Evaluation of the “Growing Tall Poppies Program: An authentic science experience for Year 10 students (2015-2017)”

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Summary of Findings and Recommendations

The evaluation of the Growing Tall Poppies (GTP) program involved an online survey and semi-structured interviews of the participants, namely, students, School Mentors, and Science Mentors. Interviews were also conducted with one of the designers of the program in Dr Eroi Barone-Nugent. Data for the evaluation also included PowerPoint slide presentations and posters created by the students in reporting on their GTP experiences, as well as the level of activity on the GTP social media platforms, Facebook and Twitter.

Key Findings

The key findings that emerged from the evaluation study were:

1. In the period 2015 to 2017 the participants in the GTP program included 217 students who came from 38 schools, both rural and metropolitan (Table 2), across three Australian states, Victoria, New South Wales and Queensland (Table 4). The students collaborated with 70 Science Mentors from 5 science organisations (Table 5).

2. Among the participating students 88% were female, most were in Year 10 and 11 (Graph 6), who came from girls only and mixed gendered schools (Graph 3) that were a mix of independent, catholic and government types (Graph 4). The significantly skewed participation of Year 10/11 female students is in line with the intentions of the project to provide student-scientist partnership experiences for female students.

3. Participating schools from both rural and regional locations and metropolitan locations were represented over the duration of the program (Graph 2). Given that the program entails students working with scientists in situ there were issues of travel and/or accommodation for rural/regional students. However, this was lessened through those schools adopting the work experience protocol for participating students.

4. The adoption of the work experience protocol proved beneficial in a number of ways. It allowed schools to participate without incurring the financial costs associated with the need to provide a supervising teacher to attend with the students and added costs of accommodation and travel for both the teacher and students. The fact that students were there without their teacher created a good model for the partnership just between the students and their mentor. The protocol meant that the careers teacher at the school become involved and was thus able to provide advice about career paths associated with undertaking physics and the higher levels of schooling, and beyond.

5. The GTP program entailed groups of students working with Science Mentors in the completion of a project that was designed by the Science Mentor in collaboration with the GTP educator. Since the inception of the GTP program there have been 50 different types of project undertaken. Many of the projects had titles that would create initial interest and appeal for the students. For example, a project on research in the use of graphene was titled, “How flying frogs can lift an elephant: the rise of graphene”.

6. In undertaking the projects the students were often engaging at a level of Physics and science that was beyond that experienced at the school level. Students showed evidence of gaining a good understanding of the, sometimes, complex science underpinning their project. The students found the projects engaging as well as challenging, but nonetheless manageable, in terms of the gaining understanding of the ideas underpinning the contemporary science associated with the project.
7. The students universally had very positive experiences in undertaking the GTP program. The student experiences:
   a. Were motivated by a desire to find out more about the role played by scientists to inform them of their future subject choices in the senior levels of schooling and careers in science beyond schooling.
   b. Added to their school science experiences through a lot more hands-on investigations often using equipment not available at the school. In comparison to school Physics, which was perceived to have a focus on learning established theories, the physics learned through the GTP experience was broader and had a greater focus on knowledge construction through investigation and hypothesising, leading to new discoveries.
   c. Provided them with further insights into the role played by scientists in terms of scientists being of both genders, are everyday people and there are many paths to becoming a scientist. Further to their insights that science is a human endeavour was that progress in science requires patience and persistence and science can be problem-solving and more than just theoretical. It can also be creative.
   d. Gave the students an increased confidence in the ability to do sciences, especially Physics (Graph 15). This increased confidence was based on an insight that pursuing Physics is open to all genders and personality types (i.e. not just ‘nerds’). The students experienced increased identity with Physics through seeing the passion in the professional lives of the scientists and normality in the scientists’ everyday lives.

8. Through participating in the GTP program the students reported a more informed view of the career pathways associated with further study in the physical sciences. This provided students with a greater relevance to Physics and science at school (Graph 12). Contributing factors to this finding might have been the mandatory requirement to research and report on career possibilities in completing the poster (a component of the project brief), advice from the careers teacher who was involved in administrating the work experience protocol, and feedback from the Science Mentors.

9. 74% of the students (Graph 14) felt they were more likely to continue with Physics or recommend Physics to others following participation in the GTP program.

10. The role of the School Mentor is critical to the success of the GTP program. These were teachers who champion the status of science in their schools through looking for opportunities for students to engage in science activities outside of the classroom, such as the GTP program. The School Mentor was the one who sought permission from the school executive for the school to participate and made the necessary arrangements in liaising with the GTP administration. School Mentors also worked with the students on their return in showcasing their experiences with the rest of the school. They also visited the students when undertaking the GTP program.

11. The School Mentors’ experiences in the GTP program included the following insights and personal benefits.
    a. The mentors were motivated by a desire to increase the profile of science at their school through providing experiences to engage with science, and Physics, outside of the classroom.
    b. The mentors realised the significance of engagement with the wider community to then create wider experiences for their students. The GTP program reinforced their view that classroom teaching needs hands-on
activities and authentic tasks and to make specific references to the career opportunities that further study in Physics can create.

c. The participation of the students in the GTP program addressed elements of the science curriculum that deal with the ‘nature of science’ and ‘science as a human endeavour’, as well as satisfying the work experience program as the school.

d. The mentors found that the adoption of the work experience protocol proved beneficial in allowing the students in their school to participate in the GTP program (refer to Finding 4).

e. There was variation in selection processes of students at the school end to participate in the program. From invitations being open to interested students to those who were invited. It was those who were invited that were targeted as the very students with which the GTP program was designed.

12. The School Mentors cited several benefits and impacts for the GTP participating students that included:

   a. Insights into scientist role models dispelling the myth that scientists are middle aged males;
   b. Opportunity to work closely with a scientist on an authentic, real world, physics project using sophisticated and complex equipment; something they could not have experienced as school;
   c. Students see Physics as a possibility to pursue in the senior years; and
   d. Development of collaborative and interpersonal skills in working with other students and the Science Mentor.

13. The participation of students in the GTP program had a positive and ongoing impact:

   a. For the parents of the participating students. This is important as the work experience protocols meant that parents had the responsibility for students’ travel to the science centre and accommodation if necessary. The parents were supportive of taking their child to the GTP workshops and conferences held during school holiday periods.

   b. At the school where the participating students engaged with other students and teachers in showcasing their GTP program experience in multiple ways such as through the school’s online website, school newsletter and presentations to classes and assemblies. This may be seen as a result of requirements of the project brief whereby the students were asked to showcase their GTP experience in various ways at the school.

   c. On the GTP social media platforms where participants could connect with other participants in sharing their experience, and have a continuing relationship with participants following their GTP project.

14. Among the scientists who participated in the program there was a range job positions, from existing university staff, students undertaking postgraduate studies such as PhD, post-graduate fellows, Project research leaders and research teams. The circumstances in which mentors came involved varied from being informed through word of mouth, and advertised and supported by PhD supervisors, research project leaders and research teams.

15. The Science Mentors noted several benefits to the students participating in the GTP program that included:

   a. Experiencing real contemporary research;
   b. Providing career options; and
c. Changing stereotypical views of scientists as aged nerd-like males

16. The Science Mentors saw benefits in participating in the GTP program through:

a. The scientists gained experience in science communication skills to enhance their curriculum vitae to pursue career advancement; and

b. Gaining satisfaction in being able to explain their work to a general audience, and providing mentoring to young aspiring scientists.

17. Apart from the GTP website and You Tube videos there are the social media platforms in Facebook, Twitter and Instagram. The production and facilitation of these platforms has been achieved through the GTP program having a media coordinator.

18. The GTP program has a very active presence in the cloud serving multiple audiences and purposes such as showcasing completed GTP projects to a wider audience, creating ongoing engagement among the participants post project, and advertising the program. Each of the social media platforms have a link to the main GTP website.
Introduction

The Australian Government Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education Australian Maths and Science Partnership Program (AMSPP) supported the funding of a project titled “Growing Tall Poppies Program: An authentic science experience for Year 10 students” for the period 2015 to 2017. This report is an evaluation of this program.

The purpose of the evaluation is to assess the outcomes with respect to the impact of the *GTP Science Partnership Program* on participating school students, teachers and scientists. Table 1 below list the AMSPP outcomes and evaluation questions.

<table>
<thead>
<tr>
<th>AMSPP Outcomes</th>
<th>Evaluation Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve student engagement in Physics and Science to Year 12</td>
<td>Do <em>GTP Science Partnership Program</em> Science Mentors increase student engagement in Physics and science?</td>
</tr>
<tr>
<td></td>
<td>Is <em>GTP Science Partnership Program</em> an effective means of increasing student engagement?</td>
</tr>
<tr>
<td>Increase numbers of Year 10 students identifying Physics as a subject to study to Year 12 level</td>
<td>Does <em>GTP Science Partnership Program</em> increase the likelihood of students studying science at Year 12 and university?</td>
</tr>
<tr>
<td>Encourage more students to study science, technology, engineering and Physics courses at university</td>
<td></td>
</tr>
</tbody>
</table>

Deakin University was sought to undertake an evaluation of the program and provide a report that describes:

- The participants;
- Student, School Mentor and Science Mentor perceptions of their experiences in undertaking the GTP program;
- Benefits to School Mentors, students and Science Mentors from participation in the program – with a particular emphasis on the students’ perceptions of physics and likelihood of undertaking the subject at higher levels of schooling;
- Provide answers to the evaluation questions given in Table 1; and
- Recommendations for future implementation.
Evaluation methodology and evaluation tools

A mixed mode methodology was used to measure the impact of the GTP program on the participants. In evaluating the GTP program (2015-7) the following evaluation instruments were employed:

- Online survey administered to the participating students;
- Focus-group interview with students;
- Individual interview with School Mentors, Science Mentors and designer of the program Dr Eroia Barone-Nugent;
- Student presentations in the form of posters and PowerPoint presentations;
- GTP website information; and
- Activity data from the GTP social media platforms in Facebook, Twitter and Instagram.

A description of each evaluation instrument is given below.

Data codes

Throughout this report reference is made to specific data. **Table 2** below provides the codes given as to the origin of such data in addition to the codes used for the Australian states.

<table>
<thead>
<tr>
<th>Data Code</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGI</td>
<td>Focus Group Interview</td>
</tr>
<tr>
<td>ISM</td>
<td>Interview School Mentor</td>
</tr>
<tr>
<td>ISC</td>
<td>Interview Science Mentor</td>
</tr>
<tr>
<td>OSU</td>
<td>Online Survey</td>
</tr>
<tr>
<td>PPT</td>
<td>PowerPoint Presentation</td>
</tr>
<tr>
<td>POS</td>
<td>Poster</td>
</tr>
<tr>
<td>WEB</td>
<td>GTP website data</td>
</tr>
<tr>
<td>SOM</td>
<td>Social media analytics</td>
</tr>
</tbody>
</table>

An example of a code might be [FGIA] meaning data from a student focus group interview from a school A.

**GTP evaluation tools**

A description of each evaluation instrument is given below.

**GTP program online survey**

The survey was constructed using the *Survey Monkey* platform and participating students were asked to undertake the survey upon completion of their GTP program experience. The questions asked are contained in **Appendix 1: GTP program online survey**.
From the 217 students who participated in the GTP program (2015-17) 207 students completed the survey, which represents a 95% completion rate. It should be noted that Q1-14 were part of all surveys; Q 14-16 were added for student participants in the later part of 2016.

Focus-group interviews (students)

Focus group interviews were conducted at the schools of the participating students after completing their GTP program experience. Interviews lasted around 20 minutes with groups of 4-6 students. 12 focus group interviews were conducted at 12 of the 38 participating schools (32% of schools).

These interviews, each led by an evaluation group member, were audio-taped and provided qualitative data as to the participants’ overall impressions of the program, reflections on completion of their project and perceptions of change. A semi-structured interview format was applied with questions like:

About the project:

1. What reason(s) did you have for participating in the project?
   a. How did you find out about the project?
2. Tell us about the project you did.
   a. What sort of processes did you go through to develop your approach to the project as you were working with your mentors?
   b. Did you get to negotiate the project that was undertaken? Did you get to have input?
   c. What was it like to work with real scientists?
3. How the whole experience compare to what you do at school? (Any experience that were similar/different?)

Views of science and scientists:

4. How does your experience through the project fit with what your views of scientists and science? Can you explain?
   a. In what ways were your expectations different or the same to what it was really like? Any surprises?
5. The whole project has Physics as a significant component, did you see that in your experiences in this project? (Teasing out a modern view of physics and the interconnections/interdisciplinary nature of science).
6. In what ways was this new to the way you see science and especially physics now? Has it been modified a little (or reinforced/confirmed)?
   a. What do modern day scientists do? How does new scientific knowledge get constructed (compare with Kepler/Newton; experiments on their own)?
   b. Were there any surprises about what the scientists were like? What do you see as the main characteristics of a modern scientist?
6. Do you think you can see yourself doing this type of work? Why is that?
7. Are there appealing aspects of this work that you did not realise before? What are they?
   a. Does it make it more appealing to be a scientist? Why is that?

Questions related to aspirations/careers/opportunities:

8. Before the project did you have a particular career in mind?
   a. Have you Year 11/12 subjects in mind?
9. Do you intend to undertake physics at Year 11/12? Why?
   b. Has the experience changed or confirmed your opinion?
10. Did this experience give you greater insights or broader perspective of how studying physics can lead to careers or opportunities in sciences?
c. What skills do you think are needed to be a scientist/physicist? (Is it only physics content knowledge?)

d. Will you consider sticking with or doing science/more science or physics into year 11 or 12? Why is this so?

11. Perceptions of their experience for other students thinking about doing science? Is it of value? Why?

12. Did this experience open up subject choices you might have for Year 11/12? In what way(s)?
   a. Is it timely or too late to have such an experience in terms of thinking about science at Year 11/12?
   b. Do you see your Year 11/12 subject choices are important for your future career?

Connection with school:

13. Have your experiences supported your learning of physics at school? Also in the future, say at Year 11/12?

14. Do you feel more connected to your science studies at school after doing this project? Why is that?

15. Did you get to hear about the career journey of your scientist? (Tell us about it and was it surprising)?

General:

16. Is anything else you would like to say?

17. Are there any ways that you would like to see the program change?

18. Would you recommend it to others?

Personal interview (School Mentors and Science Mentors)

Semi-structured interviews (20-30 minutes) were conducted with the teacher at the school (School Mentor) who supervised the participating students and who were responsible for the school’s engagement with the GTP program. Semi-structured interviews (20-30 minutes) were also conducted with the scientists (Science Mentors).

There were 10 Science Mentors (14% of cohort) and 10 school mentors (26% of cohort) who were interviewed. Typical questions given to the teachers and science mentors were:

School Mentor

1. Why were interested in the school taking part?
   a. How did you find out about the program?

2. What has been your role in enacting this project with your students?
   a. How important is this?
   b. Any hurdles/challenges have you found in making this happen?

3. What does the program provide for your students?
   a. Is it adding to what they currently experience in their science classrooms? Or filling a need (for example, Science as Human Endeavour)?
   b. What do you see as the outcomes for the students? (Were any of them surprising for you?)
   c. Do they see the program as connecting to the current curriculum? If so how? (Or is it outside of the curriculum: extra-curricular).
   d. Any thoughts about benefits or otherwise of the GTP alumni annual conference?

4. What have you learned in terms of your science understanding and teaching of science/physics through participation in the GTP program?
5. What have you seen as the impact of the program on the participating students? Any changes? (Engagement? Participating in the classroom? Transformational: Informing other students of the program? New initiatives – Junior Poppies and/or Teacher Tall Poppies).
   a. Impact on the rest of the school (Celebration – newsletter items/presentations/parent feedback)? Other students/teachers?
   b. Do you intend to participate next year? Expand or integrate the program?
   c. Is this project’s experiences motivated you to look for other ways to connect to the science community?

6. Do you see it as part of your professional practice to engage with outside organisations?
   a. How important do you see this? (It is currently stated in the National Standards for Teaching, AITSL?)
   b. Has there been take up with other teachers? Is this or as this been an issue?

7. Any thought of improving any aspect of the project, from advertising the project to implementation?

Science Mentor

1. How did you find out about the GTP program?
   a. Involvement of supervisors, leadership at you institution?

2. What are the reasons why you got involved in the GTP program?

3. What were your experiences in the program?
   a. What did you do – the various stages you went through from awareness, to preparation and then delivery?
   b. The project has an element whereby there is collaboration of the students and scientist mentor in the construction of the research project? To what extent was it collaborative from your perspective?

4. Did they get a chance to highlight their research? (Unpack this - any challenges?)

5. Did you feel confident in undertaking the program when you first heard of it?
   a. Was it what you imagined? What support PD did you get? How effective was this in supporting your role in the project? Any improvements?

6. The future? Would you think about doing it again? What supports do you think you will require? What else will help in preparing you?

7. What do you think the students gained from participating in the project? What did you gain?

8. Do you see your participation in the project as important to your role as a scientist?

9. If it were run again would you participate?

GTP website information

The GTP website [https://www.growingtallpoppies.com/] provided data that gave insights into a key mechanism to advertise and showcase the GTP program to new participants.

Presentations of students

As part of participating in the program students were required to complete a poster and/or a PowerPoint presentation from a template. Within the template students were required to address the following:

PowerPoint Presentation

The report should include some of the basic science and an outline of your learnings about:

- Why this research is important?
- How it is connected to real world problems and how can it help society, individuals?
Evaluation of Growing Tall Poppies program

- Why high school students should care about the physical sciences/potential career paths?
- How it has or can help you keep engaged with your study of science and especially physics and mathematics?

You will also work together to present a PowerPoint presentation. It only needs to be short, and the template has been provided. You will include:

- How working with the scientists has helped changed the way you learnt the science, and how it felt if it worked or not.
- Scientific questions you had/posed for investigation during the week - even ones that did not get answered.
- How your perception of the physical sciences, scientists and even career pathways may have changed.

*Poster Template*

The poster will need to include:

- Introduction.
- How is this project related to a real world problem?
- Briefly describe what you did and how. How was working with scientists different from the usual investigation and inquiry you do at school? What data did you collect and what did it mean?
- How has being part of GTP changed my appreciation for physics?
- Challenging Stereotypes of what I thought physicists were like.
- Job opportunities that physics can open up for me.
- Conclusions.

*Table 3* indicates the number of PowerPoint Presentations and Posters that were showcased on the GTP website and represent the data used in this report related to the artefacts produced by the students in participating in the GTP program.

<table>
<thead>
<tr>
<th>State</th>
<th>Poster</th>
<th>PowerPoint Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>NSW</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Queensland</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

*Level of activity on the GTP social media platforms*

Data related to the level of activity on the GTP social media platforms, Facebook, Twitter and Instagram gives insights into the nature and level of engagement with the GTP program from participants in the program and the broad community.
The GTP program

The AMSSP Funded project, which forms the basis of this evaluation report, is the widespread implementation of the *Growing Tall Poppies* (GTP) program (Barone-Nugent et al., 2012) where, mostly, Year 10/11 female students attend a science organisation for 3 to 5 days wherein they work with scientists to undertake an authentic research project directly related to a current research area. As part of the GTP program students are expected to present their findings on a poster and give an oral presentation to peers, teachers and scientists. Many of the posters and PowerPoint presentations are uploaded to the GTP website (http://www.growingtallpoppies.com/).

The GTP program began in 2008 as an initiative between a metropolitan girls school and a large research centre of excellence (Coherent X-ray Science [http://www.coecxs.org/]) that was working in the interdisciplinary areas of Physics and Biology. Since GTP’s implementation at the school there was a statistically significant increase in girls enrolling in Physics in Year 11 and completing Year 12 Physics (Barone-Nugent et al., 2012). The aim of implementing the GTP program on a wider scale in Australia is to enhance the status of school Physics by partnering more schools with science organisations and to increase the retention of girls beyond the compulsory years into Year 12 Physics.

The central role of developing partnerships with physics organisations is to provide authentic out of class experiences to address the mindset girls may have about the interdisciplinary nature, the stereotypes and the career opportunities available by studying physics. The key elements for this partnership program are:

1. A facilitator to broker participation of scientists and teachers, such as between a research Centre of Excellence based on crystallography and diffraction imaging and one or more participating secondary schools;

2. A framework to guide the development of authentic student-inquiry programs with scientists, such as ‘Colder than the depths of space’ based on a current research project where students, mentored by the scientist, design and test a diffractometer and apply it to crystallography;

3. A professional development program for the science mentors to prepare them to lead the groups of secondary school aged students to participate creatively in the inquiry project; and

4. Students are supported to take leadership with their project and work alongside scientists to produce, and present, a report to elaborate the authentic experience and publish their project outcomes onto the GTP website.

The GTP program also includes an awards program for teachers and students and alumni, and leadership events. Details of these initiatives are given below.

### Online presence of the GTP program

The GTP program employs multiple ways to advertise the program to prospective participants (Schools, Students, Scientists, Science Organisation), showcase completed projects, raise issues of gender and STEM in science, and provide ongoing social media platforms to engage participants following their GTP experience. These ways include:

- The GTP Program website [http://www.growingtallpoppies.com/]
- The GTP twitter site [https://twitter.com/GTPscience].
- The GTP Instagram site [https://www.instagram.com/gtpscience/].
- The GTP Facebook Page [https://www.facebook.com/GTPscience/]
- The GTP newsletter.
The program website

The GTP website [https://www.growingtallpoppies.com/](https://www.growingtallpoppies.com/) (see Fig. 1 for front page image) contains a wealth of information about the GTP program. The main features include:

- Details of the GTP program;
- Showcase of projects that have been undertaken by previous partnerships in each of the Australian states of Victoria, Queensland and New South Wales.
- Advice for prospective participants (Schools, Students, Science Organisations and Scientists) wishing to participate in the program.
- News items including the GTP newsletter.

![GTP Website](https://www.growingtallpoppies.com/)

Figure 1 Front page of GTP web address

Newsletter

A newsletter that provides updates about the GTP program is published regularly and sent to all participants who are currently and have previously participated. Through the GTP website anyone can request a copy of the newsletter to be sent to them via email.

Facebook page and Twitter space

The GTP program has a Facebook page (see Fig. 2 for front page image) and Twitter space (#growingtallpoppies) (see Fig. 3 for front page image).

![Facebook Page](https://www.facebook.com/GrowingTallPoppies)

Figure 2 Front page of GTP Facebook address
Wider aspects of the GTP program

Apart from the student-scientist partnership program there are associated initiatives such as:

- Awards programs: Junior Tall Poppies Award (open to Year 10 and 11 students) and Teacher Tall Poppies Award (open to Secondary Science Teachers).
- GTP Leadership days.
- Alumni conferences and workshops held during school holidays.

Below is a description of each initiative:

**Awards Program**

Through the GTP Program Website [WEB] students and science teachers can submit an application for **Junior Tall Poppies Award** or **Teacher Tall Poppies Award**. Each of these awards are outlined below.

**Junior Tall Poppies Award**

The **Junior Tall Poppies Award** recognises outstanding secondary students (ages 15-17) in science or mathematics who can develop projects in their school communities to enhance the understanding of how important the sciences are to society [WEB]. Using an application template, applicants require a nominee (Teacher/Principal) who provides a reference that gives:

- A brief outline the student’s academic and personal achievements and a description of their ability in science or mathematics, and ability to participate in activities outside of academic pursuits (maximum 300 words);
- A description of how the student displayed excellence in communication and leadership at school or in the community. Non-science communication can be included (maximum 200 words); and
- A description of why the student is being nominated and how winning this award can benefit the student and the school community (maximum 200 words).

Within the template the student:

- Briefly describes a favourite aspect of science and mathematics (with emphasis on physics where appropriate). Describes how it relates to society, community or individuals. Express the interdisciplinary connections of these fields (e.g. how physics and mathematics work together and contribute to biology) and how they increase understanding that improves outcomes for our world. Describes this in a way they would to other kids, their grandmother or a newspaper reporter (maximum 300 words);
Describes how the student would engage the community in their school to connect with the sciences to promote understanding. This would be their GTP Personal Project to implement in their school (maximum 300 words);

Describe how the student thinks about changing how the sciences are viewed in their school would benefit them and their community (maximum 200 words); and

Provides a short biography. Describe themselves and their achievements and aspirations (maximum 350 words).

The winning Junior Tall Poppies:

- Are invited to attend a GTP Conference.
- Receive their award at a ceremony at the conducted at the location of the Royal Society of Victoria.
- Participate in a three day GTP Immersion Program with scientists to have an authentic science experience.
- Are given access to a network of science workshops through a membership with The Royal Society of Victoria.

**Teacher Tall Poppies Award**

The Teacher Tall Poppies Award recognises outstanding secondary teachers who have been innovative in their school to enhance student outcomes in science and mathematics. The award aims to recognise and support the development of ‘science-champions’ in secondary schools through curriculum development and partnerships with scientists.

Using an application template applicants require a nominee (Lead Teacher/Principal) who provides a reference that gives:

- A description as to how the teacher has displayed best practice and/or innovation to improve student outcomes in science or mathematics. What impact has this had on student achievement, capacity or enrolments in the sciences or mathematics to improve your school? Include how the teacher has used evidence, such as educational research, feedback from students and student assessment or enrolment data, to inform their practice (maximum 600 words).

Within the template the teacher provides:

- A description of their motivations for their innovation/s or program/s they have implemented. How has this changed or augmented how they deliver understanding about the sciences (maximum 400 words)?
- An outline of the benefits of best practice or innovation for their students, colleagues and school. Provide evidence to support their description (maximum 350 words)
- Teacher Biography. Describe themselves, their achievements and aspirations (maximum 400 words).

The winning Teacher Tall Poppies:

- Are invited to attend a GTP in Science Conference.
- Are invited to attend an awards night celebration at the location of the Royal Society of Victoria where they will receive their award.
- Engage in a Leadership Program to develop a Personal Project on how to communicate science/mathematics
- Implement their Personal Project to communicate science and mathematics in their school next year, with the help of their teachers and support from the GTP Program

**GTP Leadership days, Alumni conferences and workshops**

Alumni participants in the GTP program which included GTP teacher and student Tall Poppies winners are invited to participate in range of workshops and conferences designed to
consolidate and further develop links between the work of scientists and the science that is taught in schools.

**Literature Review in School Student Scientist Collaboration**

There is widespread concern about the engagement of students with school science and uptake of Science Technology Engineering and Mathematics (STEM) disciplines in the post compulsory years of schooling (Office of the Chief Scientist, 2016; Osborne & Dillon, 2008). Within the Australian context the participation rate of Year 12 students undertaking the subject of physics as a proportion of the total Year 12 cohort fell from 21% to 14% over the period 1992 to 2012 (Kennedy, Lyons & Quinn, 2014). There is further concern that significantly fewer females pursue the subject in the post compulsory years as evidenced by data shown in Figure 4 which shows the sex ratios of Australian Year 12 subject cohorts over the period 1992 to 2012. Over this period there is not only a significant gender difference in favour of males, there has been a decline from 29% to 24% participation rate of females in Year 12 physics classes over the 1992 to 2012 period (see Fig. 4) indicating a significant gender imbalance. The underrepresentation of girls in Year 12 Physics accentuates the flow-on effect of fewer girls pursuing and being represented in tertiary physics-based courses and work beyond Year 12.

![Figure 4 Student sex ratios within each subject 1992-2012 (Kennedy, Lyons & Quinn, 2015 p.39).](image)

Hazari et al. (2010) suggests that the lack of sufficient growth in both female and overall participation makes it imperative to re-examine the current approach to the teaching and learning of physics with calls for more inquiry-based approaches that better represent contemporary practice in the sciences. Student-scientist partnerships is one strategy that employs authentic, inquiry-based learning to provide students and teachers with access to the scientific community that also gives students insights that will enable them to make informed career choices (Aspires, 2013; Houseal, Abd-El-Khalick & Destefan, 2014). Such partnerships imply more than a one-way flow of information from an expert to learner as the term “partnership” implies direct benefits for all parties involved. Tomanek (2005) suggests
that the ways in which partnerships between schools and universities become established and are maintained is not well documented. Identifying the key elements of successful partnerships between scientists and students can provide clarity about how to support girls’ engagement and uptake in secondary school physics.
Description of participants in the GTP Program

The participants in the GTP Program included the secondary schools, students, science organisations and scientists. Table 4 gives the numbers for each cohort of participants.

<table>
<thead>
<tr>
<th>Participant Type</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>38</td>
</tr>
<tr>
<td>Students</td>
<td>217</td>
</tr>
<tr>
<td>Science Organisations</td>
<td>5</td>
</tr>
<tr>
<td>Science Mentors</td>
<td>70</td>
</tr>
</tbody>
</table>

There were 5 main scientific institutions that participated in the GTP program. Table 5 shows that from these institutions there was a total of 70 science mentors, 37 of whom participated with more than one cohort of students.

<table>
<thead>
<tr>
<th>Participant Type</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Trobe University</td>
<td>28</td>
</tr>
<tr>
<td>University of Melbourne</td>
<td>22</td>
</tr>
<tr>
<td>ANSTO</td>
<td>6</td>
</tr>
<tr>
<td>University of the Sunshine Coast</td>
<td>4</td>
</tr>
<tr>
<td>Griffith University</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>

Appendix 2 provides details of the schools and science organisations.

Participating schools

Table 6 shows that schools from each of the three Australian states of Victoria, NSW and Queensland participated in the GTP Program. There is a larger proportion of schools from Victoria who participated in each of the three years of the program, whereas NSW schools only participating in 2016 and Queensland schools only participating in 2017. Graphs 1 to 4 indicate that there was a mix of metropolitan (inner and outer suburbs) and rural/regional schools, single sex (girls) and co-educational schools, and Government, Independent and Catholic schools who participated in the GTP program.
Table 6 Participating schools in the GTP program (2015-17)

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Schools</th>
<th>Location</th>
<th>Type</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>30</td>
<td>24</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>NSW</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Queensland</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38</td>
<td>29</td>
<td>9</td>
<td>18</td>
</tr>
</tbody>
</table>

Graph 1 shows that the GTP program grew from a small number of Victorian schools pre AMSPP to many schools across Victoria and extending into the states of NSW and Queensland.

Graph 2 indicates that rural or regional schools were represented in the GTP program. Given that the program entails students working with scientists in situ (i.e. in the workplace of the scientist) there are issues of travel and/or accommodation for rural/regional students. Several students commented that ‘travel to La Trobe university’ [OSU, Q15] was a challenge for them.
Graph 2 School Location (2015-17)

Graph 3 shows that the majority of the participating schools were co-educational with 32% being girls’ only schools whilst Graph 4 shows that all school types, Government, Independent and Catholic, were represented.

Graph 3 School Type (Gender) (2015-17)
Table 7 shows there were 5 main scientific institutions that participated in the GTP program. From these institutions there was a total of 71 Science Mentors, 37 of whom repeated their project with different cohorts of students.

<table>
<thead>
<tr>
<th>Science Institution</th>
<th>Number of Mentors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latrobe University</td>
<td>28</td>
</tr>
<tr>
<td>Griffith University</td>
<td>10</td>
</tr>
<tr>
<td>University of the Sunshine Coast</td>
<td>4</td>
</tr>
<tr>
<td>Australian Nuclear Science &amp; Technology Organisation (ANSTO)</td>
<td>6</td>
</tr>
<tr>
<td>University of Melbourne</td>
<td>23</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>71</strong></td>
</tr>
</tbody>
</table>
Students’ Participation and Perceptions of their GTP Experience

The online survey, focus group interviews and presentations in the form of a poster and/or PowerPoint presentation provided insights into the students’ participation and perceptions of their GTP experience as it relates to the following themes:

- Participation by gender and year level in the GTP program.
- Reasons for participating in the GTP program.
- The project.
- Comparison of GTP experience with school science experience.
- Insights and learning science through participation in the GTP program.
- Career aspirations and subject choice for senior Physics.
- Students’ confidence and Physics identity.
- Highlights and challenges.
- Student recommendations and thoughts.

Each of the themes are outlined below.

**Participation by gender and year level in the GTP program**

Graph 5 shows that students’ participation in the GTP program is very heavily skewed to female participation (88%), which is in line with the intentions of the project to provide student-scientist partnership experiences for female students.

**Graph 5** Participation in GTP program by gender [OSU]

Graph 6 show a heavy emphasis in participation in the GTP program by Year 10 and 11 students (94%). This is in line with the intentions of the project, which were to focus on students at the Year levels of 10 and 11.
Reasons for participating in the GTP program

The students who participated in the program were made aware of the program either through a teacher (School Mentor) or as a result of seeking work experience. Participation generally took place because of a pre-existing interest in the sciences or a desire to influence choices of school subjects at higher levels. Indicative student comments from focus group interviews included:

Personally I’ve always been interested in science, so I kind of just wanted to know how I could pursue that as a career where it’s actually physically possible. Student School [FGIA]

I was encouraged, my Dad used to work at XXX and he’s had a very scientific background, so I’m not really sure what I want to do when I’m older, so it was just a good experience to kind of see what it’s like and what kind of things you actually do. [FGIA]

To expand our knowledge I think of science and like what’s offered outside of school like what careers there can be; what different sort of things you could study. [FGID]

Well personally I wasn’t too sure about continuing sciences for year 11 and 12 so it was pretty good to get a feel of what it would be like doing that outside of just high school like seeing a bigger picture of like what science could take me to. [FGIE]

The project

The decision as to the context of the project, as in the science that underpins the project, and allocation of students to a Science Mentor, were based on the availability of the Science Mentor and the nature of his/her research. The project was designed to reflect the current research of the Science Mentor and over the life of the GTP program (since 2008) there have been 50 projects [WEB]. For example, showcased on the GTP website are the following projects:

- The Life and Death of a Battery.
In undertaking the projects there was little negotiation as to the project that was undertaken.
The students were often placed in pre-determined groups.

When we arrived we had a colour in our name tag and that was just what we did. [FGIB]

We got assigned projects – there was two groups there. [FGID]

The following are examples of the students’ reflections as to what they did in their projects:

We did nuclear medicine and we looked at a medicine that made cancers glow and it also made them show up on a particular scan so you see where it was and then while they were performing surgery they knew if they got all of it out or not if they were cutting it out. [FGIB]

We did the astronomy and robotics program and we had to program and make little robots and it related to astronomy because they, well these days scientists especially physicists are working on sending robots into space to discover and venture to the places we physically can’t venture into so. [FGIC]

It was evident in the poster and PowerPoint presentations that the students had a good understanding of the, sometimes, complex science underpinning their project. For example, the following excerpt comes from a poster generated by students who undertook a graphene project explaining what they did:

On the first day we were required to make a hexagonal lattice, as a replica of graphene, using only two different types of Lego. This was a challenge as we had to first discover the way in which they would connect to form hexagons in a repeated pattern, and then refine our design to come up with the perfect example of a graphene sheet.

We were tasked to find the smallest parallelogram on a hexagonal lattice. This was found to be a rhombus which contained two atoms. This is known as the minimum unit cell and is used to find different mathematical formulas and calculations in theoretical physics.

We also looked at moiré patterns, which occur when two sheets of the same pattern are layered upon each other. This happens sometimes when layering graphene and the moiré patterns have their own diffraction rules. [POS]

A highlight for the students in undertaking the project was collaborating with their science mentor.
We have learnt from our communication with physicists that they are passionate, friendly people, who are applying science to advance technology and materials of the future. [POS]

Comparison of GTP experience with school science experience

Graph 7 indicates that the students overwhelming felt their GTP experience added to their science experiences had at school. One area of difference is illustrated in Graph 8 [OSU] which indicates that the students experienced science inquiry/investigation within the GTP program differently than experienced at school. In focus group interviews the students made mention of the hands-on experiences using equipment not available at school:

It’s more practical because you see it in action and it was really good. [FGIA]

You do a lot of things that you were not able to do at school using all the equipment and the teaching style. [FGIF]

You get more of a hands on experience and you can learn about a lot about a lot of terms that you don’t really learn at school. [FGIG]

Graph 7: Students’ experience of GTP when compared to normal school science activities [OSU]

Did this event/activities provide you with experience/material that you do not have access to through school?

<table>
<thead>
<tr>
<th>Option</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>100.0%</td>
</tr>
<tr>
<td>No</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
The students indicated that Physics, as presented in schools, has too much a focus on established theories, being boring to learn, instead of being a lot more process-based with testing and hypothesising, and quite broad, and therefore interesting to learn.

*Our understanding of career opportunities has definitely changed as we see that there are more career options than expected, there is less theory than we expected and involves testing and hypothesising a lot... The physical sciences is definitely a field that is very broad and interesting.* [POS]

*Extending our knowledge of physics from our mentors in the GTP program helped us realise that school physics is extremely limited to theories that are straightforward, easy to prove and often boring. The world of physics opens to unlimited opportunities for discoveries and often debunks what we learnt in school.* [POS]

**Insights and learning science through participation in the GTP program**

Through participating in the GTP program that students learned more Physics and gained insights into the daily lives and personal histories of the Science Mentors as well gaining a greater understanding of Nature of Science (NOS) than that presented in the science classroom.

**Learning Science/Physics**

*Graph 9* shows a very positive overall experience by the students in terms of their perceived improvement of knowledge and/or skills in Physics (95% indicated their improvement in knowledge/skills was excellent/very good/fairly good). Indicative comments from the students included:

*I walked into that program with very little or no understanding of what a protein crystal was – the thing that we were looking at I had done the readings and stuff...*
but I didn’t fully understand and I came up and I was like yeah that makes sense and understood a bit more of just the technical aspect [FGIC]

Our understanding has changed as we have gained more knowledge of the things that are involved in physics, the way in which they work and can be useful now and in the future as we will be using them even more. We were able to gain the basic knowledge of the elements needed in order to study more on the subject of Astronomy. [POS]

So the problem solving side of things really came through from the project and I thought that was pretty good. [FGID]

**Graph 9** Students’ perceived improvement in knowledge of physics through GTP experience [OSU]

![Graph showing the percentage of students' perceived improvement in knowledge of physics through GTP experience.](image)

**Insights into the daily lives and personal histories of the Science Mentors**

**Graph 10** shows that the majority of the students (80% indicated ‘Excellent’ or ‘Very Good’) gained insights into the role played by scientists through their experience in participating in the GTP program. The quotes below highlight the findings by the students that scientists are not gender-specific, are everyday people and there are many paths to becoming a scientist.

**Graph 10** Students’ understanding of scientists in participating in the GTP program [OSU]

![Graph showing students' understanding of scientists.](image)
Scientists are not gender-specific

...we got to meet actual scientists you realise that – I didn’t realise that there were so many female scientists. Like I was really surprised. [FGID]

There is a stereotype that men are better at science, and that the majority of scientists, particularly physicists, are male. At growing tall poppies we found this was not the case, we had a female mentor studying her PHD in physics, and met female experts. [POS]

Scientists are ‘normal’ people in their daily lives

It was – I don’t know when you say scientist or when you think, or when I think of a scientist like it’s sort of always doing the same sort of thing but they’re all different, every, they’re saying what they do daily changes it’s not always the same. [FGIC]

There can be many career trajectories in becoming a scientist

The point was like she went in heaps of different paths and she came to physics. [FGIA]

We got to hear where they went, how they started out from children. So my mentor she said that at a young age she was very fascinated with space and other planets. So she gradually moved on and then her parents actually wanted her to become a doctor or something but then she kind of went for science directly because she felt so passionate about it. And then I think one of other mentors said that he was really into comic books as a kid and he liked all the sci-fi stuff. [FGICB]

Insights into the Nature of Science

Graph 11 shows a significant majority (84% indicated ‘Excellent’ or ‘Very Good’ rating) of the students felt their understanding science as a human endeavour improved through their participation in the GTP program. This is a good finding in that the experiences had by the students address one of the new strands of the National Science Curriculum: Science, being Science as a Human Endeavour (ACARA, 2012).

Graph 11 Students’ perceived understanding of the nature of science [OSU]
The following student quotes makes reference to contemporary science being collaborative, interdisciplinary and connected to the real world.

**Science is collaborative and interdisciplinary**

I liked the team work aspect, like I always saw science as like sort of individual – like the scientists will go to their lab and individually do their experiments. It was very team based – everyone worked together and shared ideas I liked that. [FGID]

Like at ANSTO they didn’t just focus on nuclear science, it was environmental science and the impact that they’re having and all kind of things. [FGIA]

I didn’t realise – at school you just kind of learn very set sciences and they don’t really, they overlap a little bit but not as much, whereas when we went here they all overlapped heaps. [FGIA]

GTP has allowed us to be a part of an experienced experimental program in physics. This program has brought together the skills required in mathematics, biology, chemistry, IT and real life. This is part of the appreciation that we have obtained over the course of this time. Physics is a very well rounded subject that combines the best of all STEM subjects. Furthermore, we have been actively involved with scientists whom are experts in the areas of Graphene. Such specialisation in a particular aspect of science is something which we had not previously experienced from our classroom teachers. This has provided a unique experience which we have not experienced elsewhere. [POS]

The most prominent thing that has changed about my appreciation for physics is that I now realize just how much it relates to the world. We can relate the light in the walls, the structure of a building or the movement of the body back to physics, and this is something that amazes me. During the program, I also began to understand how interdisciplinary physics was. We can make connections between chemistry and physics to make huge advances in medicine. [POS]

**Current science relates to real-world issues**

Growing tall poppies has increased our appreciation of physics. During the program we have learnt about real world applications of physics and how physics is used to help people. The program gave us the opportunity to meet with experts and use technology that is not available at our schools. Also this improved our knowledge and appreciation of physics, other sciences, and there applications. [POS]

Other insights into the nature of science was reflected in the following quotes where progress in science requires patience and persistence and science can be problem-solving and more than just theoretical. It can also be creative.

**Progress in science requires patience and persistence**

Because a lot of them especially when you walk past and they would be doing their work it was like they were in their own little world – they were staring at their station – very busy with whatever they were doing and the research they were conducting and the person leading my group was telling us about how some people would try and grow these protein crystals for years. They would spend years upon years monitoring their progress and making sure they would be strong enough that they could put them in the – so that they could use them for the experiments and I found that really awesome. [FGIG]
Doing science can be problem-solving and practical

So the problem solving side of things really came through from the project and I thought that was pretty good. [FGID]

I think most kids probably think oh physics is probably theoretical and all you do is just paperwork but this probably highlighted the practical side of things and how it has major applications. [FGIE]

Science has a creative element

Yes, as we have an understanding of what physics entitles and the opportunities that it can present later in life. It has shown us that this isn’t all about numbers and it has a creative element that requires large amounts of imagination. [POS]

Career aspirations and subject choice for senior Physics

Through participating in the GTP program the students reported a more informed view of the career pathways following further study in the physical sciences. This provided students with a greater relevance to Physics and science at school (see Graph 12). For many of the students the GTP experience reinforced their prior intention to continue with undertaking sciences in the senior levels and beyond. There were students who have changed their minds and are now considering taking science at the senior levels. There were others who are still undecided as to their career aspirations and subject choice for senior physics but are now informed when it comes to the time to make a decision.

Graph 12 Students’ perceived relevance of GTP experience with school physics [OSU]

You saw how science is actually applied in the world and so then that makes you more interested in school because you feel there’s a purpose to your study when you are studying text book stuff. Like it’s often to feel like oh why am I learning this? Like why does this need to be in my brain for? So then it gave a purpose to the study in school that we did. [FGID]

It made me want to do more research and get further and do that. [FGIA]

More informed about career paths in science

Graph 13 shows that nearly all students gained a greater understanding of the possible career paths following further study in the physical science. Contributing factors to this finding might have been the mandatory requirement to research and report on career possibilities in
completing the poster (part of the project brief), advice from the careers teacher who was involved in administrating the work experience protocol, and feedback from the Science Mentors.

The posters gave clear evidence of a greater awareness of career opportunities from undertaking science at the higher levels of schooling. For example,

*Our ideas of career opportunities have been broadened as we now know the different sections such as theoretical and experimental physicists. We have experienced these two sections through working with experimental physicists in the lab and learning how they make graphene and identify it. We then worked with theoretical physicists discovering the structure of graphene and its properties.* [POS]

Pathways physics can create include: Theoretical and experimental physics, Engineering, PhD opportunities, Finance jobs, Weather bureau, General modelling companies, Medical physics, Forensic science [POS]

*Through my experience with the Gamma-ray spectrometer and ITRAX I have realised how vital science is to creating a better world and how important scientists are to helping create that. By talking to the physicists and touring ANSTO I have learnt about many career opportunities. Medical physics, environmental physics, radiology, geomorphology, sedimentology, ANSTO health. This is very important because you don’t want to choose the wrong subjects to study and not be able to study the profession you may want to.* [POS]

*Our understanding of career opportunities has definitely changed as we see that there are more career options than expected, there is less theory than we expected and involves testing and hypothesising a lot...The physical sciences is definitely a field that is very broad and interesting.* [POS]

<table>
<thead>
<tr>
<th>Graph 13</th>
<th>Students’ perceived improvement in careers [OSU]</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image_url" alt="Graph 13" /></td>
<td></td>
</tr>
</tbody>
</table>

*Intention to pursue physics at the high levels*

*Graph 14* indicated that 74% of the students felt they were more likely to continue with Physics or recommend Physics to others. It should be noted that a response ‘not affected’ might imply that the students already had physics as a career direction.
The following quotes indicate the student had changed their future subject choices to include Physics or reaffirmed their intention to pursue Physics at the senior levels of schooling.

I wouldn’t have done it if I didn’t go. [FGIB]
Yep wouldn’t have crossed my mind. [FGIC]
For me I was always very arts based but I think after the project I am not as closed minded. So if I had the opportunity I would probably take it. [FGIC]
I wanted to have a science focussed career but when I did a thing it just concreted my mind I guess. [FGIE]

Physicists are normal people excited and curious about how the world works. This program has enabled us to consider a career in physical sciences as we now know more about what physics entails. [POS]

My appreciation for physics has changed. I have wanted to be a physicist for a while but I never got to see first-hand what they did in day-to-day life. So when I observed this I learnt something new and it gave me insight in what I might being in a few years. [POS]

Being part of GTP has not changed our appreciation of physics as we already had a strong appreciation of physics. However seeing the cool equipment here and participating in the experiments has only furthered our appreciation. [POS]

A final quote sums up the students’ experiences well.

After participating in the growing tall poppies program, we are more confident that we are capable of a future career in science, especially physics. This program has helped us develop confidence in our abilities to understand physics. We have also gained a sense of belonging and independence from spending time at Melbourne University. The growing tall poppies program introduced us to the exciting pathways and careers science, specifically physics offers. We have learnt that we are capable of achieving a career in science that is both intriguing and enjoyable. The program has exposed us to what studying physics is really like. It has shown us what we have to look forward to: meeting and collaborating with new and interesting people, working on exciting projects with a team. [POS]

Students’ confidence and Physics identity

The students indicated an increased confidence in their ability to do sciences, especially Physics (Graph 15) through undertaking the GTP program. This increased confidence was
Evaluation of Growing Tall Poppies program

based on an insight that the pursuit of Physics is open for all genders and personality types (ie not just ‘nerds’). There was an increased identity with Physics (Graph 16) through seeing the passion in the professional lives of the scientists and normality in the scientists’ everyday lives.

Confidence to consider physics at higher levels

The experience today challenged some of the beliefs about this subject which were that physics is an extremely difficult subject that can only be studied by “nerds” and particularly men. This experience helped us boost our confidence and take on our careers of choice without any fear of being judged. [POS]

Graph 15 Students’ perceived confidence to do science/physics [OSU]

With your experience from the immersion program do you have a greater confidence in your ability to do the sciences, especially physics?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>About the same</th>
<th>Not really</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>80.00%</td>
<td>10.00%</td>
<td>10.00%</td>
</tr>
</tbody>
</table>

Increased identity with physics

We think we will be able to do physics. If we are focussed, enthusiastic and dedicated to the subject, we will all be capable of succeeding in physics in VCE and higher education. [POS]

After attending the growing tall poppies program we found that we can identify with physicists. At the beginning of the program we had some misconceptions about physicists, but found that they are normal people with a passion for science, who are working to solve real world issues. [POS]

It is not just the intelligence it is also the passion:

Physicists look passionate and excited about finding new things, I feel that I give my best to any task and with more research I will recognise myself doing similar things to them. [FGID]
Graph 16 Students’ perceived level of improved confidence in learning physics through their participation in the GTP program [OSU]

Overall, how would you rate the improvement, through your participation today, in your confidence in learning physics?

- Excellent: 0.00%
- Very good: 10.00%
- Fairly good: 20.00%
- Mildly good: 30.00%
- Not good at all: 40.00%

Graph 17 Students’ perceived identity with physics in undertaking the GTP program [OSU]

With your experience from the immersion program do you have an improved identity with physics? (You can see yourself as a scientist like this)

- Greater identity with physics: 70.00%
- Not affected: 30.00%
- Less identity with physics: 0.00%
Highlights and challenges

The highlights for the students who participated in the GTP program were experiences working with contemporary scientists in laboratories with sophisticated equipment.

*Highlight was being able to experience working as a real scientist and that was also the challenge.* [OSU]

*One highlight- using the X-Ray tomography machine, and seeing the images we were able to create.* [OSU]

A challenge for some students was the challenging nature of the project, which involved an oral communication component.

*One challenge- presenting at the end of the three days, this was challenging for me as I have struggled with public speaking.* [OSU]

*A highlight was being able to see real scientists in their workplace, and being able to gain a better understanding of what life for scientists can be like. A challenge was keeping track of all the new information.* [OSU]

Student recommendations and thoughts

Overall, the students would recommend the Growing Tall Poppies to girls in future years. The key recommendation that students gave was to make the program longer as some students experienced a one day ‘on-site’ visit and other had a three-day experience. Preference was made for a week long experience.

*You learn a lot from it and even if you go in there wanting to do a career in science if you come out now wanting to then at least you know that that’s not for you FGIC]*

*I think it was like a good way to I guess expand horizons I guess and like might make people more inclined to study science if they wanted to promote like their aspirations of wanting to be a scientist or something like that.* [FGIA]

*I think one amendment – like if they continue the project it would be better if it related like directly to one of the topics that we were doing or one of the major components I think that would be much more helpful but I feel it was still helpful in the problem solving aspects and application of knowledge.* [FGID]

*Maybe making it a bit longer.* [FGIA]

*I think everyone would have loved it a bit more if it for a bit longer.* [FGIB]

*I felt it was really rushed – like everything was kind of thrown at us and it was really interesting and we were curious about things but then it just kind of started and ended like maybe if it had been the whole week we would have had more time to process everything.* [FGID]
School Mentors’ perceptions of GTP program

38 Schools participated in the GTP program (2015-17). Each school had a teacher who championed the program at the school and made all the necessary arrangements for students to participate. It is these teachers which are referred to in this report as School Mentors. As part of the evaluation there were 10 School Mentors (24% of cohort) who were interviewed.

The different themes that arose from the interviews included:

• The role of the School Mentor;
• Challenges encountered in the school participating in the GTP program;
• The benefits to the participating students;
• GTP program and linkage to the National Science Curriculum;
• Personal insights as a Science Mentor; and
• Impact on the rest of the school through its students’ participation in the GTP program.

The Role of the School Mentor

The role of the school mentor is critical to the GTP program in terms of making it possible for the school and students to participate. They are often the science coordinator at the participating school. When informed about the program, which has often been associated with an email, it is the mentor who gains permission from the school executive for the school to participate. The School Mentors saw their role as looking for opportunities for students at their school to engage in programs outside of the classroom.

I have always been interested in the ideas of students getting experience in the real world of science and had come from a school that was involved in an engineering in schools program and when I arrived at this school. [ISMB]

A program to encourage the girls to not see science as something that could limit them but rather something that they can embrace. [ISMA]

In the initial stages of the program one of the constraints for school participation was the need for the school to provide supervising teachers to attend the science organisation with the students. This creates the need to supply replacement teachers at the school. To address this problem the GTP program was classified as work experience for the participating students and so the school could follow the work experience protocol. The school mentors then liaised with the career teacher to arrange for a work experience protocol to be in place for participating students in the GTP program. Comments from the mentors:

... I sat down originally and worked out the best way of actually approaching, was to do it under a work experience protocol to make, so it was easier to get in to the school. [ISMA]

...you know the paper work was really easy to follow through the careers advisor being involved and it made it easy, because then the work experience and those risk assessments were reduced quite considerably, because we already had a set document that we could use. [ISMB]

Our careers teachers looked after the OHS and the careers side of the things, work experience side of things [ISMC]

The decision to adopt the work experience protocol meant that participating students were in Year 10 or 11. According to Dr Barone-Nugent:

Work experience model allows us to divest ourselves of a supervising teacher. And it was best placed at Year 10 anyway. Year 9 are unpredictable and Year 7 and 8 were too young. The fact that students were there without their teacher
created a good model for the partnership just between the students and their mentor.

Another key role by the School Mentors was to advertise the program to students, either asking for volunteers and/or nominating specific students to participate. Nominating students was seen as important as such students would not self-nominate. This strategy might be seen as quite useful in the first step to getting students thinking about Physics as an option in the higher levels of schooling. Indicative comments included:

And then the next part of it was to sell to the students which was really easy, the kids we actually had more kids wanting to do it then we actually could take. [ISMA]

...to nominate the students that we thought would be you know good candidates. And that’s what we had to do to is tap a couple of girls on the shoulder because they really weren’t going to self-nominate. Which is the point you know, they're not thinking that they can do it until they go. [ISMB]

I’m interested in encouraging girls who are interested in science, you know the ones who often get left behind because they don’t stand out. I want the kids who are curious, the ones who want to participate. So I have a practice were I send these emails at the start of the year, inviting students in year 9 and 10 particularly because there are a lot of opportunities for those girls, those year levels. [ISMD]

Apart from completing all the administrative tasks of gaining permissions and supervising the participating students, often visiting them whilst on the GTP program, the School Mentors also worked with the students on their return in showcasing their experiences with the rest of the school. For example, the following quote makes reference to the participating students providing talks to student and teacher groups upon returning to the school.

...once they came back was then to try and encourage them to take opportunities from there. Like make them talk to the teachers and tell them what they got out of it so the teacher could actually see advantages. Talk to the kids as well, so broaden from that point of view so the students actually got something from there. And continue to encourage them to take up other opportunities. [ISMA]

### Challenges encountered in the school participating in the GTP program

One of the challenges encountered by the School Mentors was in convincing girls to participate, particularly those from the co-educational schools.

...because the students don’t think it's for them. When you’ve got a co-ed school environment often the girls will sit back and let the boys do the stereotypical boy things. And we tried to break those stereotypes down very early on, but it still happens. [ISME]

The paperwork necessary for the students to participate was considered a challenge. However, in getting the students to follow the work experience protocol this work was lessened.

...but that was sort of circumvented by involving the careers advisor in the program, because then we did it as a work experience and we’ve got all the paper work, so that helped ... helped us. [ISMF]
Benefits and impacts for the participating students in the GTP program

The School Mentors cited several benefits and impacts for the participating students that included the following themes and illustrated with student comments below:

- Insights into scientist role models dispelling the myth that scientists are middle aged males;
- Opportunity to work closely with a scientist on an authentic, real world, physics project using sophisticated and complex equipment; something they could not have experienced as school;
- Students see Physics as a possibility to pursue in the senior years; and
- Development of collaborative and interpersonal skills in working with other students and the Science Mentor.

Scientist as a role model

...the biggest one I'm going to say is, is gives them massive role models... And the other thing is it gave them an opportunity to find that they could do things that they never really thought they could. Like a lot of them were very quiet, when they had to actually go and do speeches and things they were so, they really enjoyed it. [ISMA]

Real-world hands-on experiences with equipment not found at school

Real world experiencing how the stuff they learn in school actually applies to different fields. Some of the girls who aren’t necessarily too science inclined saw how it's not just science that ... into the field, it takes a lot of other skills as well. [ISMC]

It’s giving them more of a hands on experience than they get in the classroom. They get to use equipment that’s – some of it we talk about in class but we don’t necessarily get to experience it because, of course, schools – we don’t have that equipment here. [ISMF]

The chance to look at real science and the environment in which scientists work as well as meeting the scientist to give them a more realistic idea about the sorts of people scientists are, you know ordinary and varying but with passion for what they do [ISMB]

They get to play with the equipment at a much more sophisticated level than what they have the opportunity to do at school, absolute bonus because they've come back bubbling about what a wow time they had. [ISME]

Open up career option in science

I think it is vital for the future of school science to give the students an authentic link to the real world of science and scientists and give them the opportunity to be more informed about the possibilities for a possible career in the science and technology fields [ISMB]

There is a sense of confidence that they work in teams and work experience that is all science dedicated and they're working alongside research scientists doing work that isn’t just mimicking the work place. They’re actually involved in research that has an impact in real terms all those things were strong for us and we had that first experience with them and it was very successful and we were very keen to continue that [ISMA]
Awareness of the career opportunities in pursuing Physics

The School Mentors felt the students gained an increased awareness of a range of careers and the requirements that do not necessarily mean being the top academic student.

...experiences that they don’t get in the classroom would be that mentoring with someone how is working in industry... having that mentorship with a person that they know and talk to and eat lunch with and follow them around for the day and ask them questions that’s very different. [ISMB]

That’s the thing about making students aware of careers, making students aware that you don’t have to be the top kid. So many of them think if you want to be a scientist you’ve got to be the top students at the school. [ISM]

...there’s other fields that require science. [ISMD]

There were cases cited by the School Mentors where students changed their career aspirations to include Physics as a result of participation in the GTP program.

...a couple of cases where students were opened up to possible new careers and actually changed their direction to pursue a career in that area. [ISMB]

Development of teamwork and interpersonal skill.

I know they enjoyed meeting students from other schools who were likeminded, and improved their teamwork, having to work with people that they didn’t know, getting put together with someone and having to work with someone. [ISM]

GTP program and linkage with the National Science Curriculum

The School Mentors found that the GTP program addressed elements of the science curriculum that deal with the ‘nature of science’ and ‘science as a human endeavour’, as well as satisfying the work experience program as the school.

There’s a component within that stage 5 science of understanding [NSW Curriculum] where nuclear science comes from, where it fits in. So they really got a firsthand experience with that. So I could see the immediate links whether the kids could see that it’s probably a different thing. It fits in with careers, it fits in with working scientifically. So I, yeah multiple layers of linkage, collaboration, critical thinking you know. I can throw all those words out to you but literally that’s what they did on those days. [IS]

But the fact that they all do their work experience in year 10, it was a good opportunity for them to ..., you know careers related to the field, so yeah. [ISM]

Personal insights as School Mentor

Each of the teacher mentors interviewed considered that engagement with the wider community was important in terms of creating wider experiences for their students.

...it’s one of the goals that our school is to look for ways to connect to the science community and to the STEM community in general. So, yeah, all of our programs have – and the success of those programs have motivated us to kind of look for ways to work further with different institutions and to establish relationships with new institutions as well...Yes, I do. Yeah, it is one of my – it is one of my goals as well as STEAM coordinator but as a teacher as well to engage with as many outside organizations as possible and to try and encourage our students to also engage with as many outside institutions [ISM]

The School Mentors have learned to be more specific about the career opportunities for students to pursue physics at the higher year levels and beyond. It has reinforced the teachers
view that classroom teaching needs hands-on and authentic tasks. There have been more connections made to the science world.

What I’ve learnt is how important it is to make students be very much explicit in, I was saying these are opportunities for where physics can take you. The career opportunities, and making them very clear for them that it’s not that, it’s not the content only field which is where a lot of them think it is. So that was the biggest thing the girls talked about how physics wasn’t what they thought physics was afterwards. And that was because of the careers and other opportunities and pathways that they saw. And so I’m even more explicit in teaching that that I was before. [ISMA]

it reinforces – we try and do a lot but it reinforces the need to have more hands on and project based learning for – particularly for – particularly for physics and so every year we sit down – we do modify a lot of our – we do a lot of extend investigations as part of our year 7 to 10 curriculum and that’s now at the VCE curriculum as well. So, it encourages students to pick a topic that they’re very – really interested in, design some sort of experiment, conduct – just like you guys do at growing tall poppies, but our projects are a little longer. They’ll go over maybe a week instead of say, 3 days. [ISME]

like I think building connections outside is good and I got to know a few more people in the physics community and I thought if they’re at the same stage and I’m looking at something and I have a few more contacts can be good, but I don’t know in the actual physics, learning and things and the curriculum and stuff, I don’t know they did anything of that. [ISMF]

Professional practice and it has enabled me to see other possibilities and given me ideas to add some direction to uses for what I teach. [ISMB]

Impact on the rest of the school through its students’ GTP participation

The impact on the rest of the school was viewed by the School Mentors as:

- A very positive response from parents.
- Raising the profile of science at the school through showcasing students’ GTP experiences through various forms, such as the school’s Facebook site, school newsletter and class/assembly presentations.

Support for program from parents

The School Mentors cited very positive responses from parents of the participating students. This is important as following the work experience protocols meant that parents had the responsibility for students’ travel to the science centre and accommodation if necessary. The parents were also supportive of taking their child to the GTP workshops and conferences held during school holiday periods.

I'm constantly being sent by the parents of the girls saying, it's been such a wonderful opportunity, it's turned them around. I even got asked by one, so what have you done with my daughter, she's a whole ..., she's not the same kid anymore. So very much the parents have found it to be really, really engaging. The other thing it's done is with some of them it's meant that they're now taking their younger siblings to, the parents are taking them to other ... events. So it's actually inspired those parents then to actually say, hey some of the holiday programs will actually work for our ... our younger children and actually bought that link in as well. [ISMB]
Raising the profile of science at the school through showcasing the GTP experiences

Each student who undertakes the GTP induction program is provided with a written brief outlining the science project to be undertaken and tasks to be completed at the science centre as well as when returning to school. The project brief requested that students report back on their project with both a presentation and a newsletter article. The reporting could be done as a group exercise. Suggestions for reporting included:

- A 5-10 minute PowerPoint presentation is given at the school with content their peers think will find interesting or surprising.
- A newsletter item (300-400 words) for the school or local paper that includes a group photo, the name of project, the name of your scientist-mentor, the name of the school, the students involved, and the date.
- Posting on a GTP social media site.

The School Mentors reported that the participating students engaged with other students and teachers in showcasing their GTP program experience in multiple ways such as through the school’s online website, school newsletter and presentations to classes and assemblies.

We did, we posted on our school Facebook page, we did post some photos of them, and recognised them for doing that, but unfortunately there wasn’t as much as we kind of would have liked. [ISMB]

Well, we’ve had girls do newsletter articles, for example, sort of – every year we’ll pick a couple of girls to do a little – a newsletter article or a presentation just about their experiences and about their project and what they did and there’s always very good feedback for that and so a lot of the girls read that. [ISMB]

Well, I think from what we tried to do, we had an impact on the school because that’s what I said, they present at assembly. [ISMF]

Yeah as I said I think it’s, the other thing that it’s actually done is actually it has, because the students have actually taken that offer that it’s actually raised a whole profile science at the school. And so they’ve been willing to actually now say, hey it’s great to stand up and say yeah science is good and goes from that point of view. So they’re a lot, so it’s actually made that big, that big change of actually having advocates. [ISMA]

Leading and presenting material for younger children in the school, the year 7s and 8s, they’ve been involved in preparing science week and delivering science week [ISME]

Participation in GTP program led students to pursue other science based initiatives at the school. For example, participation in a science club.

This year we have had established science club, called ‘sassy science’ so sassy girls, serious about science, put a little I and the end we call it the SASSI girls (the club they have started) [ISMA]
Science Mentor perceptions of the GTP program

In gaining insights into the science mentors’ perceptions of their experience in the GTP program 10 Science Mentors were interviewed representing 14% of the whole cohort. The role of the Scientist Mentor, like School Mentors, is critical to the program success. The Science Mentors were drawn from existing university staff, postdoctoral research fellows and students undertaking postgraduate studies along with support from supervisors and university leadership. The following themes emerged as to the Science Mentor perceptions of the GTP program:

- Circumstances in becoming involved in the GTP program;
- The role of the science mentor;
- Challenges encountered by the Science Mentors;
- Perceived benefits for the students; and
- Benefits for the Science Mentors in participating in the GTP program.

Circumstances in becoming involved in the GTP program

The circumstances in which mentors became involved varied. These were through word of mouth, advertised and supported by PhD supervisors, research project leaders and research teams. Some indicate comments were:

- A fellow PhD student had been involved from the start and they were after some extra mentors and I had done previous outreach program...so I put up my hand and said I would be interested. [ISCA]
- I found out about it, internally through ANSTO...I wasn’t formally asked to help, but found out about it, I felt they had some ideas that could be implemented and involved in it, and I went and talked to my respective managers. [ISCB]
- I’m sure when I came into the role it was an established program the Uni was already running. [ISCF]
- One of my professors put me up for the program...a lot of the academics had input into the work I was doing with the students...it is an important thing and we don’t have enough girls in science as it is. [ISCG]

To provide information about the GTP program seminars were conducted at the science organisations for prospective Science Mentors (PhD students). These seminars showcased the role of existing Science Mentors and their projects as well as inviting those who attended to briefly outline their research. This opened up discussion as to possible themes for student project.

The role of the Science Mentor

The key roles for the Science Mentors were in the design and delivery of the student project. In the design of the project brief the Science Mentors worked closely with a GTP Educator in creating real-world tasks related to the Science Mentor’s research that might be understood by the students. The tasks also needed to fit in with the requirements for the students to report on their experiences through a PowerPoint slide presentation and/or poster. The Science Mentors acknowledged the assistance that was given:

- I don’t have a background in high school teaching. It was hard to know. And I hadn’t really worked with high school students before. It was hard to know exactly how they would receive the tasks and how they would go about it. [ISFI]
One of the people who works in Eroia’s team is Haydn and he talked me through it in a series of meetings. We brain-stormed and work-shopped the project. There are also templates for the schedule for the workshop – the way time would be broken up. And also templates for the introductory material you gave to the students and the schools before you arrived. [ISCI]

(We) had meetings beforehand and he – we sort of thrashed out some ideas for the, what we could do as the hands on option and stuff and he had some good suggestions, because I was initially a bit stuck for an idea and it was actually when I took him through the building and showed him, like I sort of took him on the same route that I was going to take them but he noticed something and he was like “Couldn’t we get them to do that?” you know so that was something I may not have thought of. [ISCF]

I’d say informally. We were definitely – Eroia Nugent was very involved with helping design the programs, along with David Huxley, which were two of the people we worked with. And I’d say, yeah, I felt very supported and could always ask them for advice on what I thought was the best way, and I think I learnt a lot from that, from around the organisation aspect of it. [ISCC]

From the perspective of the GTP Educator, the support to the Science Mentors in the design of the project centred on:

When discussing with the mentor there is a template to follow. What is your area of interest and what is the focal point that addresses the 4 pillars, which are: access for girls are there women in this area; how relevant are the real world contexts that would excite the girls; how can we support the self-efficacy of the student; and information about Physics careers. We use their area of research to address these four points. Yes we help them do that. [Dr Barone-Nugent]

Dr Barone-Nugent was not the only GTP Educator, one of the science organisations provided an onsite co-ordinator and educator to support the translation of the research for suitability for the participating students.

In relation to the delivery of the project, the Science Mentors indicated that they enjoyed participating in outreach programs as a way to interact with and mentor school students and sharing the knowledge of their work. Science Mentors had the opportunity to showcase their own work. Some found it as a great way to translate their research into a form that secondary school students could understand and relate to.

Most of the afternoon I spent with the high school students was about my research or at least what it was typically like and I of course explained to them what the point of it was and what we were trying to achieve. [ISCD]

I actually had taken the students through the instrumental ideas for my honours work so that was nice. [ISCA]

There were a range of experiences for the Science Mentors from leading, running and designing programs to supporting the students to produce outputs from their program involvement and undertaking risk assessments prior to student arrival.

I designed a program around the idea of showing x-ray imaging and 3-D printing. [ISCA]

I took the students through a basic sediment sample, through the collection, the preparation and the analysis. [ISCC]

I manage the Outreach programs for the University, this type of programs closely aligns with our strategic outcomes…my role was from an organisational perspective. [ISCG]
Challenges encountered by the Science Mentors

It was envisioned that project design would be a collaboration between Science Mentors and the students however this was generally not the case. In most cases, there was an acknowledgement that the tasks the students were undertaking needed to be fun and interesting but ultimately there was not a great deal of collaboration. Most programs were mentor directed and designed by the scientists in consultation with the GTP educator prior to student arrival. There were some occasions where scientists tried to incorporate elements of collaboration but this was dependent on the project.

I taught it was quite directed by myself, so I’d say less collaborative in forming the project, but that was the nature [ISCA]

It was pretty much directed by me...I don’t even remember it being pitched to me as in terms of a collaboration. [ISCD]

Support was provided to the Science Mentors in the design of the project brief some Mentors made as well of effective pedagogical practices in working with the students. However, whilst a formalised PD was not always given the Science Scholars found support was readily available when the need arose.

Professional development I guess I really didn’t get too much so I am thinking along the lines of how to teach properly or whatever but yeah I was well supported and if I ever had any issues there was always somebody that I could talk to and ask more questions. [ISCA]

I think, like if it was the first time I’d done an outreach activity, I think I would have had a lot of professional development from it, but I think because I’ve done this a lot more times, and I’d say professional development wasn’t really, it wasn’t something I’d hugely – I’m sure I gained some experience. [ISCD]

Yes and No, I talked to the science supervisor and lot but it wasn’t full on professional development, they knew I was a reliable student...having some (PD) would be good because I had some background knowledge. [ISCH]

Mentors were cognisant of their audience and engaging them in their work.

The typical challenges dealing with 16 year olds and how they worked and making sure that they were interested in what they were doing and the projects were at the right level for them. [ISCA]

Issues of site compliance and access also were mentioned as challenges.

I heard stories there was some red tape involved in getting them on site in terms of the age because they are only 15 or 16. [ISCD]

In general, the Science Mentors did not find significant challenges in their participation.

I mean, there’s always challenges but I didn’t feel they were major challenges because I had everyone’s support. [ISCB]

The benefits to the students as perceived by the Science Mentors

The Science Mentors noted several benefits to the students participating in the GTP program that included:

- Experiencing real contemporary research.
- Providing career options.
- Changing stereotypical views of scientists as aged nerd-like males
Experiencing real contemporary research

The students got to experience the role played by scientists undertaking contemporary research. This was something that was not only insightful for the students but also engaging for them.

*I think, seeing real research and seeing where science can actually lead in terms of careers, I hope that’s what we showed them. I hope we showed them that science is really exciting, and current, and always changing. [ISCB]*

*I’ve kept in touch with some of them, actually, a couple of them. It’s been beautiful. I received – for some, they got extremely excited about it, and they absolutely loved it, which I was really surprised – well I’m not surprised, it was just – it was heart-warming, I suppose it was just really nice to see how actively engaged. [ISCA]*

Insight into career paths from studying Physics

*I definitely think that they got to experience what being a scientist is like. it was great talking to them on Monday morning and then on Wednesday afternoon and seeing how their options had changed and so I think they definitely got an understanding of what it could be to be a scientist. [ISCA]*

*The students got a better understanding of the potential of careers that physics can contribute to, it’s not just about studying physics like they are doing in high schools, it provides a fantastic range of options for females in areas that interest them. [ISCF]*

Changing stereotypical views of scientists as aged nerd-like males

*I think – this is the feedback I got from last years, it was like oh wow, we thought scientists were nerds, you guys are actually cool. Or we didn’t realise that scientists do so many different things. [ISCE]*

The benefits to the Science Mentors in participating in the GTP program

The GTP website lists the following as benefits to Science Mentors in being part of the program:

1. Improve your communication skills.
2. Do great outreach about your research.
3. Develop your resume to apply for jobs or promotions.
4. Make a positive difference to the next generation of scientists & citizens.
5. Increase the number of girls taking up science and mathematics to Year 12
6. Have your outreach activities publicized to the wider community [WEB].

Benefits listed as 1 to 4 where mentioned by the Science Mentors in interviews. In relation to benefit 5 there is evidence described in the sections above that the participating girls became more informed about career considerations in pursuing the physical sciences in the senior years with many considering doing so. Benefit 6 was evident in the showcased projects described on the GTP program website as well as items in the GTP newsletter.

The Science Mentors had a good level of comfort and confidence in working in the project as most had undertaken similar type of work to this in the past. One Mentor indicated a sense of nervousness leading up to the program but the fun and engaging nature of the program put those nerves at ease. In all cases the program was what the mentors were anticipating and it was a fun experience and one which all would happily undertake again.
Enjoyment was probably one, but also, I think it really helped with my speaking – speaking to different groups, speaking to different academic levels, like high school students [ISCC]

I actually probably gained a bit more confidence in talking science at a different level. [ISCA]

Yeah, satisfaction and some friends; like I said generally girls, … girls sorry keep in touch and she’s kind of also her science Mum and so like I said to her I am saving all the trial papers from my daughters, I’m going to just pass them on to you. [ISCE]

The Science Mentors gained experience in communicating their science to the non-scientific community which they saw as an important attribute of a scientist. This view was expressed in the following comments:

It (the GTP program) assisted me to refine my ability to communicate science in lay language that would excite the students - an important skill for science communicators... I think as a scientist, it is our role to show the next generation how fabulous science is, and that there is an amazing career available should they pursue it! [ISCF]

I gained confidence in my communication skills... the skills of communicating and promoting interest in physics shouldn't be minimised for researchers. [ISCG]

Helps me understand what I know because to explain it I really have to understand it. It is about explaining the core of the science to people who are not scientists, and it’s possible to do physics without being an Einstein type genius. [ISCB]

100% yes. I think that a very important role in science is outreach and communication that’s definitely what I have got to do. [ISCC]

I would say yes because I think that a very large proportion of scientists are really bad at communicating their stuff, even to other scientists, let alone to non-scientists. So I think the more practice that any of us can get at adapting our message to make it simpler for a variety of audiences is positive. [ISCD]

I think it’s our moral obligation really of scientists to sell science to the future generation because it is interesting and also once you do science the curiosity stays with you for life. [ISCF]

Yes, because we’re going to need women in science. [ISCG]

The scientists gained experience in science communication skills to enhance their curriculum vitae to pursue career advancement, satisfaction in being able to explain their work to a general audience, and providing mentoring to young aspiring scientists. There was a view that participation in programs such as GTP was not as valuable to the scientist in terms of status as publications might provide, but did give “something else on my CV (Curriculum Vitae) for future job applications as teaching is often associated with more permanent positions as member of faculty [ISCI].”

Into the future…

Given that the Science Mentors are critical to the success of the GTP program they were asked in interviews their willingness to be involved again, what supports they would require and any suggested improvements.

The Science Mentors indicated they would undertake the GTP program again:

Yeah, absolutely. yeah. [ISCA]
We’ve got two Tall Poppies sessions planned for 2018 so that will be happening. [ISCG]

Definitely. [ISCA]

A hundred percent. Yeah, I’d be very eager. [ISCD]

Yeah for sure. [ISCD]

In relation to improvements the Science Mentors cited the extension of the program beyond three days, encourage ongoing connections between students who participated in mixed school groupings, and exploring ways to support Science Mentors in working with the students.

I think the only thing we did different this year was they mixed the groups together, like different schools which had positives and negatives; I found because last year it was one school so the girls all talked together and they kind of were support for each other. So for example, if one didn’t understand something you could say this is what it is. But this year we had mixed schools so the good thing was they were like strangers meeting each other, so for future it might be good if they kept in touch. [ISCE]

I don’t know, it might have helped if they had allowed us a bit more time. [ISCD]

I am pretty confident in my ability to look after a class but I can imagine new mentors kind of teaching them a bit better how to interact with the students and control them might be useful. [ISCA]

It’s a tough one, I very much enjoyed the program and I think it runs very well. I just know that it’s not very maintainable so it was always kind of a heavy time commitment that always required a few people that was a bit unfortunate. [ISCB]

We always thought that more collaboration amongst the different universities where programs were being held will be probably – would be helpful. [ISCC]
Online presence of the GTP program

The GTP program has a very active presence in the cloud serving multiple audiences and purposes. Apart from the GTP website [https://www.growingtallpoppies.com/] there are the social media platforms in Facebook [https://www.facebook.com/GTPscience/], Twitter [https://twitter.com/GTPscience] and Instagram [https://www.instagram.com/gtpscience/]. The production and facilitation of these platforms has been achieved through the GTP program having a media coordinator.

Social Media Insights

Facebook

Figure 5 shows interaction data in the form of views with the Facebook site over the period from February, 2016 to November, 2017. Figure 6 shows the same information broken down by sections such as posts, images and videos. The data shows consistent activity with the website over the two years of the GTP program. Apart from showcasing the students’ GTP experiences the posts to the Facebook site explored a range of issues such as women in science and contemporary science. The Facebook site has shown to be a useful platform for participants in the GTP program to continue engaging with other participants, and others, in the issues that underpin the program, such as making connections with contemporary science and issues associated with the lack of female participation in science and STEM in general.

According to the GTP media coordinator Facebook is a good vehicle to enlist interest in participating in the program. However, as the quote below indicates, activity with the site is dependent on paying the Facebook organisation for advertising.

*Facebook is a great way to get people to engage with our program, especially when redirecting them to the website. We currently have 182 page likes as of November 15th 2017. We have not yet paid for any advertising; if we do, we will see dramatic growth in our engagement/post reach/comments/shares and so on. Organic reach is usually very hard to maintain at a high level; we have sporadic growth that will only increase with paid advertising* [GTP media coordinator].

![Facebook page total views from Feb 2016-Nov 2017](image)
Twitter

**Figure 7** shows Twitter data on the number of followers, their interests and gender. It indicates that Twitter is a useful forum in connecting participants in the GTP program and wider audiences. The success of Twitter is summed up by the GTP media coordinator:

> Twitter continues to be our strongest forum in terms of connecting with the public, scientists and institutions. We currently have 523 followers that range from students to teachers to scientists to institutions in Australia and over the globe. We have sent nearly 3,000 tweets and follow 688 accounts. Over the last year, on average, we have had approximately 218 profile visits per month, ranging from 135 to 530 visits. [GTP media coordinator]
Instagram
The Instagram site has been operating since June 21st, 2016 and as at the end of 2017 had 85 followers and 258 GTP posts. The followers are mostly students and scientists (227). The site is used to post photographs of participating GTP students, events and links to science/STEM YouTube videos and articles that promote ‘Women in Science’ and ‘physics’.

According to the GTP media coordinator:

> Each time we post on Instagram, we also post on Twitter; this creates an awareness and engagement between the two media platforms. We are registered as a Business Account on Instagram, with our website and email address available on the account. [GTP media coordinator]

YouTube
As at the end of 2017 GTP YouTube had 23 videos that showcased the GTP projects across Victoria, New South Wales and Queensland. The videos were created using the online program called Rawshorts (https://www.rawshorts.com/).

According to the GTP media coordinator:
All of our YouTube videos are posted on Twitter. Many are also on our Facebook page and our website. When we post a new video, we make sure our Twitter, Facebook, Instagram and especially our website links are in the video description. This aims to create that continuity between our social media platforms.

MailChimp

MailChimp, the world's largest marketing automation platform and is seen as a vital part of the GTP communication strategy as it housed the advertising for GTP social media. Figure 8 shows the statistics ['open' and 'click' rates of our campaigns] from the newsletters, invitations, etc. that GTP has sent out since 2015.

![Figure 8 MailChimp activity of the GTP social media platforms against the industry over the period Aug 2015 – Nov 2017](image)

Initial engagement with the GTP program for participating schools and science organisations

In the initial stages of the GTP program the initial engagement with the GTP program was undertaken by one of the principal designers of the program in Dr Eroia Barone-Nugent. Dr Barone-Nugent contacted schools through email and showcased the program at science teacher conferences. Access to school contact details were facilitated through the Catholic Education Office and an external agency, Acorn. This agency had access to schools through programs involving students gaining experiences in the engineering field.

The following comment from a School Mentor indicated an email invitation:

I’m sure I had an email that came my way, and it was my first year as science coordinator in this school and I had this very strong sense that I had to read everything single thing that came across my desk, and it was one of the things that stood out. [SMI1].

The Science Mentors indicated initial knowledge of the GTP program through internal sources within their science organisation. This came about through direct engagement of Dr Barone-Nugent with the science organisation leadership, such as the directors and Deans of science. Getting the science organisation leadership to support the GTP program was seen as critical as whilst “Scientists often wish to participate altruistically they also need the backing of the director as well” (Dr Barone-Nugent).
Other strategies to raise awareness of the GTP program and requests to participate cited by Dr Barone-Nugent included:

Other strategies have been local conferences and social media Newsletter, communication network, workshops/conferences, Facebook page, twitter, Instagram and newsletters. [Dr Barone-Nugent]

The GTP media coordinator’s summation of the impact of the social media for the GTP program was:

My personal recommendation for social media, in terms of starting a conversation with institutions, organisations and policy development, would be to mainly focus on Twitter. Scientists such as Krystal Evans, Katie Mack, Alan Duffy, Lisa Harvey-Smith and Marguerite Evans-Galea are great Twitter users - likewise, so are organisations such as SAGE and Veski. Science has a very strong presence and community on Twitter - it's a great way to connect with people/institutions firsthand.

Instagram isn't really a place to start a conversation, but it’s a great way to get our image out there. Facebook, however, is harder to connect with people (unless they come looking for us). Our Facebook is currently being used as a platform for information and our website [email correspondence].
Conclusions & Discussion

In conclusion, the evidence from the GTP partnership program indicates that providing students with planned, short but intense experiences with scientists can motivate and increase the likelihood of girls to continue their study of Physics beyond the compulsory years of school. The following sections provides answers to the evaluations questions, discusses key interrelationships among the GTP participants, and discusses the future direction and sustainability of the GTP program.

Answers to evaluation questions

In relation to the evaluation questions

- Is GTP Science Partnership Program an effective means of increasing student engagement?
- Do GTP Science Partnership Program Science Mentors increase student engagement in Physics and science?
- Does GTP Science Partnership Program increase the likelihood of students studying science at Year 12 and university?

Each question is answered in the following sections:

Is GTP Science Partnership Program an effective means of increasing student engagement?

The findings from the evaluation of the GTP program indicates quite clearly that the GTP program 2015-17 was an effective means of increasing students’ engagement with Physics. The students were female Year 10/11 students who came from girls only and mixed gendered rural, regional and metropolitan schools (Finding 3) that were a mix of independent, Catholic and government types (Finding 2); each of the three states of Victoria, New South Wales and Queensland were represented (Finding 1).

The adoption of the work experience protocol was an effective means by which students could participate without the need from the school end to support the program financially through providing relief teacher funds to allow classroom teachers to attend the GTP program with their students in a supervisory capacity. The protocol meant that the careers teacher at the school become involved and thus able to provide advice about career paths associated with undertaking physics and the higher levels of school, and beyond (Finding 4).

The design of the partnership project was critical, and effective, in engaging the students. The GTP educator worked closely with the Science Mentor in creating a project that reflected the research area of the Science Mentor and was challenging but manageable for the Year level of the students (Finding 5). A key finding was that the students were often engaging at a level of Physics and science that was beyond that experienced at the school level. However, students showed evidence of gaining a good understanding of the, sometimes, complex science underpinning their project (Finding 6).

Apart from relevance to contemporary science the project brief required the students present a report to the science organisation as well as students and teachers at their school. Their report provided insights into the contemporary science research, the role of the scientist, and possible career directions with further study in Physics. The projects were clearly designed with the students in mind as they reported gaining insights into the role played by scientists (Finding 7c), which was something that motivated them in undertaking the program (Finding 7a). The students’ level of engagement with Physics was also reported as enhanced through a lot more hands-on investigations often using equipment not available at the school (Finding 7d).
In comparison to school Physics, which was perceived to have a focus on learning established theories, the physics learning through the GTP experience considered as more board and had a greater focus on knowledge construction through investigation and hypothesising, leading to new discoveries (Finding 7b).

**Do GTP Science Partnership Program Science Mentors increase student engagement in Physics and science?**

The findings from the evaluation of the GTP program indicates quite clearly that the GTP partnership program Science Mentors increased student engagement in Physics and science. This was principally due to the project that was designed to embed the research area of the Science Mentor. Through working with young scientists, both male and female, the scientists dispelled the stereotypical views of scientists as being male and nerd-like. The students found that scientists are everyday people and there are many paths to becoming a scientist. Further to their insights was that science is a human endeavour where progress in science requires patience and persistence and science can be problem-solving and more than just theoretical. It can also be creative (Finding 7c).

The GTP experiences in working with the Science Mentors gave the students an increased confidence in the ability to do sciences, especially physics. This increased confidence was based on an insight that pursuing Physics is open for all genders and personality types (ie not just nerds). There was an increased identity with physics through seeing the passion in the professional lives of the scientists and normality in the scientists’ everyday lives (Finding 7d).

**Does GTP Science Partnership Program increase the likelihood of students studying science at Year 12 and university?**

Through participating in the GTP program the students reported a more informed view of the career pathways following further study in the physical sciences and which provided students a greater relevance to physics and science at school. Contributing factors to this finding might have been the mandatory requirement to research and report on career possibilities in completing the poster, advice from the careers teacher who was involved in administrating the work experience protocol, and feedback from the Science Mentors (Finding 8). 74% of the students felt they were more likely to continue with Physics or recommend Physics to others (Finding 9).

**Interrelationships within the GTP program**

The GTP program was successful in providing authentic out of class experiences for Year 10 and 11 female students to address the mindset they may have about the interdisciplinary nature of Physics research, the stereotypes of scientists and the career opportunities available by studying Physics. The authentic experiences were generated in a 3-day partnership project between the students and a Science Mentor at the science organisation of the mentor. This interrelationship between the students and the Science Mentor is critical, and important, to the success of the GTP program. However, it is not the only important interrelationship that underpins a successful GTP program. **Figure 9** is a graphic representation showing the key participants and their interrelationships. Each is discussed in the following sections:
Students and Science Mentor interrelationship in the GTP program

Both the students and their Science Mentors benefitted from participating in the GTP program. This may be one of the reasons for the success of the GTP program.

The students

The students were engaged in contemporary science at a level that was beyond the school but manageable for the students to gain a good level of understanding. The students improved their attitudes towards science and scientists. They got insights into the way in which scientific knowledge is constructed which is interdisciplinary in nature and draws on creativity and problem solving by scientists who are not gender or aged specific. The students also got insights into the wide choices open to them career-wise in pursing Physics at higher levels. These findings give evidence to what Houseal et al. (2014) speculated as an outcome of students scientist partnership programs. They also show what Woods-Townsend et al. (2015) point out that, “Face-to-face interactions with scientists allows students to view scientists as approachable and normal people, and to begin to understand the range of scientific areas and careers that exist” (p. 1).

Another key outcome for the students who participated in the program was a greater sense of confidence in their ability to undertake science as well as an enhanced identity with Physics. Cleaves (2005) suggests that there are two key factors that militate against post-16 (years of age) subject choice. These are the students’ lack of knowledge about science occupations and science work, and the effect of a self-perception among those students who envision their science ability to be much lower than their achievements would indicate. In the GTP program the students increased knowledge of science/scientists and greater awareness of science careers may have made a significant contribution to their change in perspectives related to post-16 subject choice. According to Cleaves (2005):

The situation regarding science choices hinges on far more dynamic considerations than the stereotypical image of the potential advanced science student, committed to becoming a scientist from an early age. There is an interplay of self-perception with respect to science, occupational images of working scientists, relationship with significant adults and perceptions of school science (p.471)

Hazari et al. (2010) found in their study that students’ Physics identities are shaped by their experiences in secondary school Physics classes and by their career outcome expectations. By implication, by broadening students’ experiences in Physics, such as those within the GTP program, this may be the reason why students in the GTP program improved in their Physics identity.
The Science Mentors

The Science Mentors saw benefits in participating in the GTP program through gaining experience in science communication skills to enhance their curriculum vitae to pursue career advancement and gaining satisfaction in being able to explain their work to a general audience, and providing mentoring to young aspiring scientists. This finding was consistent with a study undertaken by Woods-Townsend et al. (2015) who found that scientists viewed the scientist–student interactions as a vehicle for science communication. Davies et al. (2012) argues that the participatory engagement between scientists and students not only raises awareness of research and promotes positive attitudes towards science, but also offers scientists an opportunity to appreciate and learn from the community.

The project

The project that was undertaken by the students and mentored by the Science Mentors provided a vehicle for the students and Science Mentors to achieve the outcomes described above. The projects were designed to give the students an authentic experience which Edelson (1997) describes as activities that adapt the practices of science that not only retain the tools and techniques of scientific research but also the attitudes and social interactions that characterise science practice. Further, the projects also reflected the view expressed by Hsu et al. (2010) that the authentic experiences have a high degree of family resemblance with the real jobs of scientists and technicians in science-related fields. It is these descriptions of an authentic experience that was evident in the projects undertaken by the students.

Interrelationships between the GTP Partnership Broker and Science Organisations and Schools

A critical aspect of the success of the GTP program, and its sustainability in the future, lies in opening up pathways for science organisations to partner with schools to then allow scientists to work closely with students in authentic projects. Housel et al. (2014, p. 88) argues that, “Developing and sustaining effective and reciprocally beneficial partnerships is rather difficult”. Useful partnerships need to have open and frequent communication between partners, and the need for all partners, including scientists and students, into the design of the activities. These authors also advocate

a third-party liaison...This is a person who is familiar with the worlds and cultures of both education and scientific community. The liaison acts as a facilitator to help mediate relationships in the partnership and raise the scientists and educators understanding of each other’s goals and needs (p.89)

The GTP program proved to be mutually beneficial for the participants. The science organisations fulfilled valuable “outreach” and “broader impact” commitments in terms of showcasing contemporary science to the wider community. Schools benefitted through gaining a high profile to interdisciplinary science, addressing ‘science as human endeavour’ (ACARA, 2012) requirements of the curriculum and providing students with work experience. The students also engage in science-based inquiry which is at the centre of science education reform efforts. Housel et al. (2014) point out that inquiry can best be taught through experiential, authentic science experiences, such as those provided by student-scientist partnerships. The benefits for the students and Science Mentors have been given above.

Dr Barone-Nugent fulfilled the role of GTP partnership broker in engaging with science organisation through making direct contact with science organisation directors and Deans. Through this initial contact provided a gateway to access research groups and prospective Science Mentors. Seminars were arranged to inform research students about the possibilities of taking part in the GTP program as Science Mentors. In terms of the third party liaison advocated by Housel et al. (2014), Dr Barone-Nugent fulfilled this role which is described as
the GTP educator in Figure 9. Two of the science organisations, La Trobe University and ANSTO, also assigned third part liaisons, or GTP educators.

The substantive increase in the online presence of the GTP program in the period 2015-2017 has greatly increased the possibility of drawing attention to the all aspects of the program to the wider community, which includes Science Organisations, scientists, schools, teachers, and students. The social media platforms of Facebook, Twitter and Instagram all link to the centralised GTP network being the GTP program website. It is here where projects are showcased and a raft of information is provided for prospective participants.

**GTP Educator and Science Mentor interrelationship in the GTP program**

The GTP Educator played a critical role in establishing a link between the Science Mentors and students and collaborating with the scientist in creating an authentic experience for the students. From one mentor:

> I don’t have a background in high school teaching and I hadn’t really worked with high school students before... in a series of meetings we brain-stormed and work-shopped the project. There are also templates for the schedule for the workshop – the way time would be broken up. And also templates for the introductory material you gave to the students and the schools before you arrived. [ISCI]

Davies et al. (2012) point out that many scientists lack the appropriate skills for effective science communication, or that they are not offered sufficient training opportunities in developing the communication skills needed. As such Woods-Townsend et al. (2015) have suggested the need for training courses to focus on developing science communicators’ questioning and interaction skills for effective interactions with students. Whilst formal training courses were not implemented for the Science Mentors they were advised and supported to act in the role of Science Mentor.

More importantly, the collaboration of the GTP educator with the Science Mentor in the design of the authentic project ensured the tasks asked of the students reflected the contemporary science undertaken by the Science Mentor. These tasks were pitched at an intellectual level the students could understand and were delivered in an inquiry-based way. The use of templates in the construction of the authentic task meant that students would get insights into careers directions with Physics and the role of scientists.

**Interrelationships of the School Mentor with other participants in the GTP program**

The role played by the School Mentor was critical to the success of the GTP program. They were teachers who champion the status of science in their schools and see the GTP program as a vehicle for raising the profile of science, particularly for girls. Whilst it was the Principal who gave permission for the students to participate in the GTP program, it was the Science Mentor who provided the convincing arguments in terms of benefits to the students and the school for participation to take place. It was the School Mentors who targeted girls who would benefit from participating in the GTP program and facilitated the showcasing of their experiences upon their return with other students, teachers and the wider school community.

Given that the School Mentor is the main driver of the GTP program from the school end, it is important that the program be advertised to such teachers in addition to the Principal. Emails and newsletters directed only to Principals are sometimes not passed onto teachers who might drive the program. Teachers were targeted in terms of providing information about the GTP program through science teacher conferences as well as through the GTP website and social media platforms.
Future directions and sustainability for GTP program

The GTP program funded by the Australian Government through the AMSPP initiative was highly successful and mutually beneficial for all the participants for several reasons, which are highlighted within this report. Sustainability of the program wrests with embedding the administration and delivery of the program within the practices of the main partners, namely the science organisations and the schools.

According to Illingworth and Roop (2015) science outreach is a term that is becoming more commonplace in the parlance of academia. Science organisations deliver outreach and broader impact commitments, often as part of federally funded research projects. Such organisations might centralise the administration of outreach and include the GTP program among a suite of programs that might be run. An issue for the GTP program is that it connects scientists to far less numbers of students than other outreach programs such as scientists who visit schools to provide talks about their research. However, one can readily argue that the student experiences with a GTP program far outweigh listening to a visiting scientist within a school setting. There is no reason why science organisations can’t offer a suite of outreach programs to include those that target many students and schools in a superficial way to those programs that target smaller groups of the students in substantive ways, such as those within the GTP program.

It is also important that the science organisation outreach team provide a third party liaison, a GTP educator, who is familiar with the worlds and cultures of both education and scientific community. This person is also important in working closely with the scientist in creating authentic projects to be undertaken by the students and mentored by the scientists. Within the period of this GTP program Latrobe University and ANSTO provided the administrative support that would be necessary for a sustainable GTP program. In fact ANSTO are running their own GTP program for 2018 and beyond.

For the schools, and science organisations, the GTP program can be delivered as work experience, which all schools and many organisations currently participate. Work experience is often given as a 5-day experience for participating Year 10 and 11 students. A 5-day GTP program was advocated by both students and Science Mentors in interviews.

Another way for schools to incorporate the GTP program into its current practices is to embed it in the school curriculum. For example, one school has created a Physics elective at Year 10 that has the GTP program embedded:

A Physics elective being offered at Year 10 enabling students to work with real scientists and see what possibilities they could have for the future. This has been one of the really good things to come from it. The school has put physics elective semester subject at school with scientists who get involved with GTP like immersion days. The kids really seem to like it and we are hoping to see more kids taking physics next year. [ISM2]

Sustaining the interest in themes that underpin the GTP program has been illustrated through the participation of GTP participants in alumni conferences/events, held during school holidays.

I had a student today who said to me oh there’s a growing tall poppies alumni event happening in December, or sometime over the holiday break, and she said...
I definitely want to go to that, you know they’re connected... they can become part of an ongoing community interested in the ongoing unravellings of their experiences and keep connected with people who are, who have walked part of the journey with them. So I think it’s really important. [ISM1]

The critical aspect highlighted by the GTP program is the need for establishing pathways for science organisations and schools establish the initial partnerships and then getting scientists and teachers to collaboratively design and create a project of mutual benefit to all participants. The GTP program has established a centralised online web presence supported by several social media platforms. Such an online presence needs to be continued for the GTP program to be sustainable. The GTP website not only showcases the successes of the program it provides the ways and means by which all participants can participate. As the online presence is open to the wider community the impetus to participate from the science organisation leadership or school leadership can comes from within the organisations through the scientists, students and teachers.

Sustainability of the GTP program can be facilitated through the open support from national and state educational bodies. Such bodies are currently engaged in reform endeavours such as STEM and inquiry-based approaches to address the growing disinterest in participating in school science and lack participating in science at the higher levels of schooling and beyond. The GTP program addresses both the issues associated with STEM and inquiry-based practices. From this perspective the sustainability of the GTP programs can be enhanced through the national and state educational bodies embedding GTP programs within their mandated curriculum policies. Whilst it might be difficult to convince national and state educational bodies to embed GTP programs within their mandated curriculum policies, the program might at least be showcased as best practice by these organisations.
References


Evaluation of Growing Tall Poppies program


Appendix 1 GTP program online survey

Q1. What is your gender?
   - Female
   - Male

Q2. What year level are you in?
   - Year 9
   - Year 10
   - Year 11
   - Year 12

Q3. Did this event/activities provide you with experience/material that you do not have access to through school?
   - Yes
   - No

Q4. Overall, how would you rate the improvement, through your participation in this program, in your knowledge and/or skill in physics?
   - Excellent
   - Very good
   - Fairly good
   - Mildly good
   - Not good at all

Q5. Overall, how would you rate the improvement, through your participation today, in your confidence in learning physics?
   - Excellent
   - Very good
   - Fairly good
   - Mildly good
   - Not good at all

Q6. Overall, how would you rate your understanding of what scientists are like compared to what you thought previously?
   - Excellent
   - Very good
   - Fairly good
   - Mildly good
   - Not good at all

Q7. Overall, how would you rate the improvement in your understanding of how sciences are interdisciplinary and physics is important to enhance progress in sciences related to human wellbeing (e.g. medical science)?
   - Excellent
   - Very good
   - Fairly good
   - Mildly good
   - Not good at all

Q8. Has the immersion program improved your understanding of careers in the physical sciences?
   - Yes
   - No

Q9. With your new experience here, are you more likely to continue with physics or recommend physics as a subject choice to others?
Evaluation of Growing Tall Poppies program

- More likely
- Not affected

Q10. With your experience from the immersion program do you have an improved identity with physics? (You can see yourself as a scientist like this)
  - Greater identity with physics
  - Not affected
  - Less identity with physics

Q11. With your experience from the immersion program encouraged you to see a greater relevance of your study of physics at school?
  - Greater relevance of physics
  - Not affected
  - Less relevance of physics

Q12. With your experience from the immersion program did you see the way of investigating/inquiring science as different to the way you do it at school?

Q13. With your experience from the immersion program do you have a greater confidence in your ability to do the sciences, especially physics?

Q14. Do you have any other comments, questions, or recommendations for the program?

Q15. Identify one highlight and one challenge in this program.

Q16. What was the most enjoyable part of the immersion experience? You can answer more than one.
## Appendix 2 2015-17 GTP Program Participant Details

<table>
<thead>
<tr>
<th>Schools</th>
<th>Organisations</th>
<th>State</th>
<th>Students</th>
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