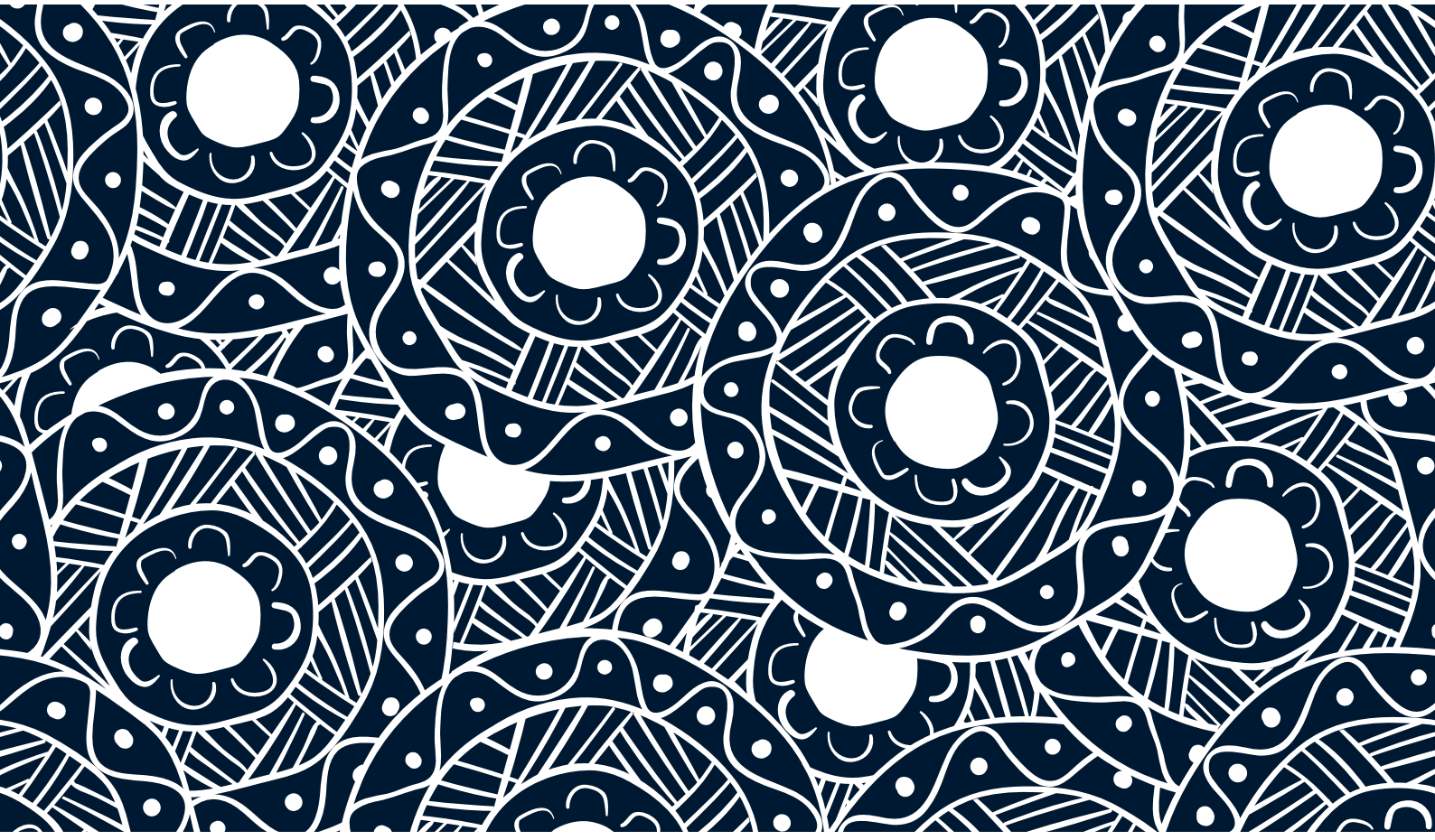
CSIRO

Australia's National
Science Agency

Indigenous STEM Awards

Stories of change

Case study evaluation report



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Acknowledgements

Acknowledgement of Country

Aboriginal and/or Torres Strait Islander peoples have longstanding scientific knowledge traditions. These traditions have developed knowledge about the world through observation, using all the senses; through prediction and hypothesis; through testing (trial and error); and through making generalisations within specific contexts. These scientific methods have been practised and transmitted from one generation to the next and contribute to particular ways of knowing the world that are unique and complementary to western scientific knowledge.

A deep respect for these Aboriginal and/or Torres Strait Islander cultural practices and knowledge underpins the philosophy and practice of the Indigenous STEM Education Project. This respect encompasses the recognition of Aboriginal and Torres Strait Islander contexts for technologies and concepts; their application in the past, present and future, including supporting Science, Technology, Engineering and Mathematics (STEM) career pathways for Aboriginal and/or Torres Strait Islander students; and reaffirming the ingenuity and creativity of Aboriginal and/or Torres Strait Islander peoples' knowledge systems.

The Indigenous STEM Education Project team acknowledges the Traditional Owners of the lands, with whom this project has collaborated, and their vibrant living cultures and knowledge systems. We pay our respects to Elders past and present and thank all community members who provide the leadership to ensure meaningful and effective engagement with Aboriginal and Torres Strait Islander communities for the six distinct but complementary STEM education programs that make up this project.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) acknowledges that Aboriginal and Torres Strait Islander peoples make extraordinary contributions to Australia in cultural, economic and scientific domains; for example, incorporating Indigenous knowledge of ecological and social systems is vital to the achievement of sustainable development.

Other acknowledgements

CSIRO wishes to acknowledge the invaluable contribution of the Aboriginal and Torres Strait Islander scientists, educators, project advisers and program leaders who have shared their knowledge and leadership, without which the development and implementation of the Indigenous STEM Education Project would not have been possible. Fifi Harris and Jordan Salmon have been recognised as co-authors of this report because of their valuable contributions of knowledge and stories. CSIRO also wishes to acknowledge the important contributions of Dr Kaye Price AM and Karlie Noon. Dr Price's commitment to the Indigenous STEM Awards, and her cultural oversight and expert advice were instrumental in the success of the program. Karlie Noon's careful stewardship of the program in its pilot year helped to build a strong foundation to recognise Aboriginal and/or Torres Strait Islander excellence in STEM.

Fifi Harris wishes to recognise the knowledge shared by her Mother and the support provided by her broader family. She also wishes to acknowledge the important role David Broun has had in her Two-way Science journey and particularly his role in highlighting Two-way Science to a broader audience.

Jordan Salmon acknowledges and thanks his family for encouraging him and standing by his side, even during the toughest of times. His community and friends are as much to thank for their continuing support. Specifically, he would like to thank his parents for helping him up when he felt it impossible and Diana Blain, his closest mentor at his school, for providing unending support throughout his secondary schooling life.

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We also acknowledge the contributions of and thank former members of the Indigenous STEM Awards project team, evaluation team, and communications staff who led or supported the program monitoring and evaluation methodologies, data collection and analysis, including Geoff Guymer and Sarah McDonnell.

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List of acronyms

ABC	Australian Broadcasting Corporation
AIEO	Aboriginal and Islander Education Officer
ASSETS	Aboriginal Summer School for Excellence in Technology and Science
CSIRO	Commonwealth Scientific and Industrial Research Organisation
I^2S^2	Inquiry for Indigenous Science Students
STEM	Science, Technology, Engineering and Mathematics

Foreword

The Indigenous STEM Awards Program has not only highlighted the many talented Aboriginal and Torres Strait Islander students in Australian schools, but also schools themselves, participating Community members and supportive, enthusiastic, and dedicated teachers within them.

This Report provides us with an understanding of two journeys, those of Fifi Harris and Jordan Salmon who were recipients of the STEM Champion Award and the Secondary STEM Achievement Award respectively. Participating in the presentation of these and other awards emphasised how important family and community are in the journeys of Aboriginal and Torres Strait Islander people.

Those of us involved in the Indigenous STEM Awards Program have followed the journeys of a number of awardees and finalists and how they have networked and increased their links with others operating in the STEM area.

There are many stories of change within the Indigenous STEM Awards alumni and I have been privileged to work with CSIRO, not only in my capacity on the judging panel, but to connect with awardees and follow their journeys.

Dr Kaye Price AM

PhD (ANU); M.Ed (UniSA); B.Ed (ECU); Dip Teach (UniTas). FACE

Executive summary

The Indigenous STEM Awards Program (Awards Program) sought to recognise, reward and celebrate the achievements of Aboriginal and/or Torres Strait Islander students, educators, and professionals studying and working in the Science, Technology, Engineering and Mathematics (STEM) fields. Awards Program staff worked with Award recipients to co-design each recipient's preferred presentation/celebration ceremony, usually with their local community. For award recipients from remote communities, these events often provided a unique opportunity for national recognition.

Figure 1. Featured Indigenous STEM Award Recipients

Felicity (Fifi) Harris received the STEM Champion Award in 2017

Jordan Salmon received the Aboriginal and Torres Strait Islander Secondary Student STEM Achievement Award in 2018

To understand the impact the Awards Program has had on participants, a short survey was sent to all finalists and award recipients. Responses were received by 16 award recipients, seven finalists and one school award recipient. Semi-structured interviews were also undertaken with two previous award recipients, Felicity (Fifi) Harris and Jordan Salmon, and a small network of people connected to these recipients. By interviewing the recipients and their mentors, family members, teachers, and colleagues, it was possible to develop a broader understanding of the recipients' awards journey and the changes they have experienced as a result of their participation in the Awards Program.

Feedback from participants indicates the Indigenous STEM Awards Program had a large influence on the individuals and the one school involved in this study. The Awards Program was highly valued and contributed to increasing the recognition award recipients felt from their family and communities. For some award recipients, including Fifi and Jordan, the additional recognition had a direct impact on their confidence and motivation levels.

As a result of receiving an award, recipients were exposed to new opportunities (for example, conference presentations, employment, and further study) and many were also able to make new professional and personal connections. The Awards Program also provided the opportunity for participants to receive communication and media training, an opportunity that was highly valued by some participants.

Award recipients also highlighted the impact their recognition and increased confidence had on their families and communities and the acceptance of Aboriginal and Torres Strait Islander knowledges. Following the announcement of their award, educators at one school noticed an increase in interest from students and staff regarding Aboriginal and Torres Strait Islander STEM concepts and ways of working.

The study highlighted some potential areas for improvement, including:

- working with media organisations to ensure all awardees receive publicity and media exposure, and
- liaising with the broader network of finalists to recognise their significant achievements and increase their connections with others working or studying in STEM.

Introduction

The Indigenous STEM Awards program (Awards Program) recognised, rewarded and celebrated the achievements of Aboriginal and/or Torres Strait Islander students and scientists studying and working in the Science, Technology, Engineering and Mathematics (STEM) fields, as well as the integral role schools, teachers and mentors have in supporting Aboriginal and/or Torres Strait Islander students in pursuing STEM education and careers. The Indigenous STEM Awards were developed to identify and showcase Aboriginal and Torres Strait Islander STEM role models, a key strategy to inspire more young people and to demonstrate real pathways to STEM education and careers. Figure 1 provides a snapshot of the nine awards categories. The Awards Program was a part of the broader Indigenous STEM Education Project funded by the BHP Foundation. The Project aimed to increase STEM aspirations among Aboriginal and/or Torres Strait Islander students in STEM subjects and related professions and promote local role models. The Awards Program ran from 2016 to 2020. As highlighted in Figure 2, during this time, it has recognised the achievement of 44 recipients and 120 finalists (this includes four school Award recipients). Finalists and recipients were selected by a selection committee comprising a range of professionals from CSIRO, the BHP Foundation and other related STEM organisations. Auntie Kaye Price served as the Chair of the judging panel and provided cultural oversight, strategic guidance, and advocacy for the Awards Program.

Starting as an initial pilot program in 2016, the Awards Program has developed and evolved. In 2018 and 2019, secondary student recipients were given the opportunity to travel to the United States to participate in the International Science and Engineering Fair (ISEF). The 2019 secondary student Award recipients were the first cohort of recipients to receive monetary prizes to support further studies in place of international travel opportunities. The first annual pre-announcement gathering was held in early 2018 with recipients of the 2017[1] Indigenous STEM Awards (except the student winners not yet in high school). This gathering provided an opportunity for recipients to meet with other Award recipients and work with Awards Program staff to co-design each recipient's preferred presentation/celebration ceremony, usually with their local community. See Appendix A for a list of presentation/celebration locations. For Award recipients from remote communities, these events often provided a unique opportunity for national recognition.

Recipients were also provided with personal development opportunities, including media and communications training, and for student winners, ongoing mentoring.

The COVID-19 pandemic forced the Awards Program team to adjust their schedule of planned events for 2020. The program was able to hold a planned in-person pre-announcement gathering with Award recipients in February 2020. In mid-March 2020, some presentations were moved to an online platform. Online events typically included a virtual panel with key Aboriginal and/or Torres Strait Islander STEM professionals and were web cast to those unable to attend. A key component of the Awards Program has been the ability to celebrate and recognise Award recipients in their communities. The shift online therefore represented a significant change for program staff and participants. It also provided an opportunity for program staff to become familiar with new streaming technologies and to look at new and innovative ways to bring people together in virtual spaces to celebrate the achievements of Aboriginal and/or Torres Strait Islander peoples in STEM. The Awards Program was able to hold some blended online and in-person celebrations in late 2020.

Figure 2. Indigenous STEM Awards Categories

- Aboriginal and Torres Strait Islander STEM Professional Award
- Aboriginal and Torres Strait Islander STEM Professional Early Career Award
- School Award
- STEM Champion Award
- Teacher Award
- Aboriginal and Torres Strait Islander Tertiary Student STEM Achievement Award
- The Aboriginal and Torres Strait Islander Secondary Student STEM Achievement Award
- Aboriginal and Torres Strait Islander Student Maths Award
- Aboriginal and Torres Strait Islander Student Science Award

1 Award ceremonies take place the next calendar year, for example, the 2017 Indigenous STEM Award ceremonies took place in 2018.

CSIRO is currently exploring options to recognise Aboriginal and/or Torres Strait Islander STEM achievement within a new, national STEM awards initiative.

Expected outcomes

The Awards Program, similar to the other programs within the Indigenous STEM Education Project, had its own Impact Statement. These statements describe the pathways by which each program was intending to effect change. They were based on CSIRO's Impact Model, which describes the logic and assumptions of each program and articulates expected outputs, outcomes, and longer-term population-level impacts.

The Impact Statement for the Indigenous STEM Awards was updated in 2021 to reflect the evolution of the program. During this revision, a number of additional outcomes were identified by program staff and stakeholders. As highlighted in Appendix B, the Awards Program was working towards the achievement of a number of short-term, intermediate, and longer-term outcomes, including:

Short-term

- Indigenous STEM achievement and best practice in STEM teaching showcased and promoted
- Network of high-achieving Aboriginal and/or Torres Strait Islander peoples pursuing STEM education or careers

Intermediate

- Active, engaged, skilled and growing awards Alumni network
- Participants engaged with other CSIRO STEM programs

Longer-term

- Increasing number and involvement of champions who are mentoring Indigenous STEM students
- Increased recognition and championing of the role of family, community, and mentors to success in STEM
- Raising student aspirations to pursue science education and careers
- Increased awareness and uptake of science inquiry pedagogy

At its core, the Awards Program sought to celebrate Aboriginal and/or Torres Strait Islander achievement in STEM, promote role models and support recipients in their STEM journeys. In an environment where Aboriginal and/or Torres Strait Island students often have to operate within a deficit-driven, western education model (Sarra et al., 2020), the Awards Program worked to change the narrative – to celebrate Aboriginal and Torres Strait Islander cultures, knowledges, and excellence with the recipient's local community. In some prominent cases, it was able to do so with remote communities that are often unable to attend capital city gatherings.

Figure 3. Indigenous STEM Awards Participation Numbers

Purpose of this report

As one of the smaller programs within the Indigenous STEM Education Project, the Awards Program was not prioritised for a detailed evaluation. Accordingly, data has not been collected against all the key outcomes listed in the Awards Program Impact Statement. In early 2021, a short online survey was sent to Award recipients and finalists; interviews were also held with two Award winners and three members of their immediate network. The purpose of this report is to present the survey findings and highlight the stories of the two featured Award recipients. These 'Stories of change' represent the unique trajectories of Fifi and Jordan. While all participants in the Awards Program had their own unique experience, combining Fifi and Jordan's stories with survey results and program staff feedback makes it possible to identify common themes and garner a broader picture of the impact the Awards Program has had on participants.

The next section discusses the data collection methodology; this is followed by a brief introduction of the two featured Award recipients. The stories of these two Award recipients are combined with data from surveys in the section that follows to highlight the key themes that emerged regarding the impact of the Awards Program. Throughout this section, the voices and stories of Award recipients are given prominence, showcasing these stories, highlighting the changes that the Awards Program has brought about and hearing directly from participants, which are key goals of this report. The report concludes with a short summary of the findings.

Methodology

Two different data collection methods were used to suit the purposes of the case study evaluation:

1. **Online surveys:** Online surveys were selected as a methodology to efficiently reach all Award winners and finalists, and to elicit consistent perceptions that could be analysed and generalised. Surveys were sent to all Award recipients and Award finalists to further understand the impact of the Awards Program on those involved. The surveys sent to recipients asked more detailed questions about the types of changes the recipients may have experienced following their Award. In total, 16 individual Award recipients and seven individual finalists completed the survey. One-third of individual survey respondents received or were finalists for a STEM Professional Award and 39 per cent of survey respondents received or were nominated for a Student Award. Other respondents were STEM Champions or teachers. Of the survey respondents, 61 per cent identified as male while 39 per cent identified as female. Educators from one school that received the Indigenous STEM Awards School Award also completed the survey after receiving jurisdictional approval to participate.

2. **Case studies:** To understand the impact of the Awards Program on recipients in more detail and to privilege the voices of winners, two individual case studies were undertaken. These case studies involved semi-structured interviews with Award recipients and a small network of people connected to the recipients. Two Award recipients were invited to participate based on obtaining a spread of geography (different states/territories, urban and remote), age, gender, and award categories. In addition, the Award recipients were selected from the 2017 and 2018 rounds to obtain perspectives on several years of being an Award winner. Snowball sampling was used to identify those interviewed based on recommendations from the Award recipient. Thematic content analysis was used to analyse the interview data. The thematic content analysis consisted of identifying common themes and patterns across all the data to reveal the overall supporting factors, challenges, and impact of the Awards Program. By interviewing the recipients and their mentors, family members, teachers and/or colleagues, it was possible to develop a broader understanding of the recipients' awards journey and the changes they have experienced as a result of their participation in the Awards Program. A few quotes from these interviews have been edited slightly to clarify meanings; these changes have been endorsed by the participants.

All evaluation activities were approved by CSIRO's Social and Interdisciplinary Science Human Research Ethics Committee in accordance with the National Statement on Ethical Conduct in Human Research 2007 (updated 2018). All participants (including parents/guardians for those under 18) were provided with participant information sheets and gave their free, prior, and informed consent to participate. The two Award recipients identified in this report are also co-authors and have provided their consent to have their stories and images included in this report.

Meet the featured award winners

Fifi Harris

Felicity (Fifi) Harris is a Wangkatja woman from Leonora, Western Australia and received the 2017 STEM Champion Award as part of the Indigenous STEM Awards. She is a Wangkatja Language Teacher at Leonora District High School in the Goldfields region of Western Australia where she has worked for 28 years. Her main role at the school is supporting Two-way Science[2] learning activities. Fifi is also the Language Co-ordinator for the Goldfields area. She has been a strong supporter of the Science Pathways for Indigenous Communities Program and an advocate for Two-way science. Fifi is passionate about the sharing and intergenerational transfer of Indigenous knowledges and provides leadership across the Goldfields Region to integrate students' local language and culture alongside Western science into school plans, teaching practice and regular community events.

Fifi's Award was presented to her during a celebration with the local community at Leonora District High School. The celebration was attended by Auntie Kaye Price and senior representatives from the Western Australia Education Department and CSIRO.

Two of Fifi's personal and professional connections also helped share her story for this report.

Jordan Salmon

Jordan Salmon is a proud member of the Wiradjuri nation and received the Aboriginal and Torres Strait Islander Secondary Student STEM Achievement Award in 2018. He was an accelerated student and House Leader at Clancy Catholic College in South-Western Sydney and, at the time of this report, is in his second year of a Software Engineering degree at the University of Technology Sydney. Jordan is also a Research Technician with CSIRO's Data61. He is passionate about electronics, technology, and computer science. While at high school, he developed a method of automatically reading number plates in accessible parking spaces and comparing them to a database of permit holders using open-source software, custom Python and scripting software with image conversion, database, and email integration. He also developed and constructed a 'B-Pad' to teach stage-one children problem-solving and a robotic system that moves blocks for teaching them mathematics. Jordan would like to become a software engineer.

Jordan received his Award from Auntie Kaye at a whole-of-school ceremony in 2019. Also in attendance were local Indigenous leaders, parliamentary representatives and former teachers, as well as executives from the Catholic education system.

Two of Jordan's personal and school-based connections also helped share his story for this report.

2 Two-way Science learning program connects Indigenous ecological knowledge with Western science and the Australian Curriculum. The program is built around on-Country projects developed through strong community partnerships with Elders and, where they exist, Indigenous ranger groups, scientists, and land management organisations.

Impact of the Awards Program

Feedback from surveys and interviews highlighted a number of key avenues through which the Awards Program has impacted the lives of participants. The key themes identified were: 1) increased recognition, 2) exposure to opportunities and 3) connections to family, culture and other Aboriginal and/or Torres Strait Islander peoples interested in STEM. This section of the report will discuss these themes in turn and will also showcase how these themes emerge in the stories of two Award recipients, Fifi Harris and Jordan Salmon.

This *Stories of change* report is unique among the case study evaluations undertaken for the Indigenous STEM Education Project due to the prominent focus on participants' experiences rather than a purely evaluative approach. However, the themes that were identified did relate strongly to the intended outcomes of the Awards Program, specifically:

Increased recognition:

- Indigenous STEM achievement and best practice in STEM teaching showcased and promoted
- Increased recognition and championing of the role of family, community, and mentors to success in STEM

Exposure to opportunities:

- Participants engaged with other CSIRO STEM programs
- Raising student aspirations to pursue science education and careers

Connections to family, culture and other Aboriginal and/or Torres Strait Islander peoples interested in STEM:

- Network of high-achieving Aboriginal and/or Torres Strait Islander peoples pursuing STEM education or careers
- Active, engaged, skilled and growing Awards Alumni network

Recognition

Fifi's story

Fifi's Indigenous STEM Awards journey is a story of recognition for a lifetime of dedication to sharing Aboriginal knowledges, languages and culture and recognition of her role in promoting two-way science. The Awards Program was able to highlight the work Fifi had been doing in Leonora, Western Australia to integrate Aboriginal knowledges into the Australian curriculum. Both Fifi and those who know her well indicated that the national recognition from the Award provided a sense of validity for her work and for Aboriginal and Torres Strait Islander knowledges. As Fifi explained:

CSIRO's a big name. To be recognised by CSIRO, you know you're going to be put somewhere so that people are going to see it... what we know, and what we do, it's acceptable... it's okay to share it. It's okay to promote it. And it's good. It's real, it's worthwhile.

As a member of Fifi's family highlighted, the Awards Program also contributed to increasing Fifi's confidence and helped her become more comfortable sharing her expertise and creating an even bigger impact.

[The Awards Program] *has shown that what she knows is valid. It's important. It's not just important in a cultural context it's important in a Western context. All of that sort of thing that adds credibility, adds validity, adds acknowledgment. It adds all of that sort of stuff, which has only amplified her confidence... From 2017 to now, you can see that all of a sudden, she's been recognised and not just by people in the community, but people in Australia, and I think that's given her a lot of confidence. That's given her a voice. She's always had a voice. It's a voice that has been given credibility... Her confidence is now creating an even bigger impact.*

This was a sentiment echoed by Fifi:

Since that Award, and the Two-Way science program, it's a validation. You actually know something. It does connect to western science or everything else in the school system. Everyone's been talking about doing what we've been doing. But you know, now that someone's given it a name or a label and you've won an award for it, it is something.

If CSIRO hadn't had done that, we wouldn't have been recognised, nothing that we do out here would have been recognised. It wouldn't be promoting Aboriginal knowledge, or looking after country, or our schools, or all the good things that we actually do. It wouldn't be promoting that, and it wouldn't be making Aboriginal people feel any better out here.

Fifi's colleague highlighted the impact of the Award presentation ceremony held in Leonora:

All those people that had come a long way to see her and to recognise her. I think that sent a really powerful message too. I think the award [presentation] *actually going to Leonora made a really big difference to the impact... I guess because her community saw all of that as well and then there were media and there was interviews and it was a really special day.*

Jordan's story

Jordan's Indigenous STEM Award journey centres around the recognition of his ability to use technology to improve the lives of others. Through a number of innovative technology projects developed during his time at Clancy Catholic College in Sydney, Jordan has consistently demonstrated a concern for others and a desire to improve the human condition. A member of Jordan's family and one of his former teachers both highlighted how the recognition provided by the Award helped to boost his confidence and his ability to tell his story to others in many different situations.

As Jordan's former teacher explained:

[Jordan] *always started looking for how he could improve the wellbeing of people. So whatever he was going to work on, it would result in better standards of living, better access to facilities.*

Talking about how receiving the Award felt, Jordan explained:

It really felt like I was finally recognised for who I am and what I've achieved.

Jordan's teacher shared similar thoughts about the impact of the recognition:

He's a student who has excellence in this particular area… So, I think for students who are possibly not skilled in the sports area, where often there's recognition and celebration in schools, here's another area for students – giving them another door to be celebrated and be acknowledged.

Jordan's Award was presented at a whole-of-school ceremony; as a member of Jordan's family explained, this marked a substantial change in the level of recognition Jordan received at his school:

[Jordan] *kind of sits in the background does a whole bunch of things, was involved in most programs in the school, but pretty invisible and I think as the visibility of this came up, he was in the limelight for a long, long time while he was promoting all of the BHP Foundation and the STEM learnings… I think there have been some very positive impacts that have come on a personal level.*

Referring to Jordan's role in the Award presentation and how he shared the recognition with those that had been part of his journey, his family member commented:

[He was] *very visible because the whole school, it is a very large school was around 1,200 students. So, to be able to stand on the stage for quite a long time to be able to paint his journey, to paint the Awards and then to have those high-ranking people on there too, you could see how tall and how proud he was standing. And as that recognition came from all directions, he was somewhat humble in the words that he chose and the words that he chose were to basically to thank and recognise all those people have been a part of it, including those people who were there.*

Fifi and Jordan were not the only Award recipients to highlight the feeling of recognition that the Awards Program generated. Recognition of individual efforts in STEM was a clear theme that emerged from the survey.

When asked to identify the best parts of being an Indigenous STEM Awards recipient, responses from individual award recipients included:

Being recognised that what I do does make a difference and is important.

Having my advocacy and volunteer work recognised as well as my scientific achievements.

My award presentation was one of the best days of my life. I had it at [name of higher education institution]*, and to see the level of effort they and CSIRO went to celebrate my achievements was just so heart-warming. I was able to share the day with my friends, mentors, colleagues and CSIRO staff and it made me feel so appreciated. I loved the fact that my presentation was tailored to me, and I hope that every other award winner had the same experience.*

A school Award recipient echoed the comments of individual recipients:

Recognition that the STEM opportunities we provide are exceptional and we need to continue with them, share with others and involve more students.

Like Fifi, other Award recipients highlighted the impact the increased recognition had on their motivation and confidence levels.

The recognition served as great motivation to continue my efforts. Meeting and engaging with other awards winners provided me with confidence and new ideas.

It has left me with an ongoing desire to seek better outcomes for Indigenous students.

94 per cent of individual respondents **agreed** or **strongly agreed** that receiving an Indigenous STEM Award contributed to the recognition of their achievements and abilities in STEM by their community.

100 per cent of individual respondents **agreed** or **strongly agreed** that receiving an Indigenous STEM Award contributed to recognition from family and friends.

Figure 4 provides a short summary of the online event that was held to recognise the achievements of Alana Dooley, the 2019 Aboriginal and Torres Strait Islander Secondary Student STEM Achievement Award recipient. It is just one example of the many unique celebrations that occurred with Award recipients.

Figure 4. June 2020 online Award presentation and panel

In June 2020, the Indigenous STEM Awards Program convened a virtual Indigenous Astronomy Panel to present the Secondary Student STEM Achievement Award to Alana Dooley, a Nunga woman from Warwick Senior High School in Western Australia. This event was a partnership between CSIRO The Perth Observatory and the International Centre for Radio Astrology Research. The presentation was broadcast from Perth and commenced with a Welcome to Country from Noongar Elders Vivienne and Morton Hansen at the Worl Wangkiny Centre: Perth Observatory; 144 people joined from across Australia and internationally. Participants heard from a panel including Alana Dooley, Dr Stacy Mader (Astrophysicist and Senior Experimental Scientist for CSIRO Astronomy and Space Science) and Kirsten Banks (Astrophysicist and Science Communicator).

The panel recognised Alana's ongoing commitment to, and interest in, astronomy and touched on a number of key topics, including the importance of Aboriginal and/or Torres Strait Islander role models in STEM and of connecting to Country, and encouraged the next generation of STEM students to take advantage of STEM opportunities.

While some Award recipients received media coverage and highlighted this visibility as important to further promoting their work and the importance of STEM for Aboriginal and/or Torres Strait Islander students, others suggested that more could be done by CSIRO to liaise with the media and promote individual STEM achievements. These comments highlight the differences in the level of media exposure received by some Award recipients. Figure 5 lists some of the media organisations and/or websites that have published stories highlighting the work of Award recipients. Social media data from 2019 indicates the #IndigenousSTEMAwards received 200 tweets and 1,125,456 timeline deliveries on one platform and on another it received 31,354 reactions and 1,492 comments.

Celebrating and the extra media publicity which provided the opportunity to share the success of the I^2S^2 program and the amazing science work that the First Nation's People conducted.

The biggest impact would be the visibility that I have gotten from it. Winning the award really propelled me into the spotlight and I believe I have been able to make the most of it by advocating for better STEM engagement to young Indigenous students in rural and remote schools, and to share my story.

Figure 5. List of media organisations that have published stories on Award recipients

Particle.scitech.org.au	CAAMA radio
The ABC	The Guardian
SBS World News	The Australian
IndigenousX	Koori Mail
National Indigenous Times	Cosmos
The Wire radio	Women Love Tech
National Indigenous Television	Local news print and web articles

Opportunities

Jordan's story

As a high-achieving student, Jordan was already on a path to success. His former teacher described him as the type of student that was always keen to pursue opportunities in STEM. The Awards Program was able to support his STEM journey by providing new connections and additional training and exposing him to new opportunities. Jordan has been involved in numerous initiatives connected to the Awards Program, including the two-day pre-announcement workshop and professional development session with other Award recipients at the Powerhouse Museum and a cadetship at CSIRO; as part of his Award, he also travelled to in Arizona, USA to participate in ISEF and meet STEM experts at Arizona State University. Through these opportunities, he's been able to connect with like-minded people and develop strong relationships. As Jordan reflected:

I think one of the greatest bits that I've actually been a part of was when we went as a group to do the training for the media and a number of things like that at the Powerhouse Museum. Being able to hear everyone's stories… Then when I started hearing about what everyone else was doing, I was actually amazed by the amount of great STEM work that Indigenous people were making and a number of those people I've still got contact with. There's this one guy who's doing his PhD at the university I'm going to, and he's introduced me to the Indigenous unit in there and a number of important people at the university.

Both of Jordan's connections spoke about a noticeable change in Jordan's ability to communicate following his participation in the Awards Program training opportunities.

During that two-day session it was teaching him how to communicate with the community, newspapers, all those sorts of things. And I think the way in which he took that on board and embraced it, gave him a lot more knowledge and skills around those sorts of areas because he became much better at expressing himself.

He did the training of how to speak to media and how to present your ideas and this evolved into his presentation, how he held himself, his eye contact, his voice projection. There was a real strong presence… and I saw a real evolution in him, because when he went up on the assembly [during the Award presentation], at the very end-when he spoke up there, he was a real guest speaker.

One of Jordan's family members spoke about the opportunities he has had to talk to different groups of people.

He has been given lots of opportunity because of [the Awards Program] *to go and express his journey and in lots of different ways. So, for example, even before he left school, he was invited to attend a big conference for all of the Catholic schools when we had about 60 principals and 2ICs… And he was able to describe his journey through primary, through secondary, through STEM through the* [BHP] *Foundation.*

Fifi's story

Like Jordan, receiving an Indigenous STEM Award marked an important moment in Fifi's career. The recognition and confidence helped her to tell the story of two-way science to a broader audience. Following the Award, Fifi was also employed by CSIRO and worked with AIEOs and educators from across the Western Australia Goldfields area to help them integrate Aboriginal knowledges into the curriculum. Fifi has also had the opportunity to present at conferences in Adelaide, Darwin, and Perth. As Fifi explained:

What's happened since I have won that award… I've had a lot more people ringing and asking and talking. Going to conferences in Perth with the education department, talking to this person, this person, making connections with everyone.

That was one thing, but the other thing for me was getting the opportunity to go and see different places, to the different conferences… Speaking in front of however many hundreds of people, on a panel presenting to people.

I don't know if you realise how much it actually has had a big impact on my life, my family's life, plus the schools around, because everyone wants to know. Everyone wants to be part of it.

Her colleague described the impact that her presentations have had.

She's a real advocate for this [two-way science] and at the end of the conference, everyone sat around in a circle and said, you know, what's your next big step? And this is 30 Aboriginal language teachers there, and half of them said two-way science. That's the kind of impact that she has as an advocate.

Many Award recipients responding to the survey also indicated that the Awards Program provided them with additional opportunities and connections. When asked to list specific opportunities, these recipients mentioned further tertiary education, job offers, conference presentations and additional project funding.

82 per cent of individual respondents **strongly agreed** that they had made new contacts as a result of receiving an Indigenous STEM Award.

I got to meet a variety of amazing people from all [over] *the world. I met young minds doing brilliant things to help the world become a more advanced and better place.*

The program has expanded my personal and professional network faster and further, allowing me to realise opportunities for growth.

[The Award] *helped me go on to win other awards and helped me with gaining new contacts.*

100 per cent of individual respondents **agreed** or **strongly agreed** that receiving an Indigenous STEM Award helped them secure education/ work opportunities.

One school Award recipient highlighted how the Award created new links at their school

It created a stronger connection between STEM and Indigenous opportunities. More staff became involved in Indigenous STEM activities.

Some recipients highlighted the ongoing nature of the connections. While an Award is given at a point in time, the connections that recipients developed were often long-lasting.

The best part of being an awards recipient is all the connections that I am able to make. I was able to connect with the other winners at the winners gathering (a number of which I now have ongoing relationships with), the connections I made at my presentation, and the connections that I can continue to make now even three years on. I am still recognised as an Award winner, and this gives me more opportunity to network with people who I can lean on to help me with my career, navigate the industry, my journey to reconcile Australia etc.

One of the characteristics of the Awards Program is that participants are also engaged in other CSIRO STEM programs. As highlighted in Figure 4, survey data collected from Award recipients and finalists highlighted that participants have been extensively involved in the Indigenous STEM Education Project and have also connected with other CSIRO STEM initiatives. This interconnectedness was often driven by Indigenous STEM Education Project staff, across all programs, who worked to ensure participants had access to as many opportunities as possible.

As expected, data on the connections and opportunities made by Award finalists was not as strong, with 33 per cent of respondents agreeing or strongly agreeing that being selected as a finalist had helped them secure education/work opportunities and 17 per cent of respondents agreeing that they had made new contacts. These results are not surprising given the Awards Program focused its resources and efforts on celebrating and promoting Award recipients. Any benefits realised by finalists were therefore incidental to the main Awards Program. Nevertheless, it highlights a potential opportunity for future awards programs to engage further with the broader network of finalists.

Figure 6. List of CSIRO initiatives survey respondents have been involved with

Indigenous STEM Education Project initiatives

- Aboriginal Summer School for Excellence in Science and Technology (ASSETS)
- ASSETS Work Placement Program
- Bachelor of Science (Extended)
- Inquiry for Indigenous Science Students Program (I^2S^2)
- Science Pathways for Indigenous Communities

Other CSIRO STEM Initiatives

- BHP Foundation Science and Engineering Awards
- Creativity in Research, Engineering, Science and Technology (CREST)
- STEM Professionals in Schools
- Sustainable Futures
- Young Indigenous Women's STEM Academy

Connections to family, culture and other Aboriginal and/or Torres Strait Islander peoples interested in STEM

Fifi's story

Fifi and those that know her well all spoke about the intergenerational impact of the Awards Program on Fifi's family and community. Fifi specifically highlighted how the validation and recognition she received flowed through to her own mother and encouraged her mother to share more of her linguistic and cultural knowledge. Likewise, her children have also grown in confidence and have been able to step into important cultural roles as advocates for two-way science and promoting cultural connections with local mining organisations.

I suppose it's made it that it's ok… it's okay to share everything. It's good to share everything. Don't hide it at all, be proud of it… You know, we don't want to talk about that history and I'm thinking If we don't talk about that history how are people going to know?

As Fifi's family member explained:

More recently with Fifi, doing all of this stuff, she's asking a lot of questions and at first, [Fifi's mother] *didn't want to answer a lot of it about different places and stories about those places, or what is the language like, I'll want to say this in Wangkatja or Tjupan, what is that? But definitely more of late she's been right on board with sharing that knowledge more.*

Fifi's colleague spoke about the broader impact within the community, and implied how the awards contributed to reconciliation and the interruption of intergenerational trauma:

People take cultural knowledge for granted, we've come from this massive, long history of assimilation and this awful history where language and culture were things that were stopped deliberately, and, then to suddenly have that be the focus of celebration, I think it's a really powerful statement and I think for Fifi and Wiluna and Boyden,[3] and all those people out in remote communities who have this long experience, awful experience, history, to see that then completely reframed as a celebration of cultural knowledge and Aboriginal science and STEM and the people who were working with it, was enormous. It wasn't in the city, all those things are just really powerful.

Jordan's story

Through Jordan's awards journey, he has been able to make international connections with Indigenous groups in Arizona, connect with local high-achieving Aboriginal and/or Torres Strait Islanders in STEM and change how Aboriginal and/or Torres Strait Islander students were acknowledged in his school.

As part of Jordan's trip to Arizona for ISEF, he connected with the Office of American Indian Initiatives and was able to spend time with representatives and students from a local Navajo group. Jordan's former teacher and a family member both highlighted how powerful these interactions were for Jordan, and how the sharing of stories, particularly stories of colonisation, helped created bonds between Jordan and the groups he was meeting with. As Jordan explained:

That realisation that we're not alone in what we've experienced. But yeah just talking to them, it was just great to connect with other Indigenous people outside of Australia.

Before [the Award presentation] *they* [Jordan's school] *only had an Australian flag, and I wrote a letter to the school saying you've got a number of Indigenous representatives, why don't we get the other two [Aboriginal and Torres Strait Islander flags] as well? So they did, they actually got them and they stood on the side of the stage for that presentation and they haven't moved since.*

While Jordan's former teacher recognised that he's always been engaged with Indigenous activities at school, the further recognition of Jordan through the Awards Program had an impact on younger Aboriginal and/or Torres Strait Islander students at the school.

He was very active in working with the younger Indigenous students here at school that were very shy – and in some cases, they were not willing to be recognised as Indigenous – in seeing Jordan being so valued, gave a very, very powerful modelling and a really great message.

3 Leonora student Boyden George received the Indigenous STEM Student Award in 2017.

Similar to Fifi and Jordan's connections to family and culture, survey respondents also made connections between the increased recognition and confidence they felt as a result of receiving an Indigenous STEM Award and the impact that had on their communities and the acceptance of Aboriginal and Torres Strait Islander knowledges.

Confidence, recognition, and validation. The awards highlights and promotes just how integral local, everyday Indigenous peoples are to lifelong learning and community, that [individual] backgrounds are not barriers to being a valued voice and engaging with and being role models within community. It draws the line between the knowledge that Indigenous peoples have always had and 'accepted' modern, western science thereby shining a spotlight on the good that is being done that otherwise would not have been seen or heard of. These are people that we know.

That confidence in my own self has now allowed me to find my voice in advocating for STEM, culture, and language to a much wider and diverse audience than I'd ever thought before. Not only to a wider audience but also my family. It has opened a path to healing for older family members and actively brought younger family back to culture, something [to] *be proud of and proud to share.*

Individual Award recipients responding to the survey also highlighted an increased sense of connection to other Aboriginal and/or Torres Strait Islander peoples working in or interested in STEM.

92 per cent of individual respondents **agreed** or **strongly agreed** that after receiving an Award they felt a stronger connection to a community of Aboriginal and/or Torres Strait Islander peoples working in or interested in STEM.

Similar impacts were felt by a school Award recipient:

[As a result of the Awards Program] *STEM has a higher profile with the Indigenous students. More students are recognising the importance of STEM. The general student and staff population of our school are keener to learn Indigenous STEM concepts and ways of working.*

Conclusion and recommendations

The Awards Program worked to build a network of high-achieving students, teachers, and professionals able to further promote Aboriginal and/or Torres Strait Islander achievement in STEM. It was a unique program that looked beyond simply awarding professional and/or academic achievement and sought to celebrate and recognise individuals, in a manner of their choosing, and support them along their STEM journeys. Feedback collected from individual and school Award recipients and finalists, alongside the stories of Award recipients, Fifi Harris and Jordan Salmon, helped paint a picture of how the Awards Program has impacted individual participants involved in this study. By increasing recognition, opening doors to further opportunities, and helping individuals and schools connect with and celebrate Aboriginal and/or Torres Strait Islander knowledges, the Awards Program has supported individuals and schools to achieve their STEM aspirations. Fifi and Jordan's stories, while very different, also highlighted the power of recognising Aboriginal and/or Torres Strait Islander excellence in STEM, and promoting and celebrating that with the broader community. There were also indications that the program contributed to broader reconciliation and healing through celebration, recognition, and placing value. These findings are connected to the intended outcomes of the Awards Program and emphasise that the Program has had a large influence on the Award recipients who participated in this study.

Recommendations

1. The Indigenous STEM Awards involves publicly announcing finalists for each category, and subsequently announcing the award recipients. It is recommended that more support and publicity be provided to finalists (if this is not feasible, it is recommended to not announce finalists). Some finalists felt personally honoured by the achievement, but the program did not have the resources to substantially advance finalists' profiles, which may have led to mis-matched expectations.
2. Maintain the community-focused, recipient-driven award ceremonies as part of future iterations of the program, as community events are a unique and beneficial place-based aspect of the program that reaches the whole-of-community level. Similarly, tailoring the celebration events to suit the different aspirations of recipients (e.g., to showcase their work, to highlight the people that helped them, to highlight something important to them, or to gain experience in public speaking) should be continued.
3. Continue to work with each Award recipient to develop individualised, tangible plans for Award recipients to achieve their STEM goals. These plans are specific and actionable and provide shared understanding between winners and CSIRO on supported pathways for further STEM-related professional/academic development opportunities.
4. Further strengthen communications partnerships with Indigenous organisations (e.g., Indigenous X, Stronger Smarter Institute) to target messages and information to Aboriginal and Torres Strait Islander young people and community members.
5. Consider an alumni mentoring model for future iterations of the program. This model could involve cohorts of recipients providing mentorship, advice, and guidance to subsequent cohorts of recipients, thereby increasing connections and networks, and the transfer of knowledge among recipients. Further, recipient cohorts involving both students and STEM professionals should be maintained, as this led to further opportunities and collaborations for the young people involved.

References

Sarra, C., Spillman, D., Jackson, C., Davis, J., & Bray, J. (2020). High-expectations relationships: A foundation for enacting high expectations in all Australian schools. *The Australian Journal of Indigenous Education*, 49(1), 32–45.

Appendix A: Presentation/ celebration locations

2016 Award Recipient Celebrations (held in 2017)

Local celebrations held at:

- Brisbane QLD
- Gordonvale QLD
- Hobart TAS
- Maryborough QLD
- Port Hedland WA

2017 Award Recipient Celebrations (held in 2018)

Local celebrations held at:

- Ballarat VIC
- Caboolture QLD
- Canberra ACT
- Gunnedah NSW
- Innisfail QLD
- Leonora WA
- Perth WA
- Townsville QLD
- Wiluna WA

2018 Award Recipient Celebrations (held in 2019)

Local celebrations held at:

- Adelaide SA (two events)
- Areyonga NT
- Brisbane QLD
- Bunbury WA
- Byron Bay NSW
- Galiwin'ku NT
- Herberton QLD
- Innisfail QLD
- Sydney NSW
- West Hoxton NSW

2019 Award Recipient Celebrations (held in 2020)

Local celebrations held at:

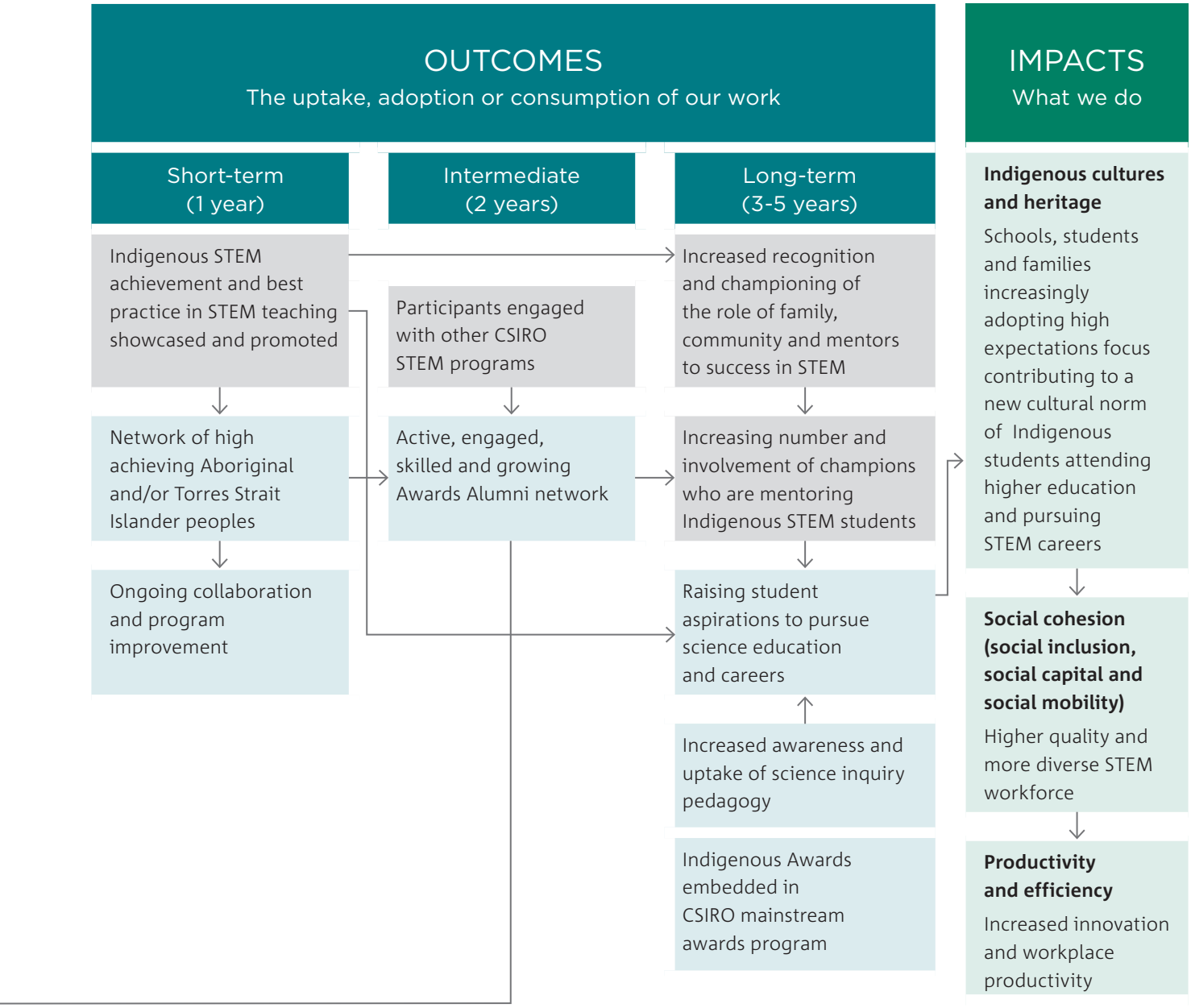
- Darwin NT
- Townsville QLD

Other events moved to online. Later in the year blended – in person and webcast.

Appendix B: Indigenous STEM Awards impact statement

INPUTS What we invest	ACTIVITIES What we do	OUPUTS Our deliverables
$1.97m	Development of award categories	Applications from schools, students, STEM professionals
Stakeholder engagement (e.g. BHP Foundation, Origin)	Development of prizes	Pre-announcement planning, mentoring and team building workshop with winners
Aboriginal and/or Torres Strait Islander community leaders	Facilitation of award application process	Meaningful community based celebration and presentation for each winner
CSIRO project team and subject area/location-based professionals	Development of judging panel and assessment criteria	Individualised support to develop award winners to engage in leadership and advocacy at a level they're comfortable with
Cultural competence, knowledge and understanding	Development of communications plan for nationally promoted awards process	Online winner/finalist profiles and historical database of winners/ finalists
Relationships with schools, community, Indigenous organisations and partners, etc]	Ongoing liaison and development of alumni network	
Comms and marketing expertise	Networking and ongoing liaison with schools, community, judging panel	
Monitoring and evaluation expertise		

Alumni skills, mentoring and cultural guidance reinvested to further shape the Indigenous STEM Awards Program


OUTCOMES
The uptake, adoption or consumption of our work
IMPACTS
What we do
Short-term (1 year)
Intermediate (2 years)
Long-term (3-5 years)
Indigenous STEM achievement and best practice in STEM teaching showcased and promoted
Participants engaged with other CSIRO STEM programs
Increased recognition and championing of the role of family, community and mentors to success in STEM
Network of high achieving Aboriginal and/or Torres Strait Islander peoples
Active, engaged, skilled and growing Awards Alumni network
Increasing number and involvement of champions who are mentoring Indigenous STEM students
Ongoing collaboration and program improvement
Raising student aspirations to pursue science education and careers
Increased awareness and uptake of science inquiry pedagogy
Indigenous Awards embedded in CSIRO mainstream awards program
Indigenous cultures and heritage
Schools, students and families increasingly adopting high expectations focus contributing to a new cultural norm of Indigenous students attending higher education and pursuing STEM careers
Social cohesion (social inclusion, social capital and social mobility)
Higher quality and more diverse STEM workforce
Productivity and efficiency
Increased innovation and workplace productivity

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