



Australia's National
Science Agency

Indigenous STEM Education Project

Aboriginal Summer School for Excellence in Technology and Science

Destination interviews data report

November 2020

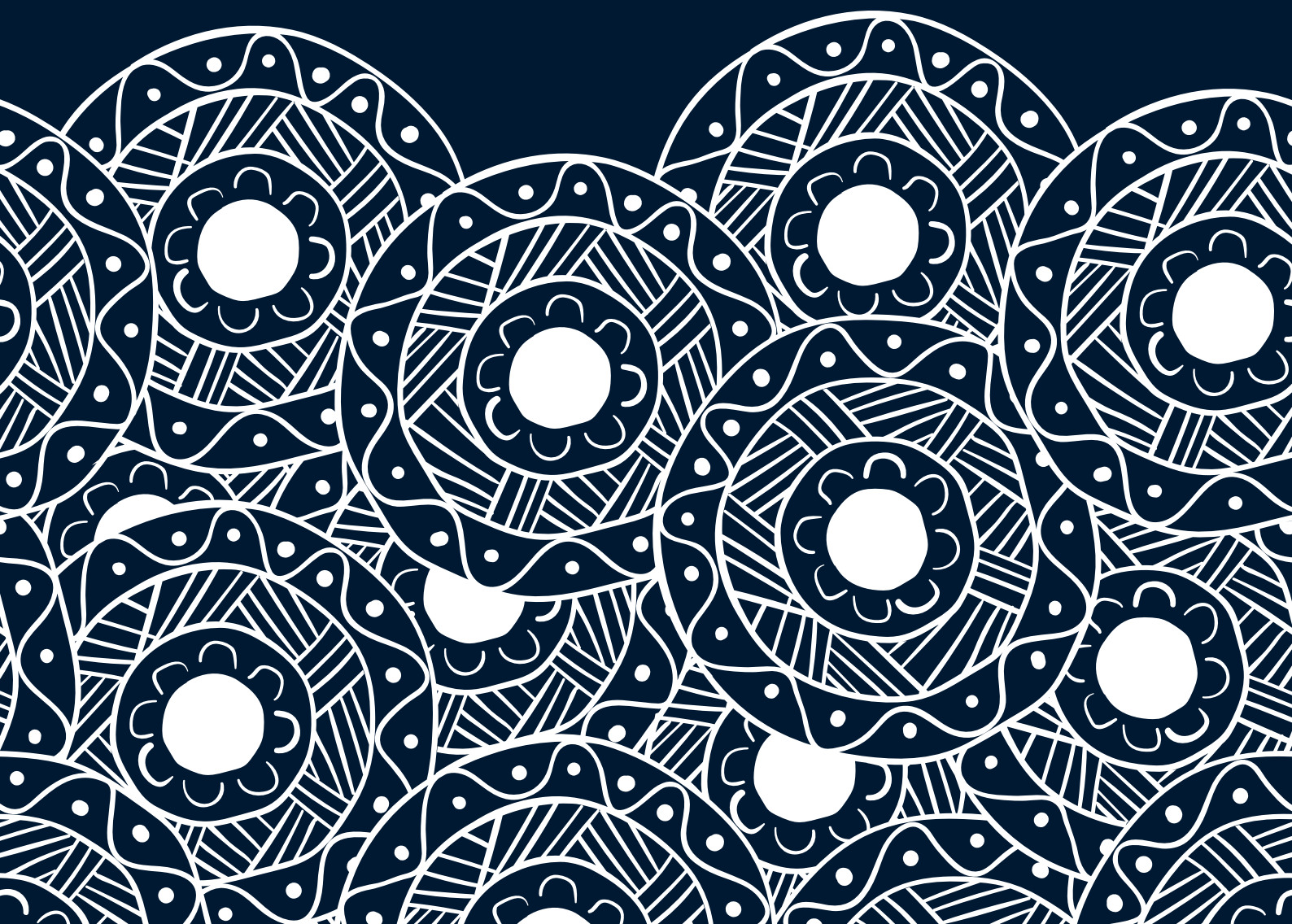


Citation

Banks, C. and ASSETS Alumni (2020). *ASSETS destination interviews data report*. CSIRO. Canberra.

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Acknowledgements

Acknowledgement of Country

Aboriginal and 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 as well as complementary to western scientific knowledge.

This respect encompasses recognition of traditional contexts for technologies and concepts; their application in the past, present and future, including supporting modern STEM career pathways for Aboriginal and Torres Strait Islander students; and reaffirming the ingenuity and creativity of Aboriginal and Torres Strait Islander peoples' knowledge systems.

A deep respect for these Aboriginal and Torres Strait Islander cultural practices and knowledge underpin the philosophy and practice of the Indigenous STEM Education Project. Recognition of traditional contexts for technologies and concepts; their application in the past, present, and future; including supporting modern STEM career pathways for Aboriginal and Torres Strait Islander students; reaffirm the ingenuity and creativity of Aboriginal and Torres Strait Islander peoples' knowledge systems.

The Indigenous STEM Education Project team acknowledges the Traditional Owners of the lands with whom this Project is collaborating and their vibrant living cultures and knowledge systems. We pay our respects to Elders past and present and thank all community members who are providing 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. We acknowledge the Traditional Owners of the lands, waterways, seas and skies on and near where the case study research was conducted.

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 significant knowledge and leadership of Aboriginal and Torres Strait Islander scientists, educators and program leaders that have made the development and implementation of the Indigenous STEM Education Project possible. In particular, the 10 ASSETS alumni that took part in this study have been collectively recognised as co-authors of this data paper because of their contributions of knowledge and stories.

CSIRO acknowledges the contribution of program partners and collaborators. CSIRO acknowledges the contributions of former members of the program teams and evaluation team who led or supported the program monitoring and evaluation methodologies, data collection, and analysis. The evaluation team members include Jessica Fidler, who organised and conducted interviews, and Dr Caja Gilbert who conducted some of the interviews, and Dr Michael Tynan, Dr Kirsten Sadler, and Karlie Noon. Throughout this report, the 'ASSETS program' is used as a short-hand primarily for the people that developed and implemented the program, and the activities they undertook. It is through the passions, capacities, knowledge and skills of the ASSETS team that the 'program' had an impact. The ASSETS program has comprised many Aboriginal and Torres Strait Islander and non-Indigenous staff, including Dr Jen Parsons, Scott Phillip, Amanda Baker, Geoff Guymer, and Carol Rance. A special thanks goes to Scott Phillip for organising the interviews with the ASSETS alumni. The study would not have been possible without his assistance. Finally, CSIRO gratefully acknowledges the thoughtful and useful feedback of the peer reviewer, Mibu Fischer from CSIRO Oceans and Atmosphere.

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Executive Summary

The Aboriginal Summer School for Excellence in Technology and Science (ASSETS) targets high-achieving Year 10 students, bringing them together for a residential summer school, as well as providing a leadership program through Years 11, 12 and beyond. ASSETS is delivered by CSIRO and funded by the BHP Foundation. A case study evaluation report on the program was released in 2019¹, which found the program was meeting its intended objectives. To better understand how ASSETS has impacted participants five to six years after participating in the program, semi-structured interviews with 10 ASSETS alumni (7 female and 3 male) were conducted in mid-2020, which consisted of eight per cent of alumni that attended the four summer schools in 2014 and 2015-16. All 10 alumni were currently engaged in higher education degrees, including eight in STEM-related fields.

The ASSETS program, including the summer school and follow-up support in Years 11, 12 and beyond, were highly valued by alumni that were interviewed, and according to alumni, contributed to long-term impacts in several areas:

- Increased **confidence** and willingness to take on more opportunities
- Increased **self-confidence** to pursue educational and career aspirations (both existing aspirations and new aspirations)
- **Focusing of aspirations** on more specific directions
- Exposure to **new opportunities** and possibilities
- Increased **connection to culture**, and increased focus on finding out about cultural heritage
- Increased ability to deal with **racism**
- Increased understanding and application of **Indigenous knowledges** in STEM
- Larger and stronger **peer networks and friendships**, and sense of community
- Enhanced skills in **working in groups** on projects
- Increased career prospects from **cadetships and internships**
- Increased insight into university and **STEM careers**

The ongoing personal and professional support provided by ASSETS staff and mentors² was highly valued by alumni and led to several opportunities and experiences that assisted them. Alumni identified a number of supporting factors not related to ASSETS that assisted in pursuing STEM education, including:

- Supportive, encouraging, and knowledgeable high school **teachers** and support staff.
- **University supports**, including Indigenous centres, although several alumni did not feel the need to engage with these centres.
- **Friends and family**, particularly parents, offered encouragement, guidance and support and were role models to their children.
- Other STEM, leadership, and Indigenous-related **campus** were beneficial to alumni.

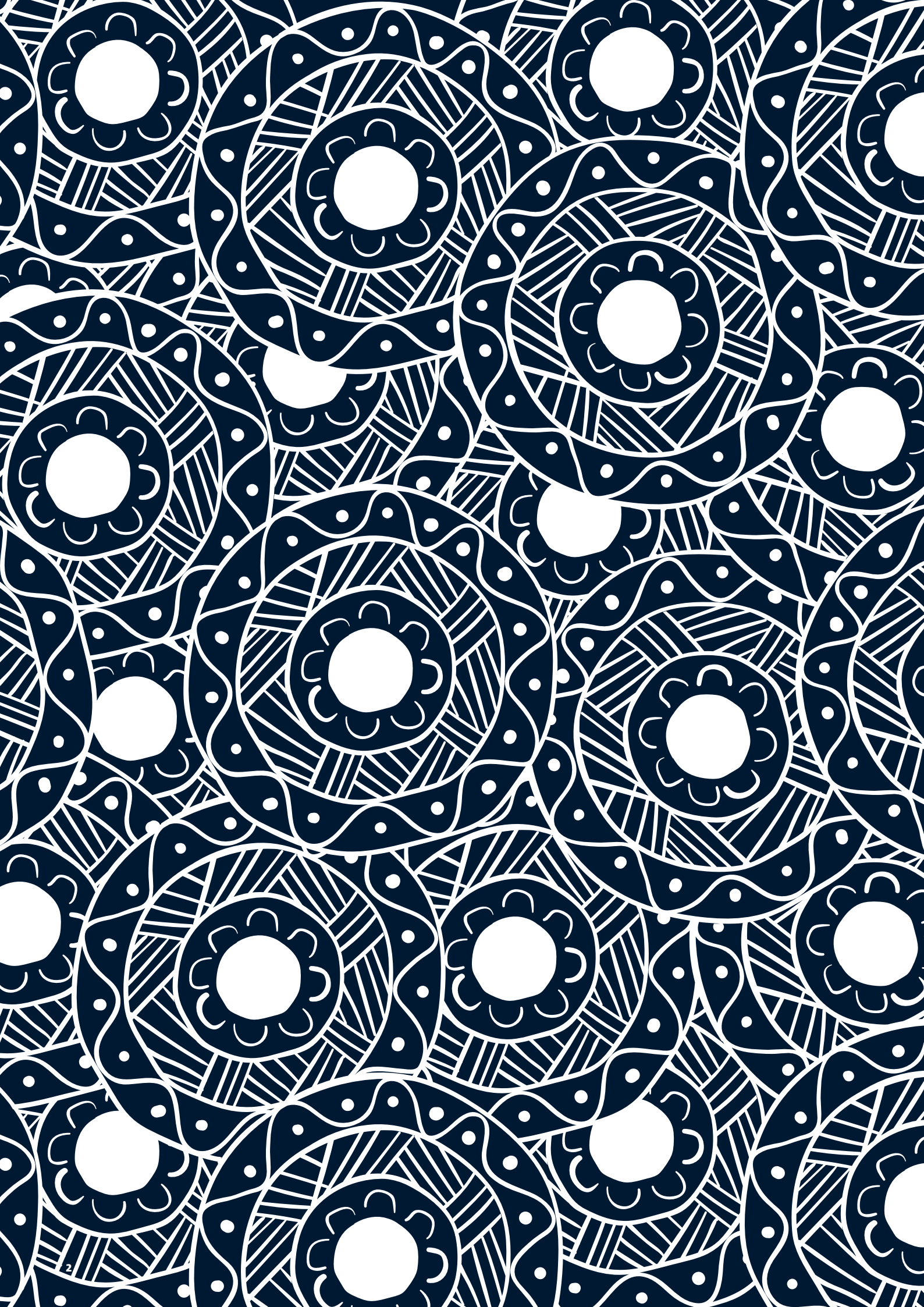
Alumni faced a number of external and personal challenges, on their STEM education pathway, including: high course load at high school and university; a few instances of unsupportive teachers and university staff; some lack of support or networks; some experiences of racism, sexism and other biases; and occasionally a lack of time and motivation. However, the cohort of 10 interviewees were highly motivated, sought out opportunities, and overcame almost all challenges that were experienced.

Although each alumni's education pathway was unique, there were some common features. A general model is presented that includes five different phases: early aspirations, transformative experiences, figuring it out, building on strengths, and achieving goals.

It was apparent that, based on the perceptions and feedback from 10 alumni, that the program contributed to high aspirations, greater understanding and confidence, stronger cultural identity, larger networks, and successes in higher education, and to some longer-term impacts such as reconciliation and creating a cohort of role models.

¹ See www.csiro.au/en/Education/Programs/Indigenous-STEM/Monitoring-and-Evaluation/Case-study-reports

² ASSETS program staff are employed by CSIRO and work full-time to deliver the ASSETS program. ASSETS mentors are recruited to provide support and leadership at the summer schools.



Introduction

The purpose of this report is to present the findings from 10 semi-structured interviews conducted with former participants of the Aboriginal Summer School for Excellence in Technology and Science (ASSETS) program (referred to as alumni in this report). The interviews were undertaken in the context of the evaluation of the ASSETS program to better understand the impact that ASSETS had on alumni over a period of 5 to 6 years, and to find out about their journeys, decision-making, and challenges. The interviews focused on ascertaining specific outcomes in the program's Impact Pathway³, comprising: participation in broader STEM initiatives; growth in student and professional networks; and success in STEM subjects in years 11 and 12 (and at university), as well as understanding any other (including unintended) educational, personal, or professional outcomes for alumni.



The findings supplement the ASSETS evaluation case study report published in 2019⁴. To recruit participants, ASSETS program staff contacted potential interviewees through the ASSETS alumni network and presented the option of being interviewed by the CSIRO Education and Outreach Monitoring and Evaluation team on their experiences since attending a summer school. Alumni that attended summer schools in 2014 (Adelaide) and 2015-16 (Adelaide, Newcastle, and Townsville), which were the first operated by CSIRO and funded by the BHP Foundation, were

targeted to understand the longer-term impacts of ASSETS, if any. Approval for the interview research was obtained from the CSIRO Social and Interdisciplinary Science Human Research Ethics Committee. All interviewees provided both written and verbal informed consent to participate in the interviews, and were provided the opportunity to review and revise their interview transcripts and this report. All alumni have indicated their agreement to be recognised as co-authors of this report.

³ See www.csiro.au/~media/Education-media/Files/Indigenous-STEM/Evaluation/Indigenous-STEM-Education-Project---Impact-Statement-ASSETS-2017.pdf
⁴ See www.csiro.au/en/Education/Programs/Indigenous-STEM/Monitoring-and-Evaluation/Case-study-reports

Methodology

The data collection methodology consisted of semi-structured interviews (see Appendix A for the questions list). Originally, it was intended that some or all the interviews would be conducted in person; however, due to the COVID-19 pandemic, all interviews were conducted by video calls. Interviews were recorded and transcribed. The interview data was analysed using a combination of thematic content analysis and narrative analysis. The thematic content analysis consisted of identifying common themes and patterns across all the data to reveal overall supporting factors, challenges, and the impact of ASSETS on personal, education, and/or career pathways, if any. The narrative analysis involved making sense of each individual alumni's story and education journey and synthesising those stories into a general model. Narrative analysis is aligned with the Indigenous research methodology of yarning⁵, which privileges narrative to understand experiences. Care was taken to ensure the identity of participants was not disclosed, although the education journey for each alumnus was unique. The findings section includes a number of quotes from alumni because it was important that individual voices of alumni were represented.

The qualitative methodology employed meant that the set of participants involved in the interviews were not intended to be a representative sample of the overall cohort of ASSETS alumni. However, it should be acknowledged that the set of participants that were interviewed were different than the total cohort of alumni in a few ways. The ASSETS alumni most likely to be contactable and agree to be interviewed were also those most likely to still be engaged with STEM education. Every effort was made to engage a wide range of alumni, including those that did not pursue a STEM pathway, but the final sample likely did not represent the overall cohort of ASSETS alumni from 2014 and 2015-16. Strategies to recruit participants included 'chain referral' where respondents that agreed to participate were asked whether they knew other alumni that may be interested in participating. The 10 ASSETS alumni were also mostly female, which did not reflect the cohort of the four summer schools, which

had an approximately even gender split. Therefore, the findings from the set of 10 alumni (representing 8 per cent of the 125 participants from the four summer schools held in 2014 and 2015-16) are not being generalised to the entire cohort, rather the conclusions are primarily limited to the set of interviewee's experiences.

The gender, summer school, and education situation of the 10 interviewees are provided in Table 1. Eight interviewees (80 per cent) were female, compared to 53 per cent female participants in the four summer schools in 2014 and 2015-16. All 10 interviewees were currently enrolled in a degree program at university, with eight pursuing a STEM-related degree. One interviewee had already completed a bachelor's degree and was currently pursuing a master's degree.

⁵ See Bessarab, D. & Ng'andu, B. (2010). Yarning about Yarning as a legitimate method in Indigenous research. *International Journal of Critical Indigenous Studies*, 3(1), 37-50.

Table 1. Characteristics of ASSETS alumni interviewed

ASSETS ALUMNI	GENDER	ASSETS SUMMER SCHOOL ATTENDED	ATTENDING UNIVERSITY?	STEM RELATED?*	CURRENT EDUCATION OR CAREER SITUATION
1	Female	2016 Townsville	✓	✓	Enrolled in bachelor's (combined) degree in Science and Law
2	Female	2016 Newcastle	✓		Enrolled in bachelor's degree - double major in Law in Society and Criminology
3	Female	2014 Adelaide	✓	✓	Enrolled in master's degree in genetic counselling (already completed Bachelor of Science degree in psychology)
4	Female	2016 Newcastle	✓	✓	Enrolled in Bachelor of Science (physiology)
5	Male	2016 Newcastle	✓	✓	Enrolled in bachelor's degree - major in Molecular and Cell Biology, minor in Chemistry
6	Female	2016 Newcastle	✓	✓	Enrolled in Bachelor of Engineering (mechanical and aerospace)
7	Male	2014 Adelaide	✓	✓	Enrolled in Bachelor of Veterinary Science
8	Male	2014 Adelaide	✓		Enrolled in Bachelor of Education (Secondary) and Bachelor of Arts
9	Female	2015 Adelaide	✓	✓	Enrolled in Bachelor of Science (Advanced), majoring in physics
10	Female	2016 Newcastle	✓	✓	Enrolled in Bachelor of Electrical Engineering

*STEM fields of study taken from Office of the Chief Scientist classification (See www.chiefscientist.gov.au/sites/default/files/Australias-STEM-workforce_full-report.pdf).



Findings

The findings from the semi-structured interviews have been organised around three general themes: (1) The impact of ASSETS, which focuses on how attending the summer school and involvement in the subsequent support program effected alumni; (2) Supporting factors (non ASSETS related), focuses on experiences and support outside of ASSETS that alumni mentioned as being important in their education and personal journeys; and (3) Challenges that alumni faced. The inclusion of numerous direct quotes from the alumni in this section is purposeful and part of the privileging of Aboriginal and Torres Strait Islander voices.



The contributions of ASSETS

Overall

The contribution of the ASSETS program to the 10 interviewees lives and pathways was apparent and ranged from *“changing my life”* to simply being a valuable experience among many others. One alumnus felt ASSETS was a watershed moment and a *“...turning point, going from living at home to going to boarding school and making a big jump, that was kind of the turning [point].”* Another alumnus relished the experience and returned to be an ASSETS mentor after five years: *“I think just the experience and getting involved in the other side of it, because I enjoyed ASSETS so much, so being able to give a bit of that back.”* The impact was evident when one alumnus encouraged their⁶ younger brother to attend ASSETS: *“...a couple of years after my brother did the [summer] school as well...it must have been...three years after I did mine...and I got to... go to his graduation ceremony...and reconnect with some of the staff there. That was really cool. But I could encourage him to do it as well because I had that understanding of how valuable it is, even though it is very daunting.”* Attending ASSETS had a motivating influence on some other alumni,

with one participant commenting: *“...before going to ASSETS...I thought I knew everything so I don’t have to try in school; I just was winging everything. But after ASSETS, I kind of realised if I put effort in, I could actually choose where I want to go...”* For one alumnus, the experience of the city where ASSETS was held prompted a move to that city for university: *“I really enjoyed it when I went to [city where ASSETS summer school was held] and I wanted a fresh start, so I ended up moving...to do uni[versity] here.”*

A central component of ASSETS, the bringing together of culture and science, was particularly impactful for several students. One alumnus recounted:

“So, going out and going and seeing these amazing universities and ASMS [Australian Science and Mathematics School] and all of these beautiful cultural centres and that kind of thing, it not only I think brought me closer to science and closer to this really big fascination I had with research, but also definitely the cultural aspect as well. It was such a fantastic experience to kind of go to these places and learn about ... how science and Indigenous culture works together. Because there was definitely an element of that and there was definitely an element of kind of blending those two ideas of science and culture. I felt

⁶ The pronouns ‘they’ and ‘their’ have been used in this report instead of gender pronouns ‘she’, ‘he’, ‘her’, and ‘his’ to protect the identity of interviewees.

like that was really important too. Yeah. No, that definitely had a big impact on me, and I felt like those whole mixes of experiences really shaped the next couple of years and how I saw not only myself but also how I saw science."

Sometimes the impact of ASSETS was more indirect, for example one student revealed: *"Even though I didn't pursue the science aspect of it, I still felt like the science aspect of ASSETS still led me to teaching because in my senior years I wanted to be a science teacher...I feel like ASSETS definitely indirectly led me towards at least the teaching component of what I'm doing now [due to the science components of ASSETS]."*

Interestingly, for one alumnus, the ASSETS summer school provided a framework for overcoming barriers and solving problems more broadly:

"It was probably the fact that it [ASSETS] taught me how to find something if I need it. Rather than... in high school a lot of the things were...'You can do this, and this is how you do it.' Or, 'You can do this; this is how you go about it.' But on the ASSETS camp it was more...'You can do this, and this is the process to get to there. And then you can use this process here and use this process here.' And it broke down the barriers I had...[and now] I can actually work towards something because I knew how to work towards it."

Confidence

Attending ASSETS had impacts across many dimensions for alumni, and improvements in confidence were prominent among them. One alumnus felt the impact was *"a combination but I think mostly it was the personal development and gaining some confidence through the experience [of ASSETS]."*

Gains in confidence were often linked to undertaking new experiences and making leaps in life: *"Well, the ASSETS camp was the first time I left the state I was born in...I went on a couple of other camps after that, like high school ones... it kind of like pushed me to expand and is, actually, the reason I moved out of the state."* Another student recounted a similar feeling of ASSETS being a springboard for increased confidence: *"I just think it was kind of scary, like not knowing anyone and going interstate, and it was my first time on a plane, and just all that. It really pushed my comfort zone, and I learnt that there are opportunities out there for me, and I've just been chasing opportunities like that ever since because it was awesome, and I had some fun. So, I just was like, yeah, I want to get involved in all this stuff more."*

Experiencing ASSETS made one alumnus more assured to take part in similar programs: *"...the whole idea of those sorts of programs doesn't seem so scary anymore and ...I have that first-hand experience of how valuable they are."*

Other alumni commented that the experience of ASSETS gave them the self-confidence to believe they could accomplish greater aspirations. One alumnus said: *"I was pretty set on medicine and I have been for a while. I think ASSETS improved my confidence and my ability to be able to do it, because before I was like, my god, really smart people do that, and I can't do that."* Similarly, another alumnus revealed:

"Well, yeah because neither of my parents attended university, so I didn't really see myself as being of the calibre, of attending university. Even the act of getting picked for ASSETS program alone kind of dispelled that idea in my mind...The fact of the matter is they were both kind of just working class and I was at the time, working in a café as well...hospitality work is for me, I'm good at it, I'll just do that until I die. Then ASSETS came along and I saw how amazing all of these centres were and how interesting it was to really engage in that kind of atmosphere...being selected was a huge contributor for that because it kind of gave me this idea that I was someone that was worth taking to uni[versity] and that definitely contributed towards me selecting all of the subjects that I needed towards going to university and kind of set up that goal in my mind."

Confirming earlier findings in the ASSETS case study evaluation report, some alumni felt ASSETS didn't change their aspirations but it did provide the confidence to continue on that path. One alumnus said: *"I always enjoyed science. I knew that I was going to study that but ASSETS really gave me sort of the drive and the confidence in myself to continue and to make sure I go to university."*

Taking part in ASSETS also changed alumni's views of their own self-confidence based on peer feedback. One alumnus encapsulated this sentiment: *"...going into ASSETS I was really worried and shy, I'm inherently kind of a shy person. But going into it I just sort of had this mindset of, I'm going to make the most of this opportunity, you know, and I did and ended up doing that speech at the end. And then the feedback that I got from that about how confident I came across and all of that, it made me feel like actually I can be that person or I can do that."*

Finally, the increased confidence that resulted from taking part in ASSETS led to taking up more opportunities, for example one alumnus articulated: *“I don’t think I knew about the opportunities and I didn’t also have the confidence in myself and my ability...but going to ASSETS really helped with that and the support onwards... that helped me be more confident to reach out for opportunities and have a go...and...it’s paid off.”*

Opening opportunities and focusing aspirations

ASSETS, particularly the summer school component, was often identified as the experience that exposed participants to new opportunities or focused their existing aspirations. One alumnus commented that the summer school was *“massive...[before the ASSETS summer school] I’d interests in...all the fields of science, but after ASSETS, it was medical research...I walked out of ASSETS and I kind of knew that...was the way to go.”* The planning and decision-making components of the summer school were of practical benefit to a number of alumni: *“on one of the last days...planning our pathways”* and *“that’s where all the decision-making [happened] in a way...from there I kind of knew the path...”* ASSETS was the deciding factor for choosing engineering for one alumnus: *“...when I went to the camp, and we did the uni[versity] course thing where you’re going through all the uni[versity] courses on the laptops and everything, and at that point I was just looking at everything...so I just started my search for what I wanted to do...I had an idea about, I’ve always enjoyed STEM, my English skills suck, so I knew I wanted to get into STEM. And I think [ASSETS staff member] had shared an engineering thing at the time and I was like, Oh, I might look into that...”* Being exposed to STEM professionals was also helpful, with one alumnus saying: *“...hearing from different researchers and scientists....their passions and theirs stories and their journeys [was beneficial].”*

ASSETS provided an opportunity for participants that they may not otherwise have been able to take up, particularly given the first-in-family situation of some alumni. For example, one alumnus said: *“I just think the experience to go out of state and experience other things other than just [own state], really, pushed me and is the reason I go to [current university] now. I just think that was awesome, because otherwise, like my parents didn’t travel, we didn’t have enough money to do that. I would never have gone out of the state if it wasn’t [for ASSETS] I just thought that was awesome and a great experience.”* One alumnus was

opened up to CSIRO as an option because of ASSETS: *“I think it was ASSETS if nothing got me looking at CSIRO and the opportunities there, but not so much in terms of a job...just sort of steered me in that direction [of STEM].”*

For other participants, ASSETS confirmed and strengthened aspirations. For one alumnus: *“...in regards to the activities I did at ASSETS...I was definitely going down the science path and...going to that camp...solidified that. The culture aspect as well – I guess that knowing that I was getting into a science degree where there was also other Indigenous students [made it easier].”* For another alumnus, attending ASSETS had an immediate impact, even if they didn’t pursue that path in the long term: *“...right from when ASSETS finished, I remember going home and literally getting a SATAC guide out and circling biochem[istry] and looking at all of the biochem[istry] kind of things. That was definitely the path that I felt I was going to take...I was all about biochem[istry] and I was so enamoured by that world. I remember over the summer holidays, doing miniature research projects and that kind of thing and being just super into that whole idea of biochemistry.”*

Culture

The cultural components of ASSETS had a significant impact on many alumni, including giving back to community. One student commented that: *“one of the big things from ASSETS...[was] cultural connection...how I can give back [to community]”,* while another said: *“That’s actually why I want to become a lawyer, to help my Indigenous mob, that’s sort of what motivated me to become a lawyer.”*

Another alumnus noted that after attending ASSETS: *“connection back home grew stronger...it was motivation...to want to give back...and to do well at high school to get into the right degree.”* While another participant described the general satisfaction with the cultural elements: *“One of the things that really stuck out for me was the night where the guys...learnt the didgeridoo while the girls... were learning one of the traditional dances. And then there was a night where we both performed for each other and I think that’s really special to me and it was just...was a really, really nice night and we all had a lot of fun...”*

Cultural activities prompted changes and increased motivation to connect to culture for participants without a strong existing connection to culture. After being asked whether ASSETS had changed the way they felt about their cultural identity, one alumnus confirmed:

"Yep, 100 per cent. More than any other experience I've had. Just because I haven't been exposed to that side of my identity really much at all before this. My family's small and they sort of don't really have...a super cultural family. So having that experience was just incredible and it really made me value my culture and sort of want to learn more about it and become more immersed in it and everything like that." Another alumnus felt more included by being around Aboriginal and/or Torres Strait Islander young people: *"I was definitely hugely in the dark [about cultural heritage]. I'm a white-skinned blackfellow, so I never really felt like I fit in anywhere. And especially in school, because I grew up in [city], so mob's a huge part of [that city], and I didn't have mob. So, I struggled a bit, but then when I found out there was so many other people in the same boat as me, it kind of helped a lot...I'd done a few group things through high school, but I never really had one where everyone came together and related so quickly [like at ASSETS]...everyone kind of had a mutual understanding at the beginning. And that was kind of like, 'Oh, so it really doesn't matter if I don't have my mob.' Everyone else still has that mutual understanding."*

The cultural activities also helped connect participants to each other, with one alumnus commenting that: *"a yarnning circle...really helped us all bond together...all of us students who were there were able to connect with each other better."* Another participant expressed the benefit of sharing culture with each other: *"...it definitely helped me express who I was. There was a lot of Indigenous activities that we did, which I liked very much. I mean, it was really fun to learn about everybody else's heritage and what their tribe was. I thought that was really good and it sort of helped find our identity."*

Another alumnus expressed the multiple benefits of sharing and the resultant motivation to find out more about culture: *"I definitely was at the end of the scale where I didn't have a strong connection to my culture but actually attending all that cultural stuff and also just being around other students who did have a deeper connection was quite inspiring...it made me...want to...dig deeper and question things and find out more because...my family...didn't really talk about it that much just because my nana didn't like to talk about it and...so...it...gave me the confidence to...actually...find out more. I did appreciate having that opportunity to speak with people and to do those cultural things."*

ASSETS being the catalyst to connect with culture was articulated by another participant: *"My father's white and I was separated from my mother a bit, so I actually didn't know I was Indigenous until I was 12...I didn't really know anything...and...I did learn a lot and it kind of did solidify like: I am Indigenous, and this is my culture, and I get to learn about all this cool stuff...it was just really awesome, and I love the dancing...it was really fun, it was awesome."*

One alumnus recounted how connecting culture to their STEM career had a big impact: *"I did enjoy the cultural activities very much and I recognised...how to apply [it] to my field...it has a big impact on my field because there's quite a lot of opportunities to be able to go out to rural areas and work with the Indigenous people out there."* The motivation to combine careers with reviving culture in communities as mentioned by several alumni, with one saying: *"I'm always for about reviving a culture in the area if you had the resources to do that."*

The impetus to connect more deeply with culture after attending ASSETS created a new, positive outlook for one alumnus: *"I was definitely asking a bit more [after ASSETS], and I became a lot more involved with the school side of it as well. Like, the Indigenous part of school, because I didn't feel like I was trying to be someone. I knew that people had an understanding, that not everyone has mob, but that everyone's still mob none the less."*

Another alumnus described in detail how ASSETS had spurred them on to strengthen their cultural identity: *"I've been trying to learn about my own tribe for quite a while, so I'd known a little bit before that camp...there's a difference between the theoretical and the practical experience...ASSETS was more of the practical experience that I got to really enjoy...before that, I tried to research my tribe. I even tried learning some language from my tribe, but it was difficult...[ASSETS] encouraged me. From that camp, it's really encouraged me to go out towards [community] and really learn a lot more about my tribe from firsthand experience."*

Several ASSETS alumni talked about being fair skinned, how that could be challenging, and how ASSETS brought about a change in self-perceptions. One alumnus said: *"There was also this fantastic element of being around people that were also fair in skin and I'd never seen an Indigenous person before who also had the same skin tone as me. That was truly special. That kind of validated a lot of negative emotions that I had about myself and my own kind of connection to culture. Because you don't really feel like you're involved in an Indigenous culture or that you're not really Indigenous when you are."*

One alumnus talked about dealing with racism at school, and how the experience of ASSETS, including the cultural activities, subsequently helped manage those experiences: *“You can definitely have that kind of struggle [racism] at least and I feel...validated...that was truly an important moment in growing up for me. ASSETS was definitely a contributing factor to that...I felt like I was a lot better at managing it and I didn’t really care so much about what they had to say.”*

One student had mixed feelings about participating in the ASSETS cultural activities, feeling both uncomfortable in their own disconnection from cultural heritage, but finding listening to other participants interesting:

“...for my cultural identity, I don't know a lot about it because my father was adopted. So I don't know exactly what tribe I'm from or anything like that. I do remember there was - we had a yarning circle and everyone had to like go around and talk about how things made them feel and talk about their tribe and stuff like that and I remember it was really great listening to other people but the fact that every single person had to talk about it, there were a lot of people afterwards that I spoke to and it made them feel really uncomfortable because there were people that were like me who didn't exactly know. So we had to talk about it but then we had to talk about things we weren't exactly comfortable with...And there was another time when there was a big map and everyone had to go up and pin where they're from and there was some people like me, we didn't know where we were from and I think for culture...it was good to listen to other people talk and participate and like the dances and some of the artwork and bush tucker and stuff like that but then there were times when it made me feel really uncomfortable because I don't have like a greater knowledge of like where I'm from and stuff that other people do.”

Networks, friendships and group work

Many alumni spoke of the impact of interacting and forming bonds with other Aboriginal and/or Torres Strait Islander students who were passionate about STEM. Students talked about connecting with other students and simply knowing how they were progressing on their pathways as reassuring. One alumnus noted *“seeing where they’re [other students] at and what they’re doing and how they’re going and how their lives are going.”*

Many alumni felt the peer networking and forming friendships was the most valuable aspect of ASSETS, particularly making connections with people with the same interests and identity:

“Networking was the most valuable part...all throughout school...I only knew a couple of other people who identified as being Indigenous. And then out of those people - some of them I didn’t even know and didn’t have the same interests...So when I went [to ASSETS], that was the first time that I was in a big group of kids who were just like me. And we were all connected from our culture. And that was really amazing and I just felt this instant comfort and connection to the other students through that. And it was just a really great and exciting experience for me because I learnt that there are people out there like me and they’ve gone through the same experiences as me. And that was probably the most valuable thing. The science and everything was obviously great but I already had a passion for science so the networking was the really important thing for me.”

“...the networking with other Indigenous students was really powerful for me because I hadn’t really been exposed to that very much at my school back home. It was just crazy that there were all these kids who liked science just as much as I did, or wanted to go to uni[versity], and I was like: Oh crap, I can actually do that. Because I’m the first in my family to graduate from high school, I haven’t really been exposed to people, with higher education aspirations...at that point.”

“...the sense of community [was the most valuable part of ASSETS]. I think a lot of the activities we did, they were enjoyable, but they didn’t stand out to me as much because I was like, I’ll be eventually doing this all the time. For me, the more important things, just getting along with the people that are in your field. That’s a very big thing for me. That’s why I want to find the right job and being able to converse with the like-minded

people is - was really enjoyable and, I guess, calmed my nerves quite a bit, especially when I started first year uni. I get into it and I'd converse with [my peers]."

"It was really easy to get along with a lot of people that were like-minded. When we were first on the camp...it freaked us out a little bit, but I think a lot of the students that I was with were quite confident. They were able to build up relationships within the nine days just really easily."

Other alumni expressed similar feelings in a more general sense:

"...creating a network...it's really good to make those connections...[it's] one of the most valuable things."

"[It was] really amazing just to be able to connect with so many different people."

"I definitely felt like there was a group of students there that definitely had my back and I formed a close connection to. By the end of it there was just this general sense of comradery within the entire cohort in general."

The networks established at the summer schools sometimes did not continue because alumni felt staying connected wasn't necessary or simply didn't maintain the connections, but often the strong peer networks developed at ASSETS lasted many years. One alumnus said: *"I have [kept in contact with ASSETS peers]. I'm really close with and I talk pretty much every day with [one peer]. And then there's another [peer] and I'm close with her as well and we intern through CareerTrackers and we see each other like once a year for the learning development institute. So I'm really close with her."* Another student appreciated the network being there when needed: *"I think...having that network and being able to reach out when I needed it. It was probably one of the biggest things."*

Beyond building friendship and peer networks, the process of working in groups was also valuable to many alumni. For example, one described: *"I think the most valuable part, I really liked at the end when we were working on a project and we were working as groups because I think everyone in my group, we had different interest[s] but we all worked together...and I think that's gone on to really help me in engineering because we do a lot of group projects and everyone has like a specialty that they're good at and then when it's all collaborated together, projects really turn out really nicely. Yeah, I think that was just like good practice for me."*

Cadetships, internships and jobs

Work experience opportunities organised by ASSETS staff were a key experience valued by several alumni. ASSETS staff provided many employment and training opportunities to alumni, including casual employment at CSIRO. One student had completed a CSIRO cadetship at the end of their first year of university, which they described as a "really great experience." Another alumnus concurred about their own work experience at CSIRO: "I love working in CSIRO. Especially with my cadetship I think it's so rewarding and it's such a great environment. The people that I work with are all so lovely and it's a really great experience so I really like being involved with the organisation like that. And it's something that I would really like to continue after university. Career-wise staying within CSIRO, I think that would be awesome if I could do that."

Other alumni expressed the benefits of being involved in cadetships in terms of opportunities and contacts that opened up for them: "[The internship allowed me to] gain a lot of contacts that are Indigenous and be involved in things within the organisation". While another alumnus said ASSETS staff support was key to obtaining a cadetship: "...in my cadetship I definitely would not have been able to know about or been exposed to that if it wasn't for ASSETS because one of my mentors at ASSETS actually told me about that and helped me with it...it's had a huge impact on where I am today."

ASSETS staff support

The majority of alumni that were interviewed spoke about ASSETS program staff from CSIRO being supportive, and proactive in maintaining connections. Some students were surprised of the depth of support provided by ASSETS staff in the years after the summer school: "I didn't [expect that level of support from ASSETS]. They told us that we'd have ongoing support but I didn't know that it would sort of extend that far or for this long after I'd had the ASSETS experience. So, that was really amazing to have that support." For another alumnus, the support of one staff member has had a considerable impact on their career path: "I got really sick and I ended up spending sometimes weeks at a time in hospital, and I didn't really want to continue with school and...I lost all mojo, but [ASSETS staff member] got in touch with me and [they] just checked up, was seeing how I was going, and [they said]...'If you ever need any help, we're here to help.' So, I had a conversation with [them] and I got back on track..."

The caring and professionalism of ASSETS staff was also prominent in the alumni's comments. For example, one alumnus said the staff member's: "...experience and...kindness..." provided a "motivation boost", and "checking in" was greatly appreciated. The thoughtfulness of staff was in service of practical support and opportunities, which was highlighted by the alumnus as the key benefit of the ongoing support element of ASSETS. Some examples of this support include:

"In terms of mentors, I've kept in contact with [ASSETS staff member] and obviously with the beginning of this year getting involved with ASSETS again and throughout year 11 and 12 when I'd have assignments and I needed help to find people that I could send questionnaires to and all that kind of thing. Yeah, [I] would just get in contact with [ASSETS staff member] and ask if [they] knew anybody in this kind of field."

"Last year I got in contact with [ASSETS staff member] when I was looking for some job or work experience over the summer break and [they] came back to me with some options and opportunities... I organised some work experience which didn't end up going ahead, but yeah, that was very helpful."

"[The ASSETS staff member] helped me throughout the whole application process and gave me support through the interview process when I was nervous and then kept up to date with my progress and everything so that was really good to have that support."

Although support from ASSETS staff was universally appreciated, sometimes planned opportunities did not eventuate. One alumnus said: "I know over the years I've always had contact with [ASSETS staff member] and [they] have tried to get me some internships with CSIRO... [but] none of that has actually come through but I did always feel like I had that support of them. Also, honestly, it was just a nice thing to put on my resume ...and people often would ask about the camp and things like that. Yeah, no, I did have a really positive experience from it." One alumnus appreciated the support from ASSETS mentors as well, even if they didn't have a direct influence on their educational choices: "I don't know if anyone really had like an impact on what I wanted to study but I felt like a lot of encouragement from everyone there and...all of the leaders on the camp, I felt encouragement from that but I don't know if any of them really made me decide what I want or like."

Overall though, ASSETS program staff and ASSETS mentors had a lasting effect on alumni, and were active in helping alumni. This proactive approach was exemplified by the experience of one alumnus: "...one of the [ASSETS] mentors...came up to me last year...and...invited me out for a coffee...He got back in contact with me last year and he found out that I wasn't utilising the Indigenous program at [the] University. So, he whisked me down to the [Indigenous] Centre...and introduced me to everyone, got me affiliated with the place, made me enrol in it and I've honestly been so thankful for that. He was an amazing influence on me, and I was so happy to have that kind of asset in my life."

Insight into university and STEM careers

Exposure into university life and potential STEM careers was also a notable feature and benefit of ASSETS for several alumni. One alumnus expressed the exposure as motivating to attend and complete university: "I think the biggest impact that ASSETS did sort of give me was to motivate me to do uni...showed me what uni life is like, when we stayed at the accommodation here ...walking around campus, going into all the different classes, that really motivated me to do uni."

Another alumnus spoke about how talking to university staff and STEM professionals provided both valuable information and confidence: "I think it was maybe the following year we all went to Melbourne for a day and had a networking day...where we got to go around the room and sit with all different professionals and...that sort of thing was so valuable to me because...I didn't know exactly what I wanted to do and I felt like the best way to work it out was to talk to other people and see what their jobs were and...definitely going to the universities... that was the first time I had that exposure, so...that was exciting because I was there with my friends [ASSETS peers] ...so it meant [that] when I actually went to uni... that was scary as well but it wasn't so unfamiliar."

Supporting factors (non ASSETS related)

The alumni that were interviewed identified a number of supporting factors that assisted in reaching personal, education and career goals that were not directly related to ASSETS. These supporting factors are summarised below, including one or more representative quotes.

High school teachers and support services

Several alumni mentioned supportive or inspiring teachers (or other school staff) as a reason for taking up opportunities or providing motivation for their educational aspirations:

"I had a really good science teacher in Year 8...[they were] a really good communicator of [science]."

"...during [high school] I kind of hit a hiccup with my health issues. So, I also had a physics teacher who was helping me through that..."

"Student Services [worker]...was my biggest motivation to do uni. She was my go-to person, she'd always tell me that I had potential, and that I could do, and I can do whatever I like."

"...my science teacher at school, I had a very good relationship with him and he is who really pushed me to do the [ASSETS] program."

"I guess thinking that I would do some sort of science degree I just looked at the prerequisites for Uni courses and most require chem[istry], so I wasn't actually very keen on chemistry but I did [it]. That's who my teacher was that got me into the program, so I think his support – yeah, he was like, Yeah, I think you should do [it] – he was mentoring what subjects he thought I should pick if I were to go into science."

"...in Year 11 and 12 I had really awesome teachers. One of my favourite teachers was my math teacher and he was really funny...we all respected him so much, he was so cool...I have two younger sisters; one of them still goes to that high school so I like being back and visiting him because he's a cool arse teacher. Also, my human biology teacher was really cool. He teaches a bunch of struggling students now, so he brought me in front of the class when I came back and visited and he was like: 'Here's a success story' – he called me a success story and it was awesome."

"There were [several teachers] that stand out quite a lot. Well, my chemistry teacher stood out even though I wasn't so great at chemistry. It was quite a difficult subject for me actually. He was quite encouraging. He tried to make sure that I was on top of...the things I was trying to learn for the week and he would spend the time was really just trying to explain that – how these compounds worked and how these reactions took off and he'd spend that time. I was also very, very keen on my biology, so my biology teacher was very much an encouragement on, I guess, getting into further studies into animals or humans."

"...my hospitality teacher...was a huge influence because not only is he a huge advocate for Indigenous people going into university and he was always a huge support in that kind of field, but also, he has a lot of involvement as a queer activist and he's super heavily involved in dispelling that myth that Aboriginality and sexuality don't really belong in the same sphere. That was really empowering too, kind of seeing that aspect."

"The leader of [a program at school]...is the reason I went on ASSETS, she was like, This is a cool arse program, do it, and I was like, Oh my God, I don't know if I can. So, she helped me with my application and stuff...she's the reason I did that, and it was awesome, I loved it."

University supports

There was a diversity of levels of engagement with university support centres: some alumni did not feel the need to engage, while others gained substantial benefits from the support of the University, primarily Indigenous support units. One alumnus said: "...the support was there, but I didn't really need it." One alumnus was helped by the tutoring service of a support unit: "...the [university] program also offers free tutoring for Indigenous students. That's been really, really helpful, probably the most helpful thing..." Other alumni talked about the individualised support offered by their university's Indigenous support staff:

"They're amazing, the staff there. They ...talk to us one by one. They asked what we wanted to do, and they sort of laid out, these are the classes that will help you get into what you want to do in the future. They helped us with that, and they gave us resources that we needed as well. So, they're very helpful."

“...the [Indigenous support unit] are really helpful; it’s kind of why I work for them now because I love them...I’ve been a mentor for the first years, and I work in outreach with high school kids trying to get them to come to uni...”

“I think the access unit at [university], they called me I think even a month before I moved and they were asking me if there was anything they could help with and then when I did move, they gave me a lot of support...”

The orientation activities organised by an Indigenous support unit was cited by one alumnus as particularly helpful:

“It’s a three-day camp before O Week starts where you meet the Indigenous cohort coming in, because they’re you’re really close friends, and all the support services, and you get to stay together before you all go to your colleges. I think that’s a really good program that they have.”

Finally, one alumnus appreciated the more flexible approach to learning that university offered compared to high school, with the alumnus feeling university put them in the “driving seat” with their learning.

Family and friends

Family and friends were a large source of support for alumnus in terms of emotional support, and specific guidance around choosing education pathways. One alumnus mentioned their mother: “...my Mum was probably the biggest influence on me...I had so many... options that I wanted to do at university but science and law [were] probably my fourth option...but then I decided to go with that because I thought that would be the best decision for me. And Mum really helped me with that. I think she’s probably the only person who I sort of had those discussions with.” Another alumnus cited their parents as a source of support: “But in regards to what helped me, very much my parents were a big encouragement...I always had someone to talk to if I was having trouble.”

Another alumnus followed in the footsteps of their parents, and had friends taking similar education routes, which was beneficial in building confidence: “...both my parents went to University. My dad is an engineer and my mum is a midwife, so I guess I had that STEM influence and also the health influence which is really what I was more interested in. My parents have always been very supportive of me and my siblings and our education...they were...big influences in my life...I did have... friends who are a bit older who were going into more STEM areas as well and a lot of them were girls as well so...I didn’t ever really feel like I was going into an area that maybe there weren’t heaps of women...I definitely think my parents and that teacher and other women in science gave me the confidence to do it I guess.”

One alumnus cited the high academic expectations of their parents: “I always strived to do well in what I enjoyed...I was also encouraged by my parents to strive to do well at school and whatever you choose after. They recommended that I do go for an OP because even if I didn’t get – even if I didn’t want to go on do something at uni, it just gives me the opportunity to go and do so many different things.” Finally, one alumnus took a gap year, which was supported by their parents: “I...deferred for a year which I had always planned on doing and my parents were very supportive of that. I am really grateful to have had that year off not to study because I was just so burnt out and I don’t think I would have done well at Uni had I gone straight in.”

Family support expressed itself in different ways, with one alumnus commenting about the motivation their mother’s comments provided: “...at the beginning of Grade 11...when you could change subjects...my mum goes, ‘You know, you don’t have to do all the hard subjects. I know that you’re going to struggle.’ And I went, ‘I’ll show you, then.’ And that was kind of my, ‘I want to show mum I can do it.’ And secretly, I think mum knew that by making that comment it was going to happen, looking back at it.”

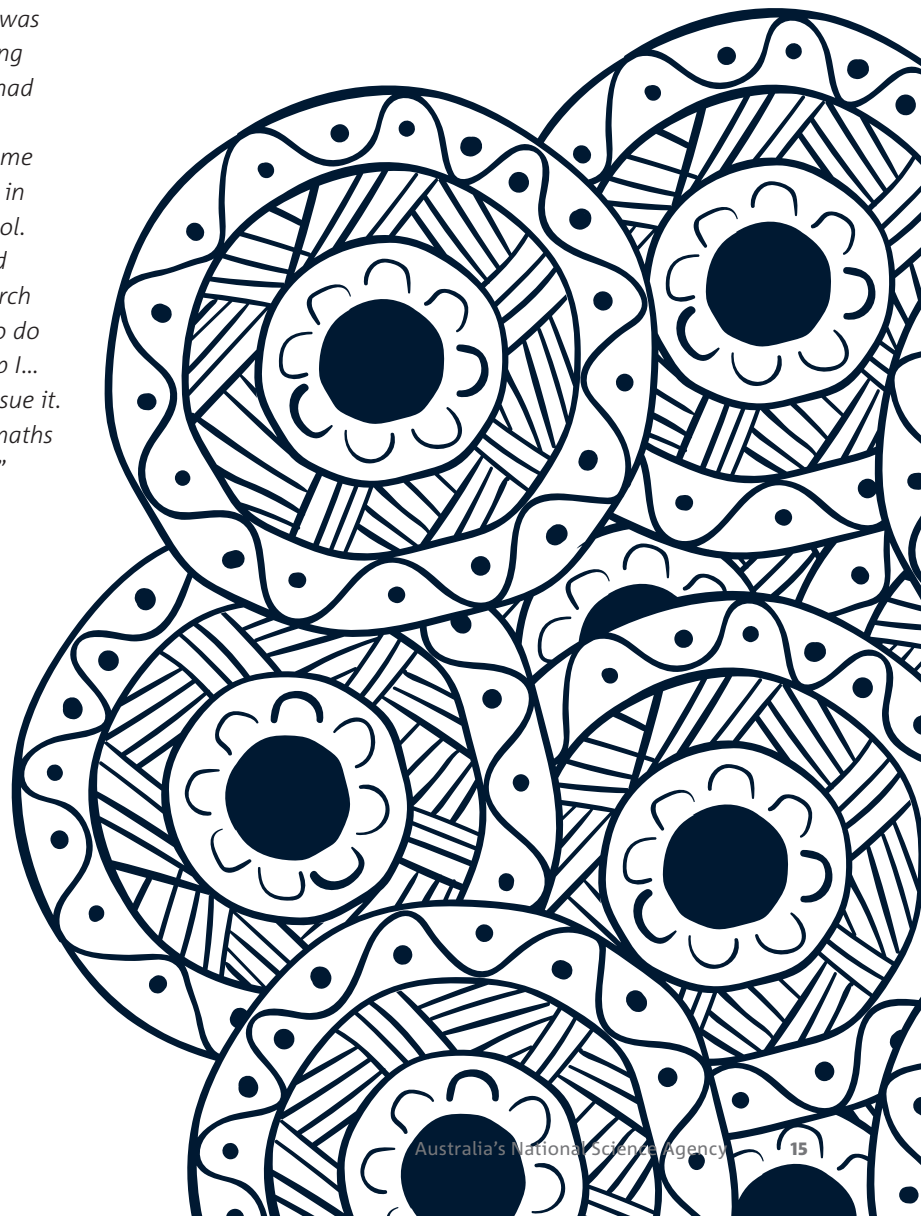
Other camps

In addition to ASSETS, other residential summer schools, STEM-related camps, and similar experiences, were named by several alumni as important opportunities in developing aspirations, knowledge, and confidence. One alumnus talked about an engineering camp that provided practical experience: *“Well, it was a lot of...getting more practical experience in engineering and really learning about all the different types of engineering because I knew that I really liked engineering because it was all of the applied maths and physics I was doing in high school. But then I didn't actually know what all of the different kind of engineers do. So then when I was going on the camps, I was meeting those kind of engineers and they were showing us what kind of things they were doing and then I was meeting other students that had the same interest set as me and some of them I'm still friends with and some of them I still see at uni and hang out with sometimes. And yeah, it was just like building a connection and getting an understanding of what I wanted to be.”*

Another alumnus' attendance at an engineering camp confirmed the intention to pursue engineering: *“I was really deciding all my senior subjects and I was picking between being a lawyer or being an engineer and I had been to one other camp before [ASSETS], which was for junior engineering...and that's really what made me interested in engineering. And I'd also been involved in different engineering competitions during high school. But then after I went on the [engineering] camp and we had this one part of it where we got to like research different unis and...the kind of subjects we wanted to do and we talked a lot about STEM. And after that camp I... really knew that I wanted to do engineering and pursue it. So then in senior subjects I went on to study all my maths and my physics and stuff, getting ready to go to uni.”*

Another alumnus said a leadership camp was an influential experience: *“I remember a particular camp I went on later was the Youth Leadership Camp...That was also a huge one for me. That was also a really big experience that was really fantastic, and I had a great time with that one.”*

Finally, for one alumnus, attending a science-related residential camp was the turning point in deciding to move to another city to pursue higher education: *“...[in relation to the camp] it was not so much the content but just being exposed to the level of education that there is and the...opportunities that are out there. And it was when I came back to my school in [small regional city] that I was like, it's just not what I want at this point. So that's when I decided that I wanted to leave [to pursue higher education].”*



Challenges

The alumni that were interviewed identified a number of challenges they faced when pursuing their education pathways. All of the alumni overcame these challenges but it is worthwhile noting some of these challenges

to inform future programs. These challenges and barriers are summarised in Table 2, including one or more representative quotes. Only challenges mentioned by at least two alumni are included.

Table 2. Challenges and barriers

CHALLENGE	NUMBER OF ALUMNI EXPERIENCING	REPRESENTATIVE QUOTE OR INFORMATION
High course load, stress and lack of time at high school and university	3	<p><i>"In year 11, I was doing ATAR, I was doing human bio, geography, English, maths, I can't remember [a lot], it's just so long ago. But yeah, I was doing ATAR, and then I just dropped to general classes, because it was just too much of a load for me."</i></p> <p>One student was unprepared for <i>"the massive amounts of content"</i> across the different courses in their first year of university but found the <i>"second year...much easier."</i></p> <p>One student didn't participate in many STEM initiatives because they <i>"just had important stuff on at those times."</i></p>
Racism, sexism and bias	3	<p><i>"I grew up...separated from culture, separated from all those elements and growing up in school I also had the disadvantage of being at a very small, rural community school. It was a fantastic school, don't get me wrong, but there must have been about three or four Indigenous students in the entire school. It was kind of the time when Indigenous discourse and Indigenous study kind of fell through the cracks in those types of schools and there was definitely some racism issues that I kind of had to deal with, especially being not a dark-skinned person. I'm quite fair in the skin. That also made it very difficult because of the fact that people would believe that you were Indigenous or had any kind of connection with that culture."</i></p> <p><i>"...And the boys [working on university project], they just weren't listening. I'd say stuff and they'd be like, 'Oh yeah, good idea,' and then not take it on board... I'm quite often having to be a lot more vocal than the boys have to be, to get my point across. And it just gets frustrating."</i></p>
Unsupportive teachers / university staff	2	<p><i>"I had a relatively good experience up until year 11, but this one science teacher she wasn't very fond of me and she'd often take some kind of vendetta against me and it was very hard to kind of keep passionate about science when I had this person who constantly told me that I wasn't really good enough...It kind of translated into me thinking that I was bad at science."</i></p> <p><i>"I've tried actually asking people, lecturers, What contacts [do] you have? Who can I get and who can I talk to? Which I have tried a couple of times...they didn't really want to speak to the younger students because they're nowhere near finishing the degree."</i></p>
Moving to attend university	2	<p><i>"Moving...was a big step for me. Also, like at a young age, I was only 19, and just leaving my family behind, all my siblings, my mum, moving...where I had no family and it's just me and my partner, it was very hard to transition..."</i></p> <p><i>"It was hard, especially, originally, I was planning on starting mid-year, and then I found out that my specific course wasn't offering mid-year at that time. So, I suddenly went from having a six-month timeframe to a three-month timeframe to move. So, I went from the stress of high school, you know, finishing Grade 12, your QCE, all that stuff, to the stress of moving and then the stress of uni. And suddenly the stress just piled up. So, the transition was quite hard."</i></p>
Lack of support or networks	2	<p><i>"...from year nine or year 10, even the school brought in this supportive role for Aboriginal and Torres Strait Islander students and so I used to maybe once a term...set learning goals...with support staff in the school but it always sort of just felt like something that they thought they should be doing but they didn't. I think there wasn't enough students where they were really putting that much effort into the program, which for me was fine but perhaps for other students who may be weren't as motivated I guess that would be...quite difficult I think."</i></p> <p><i>"...going to boarding school...was really hard once I got there but I'd just kind of thrown myself into it and then had to adapt to it...I didn't have any friends there or anything or any family. It was just kind of throwing myself into it and then making what I could of the experience."</i></p>
Lack of motivation	2	<p><i>"It was pretty hard to begin with because I was in the habit of having my evenings and my weekends off to myself, and then going into actually having to make myself study. And I found that if I didn't do that then I would get behind and things would get quite tricky if I wasn't managing my time properly. That was hard, trying to get that motivation back to do that work."</i></p> <p><i>"This...whole online stuff isn't my favourite type of learning. I did better in the classroom. I procrastinate a lot at home, so it is a bit of a struggle to find motivation."</i></p>

Individual pathways

The education pathways taken by each ASSETS alumnus were varied, non-linear, and influenced by a range of factors, including ASSETS. However, a general picture did emerge from the 10 individual pathways. Figure 1 presents a general model of individual education and personal journeys, while Appendix B provides more detailed information on the pathways taken by each alumnus, focusing on key supports, challenges, and decision-points. Specific locations and names of institutions have been removed to protect anonymity.

It is possible that some alumni may be identifiable to some people (for example family members) but all alumni have approved the content of this report.

The summary of the 10 alumni’s pathways and experiences in Figure 1 presents a general model and is not intended to fit each of the diverse individual pathways. However, it does provide a useful way to visualise the overall experiences of the alumni. The symbol represents a journey or pathway that one follows in life, focusing

EARLY ASPIRATIONS	TRANSFORMATIVE EXPERIENCES	FIGURING IT OUT	BUILDING ON STRENGTHS	ACHIEVING GOALS
<ul style="list-style-type: none"> Interested or passionate in STEM but not a specific area Wanting to know more about culture Few Aboriginal and/or Torres Strait Islander peers interested in STEM 	<ul style="list-style-type: none"> ASSETS and other summer/ winter STEM schools Being around peers with similar interests and experiences Exposure to university campus, cultural activities, Aboriginal and/or Torres Strait Islander mentors, STEM professionals, and science facilities Leaving family and home for first time Building peer networks 	<ul style="list-style-type: none"> Teachers and family provide support and motivation Assistance from CSIRO staff and others Connecting or reconnecting more deeply to culture Learning about education options and careers Overcoming barriers and challenges Solidifying specific education plans Confirming that goals can be achieved 	<ul style="list-style-type: none"> High achievement in high school Growing confidence and skills Building networks and connections Taking advantage of opportunities, including internships Cultural identity growing stronger 	<ul style="list-style-type: none"> Entry to or completion of university Perseverance through challenges of moving and difficulties of university Becoming role models and mentors for others Giving back to community High aspirations for the future

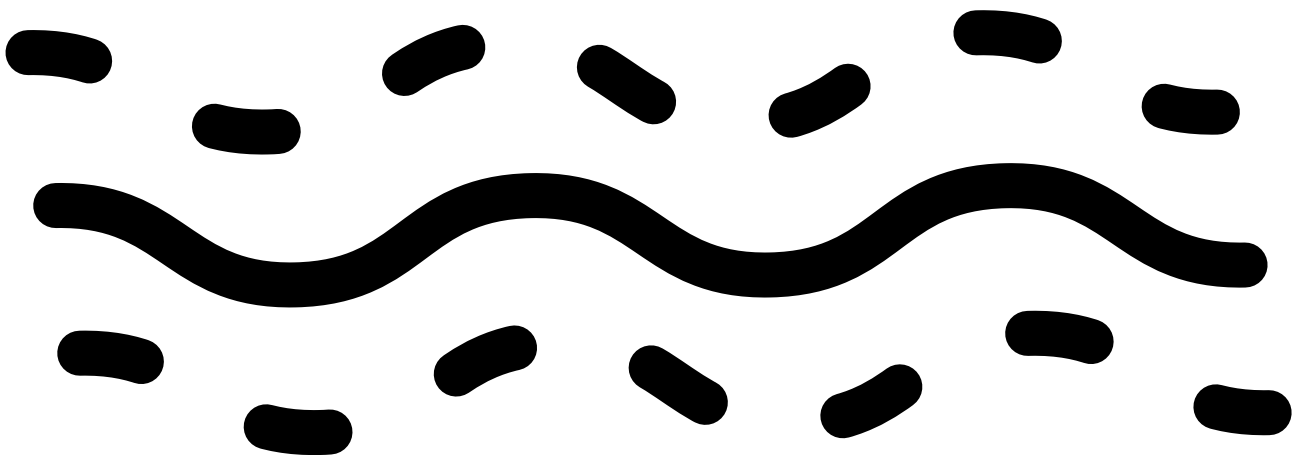


Figure 1. Summary of ASSETS alumni pathways

both on the goal and the journey. Before ASSETS, most alumni knew they wanted to pursue STEM studies but usually not a specific area, and alumni had few, if any, Aboriginal and/or Torres Strait Islander peers interested in STEM at school. Although some alumni had strong connections to culture, it was more common among the 10 alumni to be separated from culture or have limited experience with and connection to cultural identity. ASSETS was a transformative experience for most alumni, as it involved exposure to a multitude of experiences important for personal and educational growth, most notably leaving family and home (often for the first time) for a residential experience, and being exposed to cultural activities, peers with similar experiences and interests, and STEM professionals and facilities. These experiences took place at a time for students (between years 10 and 11) when it was important to understand options and to make decisions. The support of individual

teachers, family members, and CSIRO staff through the ongoing ASSETS support program was pivotal for many alumni. ASSETS and other experiences also sparked greater curiosity to connect more closely with culture, and also gains in confidence. During years 11 and 12, alumni solidified their educational intentions and took advantage of opportunities, including through CSIRO. By the time alumni were entering university and completing the first few years of study, their confidence was high as they achieved their goals, overcame challenges, and began to look more outwardly in terms of being mentors and giving back to their communities. The future plans of alumni were ambitious and specific. All alumni felt ASSETS had a positive influence on them, and for many it was transformative experience with long-lasting contributions to cultural connections, personal growth, and education and career outcomes.



Conclusions

The thematic and narrative analyses indicated that five to six years after attending an ASSETS summer school, all 10 alumni felt the program had a sizeable effect personally and educationally. Although the education successes of the interviewees cannot be attributed solely to ASSETS, according to alumni, the program contributed to a substantial degree. The ASSETS summer school took place at a transformative time in many alumni's lives, when education and career decisions were taking place and aspirations were being formulated, changed or strengthened. ASSETS had a large influence on other areas as well, particularly cultural identity and heritage. The structure and approach of ASSETS, specifically combining STEM and cultural components, is relatively distinctive among STEM residential experiences in Australia. The findings from these interviews indicate that this approach was highly beneficial to participants and that if it weren't for ASSETS, there were limited opportunities to explore and strengthen connections to culture for many alumni. The diversity of experiences and pathways of the 10 alumni outlined in Appendix B demonstrate how unique each person is, but also reveal how an experience such as ASSETS can have a similar and sizeable effect (see Figure 1).

The case study report⁷ released in 2019 focused on assessing the program's achievement of the program's 10 intended outcomes⁸. The destination interviews in this report, although relatively few in number, provide further support for the achievement of several of these outcomes over the longer term of 5 to 6 years:

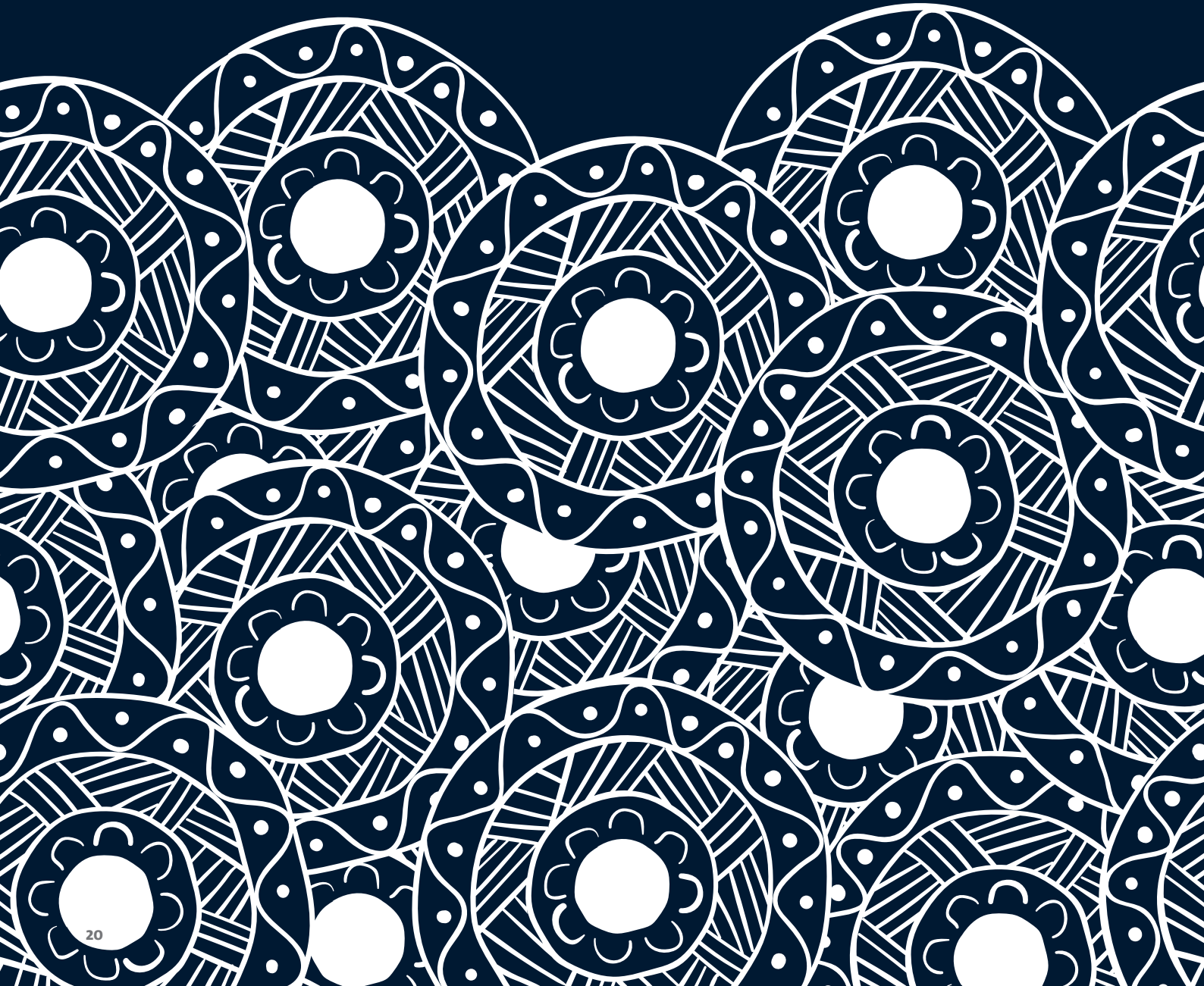
- High aspirations for STEM career
- Better understanding of and confidence pursuing STEM career pathway
- Greater confidence in cultural identity and the relevance of culture for STEM career
- Growth in student and professional networks
- Success in STEM subjects in Years 11 and 12
- Subject choice referencing university prerequisites
- Participation in broader STEM initiatives

More importantly, the indications from the sample of ASSETS alumni are that contributions to broader impacts are being made as well, including: social cohesion/reconciliation; (creation of a) cohort of role models – Indigenous knowledge and two-way science; and more, higher quality and greater workforce diversity of STEM professionals.

⁷ See <https://www.csiro.au/en/Education/Programs/Indigenous-STEM/Monitoring-and-Evaluation/Case-study-reports>

⁸ see <https://www.csiro.au/~media/Education-media/Files/Indigenous-STEM/Evaluation/Indigenous-STEM-Education-Project---Impact-Statement-ASSETS-2017.pdf>

Appendices



Appendix A – Interview Questions

Introductory and overall questions

What have you been up to since you attended the ASSETS summer school? (i.e., was it STEM related)

What impact, if any, did ASSETS have on your education, career, and/or life?

Do you keep in contact with anyone else from ASSETS (e.g., other participants, ASSETS staff, university staff, mentors, etc.)? If you do, who and how?

ASSETS – the summer school and leadership/support program

On reflection, what do you think was the most valuable part of being involved in ASSETS?

What were there any parts of ASSETS that stood out to you as being the most beneficial (e.g. the summer school, work placements, peer networking)?

Do you feel that ASSETS changed the way you feel about your cultural identity?

Have you participated in any other CSIRO or other STEM initiatives in addition to ASSETS? If so, what were they? (i.e. student mentoring, Awards programs, CREST, BHP Foundation Science and Engineering Awards, university STEM programs)?

If yes, what did you hope to gain from doing these and how did they compare to ASSETS?

Years 11 and 12

What subjects did you choose in your final years of school? Why? Did your participation in ASSETS effect your subject choices in Year 11 and 12?

How did you do in terms of grades in Years 11 and 12? (NB: not asking for specific grades, rather whether the student felt they were successfully academically) Were grades important for you? (i.e. to achieve your study/career goal/s)

Are you currently working/doing other study/a cadetship/traineeship or internship?

Career path

Can you tell me a bit about the choices you've made/opportunities you've been given that have brought you to where you are in your study/career journey?

Is this the career (or path) that you envisioned for yourself when you were in school? (i.e. has this changed?)

What role, if any, did ASSETS play in your study/career decision making?

Where to from here? (i.e. any plans extending beyond what they are currently doing?)

For participants at university/completing extra study:

How did you find the transition from school to University? What extra supports would have been helpful?

Did you choose X (degree) specifically to be a X (career)? (i.e. was your career path clear)

Networks and key people

Can you think of any key people who have influenced/guided decisions about your study or career?

How important are/have the people you met through ASSETS been to you/your career?

Appendix B – Individual Pathways

PHASE	ALUMNUS 1	ALUMNUS 2
Before ASSETS	<ul style="list-style-type: none"> • Always enjoyed science • Had no idea what they would be doing after high school • Did not know about STEM opportunities • Did not have confidence in self or abilities 	<ul style="list-style-type: none"> • Wanted to become a mechanical engineer, then a civil engineer, then a doctor, then a teacher • Student services counsellor at high school was a big influence – told that had potential
At ASSETS summer school	<ul style="list-style-type: none"> • ASSETS gave drive and confidence to continue in science and go to university • Experience increased the valuing and curiosity of culture • Provided increased awareness of opportunities 	<ul style="list-style-type: none"> • Provided insights into university life • Boosted motivation to attend and finish university • Was first summer school they attended – sparked interest in attending other residential camps and visiting other universities and keeping options open • Cultural components helped self-expression • Wanted to be mechanical engineer at the time
Post-ASSETS summer school support and networks	<ul style="list-style-type: none"> • Kept in touch with an ASSETS staff member • ASSETS staff member helped identify cadetship opportunity and with application process • Kept in touch with most other students from summer school (through Facebook) 	<ul style="list-style-type: none"> • Creating a network has very valuable • Connected with CareerTrackers • Stayed in touch with a handful of other participants • Network was for friendship and career inspiration • Does not keep in touch with ASSETS staff or mentors (doesn't feel need to, but knows they are there if needed)
High School and transition to university	<ul style="list-style-type: none"> • Involved in another residential STEM (winter) school (100 participants); preferred ASSETS, which was smaller and more comfortable, and included support component • Would have chosen science elective subjects, even without ASSETS • The thought of going to university motivated alumnus to achieve high grades • Mother was large influence—helped make decisions about university 	<ul style="list-style-type: none"> • Attended another STEM summer school; best thing was seeing a different university campus • Part of Follow the Dream program at high school, including leadership camp • Received a lot of encouragement and support to attend university from family, friends, teachers • Last minute decision to enter law, switching from teaching • Took random subjects, without a clear pathway • Switched from ATAR to general subjects because it was too much course load
Transition to and at university	<ul style="list-style-type: none"> • In third year of combined science and law degree • Got a cadetship with CSIRO in first year of university • Currently involved in science radio show, after being interviewed about ASSETS—providing advice on Indigenous engagement • Involved in equity committee at university-mentoring Aboriginal and/or Torres Strait Islander students • Transition to university was not difficult academically; first semester was somewhat challenging socially • Aware of Indigenous support unit at university, has used free tutoring service 	<ul style="list-style-type: none"> • Took a gap year to work • Currently in first year at university • Moved across the country with partner • Did an Aboriginal Orientation Course to enter university – very helpful foundation course in transition • Did not access support to transition to university, relied on own strength • Part of Indigenous student club at university • Involved with CareerTrackers – doing summer and winter internships • Accessed Indigenous support unit at university • Completed Bachelor's degree in Psychology
Future plans	<ul style="list-style-type: none"> • Science career, but using law, such as science policy • Would like to work for CSIRO 	<ul style="list-style-type: none"> • Complete Master's degree – become lawyer in human rights/criminal area – to help own mob

PHASE	ALUMNUS 3	ALUMNUS 4
Before ASSETS	<ul style="list-style-type: none"> • Always interested in science • Unsure of what area to pursue • Very good relationship with science teacher at school – encouraged them to do ASSETS • Did not have strong connection to culture – family didn't talk about it • Both parents went to university for STEM – had large influence and were supportive of education • School started support role for Indigenous students – once a term helped students develop learning goals (school did not put much effort into program though) 	<ul style="list-style-type: none"> • Always hands-on and interested in tools and how things work • First in family to graduate from high school • Did not know was Indigenous until 12 years old • Intent on pursuing medicine and science for quite some time • Observed physiotherapists through dad's footy league
At ASSETS summer school	<ul style="list-style-type: none"> • Scared to go to summer school, but had the best time • Connected with different people • Very positive experience • Going alone increased confidence • Made close connections with peers • First exposure to a university • Inspired to connect more deeply with culture – felt more confident to 'dig' 	<ul style="list-style-type: none"> • Attending ASSETS was first time leaving state born in, never had money to do it before • Networking with other Indigenous students (who liked science) was powerful • Learned a lot about culture and solidified cultural identity, prompted to dig deeper • ASSETS improved confidence to take STEM subjects, and think of oneself as smart enough
Post-ASSETS summer school support and networks	<ul style="list-style-type: none"> • Finished HSC • Connected with ASSETS alumni at a face-to-face university-based event – valued the face-to-face contact but understands the expense is high • Took gap year to travel and work – felt burnt out; would not have succeeded at university without break • Kept in contact with ASSETS staff member – doesn't contact often but knows is there if needed • Keeps in contact with ASSETS peers through Facebook • Brother did ASSETS two years later 	<ul style="list-style-type: none"> • ASSETS pushed to expand aspirations (e.g. to go to university out-of-state) • Learned about more opportunities through ASSETS, and gave confidence to pursue • Does not keep in contact with other alumni, but knows they are there if needed
High School and transition to university	<ul style="list-style-type: none"> • ASSETS staff member attempted to arrange internship at CSIRO but didn't work out; central CSIRO • Attended networking day at a university • Did not attend any other STEM experiences • Did maths, chemistry and biology subjects • Supportive teacher – advised on subject selection to get into university • Had older friends (women) that went into STEM – provided confidence to do it themselves 	<ul style="list-style-type: none"> • Did a winter engineering (residential) camp • Did a university experience camp (three days) for interstate students • Took part in Follow the Dream, and was an ambassador for the Follow the Dream program one year – inspired alumnus to have high attendance at school • Follow the Dream coordinator facilitated involvement in ASSETS • Had funny and engaging Math teacher, and a human biology teacher who brought alumnus back to high school for a visit and called alumnus a success story, which was inspiring • Few Aboriginal and Torres Strait Islander students at school, mostly on TAFE pathway • Mentored younger student through Aboriginal Excellence program
Transition to and at university	<ul style="list-style-type: none"> • Involved in another residential STEM (winter) school (100 participants); preferred ASSETS, which was smaller and more comfortable, and included support component • Would have chosen science elective subjects, even without ASSETS • The thought of going to university motivated alumnus to achieve high grades • Mother was large influence—helped make decisions about university 	<ul style="list-style-type: none"> • Attended another STEM summer school; best thing was seeing a different university campus • Part of Follow the Dream program at high school, including leadership camp • Received a lot of encouragement and support to attend university from family, friends, teachers • Last minute decision to enter law, switching from teaching • Took random subjects, without a clear pathway • Switched from ATAR to general subjects because it was too much course load
Future plans	<ul style="list-style-type: none"> • Science career, but using law, such as science policy • Would like to work for CSIRO 	<ul style="list-style-type: none"> • Complete Master's degree – become lawyer in human rights/criminal area – to help own mob

PHASE	ALUMNUS 5	ALUMNUS 6
Before ASSETS	<ul style="list-style-type: none"> • Supportive Year 8 science teacher • Fell in love with science • Had visited university campuses during school 	<ul style="list-style-type: none"> • Deciding between law and engineering • Didn't know a lot about own background or cultural history
At ASSETS summer school	<ul style="list-style-type: none"> • Summer school led to decision to pursue specific STEM field • Cultural components crystallised desire to give back to community • Was not first time away from home • Science activities were well structured 	<ul style="list-style-type: none"> • Felt encouraged by leaders and students at ASSETS, didn't influence subject choice • Most valuable elements were working on the inquiry project and collaboratively in groups • Felt somewhat uncomfortable not being able to talk about own culture at summer school due to lack of knowledge • Cultural activities, including learning traditional dances, was special
Post-ASSETS summer school support and networks	<ul style="list-style-type: none"> • Kept in touch with seven to 10 ASSETS alumni (through Facebook) • Kept in touch with two ASSETS staff/mentors • ASSETS staff member provided reference for tutoring job • ASSETS staff member hired alumni for casual position at CSIRO • ASSETS staff members were pivotal in supporting and inspiring 	<ul style="list-style-type: none"> • In close contact with two fellow ASSETS participants – they talk every day
High School and transition to university	<ul style="list-style-type: none"> • Difficulty choosing between STEM subjects—science teacher helped and reassured • Selected all STEM elective subjects—made good choices but some luck involved • University was more relaxed than high school, because alumnus felt they were more in the “driving seat” with high school was more being told what to do • University was better suited to their independent learning style 	<ul style="list-style-type: none"> • Attended junior engineering camp and other science camps across multiple states, met lots of other students interested in engineering • Involved in engineering competitions • Won national STEM award and travelled overseas to STEM event as part of prize • Graduated with good OP and got into engineering and maths degree
Transition to and at university	<ul style="list-style-type: none"> • Undertaking STEM bachelor's degree • Family member told alumnus about STEM internship opportunity • Undertaking research internship at laboratory during university breaks • Obtained scholarship for both attending university and doing internship—has not needed to work • Expects to graduate in 2021 • Does not feel need to access Indigenous support unit at university but knows it is there if needed • Living with parents while attending university 	<ul style="list-style-type: none"> • Transition to university was relatively easy; Indigenous support unit was helpful • Studying engineering and maths, majoring in mechanical and aerospace engineering • Interned with large engineering company three times over summer holidays, and with aerospace company • Involved with Indigenous support unit at university • University felt like it was building on knowledge from high school – a lot of friends moved to the university city as well
Future plans	<ul style="list-style-type: none"> • Honours degree and PhD • Internship research institute has offered honours degree opportunity 	<ul style="list-style-type: none"> • Graduating in 2023 • Wants to work for large aerospace company that alumnus is interning with • Perhaps go to the USA or Europe on an internship

PHASE	ALUMNUS 7	ALUMNUS 8
Before ASSETS	<ul style="list-style-type: none"> • Always interested in animal science, potentially being a ranger • Always enjoyed hands-on activities • Science wasn't their strongest subject in school but enjoyed them the most • Didn't know a lot of fellow Indigenous students who wanted to take an academic route • Indigenous teacher aid/guidance officer told about ASSETS • Always encouraged by parents to do well at school 	<ul style="list-style-type: none"> • Grew up separated from culture • Went to small rural school with few Indigenous students – no culturally responsive elements in the curriculum • Experienced racism – being lighter complexion, some people did not believe alumnus was Indigenous • Neither parent attended university – alumnus didn't see themselves as being the calibre to attend university • Being selected to attend ASSETS made alumnus think they were good enough to attend university
At ASSETS summer school	<ul style="list-style-type: none"> • Going to ASSETS solidified interest in science • Knowing that other Indigenous students were going into science provided assurance • Most valuable part was sense of community – interacting with like-minded people in same field • Felt more comfortable with other students than with mentors • Learned how to apply cultural activities to field of study – future career may involve travelling to rural areas and working with Indigenous people • Was able to develop relationships quite quickly • Rewarding to experience Indigenous cultures from across the continent 	<ul style="list-style-type: none"> • Had “fantastic” time at the summer school • Felt there were a small group of students that “had my back” and formed close connection to • Felt general sense of comradery with the entire cohort • Felt other students at ASSETS had stronger connection to culture • Fantastic to be around people with same skin tone – was special and felt validated • ASSETS brought alumnus closer to science and culture, and how they work together
Post-ASSETS summer school support and networks	<ul style="list-style-type: none"> • Doesn't keep in close contact with other ASSETS participants • ASSETS encouraged to travel to birthplace and learn more about own tribe • Involvement in cultural has had big influence on career path – wants to find balance between work and personal 	<ul style="list-style-type: none"> • Was excited about biochemistry after ASSETS • Attending ASSETS indirectly led to a teaching education path • Felt a bit embarrassed not to pursue STEM pathway • Kept in contact with one mentor but not fellow participants • After attending summer school, was better at managing racism and not caring so much about what others had to say
High School and transition to university	<ul style="list-style-type: none"> • Knew veterinary science was difficult – was challenging but was encouraged to keep going by friends and family • Involved in Indigenous dance through-out high school • Not many opportunities to attend Indigenous residential camps • Chemistry teacher was very encouraging generally, and biology teacher encouraged to go into veterinary science 	<ul style="list-style-type: none"> • Initially wanted to pursue science teaching but had bad experiences with science teachers in senior years of high school – led to thinking was poor at science – but learned about how important teachers are for students • Set up Indigenous weaving program at school with help of School Indigenous coordinator • Attended youth leadership camp, which was also a meaningful experience • Hospitality teacher was very engaging – thought about going into teaching
Transition to and at university	<ul style="list-style-type: none"> • Doing a Bachelor of Veterinary Science • First year felt ‘babied’ a bit, which was fine because of difficulty of degree • High work load, tested persistence • Works part-time job • Socialises with other Indigenous students on campus • Would like to mentor Indigenous high school students and encourage them to take advantage of opportunities • Uses tutors but has felt didn't take advantage of as many opportunities at university as they could have • Family was always around to help and support 	<ul style="list-style-type: none"> • Former ASSETS mentor provided encouragement to engage with Indigenous support centre at university – alumnus was very thankful • Doing Bachelor of Education Secondary and Bachelor of Arts • Found teaching placement challenging – working at a job at the same time
Future plans	<ul style="list-style-type: none"> • Proactively seeking out opportunities through contacts • Interested in commercial fish industry • Interested in reviving culture in remote areas 	<ul style="list-style-type: none"> • Will be a teacher, in hospitality area or English • Wants to work in public sector, to change perceptions of public education • Wants to incorporate Indigenous knowledges into teaching practice

PHASE	ALUMNUS 9	ALUMNUS 10
Before ASSETS	<ul style="list-style-type: none"> • Always strongly identified as being Indigenous but doesn't speak language and not involved in cultural practices • From large family network • Teacher recommended ASSETS • Early high school career aspirations included architecture and scientific journalism 	<ul style="list-style-type: none"> • Was overconfident in school, was not trying • Originally wanted to be a teacher • Fair skinned; didn't feel like they fit in • Felt motivated when people, including parent, said they couldn't or shouldn't do something
At ASSETS summer school	<ul style="list-style-type: none"> • Surprised that some Indigenous students were not connected to culture • Was shy but made the most of opportunity and came away more confident • Biggest impact of ASSETS was on personal development and gaining confidence 	<ul style="list-style-type: none"> • Experience at summer school provided framework to achieve goals and overcome barriers • Being with other students with similar interests and experiences helped • Felt that all the participants came together quickly and related to each other with mutual understanding • Felt that the mentor at summer school was fantastic
Post-ASSETS summer school support and networks	<ul style="list-style-type: none"> • Keeps in touch with alumni on Facebook • Kept in contact with one mentor, who provides ongoing support • Biggest benefit was having network, and ability to reach out when needed • Attending was turning point between living at home and going to boarding school • More curious about culture after summer school – asked father questions • ASSETS prompted alumnus to look at opportunities at CSIRO 	<ul style="list-style-type: none"> • After summer school, put more effort into school because realised it would provide more options • Had health issues after summer school; ASSETS staff member got in touch and got alumnus back on track • ASSETS staff member and parent prompted alumnus to look into engineering as an option • Has kept in regular contact with ASSETS program staff and has helped at a subsequent ASSETS summer school • Became more involved in finding out about culture after attending ASSETS, and got more involved in culture at school
High School and transition to university	<ul style="list-style-type: none"> • Interested in physics and mathematics in high school • Maths teacher highlighted opportunities, including ASSETS – sold as networking and broadening horizons opportunity • Attended an Indigenous winter school, and a leadership camp • Took part in some Indigenous leadership programs • Unsure whether wanted to do Bachelor of Science until half way through Year 12 • Mother encouraged to take specialist maths (prerequisite) • Motivation dipped somewhat in high school – lifted game in time • Principal encouraged alumnus to work as teacher's aide • Wasn't able to get involved in CareerTrackers because of scholarship restrictions 	<ul style="list-style-type: none"> • Moved to city to attend university based on where ASSETS summer school was held • Physics teacher provided support • Involved at a STEM day at a university • Briefly involved in school STEM club targeting young women • Wanted to show mom that could succeed in 'hard' subjects • Transition to university was difficult and stressful, particularly time pressures • Occasionally engaged with Indigenous support unit but feels too busy to engage more
Transition to and at university	<ul style="list-style-type: none"> • Studying Bachelor of Science • Not engaged with Indigenous support unit; doesn't feel need to • Returned to ASSETS as mentor 	<ul style="list-style-type: none"> • Undertaking an electrical engineering degree • Involved with CareerTrackers internship – finds it highly enjoyable • Attended Garma with CSIRO staff • Feels there is some sexism among some male engineering students
Future plans	<ul style="list-style-type: none"> • Wants to complete PhD 	<ul style="list-style-type: none"> • Wants to work in systems management



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