



Australia's National  
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# Interim evaluation report: Digital Careers

Impact and evaluation, CSIRO Education and Outreach

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# Executive summary

The CSIRO Digital Careers Program ('Digital Careers') seeks to raise awareness of and interest in information and communications technology (ICT) careers to grow and diversify the pool of tertiary students preparing for a career in the ICT industry. The 2021–23 Digital Careers program is delivered by the CSIRO Education and Outreach unit (CEdO) and funded by the Department of Industry, Science and Resources.

This interim evaluation report draws on the results and findings of evaluation activities, including participant surveys and interviews, undertaken from January 2021 to June 2022. It examines participation rates and assesses performance against intended outcomes for the following Digital Careers elements:

- Bebras Computational Thinking Challenge (Bebras)
- CyberTaipan Program (CyberTaipan)
- Microsoft FarmBeats for Students Australia pilot program (FarmBeats).

The report also provides a high-level summary of participant demographics and post-event feedback for the Educator Professional Learning (PL) program.

The Digital Careers team co-fund the Computational and Algorithmic Thinking Challenge (CAT) and the Young ICT Explorers Program (YICTE). These programs are delivered by third parties and have not been included in the Digital Careers program evaluation.

As illustrated in Table 1, over 54,000 students, 2600 educators, and 20 mentors participated in the Digital Careers program in 2021.<sup>1</sup> Figures for the first half of 2022 indicate these participation figures will likely be maintained or exceeded in 2022.

## Interim evaluation findings

Data collected to date provides an early indication that some educators and students are observing improvements in student skills, understanding, and confidence. Similarly, educators have also reported improvements in their own confidence and capability. While the interim evaluation results are promising, small sample sizes make it difficult to generalise these results across all Digital Careers participants.

Table 1. Digital Careers participation (January 2021 – June 2022)

	STUDENTS	EDUCATORS	MENTORS
2021	54,032	2663	20
2022 (Jan to Jun)	28,227	1698	52

<sup>1</sup> This figure likely includes some double counting of students and educators that participated in Bebras Round One and Round Two

## Bebras

Bebras is maintaining strong participation figures and there is evidence to demonstrate that the program is on track to achieve its intended early and medium-term outcomes. Survey responses indicate that educators value the program and are observing improvements in the confidence and the computational thinking skills of their students.

For example:

98 per cent of surveyed educators agreed or strongly agreed that they noticed improvements in student confidence using computational thinking since participating in Bebras (n=44).



## CyberTaipan

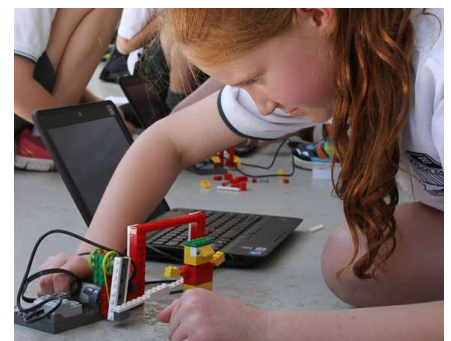
CyberTaipan is seeing increased program participation and is working towards achieving its early and medium-term outcomes. The small sample of participants that provided feedback in 2021 indicated that the program was positively received by participating students, coaches, and mentors and that students and educators had observed improvements in their cyber security skills and awareness, for example:

- The per cent of students rating their understanding of the range of options to study cyber security as at least moderate, increased from 54 per cent to 100 per cent following participation in CyberTaipan (n=12).<sup>2</sup>
- Following the CyberTaipan competition, 100 per cent of surveyed coaches rated their confidence advising students about cyber-security education and careers as moderate, high, or very high (n=10).



## FarmBeats

Evaluation data indicate that the first iteration of the FarmBeats program, run as a small-scale pilot in 2021, provided an innovative addition to traditional digital technology classrooms and successfully engaged students in hands-on, real-world inquiry-based activities. Feedback from the pilot is being used to refine and expand the program for future cohorts of students.



## Educator PL

The Digital Careers Educator PL program underwent significant development in 2022. Registration figures for the first half of 2022 have exceeded program team expectations, with anecdotal feedback from participants indicating that they found the sessions engaging and were satisfied with the information provided.

## Opportunities for improvement

As part of the interim evaluation, three areas have been identified as potential opportunities to further improve and refine the overall Digital Careers program.

- Review program registration process with a view to streamlining
- Consider providing additional resources to further support educators
- Investigate options to increase participation from underrepresented groups.

Program teams have been proactive in responding to these opportunities and have begun implementing new practices, developing additional resources, and improving their processes.

<sup>2</sup> Answer scale: No/none, Low, Moderate, High, Very high.

# Introduction

## Background

Data-driven innovation and digital technologies represent key areas of economic growth globally, and for Australia, and require new knowledge, new technologies, and innovative thinking. As the Australian Government recognised in its 2021 Digital Economy Strategy, to capitalise on these opportunities and realise potential for innovation into the future, Australia needs to ensure that the workforce has the necessary skills and knowledge (Commonwealth of Australia, 2021).

These goals are reinforced by the Australian Computer Society's annual snapshot of the Australian Technology Industry which estimates that the number of workers in ICT-related industries will grow to 1.2 million by 2027 and represent an increasing share of the Australian workforce (from 6.7 per cent in 2022 to 8.5 per cent in 2027) (Australian Computer Society 2022). Acknowledging the importance of digital technologies to Australia's future, there has been a push by federal and state governments to increase and improve digital technology education in Australia. The introduction of the Australian

Curriculum: Digital Technologies in 2015 saw digital technologies, problem solving and teaching students to operate in a knowledge-based society recognised as critical to the wellbeing and sustainability of the economy (Australian Curriculum Assessment and Reporting Authority (ACARA), 2022).

In addition, across the broader Science, Technology, Engineering and Mathematics (STEM) field there is concern that Australian students at school and tertiary levels are not engaging in STEM. This is reflected both in overall numbers of students undertaking STEM studies and falling academic performance against international benchmarks (Australian Council for Educational Research (ACER), 2018). In addition, minority groups are less represented and have fewer opportunities in STEM. This includes students who identify as Aboriginal and/or Torres Strait Islander, girls, students from low-SES and regional and remote communities. Recent research from the Department of Industry, Science, Energy and Resources (DISER) showed that women are not enrolling in STEM Related university courses at the same rate as men, with 42 per cent of men enrolled in a higher education course, choosing a STEM related course compared to 19 per cent of women (Department of Industry, Innovation and Science, 2020).

The CSIRO Digital Careers Program ('Digital Careers') was first established in 2011 to help raise awareness of and interest in ICT careers to grow and diversify the pool of tertiary students preparing for a career in the ICT industry. The 2021–23 program, funded by the Department of Industry, Science and Resources, builds on the work conducted in the Digital Careers program from 2011. The program is comprised of eight elements which seek to support teachers and encourage students' understanding of digital technologies and build the foundational skills they require in an ever-changing workforce. The eight elements of the Digital Careers program are listed below.

1. Bebras Computational Thinking Challenge Australia (Bebras).
2. CyberTaipan Program (CyberTaipan).
3. Microsoft FarmBeats for Students Australia (FarmBeats).
4. Computational and Algorithmic Thinking Challenge (CAT).
5. Young ICT Explorers Program (YICTE).
6. Teacher Professional Learning resources to support these programs (Educator PL).
7. Digital Careers Web Resources (Web resources).
8. Research: Girls' participation in DC Programs (Research).

Program elements 1–3 (Bebras, CyberTaipan and FarmBeats) are independent program elements delivered by Digital Careers, program elements 4–5 (CAT and YICTE) are co-funded by CSIRO and delivered by a third party, elements 6–7 (Educator PL and Web resources) span multiple programs and element 8 (Research) is a CSIRO commissioned research project currently being completed by the Australian Council for Educational Research (ACER) to inform future Digital Careers program delivery.



## Digital Careers objectives

The overarching Digital Careers objectives are:

- Promote digital career pathways and increase the pipeline of skilled digital professionals in Australia.
- Provide education and training material and professional development for educators delivering digital technology curriculum and activities (e.g. Bebras, YICTE, CyberTaipan).
- Increase interest and participation amongst school students in computational thinking, ai, cyber security, big data, and digital technologies, particularly among underrepresented groups in ICT.
- Increase awareness of career diversity, opportunities and benefits of ICT jobs and careers.

Bebras, CyberTaipan and FarmBeats each have their own Impact Statements (see Appendix A). These statements, based on CSIRO's Impact Model, describe the logic and assumptions of each program, and articulate the expected outputs, outcomes, and longer-term impacts. The Impact Pathways include both short and medium term direct program outcomes and longer term, indirect impacts. The Educator PL program does not have a stand-alone Impact Statement but is integrated into the other Digital Careers programs. Table 2 provides a summary of the key program elements delivered by, or managed by, the Digital Careers team.

Table 2. Program descriptions and key elements

DESCRIPTION	
Bebras	<p>Bebras is an international initiative which aims to promote informatics, computational thinking, and problem solving among students in years 3–12.</p> <p>Key elements:</p> <ul style="list-style-type: none"> <li>• Bebras Challenge – an online event to engage students in problem solving and computational thinking, held twice per year.</li> <li>• Bebras 365 – online and downloadable resources which use questions from past years of the Bebras challenge.</li> <li>• Bebras Mini Challenges – shorter versions of the Bebras Challenge available all year with a focus on one computational thinking skill.</li> <li>• Bebras Unplugged – an offline, printable version of the Bebras Challenge for use at home or in the classroom.</li> </ul> <p>Computational Thinking in Action activities – downloadable worksheets designed to develop teamwork; critical and creative thinking; problem solving; and computational thinking skills.</p> <p>According to one recently published Australian study, Bebras is one of the best-known international instruments for measuring the general computational thinking skills and knowledge of students (Boom et al. 2022).</p>
CyberTaipan	<p>CyberTaipan is an Australian cyber defence program for high-school aged youth, consisting of a national competition and week-long holiday camps. The program is an adaptation of the United States Air Force Association’s CyberPatriot program and is designed to educate, engage, and inspire young people to develop skills and pursue careers in cyber security and other science, technology, mathematics, and engineering (STEM) fields.</p> <p>Key elements:</p> <ul style="list-style-type: none"> <li>• CyberTaipan competition (held over two rounds)</li> <li>• CyberTaipan national final (for the top 10 teams)</li> <li>• CyberTaipan awards ceremony.</li> <li>• CyberTaipan CyberCamps – five day in-person camps held with small groups of students to promote interest in cyber security.</li> </ul>
FarmBeats	<p>In 2021 CSIRO partnered with Microsoft to pilot FarmBeats with students from years 8–10 across 18 Australian schools. The program sought to increase student skills and teacher confidence in key information technology areas, including Artificial Intelligence (AI), Internet of things (IoT), big data and machine learning.</p> <p>FarmBeats was run in terms three and four of 2021 and included the following elements: teacher professional learning sessions; resources and activities; opportunities for teachers to participate in the creation of program materials; and opportunities for students to design and implement an inquiry project.</p> <p>Each participating teacher was given a set of Microsoft FarmBeats for Students kits to deliver the program with their class. Kits included a Raspberry Pi and sensors for soil moisture, light, ambient temperature, and humidity.</p>
Educator PL	<p>CSIRO recognises the importance of supporting teachers to further their understanding of the digital technology curriculum content and pedagogy, with up-to-date training and resources. The overarching goals of the Digital Careers Professional Learning element are to provide up-to-date training and information on; curriculum resources, Digital Career programs that can be utilised by teachers in the classroom, and fundamental Digital Technology concepts. The PL program also aims to highlight the innovative work being done by CSIRO that link with the Digital curriculum.</p> <p>The PL program incorporates a series of live and recorded educator PL sessions. The sessions are aligned with the professional standards endorsed by the Australian Institute for Teaching and School Leadership. Attendees at Educator PL sessions receive a certificate of attendance and can include the session as part of their annual PL requirements.</p>
Research	<p>CSIRO has commissioned ACER to critically examine the factors that impact the participation of young women in digital technology education programs and develop practical recommendations and tools to address this disparity within Digital Careers. ACER have been contracted to deliver the following:</p> <p><b>Part 1</b></p> <ul style="list-style-type: none"> <li>• A brief literature review and list of recommendations for the Digital Careers team.</li> <li>• A set of resources for key stakeholders in the field of digital technology program engagement.</li> </ul> <p><b>Part 2</b></p> <ul style="list-style-type: none"> <li>• Primary research to gain further insight into the factors that facilitate and hinder young women’s engagement with digital technologies and STEM.</li> <li>• Final research report.</li> </ul>



## Purpose of this report

This interim evaluation report draws on the results and findings of evaluation activities undertaken from January 2021 to June 2022. It examines participation rates and assesses performance against intended outcomes for Bebras, CyberTaipan, and FarmBeats. It also provides a high-level summary of participant demographics and post-event feedback for the Educator PL program.<sup>3</sup> As an interim evaluation report, this report focuses on i) assessing performance against intended outcomes that the programs can directly influence in the short to medium-term, and ii) identifying actionable opportunities for improvement in Digital Careers programs. The final evaluation report, completed at the end of program activities in 2022, will consider if programs have led or contributed to any longer-term outcomes.

The programs that comprise Digital Careers are at different stages in their implementation timelines, with substantially different participation targets and expected outcomes. For example, FarmBeats was run in 2021 as an initial pilot program over two terms with a small cohort of schools willing to test and refine the early iteration of the initiative. In comparison, Bebras has been running in Australia since 2014 and has close to 30,000 students participating in each round. Bebras and CyberTaipan are also programs which students tend to only engage with for a few days each year. The programs are therefore not being compared against one another but are assessed as individual Digital Careers elements. Where applicable, the report will identify any common themes and opportunities for improvement across the broader Digital Careers program.

As outlined in the Australian Government's guide to evaluating STEM gender equity program (Kingsley, 2020) publishing evaluation findings is an important step in helping other organisations and individuals learn what works, and what does not, to improve STEM education in Australia. It is intended that the publication of the Digital Careers evaluation results will contribute to the small body of research that currently exists on the outcomes and effectiveness of computer education programs in Australia.

## Program implementation

Over the period from January 2021 to June 2022 the Digital Careers program team had to overcome a number of challenges to ensure all programs were delivered in a consistent and high quality manner. These challenges included:

- The Covid-19 pandemic continued to impact schools, workplaces, and families. The impact of lockdowns, home schooling, and staff shortages placed unprecedented demands on schools, educators, and families. Anecdotal evidence from some Digital Careers participants indicated that the impacts of the pandemic meant that participation in the Digital Careers program was not possible.
- The Digital Careers team experienced turnover in a number of key positions, including the Program Manager role. Despite the challenges associated with staff movements, the team worked well to support each other, onboard new staff, and fill any capability gaps.



<sup>3</sup> At the time of writing, ACER has provided a draft literature review and is moving into the primary research phase of the project. An assessment of the impact of this program element will be included in the final evaluation report.

# Methodology

## Evaluation questions

Table 3 provides a summary of the key evaluation questions (KEQs) that are guiding the evaluation of the Digital Careers program.

Table 3. Key evaluation questions

KEY EVALUATION QUESTIONS
1. To what extent did the Digital Careers Program successfully engage students, teachers/educators, schools, and industry?
2. To what extent did the Digital Careers Program deliver intended benefits for students, teachers/educators, schools, and industry?
3. How significant is the Digital Careers Program in relation to being unique, efficient, valued, and sustainable?

## How we measure success

Based on these evaluation questions and the key program outcomes identified above, an evaluation rubric has been created to assess the success of each Digital Careers program (see Table 4). This rubric provides a framework to assess achievement of outcomes relating to the first two evaluation questions. The rubric intentionally focuses on student and educator involvement in the Digital Careers program. The final evaluation report will consider how the various program elements have engaged with industry and if these elements have delivered the intended benefits to industry.

In relation to the third evaluation question, and specifically the question of how valuable participants found Bebras, CyberTaipan, FarmBeats, and the Educator PL sessions, this interim evaluation report will report on participant satisfaction levels and willingness to recommend programs to others as a proxy measure for value.

A full assessment of this evaluation question, including a review of other programs, analysis of discussions with the program team, and detailed feedback from program participants will be included in the final evaluation report.

## Data collection methods

Figure 1 summarises the data collection methods that have been utilised across the individual elements of the Digital Careers program to date. The data collection methods have been tailored to the specific program being evaluated, with participant engagement in the evaluation varying accordingly. Table 5 provides a summary how program participants have been involved in the evaluation activities conducted to date, and in future planned activities.

The evaluation activities rely primarily on student, educator and mentor self-reports of their program experiences and observations of any changes they, or their students have experienced following participation in a Digital Careers program. Due to time and resource constraints, it was not possible to obtain administrative or school data, for example on students' academic results or elective selections, which would have added stronger evidence for the conclusions made in this report. The reliance on self-report survey data has some potential bias, for example because those most engaged with a program (both positively and negatively) are more likely to complete a survey. This is exemplified in the case of respondents to the Bebras survey, where the survey sample included a disproportionately high number of educators with students performing in the top tier of the challenge, as a result, care should be taken when interpreting results. Further information on the Bebras survey sample is provided in the Findings section below.

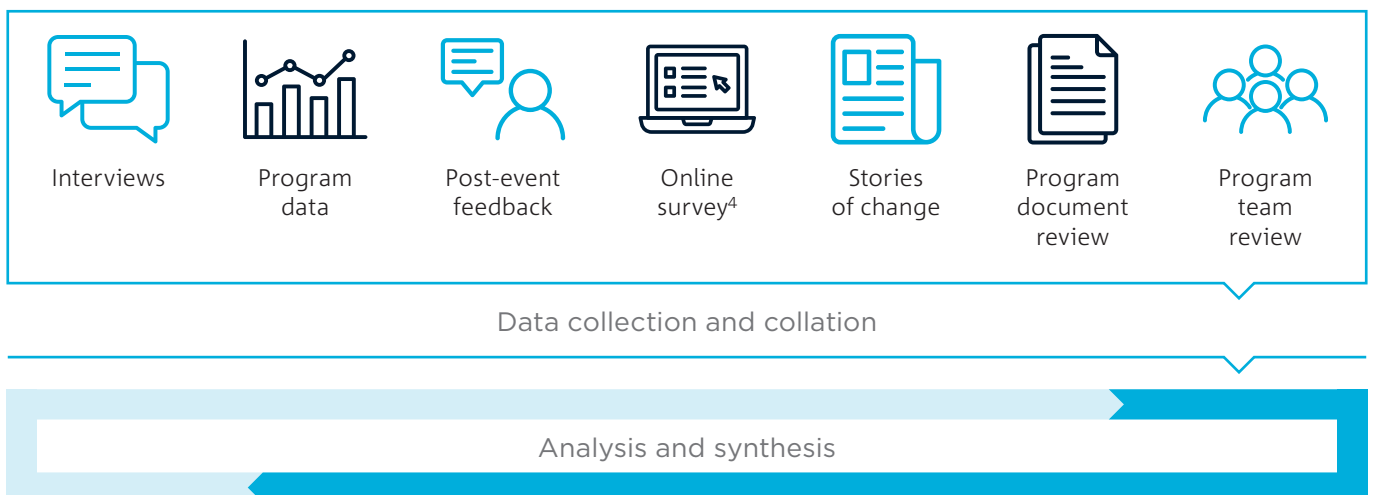


Figure 1. Digital Careers data collection methods

Table 4. Evaluation rubric: how we measure program achievement

PROGRAM DOMAIN	A. STUDENT PARTICIPATION AND ENGAGEMENT	B. STUDENT AWARENESS AND INTEREST	C. STUDENT CAPABILITY AND CONFIDENCE	D. TEACHER CAPABILITY AND CONFIDENCE
<b>Link to KEQ</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>Emerging</b>	The program has developed strategies to increase participation	The program has developed strategies to increase student awareness and interest	The program has developed strategies to improve student capability and confidence	The program has developed strategies to increase teacher capability and confidence
<b>Developing</b>	The program has developed strategies to increase participation	The program has developed strategies to increase student awareness and interest	The program has developed strategies to improve student capability and confidence	The program has developed strategies to increase teacher capability and confidence
<b>Consolidating</b>	The program is seeing measurable increase in student participation	The program is seeing measurable increase in student awareness and interest	The program is seeing measurable improvement in student capability and confidence	The program is seeing measurable increase in teacher capability and confidence
<b>Highly developed</b>	The program is seeing substantial measurable increase in student participation	The program is seeing substantial measurable increase in student awareness and interest	The program is seeing substantial measurable improvement in student capability and confidence	The program is seeing substantial measurable increase in teacher capability and confidence

Table 5. Participant data collection methods

	2021	2022
<b>Bebras</b>	Educator survey	Stories of change* Semi-structured interviews Educator survey
<b>CyberTaipan</b>	Educator survey Student survey Mentor survey Post-CyberCamp survey	Educator survey Student survey Mentor survey Post-CyberCamp survey
<b>FarmBeats</b>	Semi structured interviews	NA
<b>Teacher PL</b>	Post-event feedback	Post-event feedback

\*All Bebras Australian registered educators, for whom we had jurisdictional approval were invited to submit a Story of Change they observed and relate to Bebras. The approach was proposed to illicit a deeper understanding of the impact of Bebras. There was limited participant uptake of the stories of change activity following Bebras Round One in 2022. This was likely to due to the high demands already placed on teachers and the comparatively little time students engage with Bebras compared to other school activities. Consequently, the decision was made to shift to semi-structured interviews with a select group of participants later in 2022.

4 Not all respondents answered every survey question. As such, when discussing proportions for each question, the sample size (n=X) is included to provide clarity around how many respondents completed that specific question

# Findings

## Bebras

Bebras is maintaining strong participation figures and there is some evidence to demonstrate that the program is on track to achieve its intended early and medium-term outcomes. Survey responses indicate that educators value the program and are observing improvements in the confidence and the computational thinking skills of their students.

Table 6 provides a summary of Bebras Challenge participation for figures for 2020, 2021, and 2022 (Round 1 only). The majority of Bebras participants are of primary school age (years 3 through to 6), which likely reflects that some schools use Bebras as an educational activity across whole primary school year levels. Participation from older cohorts tends to be from students enrolled in a Digital Technology subject at high school.

Table 6. Bebras participation

	2021		2022
	Round 1	Round 2	Round 1
Student participants	32,305	20,790	27,439
Female	17%	21%	32%
Male	17%	24%	38%
Unknown <sup>5</sup>	66%	55%	29%
Years 3+4	31%	35%	33%
Years 5+6	42%	43%	42%
Years 7+8	19%	16%	16%
Years 9+10	6%	6%	8%
Years 11+12	1%	<1%	1%
Educators (Coordinators)	1183	1400	1228

The Bebras team have been working to improve the quality of participant demographic data to garner a more accurate understanding of different Bebras participants each year including the gender and Aboriginal and/or Torres Strait Islander background of participants.<sup>5</sup>

Following the completion of Bebras Round Two in August 2021, 286 participating home school and school-based teachers (for whom jurisdictional research approval was granted) were invited to complete a voluntary online survey. In total, 60 educators responded to the survey.

The survey sample therefore has a disproportionately high number of educators with students on the Honour Roll, potentially introducing some bias into the survey results. This potential bias highlights an inherent challenge with evaluation surveys, wherein those that are heavily engaged with a program are most likely to provide feedback. Feedback from educators indicated that Bebras is on track to achieving its intended student and educator outcomes, specifically:

- **98 per cent** of surveyed educators agreed or strongly agreed that they noticed improvements in student confidence using computational thinking since participating in Bebras (n=44), and that their students' understanding of what computational thinking is had improved (n=43). See Figure 2 for more details. When asked to estimate how many students improved their computational thinking knowledge and skills, 80 per cent of school-based teachers indicated they noticed improvements for at least half of their students in the concepts listed.

<sup>5</sup> The Bebras registration system requires coordinators to upload student demographic information through an online platform. In previous years, many coordinators were leaving the gender field blank for their students. The registration process was adjusted in 2022 to make it easier for Coordinators to provide demographic information on their students.

“Bebras creates a shared vocabulary for lessons about computational thinking. We can refer to particular tasks we have done together, or use the terms such as algorithm or abstraction, and students have a better understanding of what those terms mean.” (Bebras educator)

Survey results indicated that educators were satisfied with their Bebras experience and found the program elements useful. Asked to indicate on a scale of 1–10 how likely they would be to recommend the program to others, **81 per cent** of survey respondents answered with a 9 or 10 (n=52).

- **98 per cent** of surveyed educators agreed or strongly agreed that they noticed improvements in their confidence teaching computational thinking skills to students, while 92 per cent observed improvements in their ability to explain what computational thinking is (92 per cent). See Figure 3 for more information.

Educators provided detailed qualitative feedback and identified several areas where the program could be strengthened. Suggested areas for consideration included:

- Providing deeper insights on student results, including highlighting the connections between student results and computational thinking skill areas.
- Streamlining the registration and certificate distribution process.
- Refreshing the Bebras website to improve the user experience.

“Bebras has significantly raised my ability to help students, especially stage 2 [years 3 and 4], to conceptualise exactly what is meant by computational thinking in all its guises”. (Bebras educator)

Figure 2. Extent to which educators agree/disagree that they have noticed improvements for one or more of their students

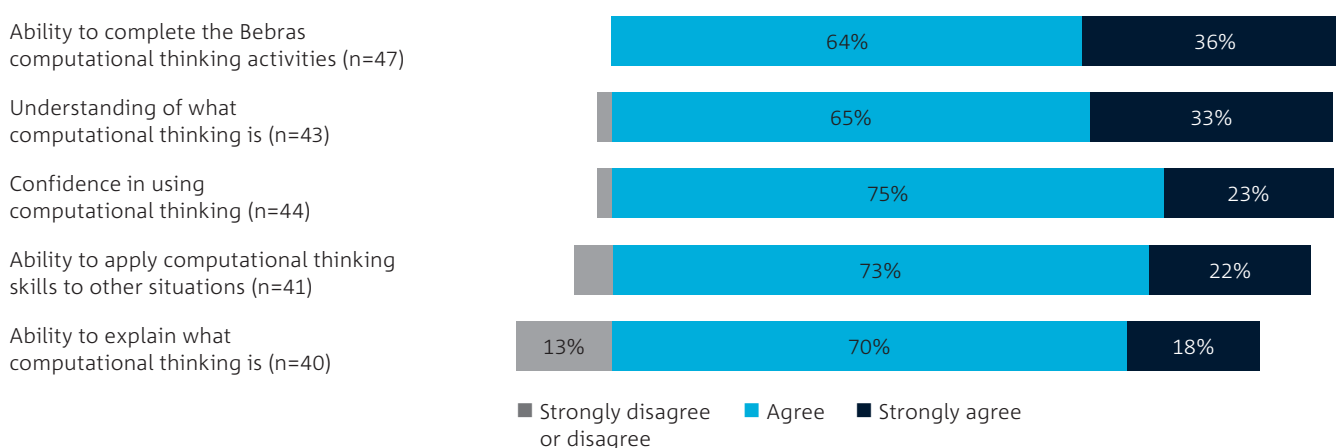
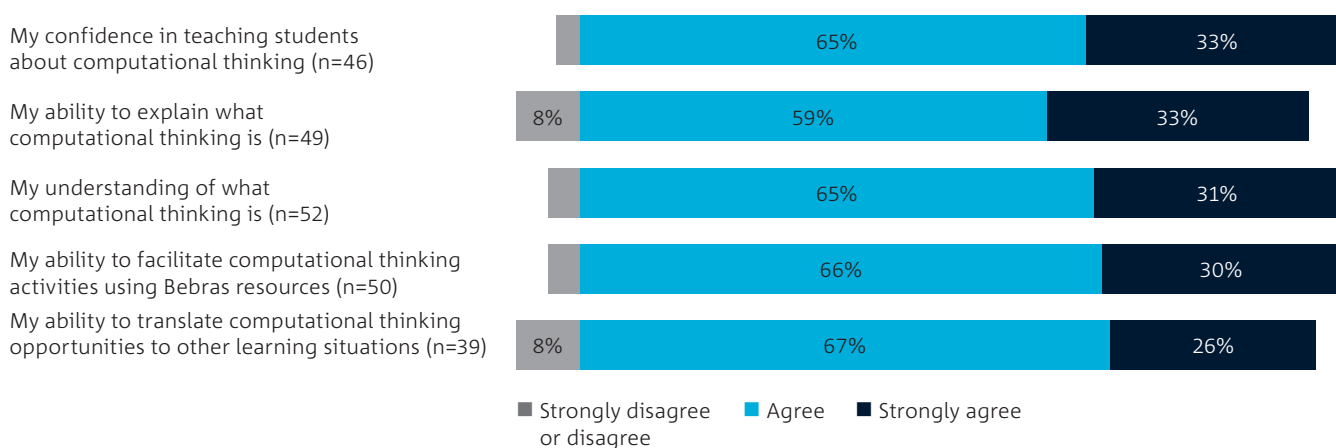


Figure 3. Extent to which educators agree/disagree that they have noticed improvements in their own skills



## Progress towards outcomes

Table 7 provides a summary of how Bebras is progressing with regard to achieving its intended outcomes. The program has been assessed as having a “Consolidating” outcome in three of the four program domains. This reflects the positive feedback received from educators in the 2021 survey. As noted above, this feedback comes disproportionately from educators with students performing at the higher end of the Bebras Challenge. Evaluation activities following Round Two 2022 will focus on receiving feedback from a diverse range of schools with a view to understanding how other participants and educators experience the program.



Table 7. Bebras: progress towards key expected outcomes

PROGRAM DOMAIN	A. STUDENT PARTICIPATION AND ENGAGEMENT	B. STUDENT AWARENESS AND INTEREST	C. STUDENT CAPABILITY AND CONFIDENCE	D. TEACHER CAPABILITY AND CONFIDENCE
<b>Early outcomes</b>	<ul style="list-style-type: none"> <li>Students participate in Bebras activities finding them enjoyable and appropriately challenging.</li> </ul>	<ul style="list-style-type: none"> <li>Students improve their understanding of computational thinking.</li> </ul>	<ul style="list-style-type: none"> <li>Students develop knowledge and skills in computational thinking and problem solving.</li> <li>Students (in group settings) develop skills in communication, leadership, and negotiation.</li> </ul>	<ul style="list-style-type: none"> <li>Teachers engage with and utilise Bebras resources and technical support, finding them easy to use and valued.</li> </ul>
<b>Medium to long term outcomes</b>			<ul style="list-style-type: none"> <li>Students utilise skills in computational thinking and problem-solving across educational contexts.</li> </ul>	<ul style="list-style-type: none"> <li>Increased knowledge, skills, and confidence in facilitating computational thinking/problem solving activities.</li> <li>Teachers use Bebras as a resource to facilitate improvement in student Computational Thinking.</li> </ul>
<b>Progress</b>	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed
Data source/evidence	Participation data Educator survey results	Educator survey results	Educator survey results	Educator survey results

## CyberTaipan

CyberTaipan is seeing increased program participation and is working towards achieving it's early and mid term outcomes. The small sample of participants that provided feedback in 2021 indicated that the program was positively received by participating students, coaches, and mentors and that students and educators had observed improvements in their cyber security skills and awareness.

The 2021 CyberTaipan competition attracted substantial interest from Australian youth, schools, and community groups. In total, 125 teams competed in two competition rounds, held in September and October. The 10 top performing teams competed in a National Final, sponsored by the Australian Signals Directorate, and held virtually in November 2021. All rounds of competition in CyberTaipan took place online, allowing teams to compete from any location and in line with local restrictions and social distancing requirements in response to COVID 19. A Cyber Security Professionals Q&A session held in October 2021, was attended by 27 participants. The 2021 winning team was announced at a virtual awards ceremony held on the 3rd of November. The ceremony, attended by 31 participants, included speeches from program sponsors and a keynote address from Abigail Bradshaw, Head of the Australian Cyber Security Centre.

As illustrated in Table 8, the number of students participating in CyberTaipan has increased each year, with registrations for the 2022 competition, to be held in August, looking particularly strong. Similarly, the number of mentors registered to help teams in 2022 is more than double the number that participated in 2021, with all of the 2021 mentors registering to participate again in 2022. These figures reflect the significant effort the CyberTaipan program team has put into student and mentor recruitment for the 2022 competition. Of particular note, there has been a strong increase in the number of Army and Airforce Cadet teams in 2022. In addition to the competition registrations, 25 students participated in the first 2022 CSIRO CyberCamp held in June 2022.

Table 8. CyberTaipan competition participation

	2021 PARTICIPATION	2022 REGISTRATION ONLY
<b>Teams</b>	125	173
<b>Students (% female)</b>	540 (18%)	791 (22%)
<b>Coaches (% female)</b>	62 (34%)	68 (32%)
<b>Mentors (% female)</b>	20 (25%)	52 (17%)

Following completion of the 2021 competition, initial feedback was collected from a subset of participating coaches, mentors, and students. The student survey invite was emailed to parents (via coaches).

It is therefore not possible to track the number of students that received the survey invite. As illustrated in Table 9, the number of survey responses received from CyberTaipan participants was lower than evaluators expected. Challenges associated with jurisdictional approval and the impact of COVID-19 affected teacher capacity to complete surveys, which likely contributed to low response rates. While the small response numbers limit the ability to generalise results across all participants, the results do provide useful information on how this sample of students, coaches and mentors felt about the program. Following completion of the 2021 competition, initial feedback was collected from a subset of participating coaches, mentors, and students. The student survey invite was emailed to parents (via coaches).

Table 9. CyberTaipan survey responses

	SURVEY RESPONSES	SURVEY INVITES
<b>Students</b>	14	Unknown
<b>Coaches</b>	11	37
<b>Mentors</b>	6	22

Key insights from the 2021 post-competition survey include:

- The majority of surveyed students noted an increase in their cyber security and IT skills. For example, the proportion of students rating their skills using scripting and command line operations as high or very high increased from 17 per cent to 50 per cent (n=12). See Figure 4 for more details.

“CyberTaipan was an amazing in-depth competition which helped push my limits and to work within a deadline to perform highly complex commands.” (CyberTaipan student participant)

Surveyed students also noted improvements in their understanding of future study and employment options in cyber security.

For example, the per cent of students rating their understanding of the range of options to study cyber security as at least moderate, increased from 54 per cent to 100 per cent following participation in CyberTaipan (n=12).<sup>6</sup>

- 75 per cent of survey students indicated that participating in CyberTaipan ‘somewhat’ or ‘significantly’ impacted their future career/study goals (n=12).

Most surveyed coaches noted increases in their understanding of cyber security and their confidence in teaching/advising students about cyber security related concepts. For example, following the competition, 100 per cent of surveyed coaches rated their confidence advising students about cyber security education and careers as moderate, high, or very high (n=10). See Figure 5 for more details.

- 100 per cent of surveyed coaches agreed or strongly agreed they would take part in CyberTaipan again and 88 per cent of surveyed coaches agreed or strongly agreed that they would recommend the program to others (n=10).

“I came across different aspects of cybersecurity and (am) more confident sharing with students cyber security learning and training opportunities.” (CyberTaipan coach)

Post-competition survey respondents were asked to identify opportunities to improve CyberTaipan. Six coaches and one mentor expressed a preference for additional training resources and practice opportunities.

Twenty-five students attended the June 2022 CyberCamp, 23 of these students (92 per cent) provided feedback on their camp experience in the post event survey.

Figure 4. Percent of students that rated their skills as high or very high, before and after participating in CyberTaipan

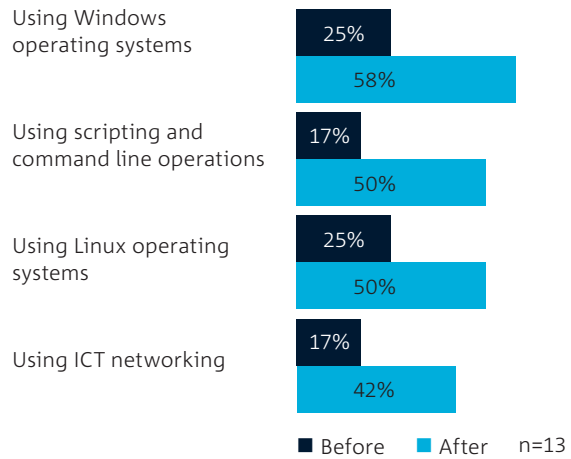
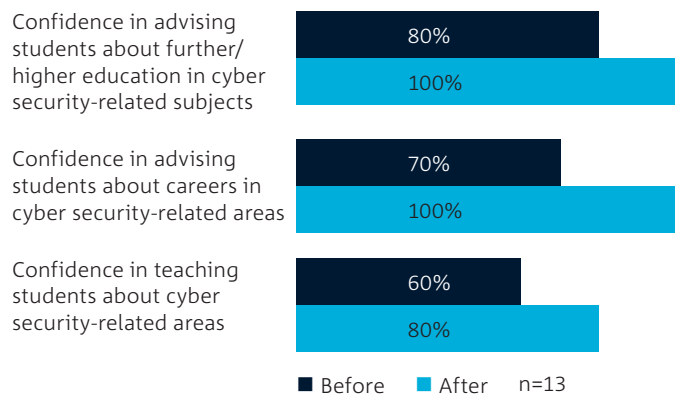


Figure 5. Percent of coaches that rated their confidence teaching/advising students about cyber security-related concepts as at moderate, high, or very high, before and after participating in CyberTaipan



Results indicate that participants enjoyed the experience and that students had an increased interest in learning about cyber security following the CyberCamp. Specifically, following participation in the CyberCamp:

- **95 per cent** of respondents were more interested in learning about cyber security (n=22)
- **85 per cent** of respondents were more likely to study technology in years 11 and 12 (n=20)
- **91 per cent** of respondents knew more about cyber security job options available to them (n=22)
- **83 per cent** of respondents knew more about cyber security education options (n=23).

<sup>6</sup> Answer scale: No / none, Low, Moderate, High, Very high



## Progress towards outcomes

Table 10 provides a summary of how the CyberTaipan program is progressing with regard to achieving its intended outcomes. The program has been given a 'Consolidating' rating for participation/engagement as there have been measurable increases in student participation. Assuming the high registration rates for 2022 translate into program participation, this is expected to increase to the 'Highly Developed' rating. Given the challenges with low survey response rates identified above, there is only limited evidence to report on the impact the program is having on the student awareness/interest and capability/confidence program domains. Feedback from those that responded to the survey was predominantly positive and will be combined with additional evidence from 2022 evaluation activities to assess performance against these domains in the final evaluation report.



Table 10. CyberTaipan: progress towards expected outcomes

PROGRAM DOMAIN	A. STUDENT PARTICIPATION AND ENGAGEMENT	B. STUDENT AWARENESS AND INTEREST	C. STUDENT CAPABILITY AND CONFIDENCE	D. TEACHER CAPABILITY AND CONFIDENCE
<b>Early outcomes</b>	<ul style="list-style-type: none"> <li>Increased number and diversity of CyberTaipan participants</li> </ul>	<ul style="list-style-type: none"> <li>Increased knowledge of and interest in interest in cyber security</li> </ul>	<ul style="list-style-type: none"> <li>Increased skills in applying cyber security concepts</li> </ul>	<ul style="list-style-type: none"> <li>Increased knowledge and confidence in cyber security concepts</li> </ul>
<b>Medium to long term outcomes</b>	<ul style="list-style-type: none"> <li>Increased opportunity for young people to participate in additional cyber security related activities</li> </ul>	<ul style="list-style-type: none"> <li>Increased number of students considering and/or pursuing education/ career pathways in cyber security</li> </ul>	<ul style="list-style-type: none"> <li>Increased number of young people skilled in cyber security (or related fields)</li> </ul>	<ul style="list-style-type: none"> <li>Increased confidence advising young people of cyber security education and career opportunities</li> <li>Increased inclusion of cyber security concepts and activities in high schools (and clubs)</li> </ul>
<b>Progress</b>	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed
<b>Data source/ evidence</b>	Participation data Student survey results	Student and coach survey results	Student and coach survey results	Coach survey results

## FarmBeats

Evaluation data indicate that the first iteration of the FarmBeats program, run as a small-scale pilot in 2021, provided an innovative addition to traditional digital technology classrooms and successfully engaged students in hands-on, real-world inquiry-based activities. Feedback from the pilot is being used to refine and expand the program for future cohorts of students.

In 2021 CSIRO partnered with Microsoft to pilot FarmBeats with 397 students from years 8–10 across 18 Australian schools. The program sought to increase student skills and teacher confidence in key information technology areas, including Artificial Intelligence, Internet of things, big data, and machine learning. In addition to these intended outcomes, the program also sought to demonstrate the feasibility of the FarmBeats program and provide a platform for future expansion. Each participating teacher was given a set of Microsoft FarmBeats for Students kits to deliver the program with their class. Kits included a Raspberry Pi and sensors for soil moisture, light, ambient temperature, and humidity.

To help CSIRO understand the experiences of schools during the pilot phase of the program, the CSIRO Education and Outreach Impact and Evaluation Team conducted semi structured interviews with teachers from four different schools in Queensland (2), Western Australia (1), and South Australia (1). The interview transcripts were thematically analysed to understand the unique experiences of the four schools and to identify commonalities.

Key insights from the educators interviewed included:

- FarmBeats was well received by the teachers interviewed and their students. The lesson resources were helpful, easy to use, and prompted thoughtful classroom discussions. For example, one teacher commented:

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**“On the whole, the materials were very well composed and had a good, logical progression to them and really got students to stop and think about some of the stuff that’s going on rather than just following instructions.” (FarmBeats teacher)**

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- The practical nature of the program, its connection to agriculture, and AI elements of the program were particularly engaging for students of those interviewed. For example, as one teacher noted:

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**“The more real it becomes the more excited the students get. It’s not often when we’re in a digital technology classroom that we get to go and touch and smell them. I mean, as much as I love computers, it can be quite abstract ... to be able to get out into the sun, get vitamin D and watch something grow and know that you’ve done that, it’s pretty cool. It’s pretty satisfying, and I think all the students got to experience that in the same way I did.” (FarmBeats teacher)**

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- All teachers interviewed encountered challenges connecting the provided hardware and software which impacted their delivery of the course to varying extents. Despite these challenges, teachers were keen to be involved in further iterations of the program and offered useful suggestions for improvement.
- In addition, all teachers interviewed agreed they would recommend the program to other schools and teachers.

Based on feedback from the four interviewed teachers and discussions with the program team, the Impact and Evaluation team identified five areas where the program could be enhanced:

- Consider alternative technology arrangements or program delivery methods.
- Provide additional resources and/or support to accompany the Lobe AI activities.
- Encourage and support teachers to engage with local industry and universities.
- Provide additional information to support the outdoor setup of FarmBeats hardware/garden.
- Provide additional guidance and/or training to teachers on how to collaborate on Microsoft teams.

## Progress towards outcomes

Table 11 provides a summary of how FarmBeats is progressing with regard to achieving its intended outcomes. The program has been given a Developing' rating for student participation and engagement. This reflects teacher feedback about the engaging nature of the content for students and the unique elements the program introduced to the Digital Technologies curriculum.

FarmBeats has been rated as 'Emerging' in the other outcome domains. This reflects the early phase of the program's development, the small sample of teachers interviewed, and the technological challenges experienced by some participants. With regard to the latter, teachers worked closely with the program team to troubleshoot the technology issues and identify workarounds, however, some participants were not able to experience the program to its full extent.



Table 11. FarmBeats: progress towards expected outcomes

PROGRAM DOMAIN	A. STUDENT PARTICIPATION AND ENGAGEMENT	B. STUDENT AWARENESS AND INTEREST	C. STUDENT CAPABILITY AND CONFIDENCE	D. TEACHER CAPABILITY AND CONFIDENCE
Early outcomes	<ul style="list-style-type: none"> <li>Students gain experience and feel engaged in applying AI, IoT, big data and machine learning and their practical applications in agricultural contexts.</li> </ul>	<ul style="list-style-type: none"> <li>Students have an increased awareness of AI, IoT, big data and machine learning.</li> </ul>	<ul style="list-style-type: none"> <li>Students gain skills and confidence in practical application of AI, IoT, big data and machine learning concepts.</li> <li>Students (in group settings) develop skills in communication, leadership, and negotiation.</li> </ul>	<ul style="list-style-type: none"> <li>Teachers feel engaged as partners in the FarmBeats for Students program, helping to shape local adaptation and implementation.</li> </ul>
Medium to long term outcomes	<ul style="list-style-type: none"> <li>Students feel engaged and gain an increased understanding of agriculture, land management, environmental monitoring and management, and sustainability that is relevant to them.</li> </ul>	<ul style="list-style-type: none"> <li>Students gain an increased understanding of agriculture, land management, environmental monitoring and management, and sustainability.</li> </ul>	<ul style="list-style-type: none"> <li>Students increase their digital literacy and interest in STEM-based study (and careers).</li> </ul>	<ul style="list-style-type: none"> <li>Teachers gain skills and confidence in effectively engaging students in practical application of AI, IoT, big data and machine learning concepts.</li> </ul>
<b>Progress</b>	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed	Emerging Developing Consolidating Highly Developed
<b>Data source/ evidence</b>	Participation data Semi-structured teacher interviews	Semi-structured teacher interviews	Semi-structured teacher interviews	Semi-structured teacher interviews

## Educator PL

The Digital Careers Educator PL program underwent significant development in 2022. Registration figures for the first half of 2022 have exceeded program team expectations, with anecdotal feedback from participants indicating that they found the sessions engaging and were satisfied with the information provided.

Educator PL sessions have been a core component of Digital Career since its inception. Historically, CyberTaipan and Bebras have held multiple PL sessions each year to provide program information to educators and increase awareness about ICT career and education options. Beginning in 2022, the PL program was formalised into a stand-alone Digital Careers stream, with dedicated staff overseeing the program. This has seen the ‘program specific’ PL sessions augmented with PL sessions targeting elements of the Digital Technologies curriculum. The developments in the Digital Careers Educator PL program are in line with recommendations from the Australian Computer Society, encouraging schools and education departments to support the upskilling of teachers in the Digital Technologies curriculum through systematic PL programs (Zagami, 2022).

PL sessions were offered as live webinars, with participants able to make comments and ask questions throughout the session. Recordings were also made available to all registered individuals. As of 30 June 2022, 405 participants registered for a PL session in 2022, with 102 of these registrants attending a live PL webinar.<sup>7</sup> Given the many demands placed on teachers throughout their school day, the ability to view recordings is seen as an important component of the PL program.

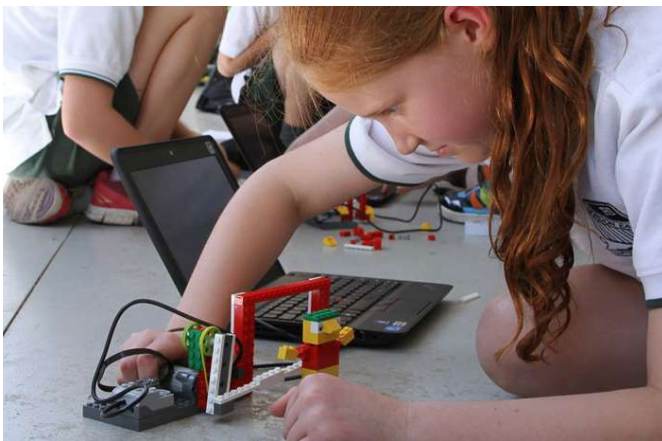


Table 12 provides a list of the individual PL sessions held from January to June 2022 and indicates the number of times the recording has been viewed online.<sup>8</sup>

The Impact and Evaluation team have been working with the PL coordinators to improve the demographic data that is collected from participants (see Table 13).<sup>9</sup> Information to date indicates that close to half of the registered participants (53 per cent of known participants) are female and that registrants come from all states and territories except the Northern Territory. New South Wales (16 per cent, and Queensland (15 per cent), are the most common locations for registered PL participants.

Table 12. PL webinars held in 2022

PL NAME	NUMBER OF LIVE SESSIONS HELD	ONLINE VIEWS
Authentic Learning with engaging data	2	Not available
Bringing AI and ML into the classroom	4	13
Cybersecurity 101	3	46
How to CyberTaipan	2	55
Planning Your Year with Digital Careers	2	19
Round 1 Bebras: Where to next?	1	35
<b>Total</b>	<b>14</b>	<b>168</b>

Table 13. Demographic information of registered PL participants in 2022

GENDER (OF THOSE THAT INDICATED A GENDER)	ABORIGINAL AND/OR TORRES STRAIT ISLANDER		
Male	36%	Yes	1%
Female	64%	No	99%

<sup>7</sup> This is not a unique count; it is likely that participants attended more than one PL session

<sup>8</sup> Online views as of 25th July 2022

<sup>9</sup> Information on the gender and location of participants only became available following implementation of a new registration process in April 2022. The proportion of ‘unknown’ responses is therefore expected to reduce as future PL sessions are held.



In line with the DISR funding agreement, the educator PL program is aiming to engage 750 educators in PL activities for the 2022 calendar year. The participation figures reported above indicate that the Educator PL program is on track to meet these targets.

The Educator PL program does not have specific outcomes against which this evaluation will assess its success, rather, the PL program supports and contributes to the outcomes for Bebras, CyberTaipan, and FarmBeats. Notwithstanding, following each PL webinar, those attending are invited to complete a voluntary, online survey to provide their feedback on the session and offer suggestions for improvement. Just under half of all attendees (46 per cent) have completed the survey.

Feedback from the survey shows that respondents have found the PL sessions engaging and valuable, specifically:

- 92 per cent of respondents were ‘extremely satisfied’ or ‘very satisfied with the PL session attended (n=42).
- 86 per cent of respondents were very likely or extremely likely to recommend the session to another educator or colleague (n=42).

Qualitative feedback indicates that participants particularly valued:

- the engaging style of presentations, for example, as one participant explained:

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“Engaging session with a great balance of audience interaction and information”. (Participant in the Cyber Security 101 PL)

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- the practical examples provided and their relevance for the classroom, for example one respondent highlighted:

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“The examples of AI in practice - these are always very useful to demonstrate to students when talking about AI.” (Participant in the Bringing AI and ML into the classroom PL)

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- while another participant noted:

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“The links to the Bebras computational thinking information and activities. I can see this being very useful for assessing these skills in my role as a technology specialist, then targeting the areas for improvement.” (Participant in the Planning Your Year with Digital Careers PL)

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# Summary of key findings

This interim evaluation report focuses on understanding how key elements of the Digital Careers program were implemented over the 2021–22 period. For CyberTaipan, Bebras, and FarmBeats, the evaluation assessed progress with regard to achieving their intended short and medium-term outcomes. The participant registration numbers and feedback on post event satisfaction were used as key markers of success for the Educator PL program.

As illustrated Table 14, over 54,000 students, 2,600 educators, and 20 mentors participated in the Digital Careers program in 2021 (this figure likely includes some double counting of students and educators that participated in Bebras Round One and Round Two). Through these programs, participating educators accessed a variety of curriculum aligned resources and students were able to engage with key digital technology concepts including computational thinking, cyber security, artificial intelligence, and machine learning.

Table 14. Digital Careers program participation

	STUDENTS	EDUCATORS	MENTORS
<b>2021</b>			
Total participation	54,032	2,663	20
Bebras (Rd 1 & 2)	53,095	2,583	-
CyberTaipan	540	62	20
FarmBeats	397	18	-
<b>2022 – JANUARY TO JUNE</b>			
Total participation	28,227	1,698	52
Bebras (Rd 1 only)	27,436	1,228	-
CyberTaipan (camp attendance and competition registration)	791	65	52
Educator PL registrations	-	405	-

Notwithstanding the caveats mentioned in the methodology section of this report, survey and interview data collected to date provides evidence to support the following interim findings:

- Bebras** – this program has strong participation figures and there is evidence to indicate that educators have observed improvements in the computational thinking skills of their students and their own confidence in teaching computational thinking. Additional evaluation activities from a wider range of participants will help inform the findings of the final evaluation report.
- CyberTaipan** – this program is seeing the results of a concerted recruitment push, with 2022 participation figures well above 2021 levels. Feedback from a small sample of participants indicated the program was positively received by participants and that both students and educators observed improvements in their cyber security skills and awareness. Participants in the first CSIRO CyberCamp also found the experience beneficial, noting their increased interest in cyber security education and career pathways following attendance at the camp.
- FarmBeats** – Feedback from educators indicated that this program provided an innovative addition to traditional digital technology classrooms. The classroom resources were well received by educators, who were able to engage students in hands-on, real-world applications of key concepts including AI, Machine Learning, Big Data, and IoT. Feedback from the pilot is being used to refine and expand the program for future program iterations.
- Educator PL** – there have been strong registration numbers for PL sessions held in the first half of 2022. Feedback from participants indicates the engaging, interactive, and practical nature of the information provided has been particularly valued.

Table 15 provides an initial assessment against the key evaluation questions based on the findings discussed in this report. As mentioned previously, limitations in sample sizes make it difficult to generalise the results across all Digital Careers participants. Subsequent evaluation activities will expand evaluation data sources and provide more detail on the findings against the key evaluation questions.

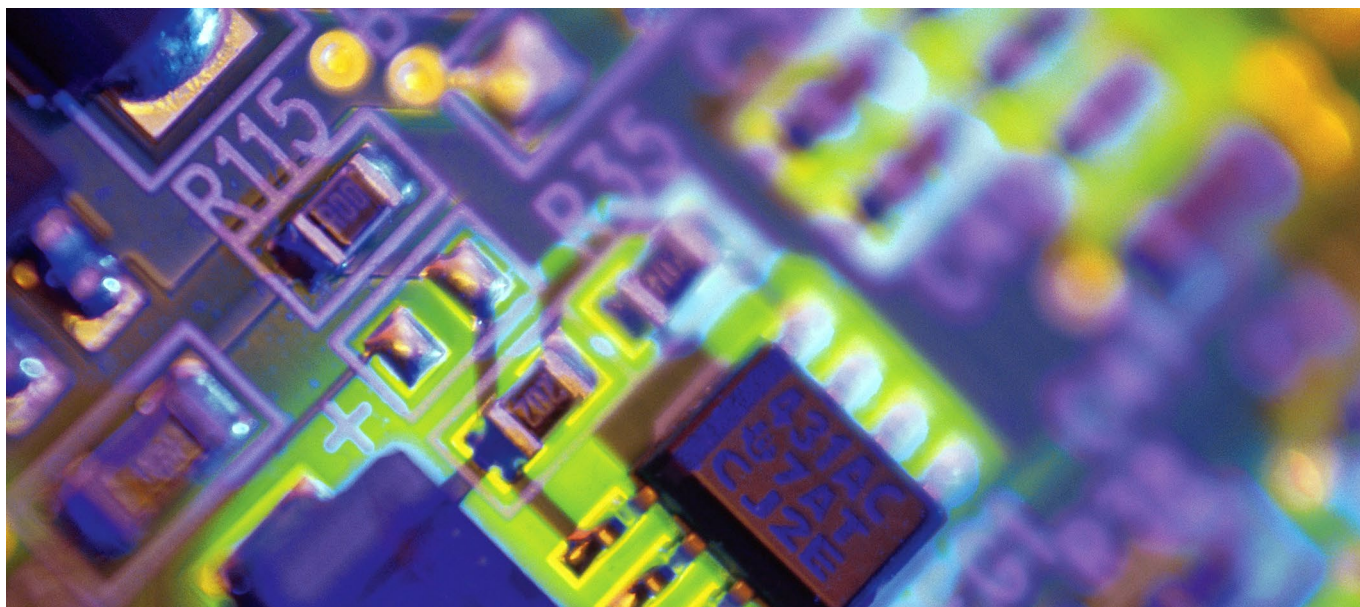


Table 15. Key evaluation questions: interim results

KEY EVALUATION QUESTIONS	PROGRAM DOMAIN	INTERIM ASSESSMENT
1. To what extent did the Digital Careers Program successfully engage students, educators, schools, and industry?	A. Student participation and engagement	The interim evaluation examined student, educator, and mentor participation in the Digital Careers Program. Participation figures indicate there is substantial, and in the case of CyberTaipan increasing, interest in the programs offered. Survey findings from students and educators indicate that respondents have found the Digital Careers Programs, including the Educator PL sessions, interesting and engaging.
2. To what extent did the Digital Careers Program deliver intended benefits for students, teachers/educators, schools, and industry?	B. Student awareness and interest C. Student capability and confidence D. Teacher capability and confidence	Evaluation participants were asked to reflect on any changes they observed in their, or their students' interest in, capability, and confidence in key digital technology concepts following participation in one of the Digital Careers programs. Data collected to date, particularly for Bebras, provides an early indication that educators and students are observing improvements in student skills, understanding, and confidence.  Similarly, educators that participated in the evaluation have also reported improvements in their own confidence and capability.  While the interim evaluation results are promising, small sample sizes make it difficult to generalise these results across all Digital Careers participants.
3. How significant is the Digital Careers Program in relation to being unique, efficient, valued, and sustainable?	E. Program significance	All participants in the evaluation were asked if they would recommend the program to other students or educators. Results provide an indication of how useful and valuable participants found their experience. Responses for Bebras, CyberTaipan, FarmBeats, and the Educator PL sessions were overwhelmingly positive and provide strong evidence that respondents value the Digital Careers program.

# Opportunities

All participants in the evaluation were asked to identify any changes or improvements that could be made to the Digital Careers programs. The suggestions for each program are discussed in the Findings section of this report. An analysis of participant feedback highlighted several commonalities across the four Digital Careers programs examined in this report. Based on this analysis and consideration of the overall interim evaluation results, three areas have been identified as potential opportunities to further improve and refine the Digital Careers program.

In all instances, the opportunities for improvement were communicated to the respective program teams following completion of the interim evaluation data collection and analysis. As noted below, in response to this feedback program teams have been proactive in implementing new practices and improving their processes.

## **1. Review program registration process with a view to streamlining**

Both Bebras and CyberTaipan experienced challenges with their program registration process in 2021. For CyberTaipan, there was a general sense from the program team that interactions with coaches in 2021, including the program registration process, could be improved and streamlined. Feedback from educators indicated that 22 per cent were not satisfied that the registration process was straightforward.

For Bebras, the registration process, including the creation of pseudonyms and distribution of student certificates was identified by some survey respondents as creating a significant administrative burden for educators.

In response to this feedback, program teams have reviewed and amended their registration processes where necessary, specifically:

The CyberTaipan team moved registrations to a new online platform that significantly streamlined the registration process, both for the CSIRO team and for participating coaches.

Similarly, the Bebras team have improved the processes to collect demographic information during the registration process and will be implementing significant changes to the honour roll and certificate distribution process to simplify registrations for Round Two, held in August 2022.

- The Educator PL team have also worked over the first half of 2022 to refine and improve the webinar registration process. The team moved registrations to a new online platform that better integrated calendar invites and the collection of participant information. As a result of these efforts, the team have a better understanding of the types of PL participants.



## **2. Consider providing additional resources to further support educators**

Both Bebras and CyberTaipan educators indicated an interest in additional resources. For Bebras participants this was in the form of deeper insights into student performance, both in relation to other students and to key computational thinking skills. CyberTaipan educators identified additional training resources and information on what to expect on the competition day as potentially valuable additions to the program.

The interviewed FarmBeats educators identified two areas where additional information could also have been of assistance. Firstly, the teachers noted challenges around the AI activities and raised the possibility of CSIRO providing additional images to support these activities. Secondly, teachers could have benefited from additional information on how to set up the outdoor hardware/garden components of the program.

All three program teams have taken action to provide additional resources to educators, for example:

- The Bebras team has spent considerable time investigating the Bebras data with a view to understanding the key trends and how students answer questions. They held one PL webinar to share the findings of this analysis with educators and are investigating options to provide educators with detailed post-challenge results for their students.
- The CyberTaipan team have worked with the Educator PL team to schedule a number of webinars designed to provide educators with more information on the competition, including how coaches can prepare their students.
- Based on feedback received during the pilot phase, the FarmBeats team have spent the first half of 2022 refining the program, including identifying areas to provide additional support and resources to educators.

## **3. Investigate options to increase participation from underrepresented groups.**

As identified at the start of this report, there are concerns that opportunities and barriers to participate in STEM activities are unequal. In particular, students who identify as Aboriginal and/or Torres Strait Islander, girls, students from low-SES, and regional and remote communities tend to be underrepresented in STEM activities and the STEM workforce. All Digital Careers programs have worked to improve the quality of the participant demographic information collected to garner a better understanding of the different sections of the community that are involved in the programs.

Overall, the Digital Careers team is considering alternative program recruitment and engagement strategies with a view to increasing the diversity of participants. The teams are also implementing the following:

- The CyberTaipan team are working with key program sponsors to develop post competition events for young women that participate in the 2022 competition. Events are still being finalised but may include a young women's CyberCamp, and a virtual celebration event. The events are intended increase young women's knowledge of an interest in cyber security.
- The Bebras team have made a number of changes to the program including: i) changing the Honour Roll structure to recognise high achievement within schools, instead of only recognising students that achieve a perfect score across the whole competition; ii) incorporating text to speech options to increase the online accessibility of tasks; iii) continuing their work to ensure tasks are based on 'real-world' contexts; this change is in line with research demonstrating that young women are more engaged by visually appealing, real-world problems (Hubwieser et al., 2016)

The findings of the ACER research into the participation of young women in digital technology education programs will inform further work in this area.

# Conclusion and next steps

As highlighted at the start of this report, digital technology skills are a key area of growth for the Australian economy. The CSIRO Digital Careers program, with approximately 54,000 students and 2600 educators participating each year, plays an important role in developing students skills and teacher confidence in key ICT related areas.

The interim Digital Careers evaluation provides an initial, high-level assessment of the performance against expected short and medium-term outcomes for Bebras, CyberTaipan, and FarmBeats, and examines participation rates and satisfaction for the Educator PL program

Overall findings indicate that both educators and students are reporting improvements in their confidence and skill levels following participation in a Digital Careers program. While the interim results are promising, small sample sizes limit the ability to generalise results across all program participants. Key areas for improvement include streamlining program registration processes, providing educators with additional resources and investigating avenues to increase participation from underrepresented groups.

The next phase of the evaluation seeks to expand evaluation data sources and provide more detail on the findings against the key evaluation questions. Participant feedback will also be sought to understand the impacts, if any, of the program refinements made by the Digital Careers team in response to the interim evaluation findings. The evaluation team will also work with Digital Careers program teams to examine any implications arising from the ACER research into the factors influencing the participation of young women in digital technology programs for the Digital Careers programs. Final evaluation results will be published and made available on the CSIRO webpage. It is intended that the publication of these evaluation results will contribute to the body of evidence regarding the impact of digital technology education programs.

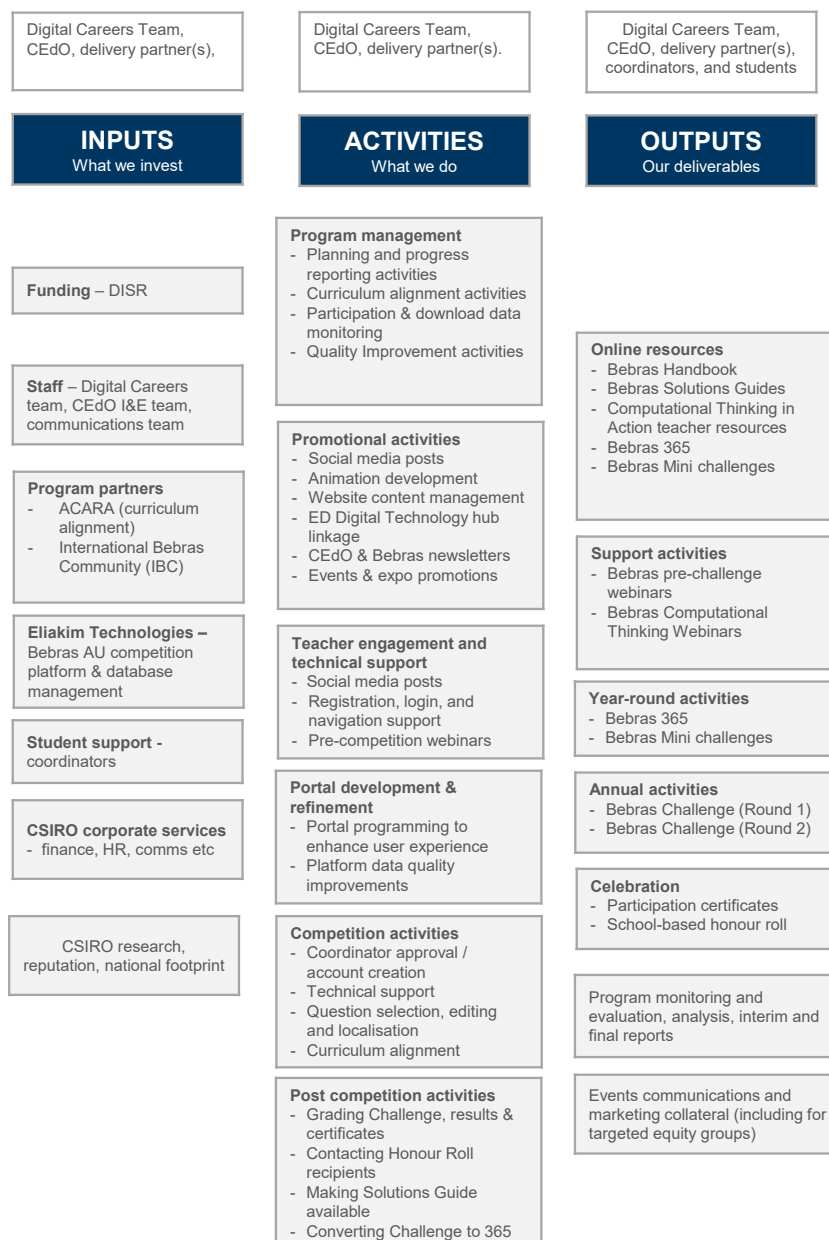
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# Appendix A: Impact pathways

## Bebras

PARTICIPATION: Who we need to reach across the various parts of the pathway?



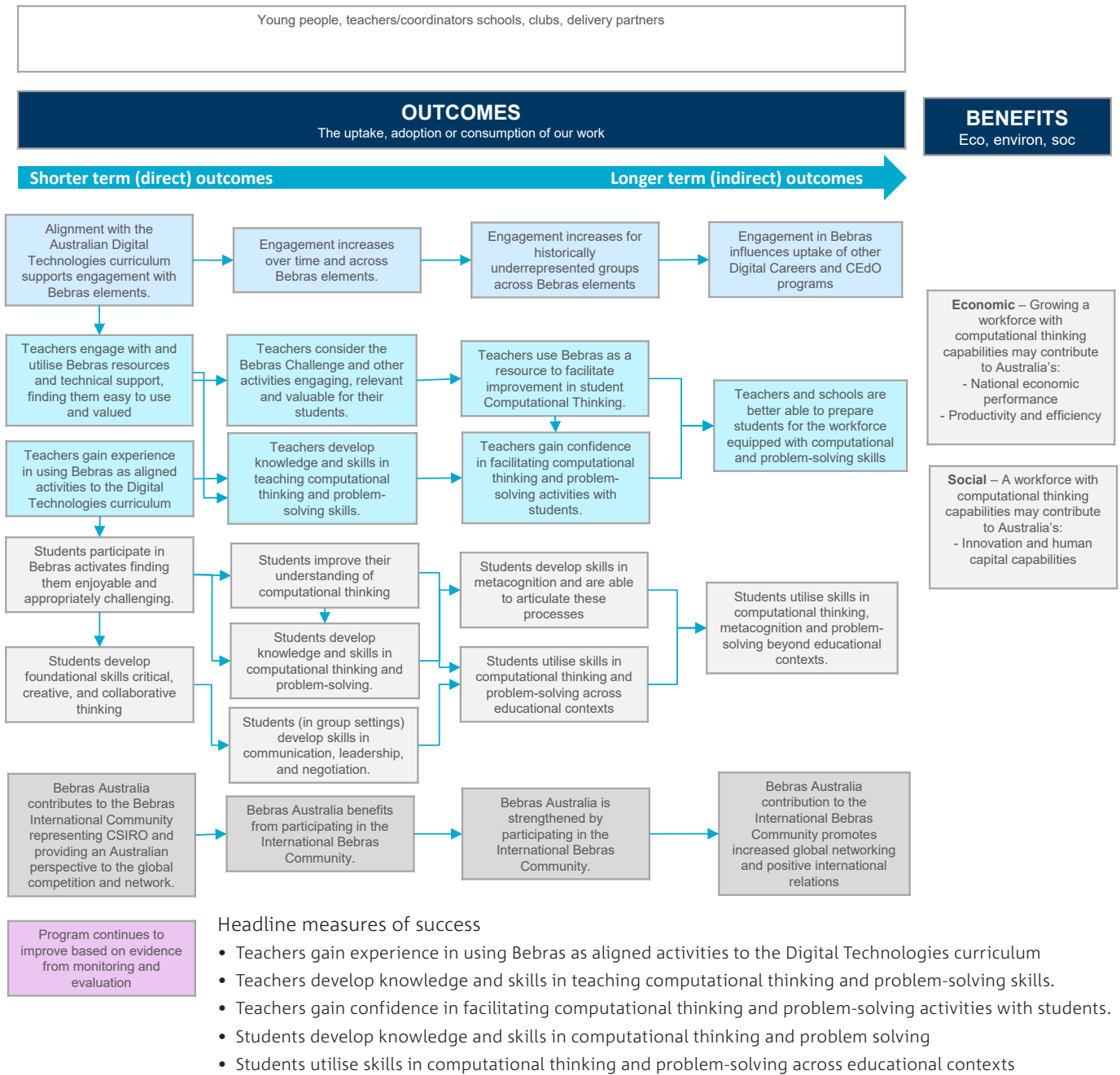
### Assumptions:

- Cyber security continues to be perceived as important by the Australian government and to society.
- Program funders and sponsors continue to support CyberTaipan for its planned duration.
- Links between the Cyber security industry and the Australian education system continues to strengthen.
- Schools and clubs continue to show an interest in Cyber Taipan.
- Program materials are informed by industry experts and align to the needs of competition participants.
- Programs are developed and delivered in inclusive ways that encourage participation

### Risks:

- CyberTaipan sponsors and advocates withdraw support (financial and operational).
- Brand image is incongruent with the student target audience i.e. formal image vs informal target audience.
- Competition support is below stakeholder expectation.
- The competition becomes monotonous for those who have participated two or more times.
- CyberTaipan communications and marketing activities have limited reach or fail to stimulate interest.
- CyberTaipan timing or requirements precludes involvement by some schools/coaches/ groups/mentors

**Impact Statement: Bebras Australia engages students in collaborative, creative and critical thinking challenges that helps to develop their problem solving and computational thinking skills. Educators are also engaged in the program through provision of relevant and useful resources.**



The counterfactual:

If CyberTaipan was not delivered/or does not deliver its expected outcomes:

Short term:

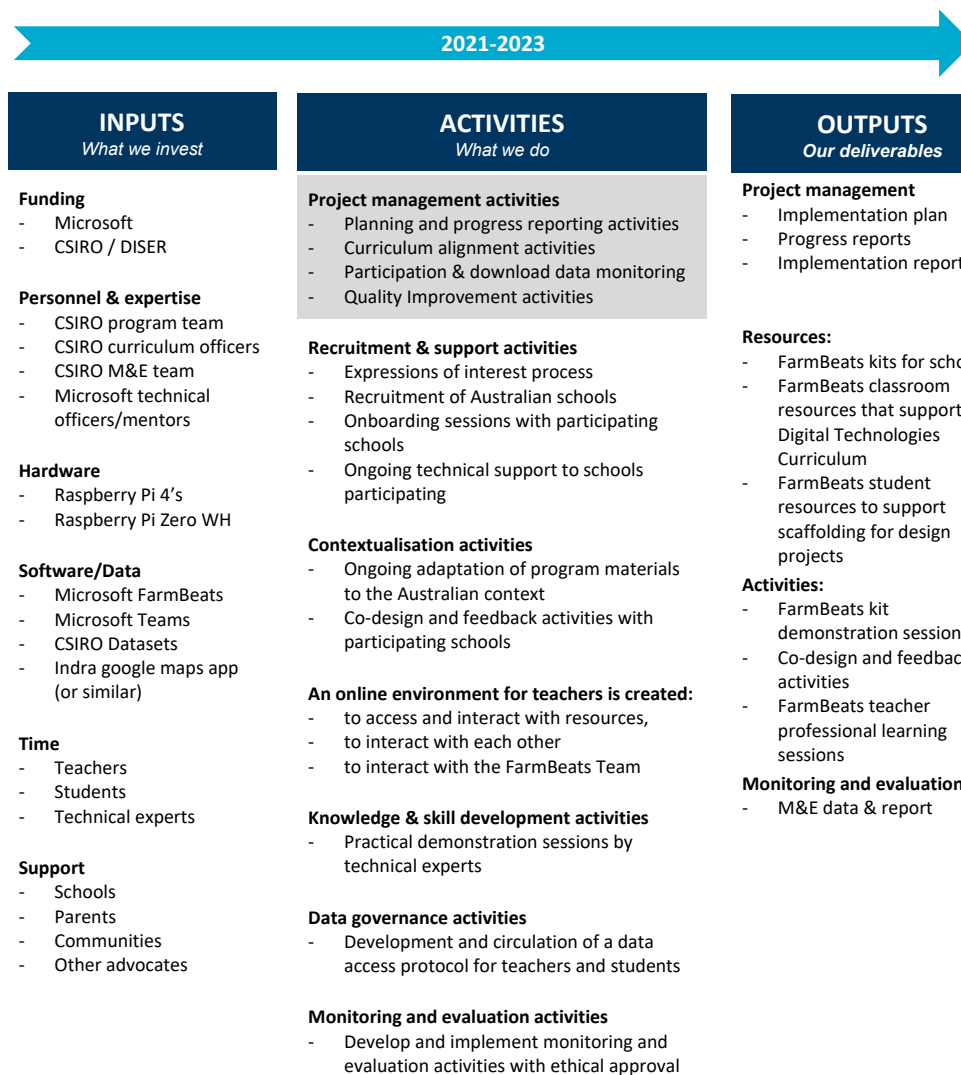
- Low levels of interest and skills in cyber security amongst young Australians.
- Insufficient interest and skills in cyber security in the education sector.
- A disconnect between the real-world cyber security industry and school/club based cyber security experiences.

Long term:

- Limited options in cyber security related education, training and career pathways.
- Lack of skills and knowledge in the Australian cyber security workforce.
- Growing risk of cyber threats to Australian intelligence, industry and households.
- Ultimately a gap would grow between Australia's cyber security capability in contrast to its needs.

# FarmBeats

PARTICIPATION: Who we need to reach across the various parts of the pathway?



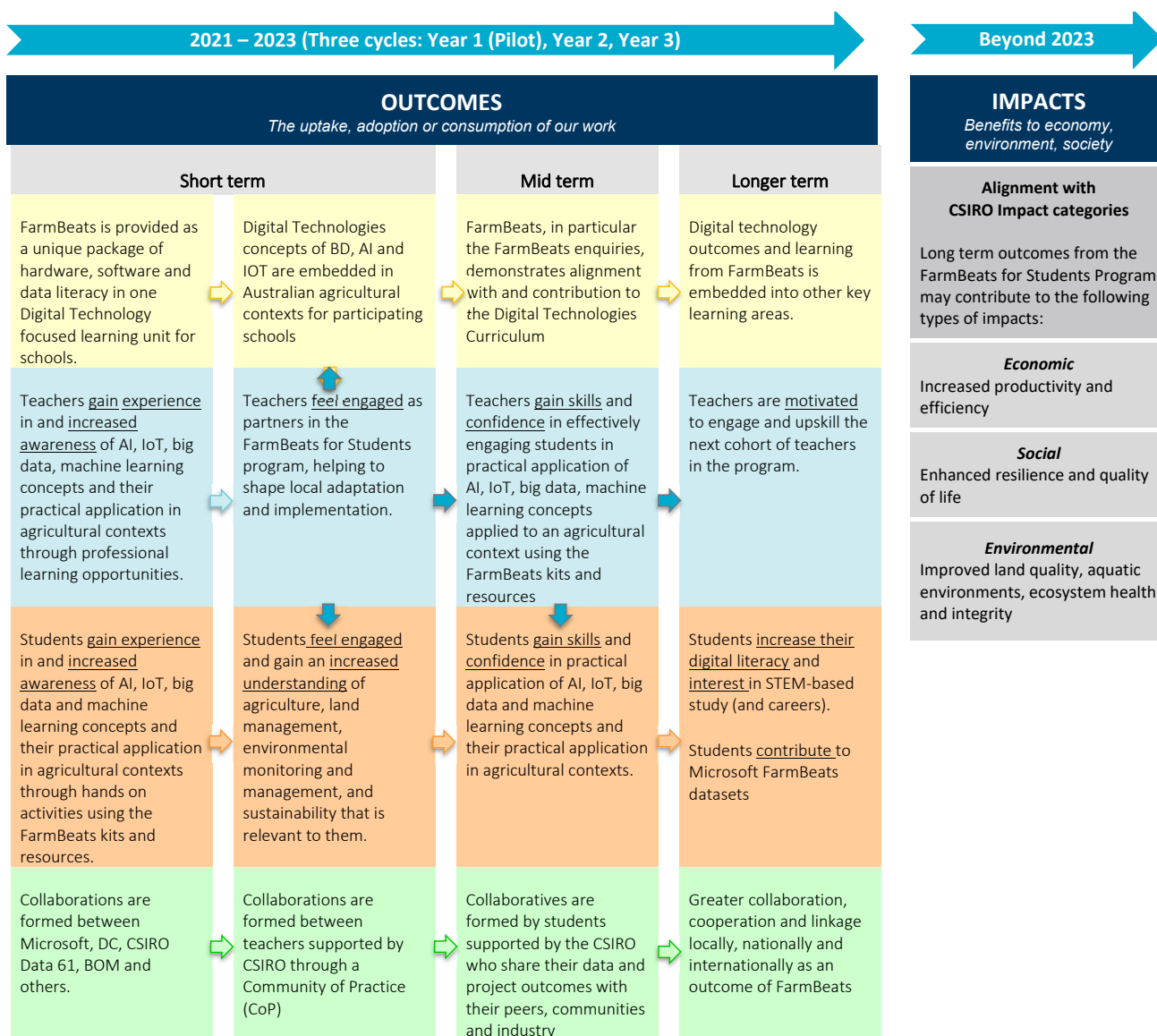
## Counterfactual:

- If the Microsoft FarmBeats for Students Australia did not exist:
- Teachers and students would lose a valuable, free, curriculum aligned opportunity to become upskilled in practical application of AI, IoT, big data, machine learning concepts applied to real world agricultural contexts.
- Teachers and students would miss out on the opportunity to engage with technical experts, equipment and data that could significantly heighten the learning experience.
- CSIRO would lose an important opportunity to engage with schools and Industry world leaders as partners.
- Australia would lose an important opportunity for engaging young people in learning skills considered valuable for Australia's economy, environment, and social resilience.

## Risks:

- The program is pitched at the wrong level (language and content).
- The program materials are not relevant or engaging.
- Teachers do not buy into the program and/or have competing priorities (Major).
- Terms and conditions of engagement are not acceptable.
- The required technology (Raspberry Pi's) are not available or do not meet expectation.
- There is misalignment between the FarmBeats content and the Australian school curriculum.

**Impact Statement: Microsoft FarmBeats for Students Australia provides a unique hands on opportunity for Australian students to apply digital technologies concepts of big data, artificial intelligence and internet of things to agricultural challenges.**



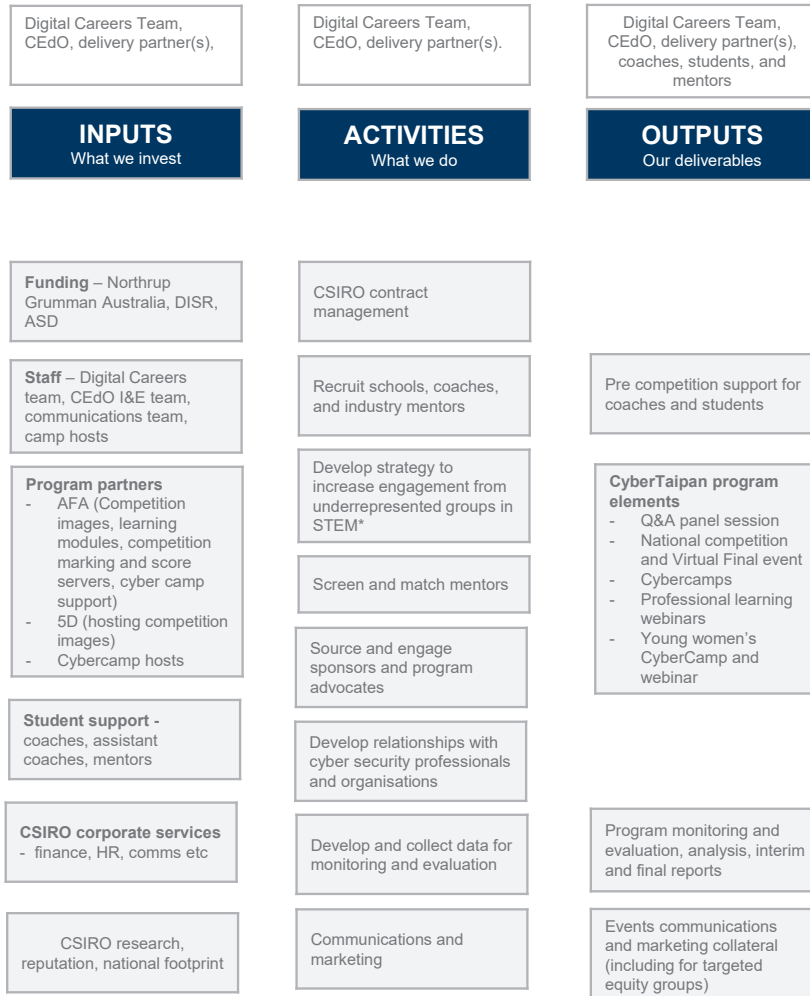
- There may be discrepancies and or misalignment in the program intent and the way it is delivered locally.
- A lack of clarity in the role of the mentors.
- Difficulties in ensuring all adults have completed the required working with children checks.
- Effective program delivery is compromised by the limitations of the school calendar.
- Not all schools have the capacity and capability to use the collaboration technology (MS Teams) effectively.
- Excel Document Macros do not respond as expected which requires additional workaround.

**Assumptions:**

- All schools have capacity and capability to use the collaboration technology (MS Teams).
- FarmBeats kits are durable for use for a whole school term and beyond.
- The FarmBeats kit and program align with teacher expectation.

# CyberTaipan

PARTICIPATION: Who we need to reach across the various parts of the pathway?



## Assumptions:

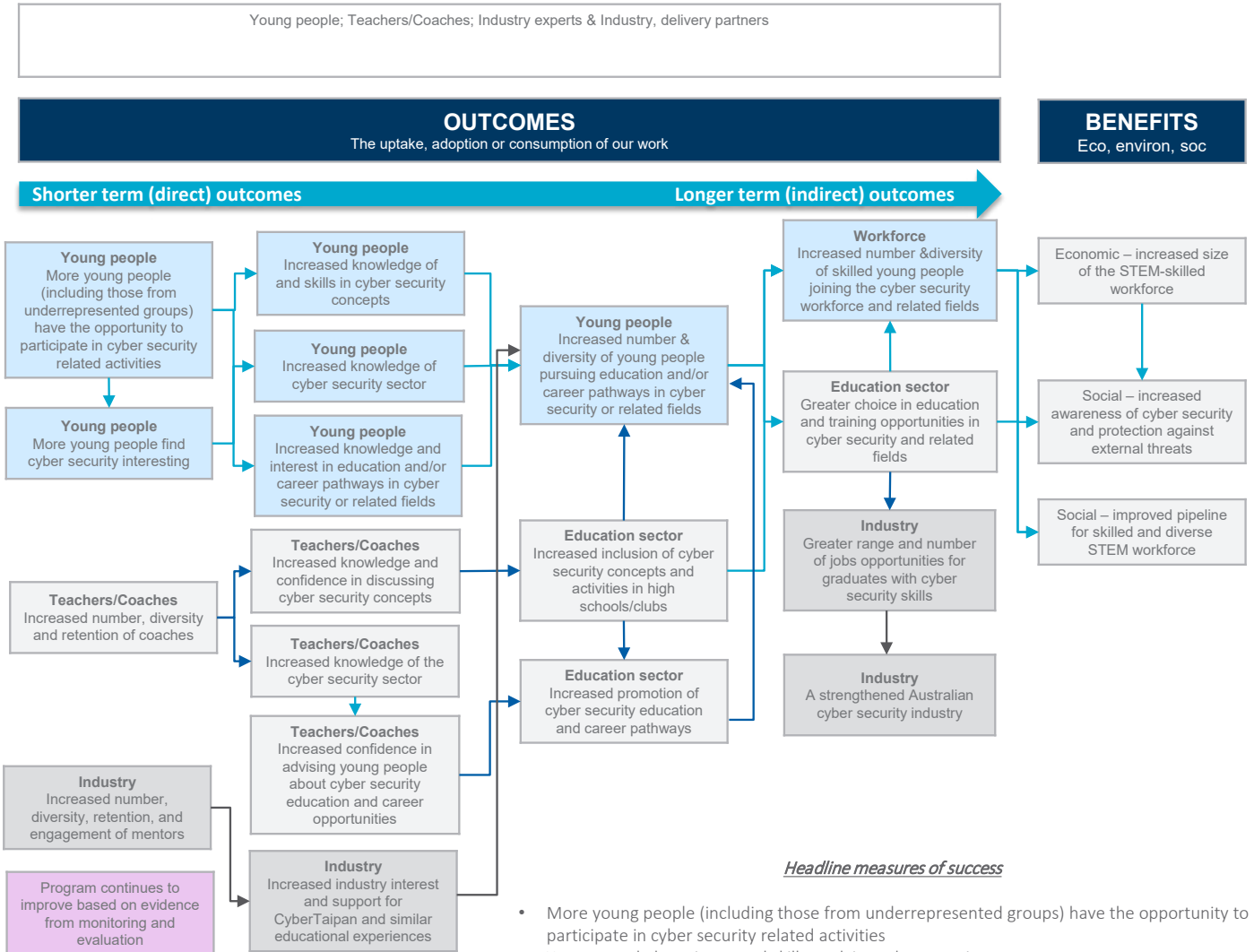
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**Impact Statement: CyberTaipan helps young Australians to gain cyber security industry knowledge and skills through real world problem-based competitions. This experience provides motivation to explore education and career pathways in cyber security and related fields.**



**The counterfactual:**

If CyberTaipan was not delivered/or does not deliver its expected outcomes:

- Short term:
  - Low levels of interest and skills in cyber security amongst young Australians.
  - Insufficient interest and skills in cyber security in the education sector.
  - A disconnect between the real-world cyber security industry and school/club based cyber security experiences.

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  - Limited options in cyber security related education, training and career pathways.
  - Lack of skills and knowledge in the Australian cyber security workforce.
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