural industry placement and a written report was submitted, with student then presenting a 3-5minute presentation at various Reporting Back Sessions. **APPENDIX 5**
- Article in Banana Growers e-Bulletin January 2013 'Industry supports Young Scientists' - **APPENDIX 6**

Outcomes

Despite reduced participation numbers during the 2012/2013 'transition year', PICSE's 2013/2014 feedback has been consistent with previous years - reinforcing the program's positive contribution to raising the profile of science and primary industries within schools as well as forming links between students, teachers, universities and industry partners. School age participants have been enthusiastic about their involvement in activities and motivated to change/pursue their future direction as a result of expanded career and industry horizons. Teachers also continue to express that they have been strongly impacted as a result of PD activities, particularly in their thinking and understanding of primary industries and science career pathways. They also appreciated the networking opportunities with industry. IPS camps and placements facilitate linkages between industry and students. Industry mentors generally felt that their student's attitude had changed positively towards primary industries as a result of their experience. As noted earlier, this personal contact has been given by students as one the most influential and beneficial experiences in terms of impacting on their awareness of and interest in science.

Outcomes related to each aspect of the program are as follows:

Teaching Resources

Each year PICSE adds to its collection of teaching resources. These are produced as a collaborative output from all of the Activity Centres. These teaching resources are selected annually to reflect topical issues in the food and fibre industries and to reflect relevant work being undertaken amongst partner organisations. They form classroom showcases that are made available to teachers both inside and outside the PICSE network. PICSE's teacher resources are distributed nationally during PICSE teacher professional development, CONASTA, and State Science Teachers' conferences, as SEOs visit schools and by mail on request. During 2013, PICSE distributed over 1300 CDs nationally. An extensive website has been established to allow students and teachers access to PICSE resources established across the duration of the project. These can be viewed at: <http://www.picse.net/HUB/resources.htm>

The 2012 resource 'Science Taking You Places 4' was booklet of practical laboratory based activities that aligned with the Australian Curriculum as well as highlighting a variety of primary industry sectors. The Horticulture focussed mare extracted and shown in **APPENDIX 7**. 2013/14 Teaching Resource 'Living Science: Food,

Agricultural Science and Natural Resource Careers' poster and associated case studies. The posters have been distributed nationally through SEO's schools visits, conference presentation, Teacher Professional development forums and request received via website directed traffic. Approximately 2500 have been distributed. **APPENDIX 8** for Poster and Case Study Booklet can be viewed at http://www.picse.net/resources/PICSE_booklet2014.pdf and an online version at: <http://issuu.com/picse/docs/livingscience/1>.

PICSE SEO's also presented workshops at a range of external organisations conference. The most significant of these is the annual Australian Science Teachers Association conference (CONASTA), where an average of two workshops per year has been presented. Example of two of these workshops are shown in **APPENDIX 9** where industry researcher presented a mini research forum and include two researchers discussing their bananas research projects; and **APPENDIX 10** with a hands on practical investigation for sugar and starch content in oranges and apples as well as the analysis of soil pH.

Science and Engineering Investigation Awards (SEIAs)

In 2013, there was a 54% decrease (from 2012) in student participant numbers with 538 projects, primarily due to the closure of Activity Centres. However, students still enjoyed being part of the awards, with most indicating they were keen to join in again the following year. In 2014, over 980 student projects were submitted for face-to-face presentation and judging events held.

Findings have been consistent across the years in confirming the positive impact the awards have on primary and secondary school students' attitudes towards science. This year primary students almost unanimously indicate that they liked science more after their experiment while two thirds of secondary students indicated that their interest in science was positively impacted. In addition, most (81%) secondary students said that as a result of the SEIAs they had improved their understanding of the importance/relevance of science. This suggests that the awards are continuing to influence student career paths and expand the knowledge underpinning study choices.

Teachers and judges are unchanged in their belief that the awards have a fairly high impact on students' interest in science. Observations are that the awards are involving students already with an interest in science. As the awards have now been conducted for a number years, it is possible that the same students from the same schools are being involved year on year. Each year, participants from all grades have indicated that they are keen to be involved in the awards the following year, which means there may be a shrinking pool of students within participating schools who are not already interested in science. Comments are that the awards process is able to extend and engage students improving rigour and inquiry skills and enabling them to see an end goal.

Science for Growth Awards (SGAs)

Initially piloted in 2012, the Science for Growth Awards was held again in semester one 2014 with registrations opening 30 January and closing 30 April. Judging and winner announcements were announced in June. Last year, most entrants enjoyed being involved and picking their own topics. They agreed that their involvement had increased their interest in further science studies and improved their understanding of the relevance of science to society. Teachers were positive and also believed that the SGAs had a positive impact on students'

interest in science as a study area.

The web-based program has the potential to allow students and teachers from all schools (including those geographically remote) the opportunity to participate in the SEIAs. Built into the structure are means of continual support and assistance for teachers to deliver on the Australian Curriculum Science Inquiry strand, either from information on the website or from the SGA coordinator via an EdModo forum, Skype, email or phone. National winner this year was Alana Mastroianni, Alana's investigation poster, Natural vs. Chemical Antiseptics. The best Primary Industry (related) recipient was Rebecca Castor with her scientific investigation, How does the pH of the Nepean River change due to Penrith's pollution?

Industry Placement Scholarship (IPS) - Camp and Industry Placement

The IPS program involves an application and interview process for student to participate in a one week science camp and a follow up one week industry placement, in their vacation time. Students then have to produce a one-page written report and present three minute presentation at the Reporting Back Session (RBS). An example of a 2012 and 2013 Camp Program are shown in [APPENDIX 11 and 12](#) respectively. Data from IPS students' evaluations indicates the whole IPS experience clearly influences the thinking and choices of students who attend. Camp attendees valued the fun experience of hands on learning and the new knowledge gained around agriculture and primary industries. The industry interactions and networking are a vital part of the experience and have been shown to have a big impact not only on student understanding of primary industries associated career paths but also their choices to either continue in a chosen area or move to something new. Industry mentors during placement commented that they saw student enthusiasm increase over the week as they learnt and understood more about the industry. They also generally indicate that their students had either changed their interest in a career in primary industries or were already interested.

As noted above, there is strong ongoing evidence, not only from student feedback, that participation in the PICSE program positively influences students. Guests attending the (RBS's) generally believed that the industry placements had very positive impacts (average rating 9.1 out of 10) and significantly increased student enthusiasm for and commitment towards a career in science and/or primary industries. Additionally, almost all felt that their own understanding of primary industries and the importance of science had been enhanced as a result of attending the RBS presentations. This could have a flow-on effect to students who gain support from their parents in particular as they seek to confirm their career paths for the future.

A strong indication of the influence of the IPS camp on student thinking and potential choices is the change in students' before and after career interests. Most Industry Placement students (average 85%) noted that their placement influenced their study and career pathways. While the table below does not necessarily show definitive career paths it does demonstrate how students have broadened their understanding and knowledge of available careers. It can be extrapolated that this change in thinking would have some impact on their study and career choices moving forward. There is usually a clear swing of interest towards agricultural science or science in general - which is something that should be clearly communicated to industry as a benefit of the PICSE program (2013 IPS data shown below).

Career Area	Expressed interest before camp	Expressed new interest after camp/maintained interest
Agricultural science or science generally/considering different pathways in science/Primary Industries/horticulture/agronomy	7	34
Research, chem. biology, micro-biology etc./biotech and GM food/genetics/biochemist		8
Aquaculture/marine science/marine biology	4	8
Medical Sciences/Psychology/pharmacy	11	6
Veterinary science/animal sciences/zoology/animal behaviour/animal ecology.	3	5
Food science and technology/industrial chemistry	2	4
Engineering/environmental engineering/chemical engineering	3	3
Business/agribusiness	1	3
Environmental science/conservation/sustainability		2
Geology	3	2
Astronomy		2
Unsure/still unsure	2	1
Physics	1	1
Accountancy	1	1
Graphic Design		1
Artistic	2	
Law	2	

Undergraduate Student and Teacher Industry Internships

Systematic feedback is yet to be gained from the Teacher Industry Internship (TII) that have participated to date. These have been a trial implementation in 2014 to allow teachers to experience practical engagement, develop local networks with researchers and scientific industries, enhance their own professional knowledge and enhance their curriculum development with local contexts.

Undergraduate Industry Internships were also introduced in 2013/2014 to provide university students with industry experience relevant to their area of studies, allowing them to make informed decisions on university career paths. All formal written feedback is currently being collated from all participants of the Undergraduate Industry Internship (UII). Initial comments from one participant indicate that the activity has strong potential to progress choices around career progression. The student said that as a result of their internship they were going to "rearrange my enrolment pattern so I can study USQ's Microbiology courses as part of my biology major". While the student is not yet sure that a career in plant pathology is where they will end up, it is definitely now an option for them.

USQ undergraduate, Stephanie Piper, who undertook a placement at Queensland Health, Forensic and Scientific Services reports "During my stay, I was able to assist and observe some of the many projects currently in the pipeline for Queensland's Agriculture. Some of these included banana freezing techniques for unsellable waste utilization." Stephanie continues, "What made the largest impression upon me, however, was the style in which these experiments were conducted. The common sense approach, attention to safety and simplicity of design was great to see. Due to the restructure of the Science courses at USQ it was difficult find courses which had a large practical component. I had a growing fear that I would be out of the loop and struggle with picking up the practical approach within the industry. It was very reassuring to see these key, basic concepts which were reinforced during theory lessons being put into practice in a straightforward manner. I feel as if my skills acquired during the course of my degree have prepared me for work after graduating".

Teacher Professional Development (PD) workshops

The professional development workshops are two day events focused at senior science teachers and laboratory technicians, which incorporate three key activities:

1. Presentation about contemporary science and industry related research
2. Hands on practical activities that can be integrated into their classroom teaching practice, and 3
3. Industry tours/visits, involving local primary industry related operations/businesses or government research facilities

Teacher PD programs highlighting the program format and the variety of industry participants involved is provided in [APPENDIX 13](#). Teachers' feedback across the years is predominately positive and that the practical experiences improves their thinking and motivation while being very useful in helping teach science (average rating 8.7). Tellingly, participants continue to comment that they would recommend the program to other science teachers and would continue to attend similar programs in the future. PICSE is continuing to provide resources that are viewed as relevant in the classroom/laboratory/field as well as helping to foster beneficial relationships between teachers and industry.

A key message is that over the last three years, the PD been proved to impact strongly on teachers' understanding of primary industries and career pathways and their ability to advise students about career opportunities in science based industries. Increasing the capacity of teachers to interact with students about science in primary industries can logically be assumed to increase their level of influence in this area. It provides students with another well-informed resource to consult when deciding future careers and study options. In addition, helping teachers with useful and relevant resources (including industry contacts) to help make science more exciting in class – particularly in primary industries - would also help foster student interest in the area.

Evaluation and Discussion

Each year we produce an evaluation report to capture and analyse the impact on students and teachers from their participation in PICSE activities and make judgements about how well the program has met its Mission, ie to "Increase participation in science professions that support primary industries". An example of the evaluation summary for an individual Activity Centre is provided in [APPENDIX 14](#). The evaluation is collected after each activity from the participants, and in the case of IPS preliminary surveys are also conducted. Each Activity Centre is also required to produce middle year and end of year project reports, which are presented to their local Steering Committees for discussion and forward planning, as well as to PICSE National Office. Detailed reports are provided in [APPENDIX 15](#) from University of Sunshine Coast Activity Centre and [APPENDIX 16](#) from University of Adelaide and GrowSmart.

Impact on increased understanding of workforce needs and student career pathway opportunities by teachers

There is strong ongoing evidence that as a result of being involved with PICSE, particularly the PD activity, teachers increase their understanding of primary industries and potential student career pathways. Year on year, teachers have said that their thinking and motivation in teaching science has been impacted and that they are better able to advise students about career opportunities in science based industries. Feedback has been very positive about the PD experience with teachers calling it excellent, well organised, engaging and useful. There is a sustained belief that PICSE resources positively contribute to the science curriculum with activities/resources which could be used in the classroom/laboratory/field.

Impact on the development of a deeper understanding of the value of science courses and their relevance to the contemporary workforce by students

Over the last three years, PICSE has continued to deliver a range of experiences for students that reinforce the relevance of science and make it exciting. These key PICSE goals have been consistently met over the years with students participating in the SEIAs and IPS camps providing the same message, that as a result of being involved their understanding of, and interest in, science has increased - particularly within primary industries. A recurrent theme is that students are now more aware of the broad range of science and its capacity to open doors to diverse careers. There is evidence that primary school student attitudes towards science are being impacted by their involvement in the SEIAs, which can logically be assumed to have a flow on effect to secondary and tertiary study options. Personal contact with industry representatives has been raised by students as one of the most beneficial aspects of the process.

Impact on attracting students into tertiary science and increasing the number of skilled professionals in science-based primary industries

The last three years of collated data shows compelling evidence that the IPS program in particular is delivering innovative and experiential engagement opportunities to make science interesting and allowing students to make informed choices for tertiary education. Unfortunately, tracking data is yet to be collated this year from Activity Centres which means no hard conclusions can be made in this report about student follow through of

intended study and career choices. There is clear ongoing evidence however that student attitudes towards science are changed as a result of the IPS camp. While there was a drop in the number of students indicating they had changed their interest in studying/seeking a career in science that supports primary industry there was an increase in the number of students who indicated that there was no change as they were already committed. This potentially indicates an increasing involvement of students involved in IPS who are already 'sold' on science.

Extent to which the outcomes have helped to address the needs that lead to the project

While 2013 was a transitional year moving to an enhanced model (PICSE MKII), all ongoing evidence points to the PICSE program being an approach that successfully increases school students' interest and motivation in the area of bioscience. It is now well documented that its activities increases awareness and knowledge of a diverse range of career paths not only for students but teachers as well. Year on year students have indicated that as a result of PICSE activities they intend to either change direction or become determined to continue exploring science career and study options. Supporting teachers with PD opportunities, resources and SEO visits is highly valued and an important link in the chain. Undergraduate Industry Internships are looking promising as an avenue for students to gain practical engagement and networking opportunities to help with informed career progression. One of the first participants said that they were going to rearrange their enrolment pattern to expand their career options.

The overall identified programs benefits being:

Environmental Benefits

- Intensive food production in a changing climate requires deep understanding of the complex environmental factors that affect crop yields. The outcomes of the PICSE programs are designed to ensure there are sufficient graduates with this understanding and who are able to support food production in an environmentally-friendly and sustainable manner.

Social Benefits

- PICSE programs aim to support young people thinking clearly and logically through problems. These skills will lead to social benefits such as communicating more clearly, as well as making better personal and business decisions. Graduates of PICSE programs are also likely to be future community leaders (resulting from a combination of the broad network connections and respected skills).

Economic Benefits

- University science graduates living in rural and regional areas support both primary industries and their local community by enabling rural businesses to run profitably and in a sustainable way. They will also help communities by directly contributing to local farm businesses, ensuring an easy transition to a carbon based economy and by increasing the socio-economic status of their local region.

The risks that program addresses are:

Environmental Risks

- As the world's population heads towards 10 billion by 2050, farmers will need to double global food production. Without world-class scientists we could suffer environmental damage already being

experienced in many countries. These problems include soil degradation and erosion, increasing salinity, depletion of groundwater, pollution of soil & water, and inability to adapt to climate change.

Social Risks

- The risks of not having the PICSE program include risking Australia's food security through the shortfall of trained agricultural scientists, the continuation of the poor retention rates of high school students (particularly those studying science subjects) and finally by not encouraging our best and brightest we will put at risk our global, social and economic competitiveness.

Economic Risks

- There is a significant shortfall of new agricultural scientists graduating across Australia. A critical shortage of people taking on positions in industry support, and more directly through running farms, could result in business contraction or closure. In turn, this would lead to fewer farms producing less grain which in turn would affect the viability of rural and regional economies.

Recommendations

Despite the changing circumstances impacting on the program leadership, funding arrangements and Activity Centres, the key messages remain the same. Students, teachers and judges enjoy being involved in the program and believe it has positively impacted their broader awareness and understanding of science, primary industries and associated career paths. Students indicate that involvement (particularly the IPS camp) has influenced their future study plans and career choices, teachers said that it has been valuable and helped them teach science better (PD program) and judges (SEIAs) believe that students are more positively engaged with science and inspired to pursue their area of interest.

The enhanced PICSE integrated activity model represents good value for investors and partners as participants continue to provide solid evidence of its impact on their perception of the breadth and depth of career pathways available within agriculture and science.

IP/Commercialisation

The project did not produce commercialised/IP property.

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Appendices

Appendix 1: Examples of Class Presentation PowerPoint Slides

Appendix 2: Young Professionals' Article

Appendix 3 Bananas Presentation 2012

Appendix 4 HAL Presentation PICSE Forum 2011

Appendix 5 Combined Centre Student IPS Reports

Appendix 6 Banana Growers' e-Bulletin

Appendix 7 Science Taking You Places 4 Laboratory Activities

Appendix 8 Living Science Poster

Appendix 9 Research Presentations at Darwin CONASTA

Appendix 10 Teacher Resource Practical Activities

Appendix 11 PICSE USC Student Camp Program

Appendix 12 Camp Program Adelaide-GrowSmart

Appendix 13 Examples of Teacher PD Programs

Appendix 14 Example Centre Evaluation Report

Appendix 15 PICSE USC Annual Reports

Appendix 16 PICSE UoA-GrowSmart Reports

Appendix 17 PICSE Teacher Resources