Australia's National Science Agency

Engaging Young Female Students in Digital Technology Programs

Part Two: Primary Research Project Report for CSIRO

Kristy Osborne, Rachel Felgate and Sarah Buckley

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Executive summary

Part Two of the larger project relates to a primary research project designed to gain further insight into the factors that facilitate and hinder young female students' engagement with digital technologies and STEM. To achieve this aim, the research project focused on gaining the perspectives of Australian teachers including those involved in CEdO programs, a small group of students aged 14-16 years, and a sample of STEM educators in tertiary institutions.

This report firstly outlines the approach used to gain the perspectives of the first and second groups, namely:

- A sample of Australian teachers
- A sample of students aged 14-16 years.

This is followed by a findings section which integrates the teacher and student data to discuss key themes that emerged from the analyses. The next section outlines the method and findings for the third group, a sample of STEM educators in tertiary institutions.

The final section of this report presents the key findings that emerged across the different data collected in the research project. It also connects these findings to the recommendations made in the Part One report to illustrate the links between the two aspects of the project.

1 Introduction

Promoting student engagement with STEM, including digital technologies, is crucial for the national interests of Australia for several reasons. Firstly, at the macro level, ensuring a digitally literate workforce is at the heart of the Australian government's tech future agenda, and considered vital for the economy (Australian Government Department of Industry, Science, Energy and Resources, 2018). Secondly, at the micro level, STEM skills are often highly valued in the workforce and individuals with these skills have more opportunities in the labour market. However, the recent national STEM Equity Monitor summary report (Australian Government Department of Industry, Science, Energy & Resources, 2020a) shows that females continue to be under-represented in STEM tertiary education programs and in the STEM workforce. Australia has a significant gender divide, with females accounting for only 39% of information media and telecommunications graduates (Australian Government Department of Industry, Science, Energy and Resources, 2018). This disparity widens when considering the workforce, with 2019 data showing only 14% of jobs requiring STEM qualifications were held by females (STEM Equity Monitor, 2020). Investigating ways to improve female engagement with digital technologies is therefore important for ensuring equity in the field and is a priority for the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

This report is part of a larger project commissioned by CSIRO and designed to highlight the enablers and barriers to young female students engaging with digital technology through a primary research project. This research aimed to gain insight from teachers, students and tertiary educators in order to trace the pathway from primary through to tertiary digital technology education. The perspectives of these stakeholders are compared with the findings from Part One of the project.

Please note that in this report, the term 'female' includes those who are cisgender, transgender, non-binary, and intersex persons who identify as female.

2 Teacher and Student Perspectives

2.1 Approach to teacher survey and student workshops

The general teacher survey was designed to gather views relating to:

- attitudes towards science, mathematics, engineering and digital technology,
- whether female and male students view subjects differently,
- how digital technology is taught in the classroom, and barriers and enablers to student participation, and
- STEM in the workplace.

The teacher survey was delivered online through the secure PeoplePulse platform. Teachers were recruited and informed about the study via an advertisement about the research project delivered in the CSIRO Digital Careers' newsletter, an article in Teacher magazine (https://www.teachermagazine.com), at a stand at PAX Aus 2022 where ACER was informing teachers about the STEM Video Game Challenge, and through researchers' networks.

Participants gave active consent to have their responses included in the research project at the start of the survey after reading a statement about the project and clicking next to continue onto the survey questions. Table 1 details the characteristics of the 129 teacher questionnaire respondents. Due to the recruitment method, it is expected that the respondent teachers will be more likely to be engaged with digital technology in their schools which may create bias in responses. However, as responses were gathered from all States and Territories, across the three school sectors and from all school types, all these groups have representation. It should be noted that two-thirds of the respondents teach digital technology and therefore the respondent group will be biased towards digital technology teachers' perspectives.

Table 1 Characteristics of teacher questionnaire respondents

CHARACTERISTIC		NUMBER OF RESPONDENTS	PERCENTAGE OF RESPONDENTS
State or Territory	ACT	5	4%
	NSW	29	23%
	NT	1	1%
	QLD	19	15%
	SA	8	6%
	TAS	3	2%
	VIC	42	33%
	WA	22	17%
School sector	Catholic	29	23%
	Government	64	50%
	Independent	36	28%

School type	Combined	45	35%
	Primary	26	20%
	Secondary	57	44%
	Special	1	1%
Role of respondent*	Principal or Acting Principal	6	5%
	Member of the leadership team	33	26%
	Member of the teaching team	94	75%
	Member of the administrative/ICT team	4	3%
Year levels taught*	Reception/Prep/Kindergarten	11	9%
	Year 1	16	12%
	Year 2	17	13%
	Year 3	15	12%
	Year 4	20	16%
	Year 5	21	16%
	Year 6	25	19%
	Year 7	50	39%
	Year 8	54	42%
	Year 9	59	46%
	Year 10	51	40%
	Year 11	50	39%
	Year 12	43	33%
	None – I have no teaching responsibilities	11	9%
Do you teach digital technology?	Yes	85	66%
	No	44	34%
Gender	Female	63	49%
	Male	33	26%
	Other or prefer not to answer	2	2%
	Unknown	31	24%
Total respondents		**129**	**100%**

*Percentages will not sum to 100 as multiple responses could be given.

A different approach was used to gain an understanding of students' perspective in the research project. Recruitment was via ACER staff networks as a convenience sample. Year 9 students were invited to participate in one of four student workshops held at the ACER Adelaide office during the school holidays. Each workshop took about 30-45 minutes and asked students about their attitudes towards science, mathematics, engineering, and digital technology, whether they think females and males view subjects differently, and who influences their attitudes. Table 2 describes the characteristics of the students from the four workshops held from the 23rd to 27th January 2023. Note that one student that participated was in Year 8.

Table 2 Characteristics of student forum participants

CHARACTERISTIC		NUMBER OF PARTICIPANTS
School type	Government Secondary ICSEA* 1000-1100	5
	Non-government Combined ICSEA Over 1100	2
	Non-government Combined ICSEA Over 1100	4
	Government Secondary ICSEA 1000-1100	3
Gender	Female	12
	Male	1
	Other (Non-binary)	1
Year level	Year 8	1
	Year 9	13
Do you study digital technology?	Yes	4
	No	5
	Don't know	5
Total participants		**14**

*ICSEA is the Index of Community Socio-Educational Advantage (average=1000).

The findings from the teacher survey and student workshops are discussed in the next section. Basic descriptive data is also reported in the Appendix.

It should be noted that when student and teacher responses are compared percentages are used to allow for this comparison. As there are only 14 students, and some subsets of teachers are small, then percentages are only appropriate when making comparisons.

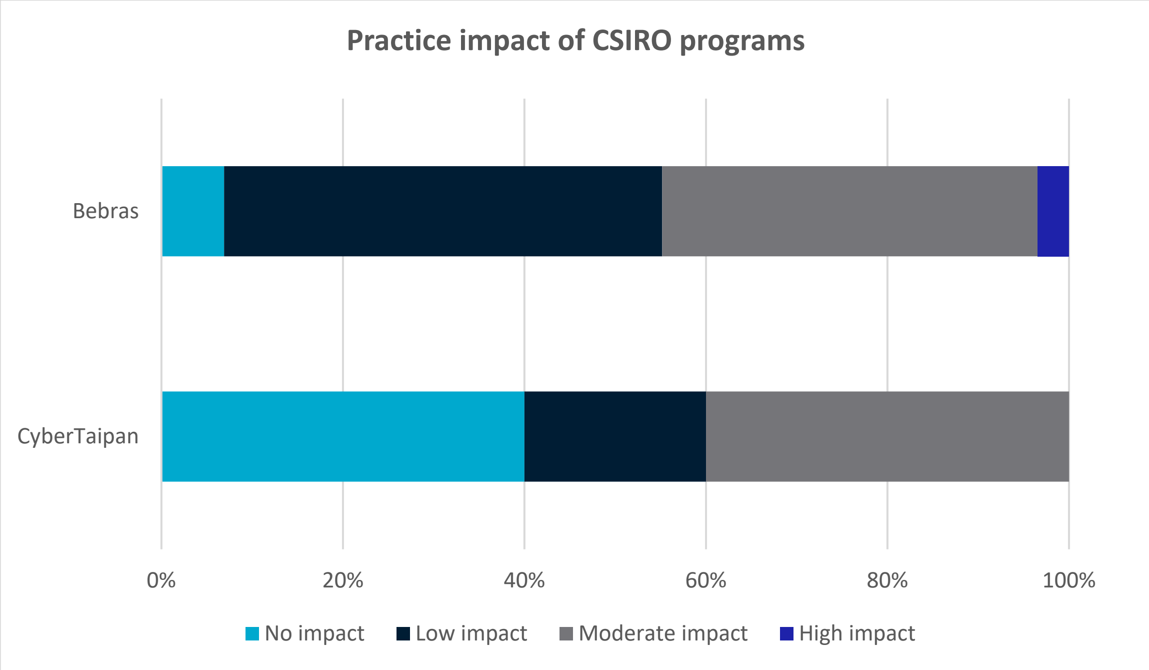
2.2 Findings from the teacher survey and student workshops

2.2.1 CSIRO program awareness

The 129 respondents to the teacher questionnaire were asked about their awareness of CSIRO programs or activities related to digital technology. Most of the respondents (75%) had not participated in any of CyberTaipan, FarmBeats or Bebras. Six respondents had participated in CyberTaipan and 29 respondents had participated in Bebras. None had participated in FarmBeats.

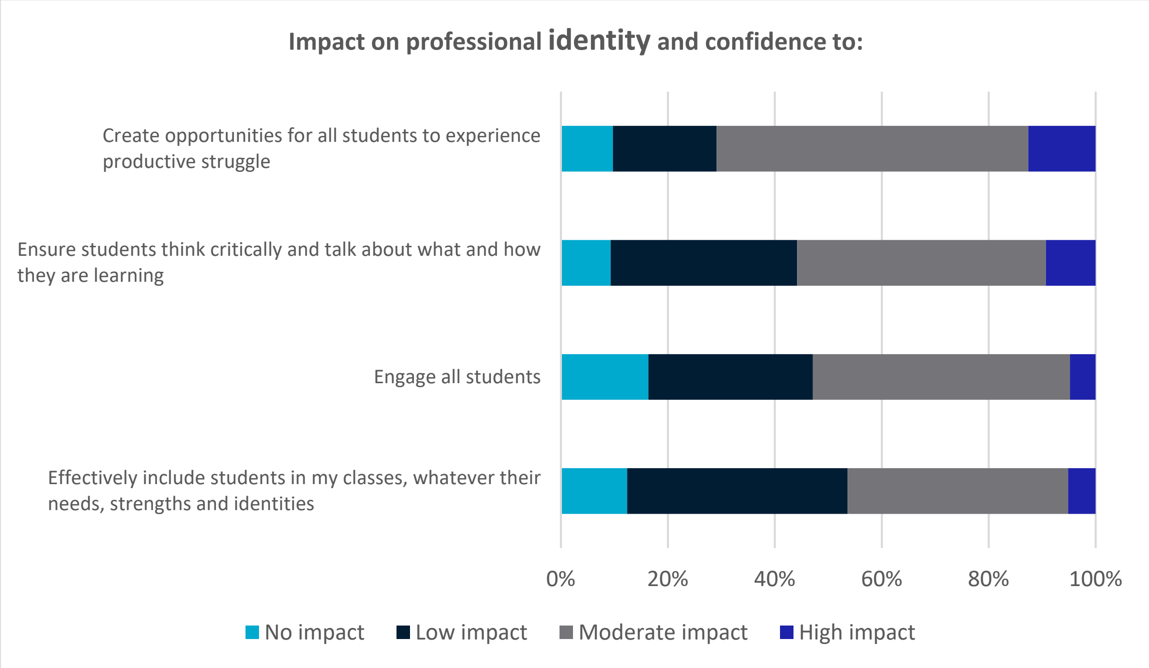
Respondents who had participated in either CyberTaipan or Bebras were asked if participation had a positive impact on their practice. As shown in Figure 1 over half the respondents felt that both programs had no or low impact on their professional practice. Note that it is not possible to determine from these data why these respondents felt the program had little or no impact on their practice (e.g. was this because they were already highly confident in their ability to teach digital technology before they engaged with the program?).

Figure 2.1 Perceived practice impact of CSIRO programs (Bebras N=29, CyberTaipan N=6)



Respondents who had participated in one or both of CyberTaipan and Bebras (32 teachers) were asked if participation had any impact on their professional identity and confidence in their practice. Figure 2 shows that over half the respondents (69%) felt that the programs had the most impact in their confidence to create opportunities for all students to experience productive struggle. Over half the respondents (53%) also felt that the programs had moderate to high impact on their confidence to ensure students think critically and talk about what and how they are learning.

Figure 2.2 Perceived impact of CSIRO programs on professional identity and confidence (N=32)



The same group of respondents were asked which CSIRO resources they had used as part of their participation in CyberTaipan or Bebras. Table 3 shows that the most used resources are the Bebras teacher resource sheets and solutions guide along with website resources.

Table 3 Digital technology resources (N=32)

DIGITAL TECHNOLOGY RESOURCES	NUMBER OF RESPONDENTS	PERCENTAGE OF RESPONDENTS
Teacher resource sheets (Bebras)	15	52%
Website resources	14	48%
Solutions guides (Bebras)	14	48%
Printable cards for classroom activities (Bebras)	10	35%
Teacher professional learning resources	8	28%
Student worksheets or workbooks (Bebras)	7	24%
Program information webinars	5	17%
Practice round (CyberTaipan)	4	14%
Other	1	3%
Mentor's support (CyberTaipan)	0	0%
None of these resources	9	28%

*Percentages will not sum to 100 as multiple responses could be given.

2.2.2 Digital technology in your school

Digital technology teacher perceptions

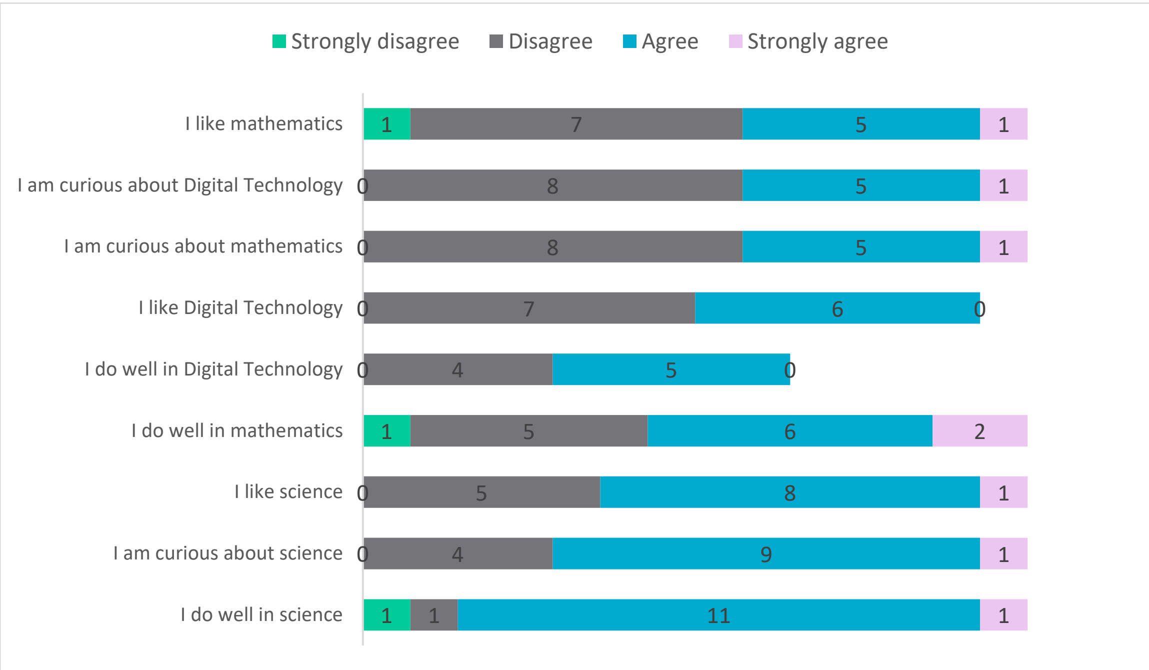
Of the participants that responded to the teacher survey, 66% taught digital technology subjects. The majority of these teachers agreed or strongly agreed (59%) that they received access to ongoing, day-to-day digital technology support. Teachers from secondary schools were the largest percentage of respondents that agreed or strongly agreed they had day-to- day support (64%) compared to teachers working at combined (57%) and primary schools (52%).

Sixty-two per cent of respondents agreed or strongly agreed that the support they received in digital technologies was easily transferrable to their work as a leader of learning. Eighty-four per cent of respondents also felt supported and encouraged to experiment with new ideas in the teaching of digital technologies.

Student perceptions

Of the students that participated in the workshops, four studied digital technology subjects with 10 saying either they did not or did not know if they studied digital technology. The majority of students agreed or strongly agreed (12) that they do well in science, that they are curious about science (10) and that they like science (9). Students shared mixed views about digital technology with 5 of 9 students responding agreeing they do well in the subject and seven disagreeing that they like digital technology. Students were more likely to disagree or strongly disagree that they like mathematics (8) or are curious about mathematics or digital technology (8 each). Figure 3 illustrates the responses.

Figure 2.3 Student attitudes to STEM and digital technology at school (N=14)



2.2.3 Confidence

In part one of this research project, confidence was emphasised as an important theme in the research literature, in programs for engaging females in digital technology and in policy. Higher levels of confidence, whether that be for students or teachers of digital technology, were repeatedly linked to greater engagement and learning outcomes. This section of the report explores both student and teacher perceptions around confidence that were collected in part two of the project and how some of these responses compared to other subject areas.

Teacher perceptions

Teachers were asked to rate their level of confidence in teaching digital technology. Thirty- eight per cent of respondents rated themselves as very confident and 38% rated themselves as somewhat confident. Smaller percentages of teachers reported themselves as only slightly confident (15%) and not confident in teaching digital technologies related subjects (10%).

Figure 4 presents the teaching confidence data but differentiates the responses of teachers that teach digital technology and those that do not. Of those that teach digital technology, 47% of respondents rated themselves as very confident in teaching digital technology compared to 5% of respondents that do not teach digital technologies.

Figure 4 also shows responses for digital technology teachers versus non-digital technology teachers when asked to rate their confidence in connecting digital technology to relevant, real-world applications. A higher percentage of teachers that teach digital technology subjects are very confident (39%) in connecting digital technology to relevant, real-world applications and career examples compared to 14% of teachers that do not teach digital technology.

Figure 2.4 Perceived confidence in teaching digital technology by teacher type (N=129)

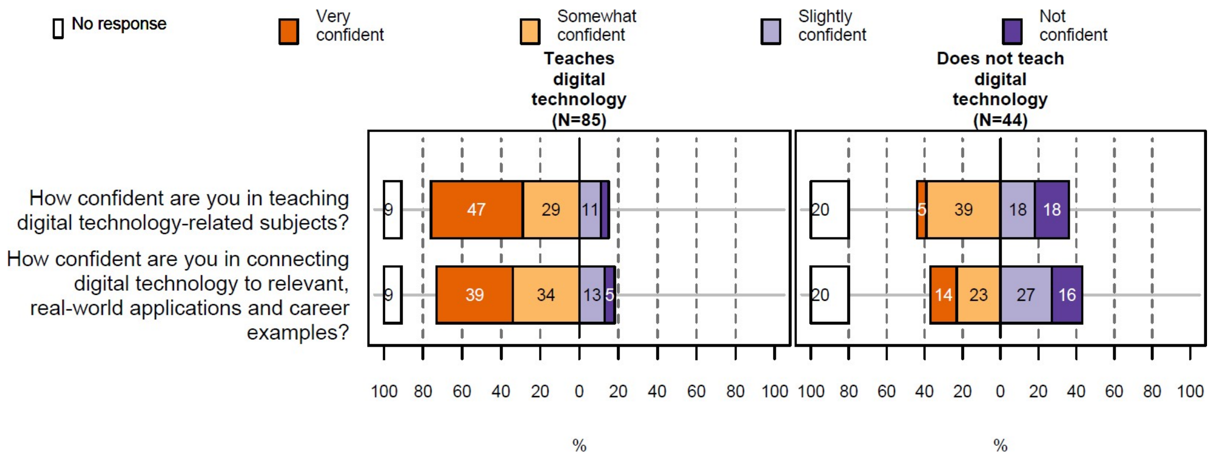
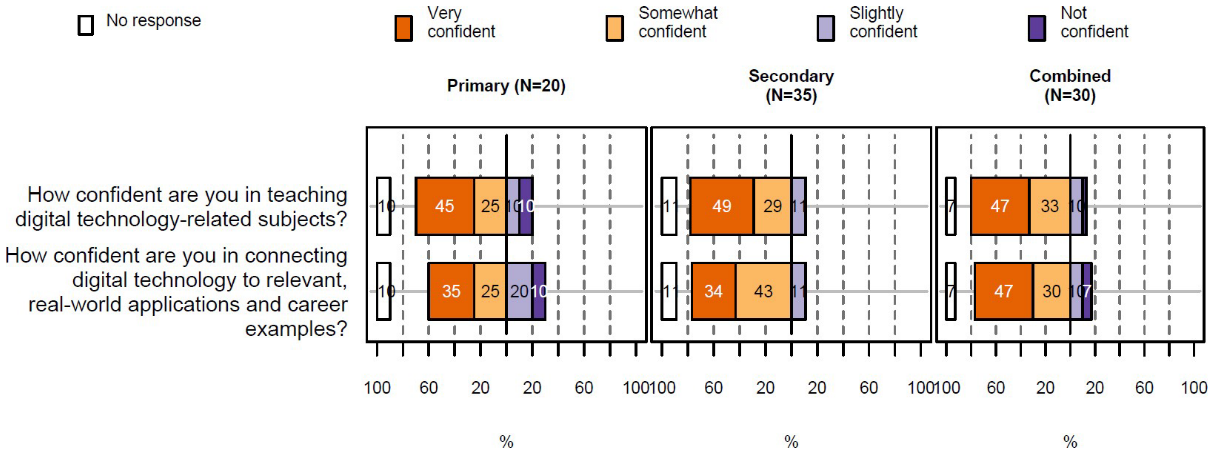


Figure 2.4 presents the teaching confidence data for teachers of digital technology but differentiates the responses of teachers that teach in secondary, primary and combined schools. Seventy percent of primary teachers that teach digital technologies rated themselves as somewhat confident or very confident, compared to 78% of secondary teachers and 80% of teachers working at combined schools. Conversely, there are a higher percentage of primary digital technology teachers who rate themselves as not confident (10%), compared to very few (3%) combined digital technology teachers and no secondary digital technology teachers. Similarly, a higher percentage of primary digital technology teachers rate themselves as not

confident in connecting digital technology to real-world applications (10%), compared to very few (7%) combined digital technology teachers and no secondary digital technology teachers.

Figure 2.5 Perceived confidence in teaching digital technology for digital technology teachers by school type (N=85)



The survey also provided respondents an opportunity to provide open-text responses to elaborate on key themes. One teacher reported that they believed a lack of teacher confidence, a lack of relating applications and potential careers to digital technology, peer influence and stigma around the subject could be a factor in students' attitudes towards digital technology subjects:

> "Disappointing number of girls interested in digital tech in middle/senior school largely because of peer influences - seen as "uncool" and a "boys subject". Lack of understanding amongst teachers, myself included, about application and potential careers with digital tech. Lack of confidence amongst staff to teach the subject - so not taught at all or poorly taught."

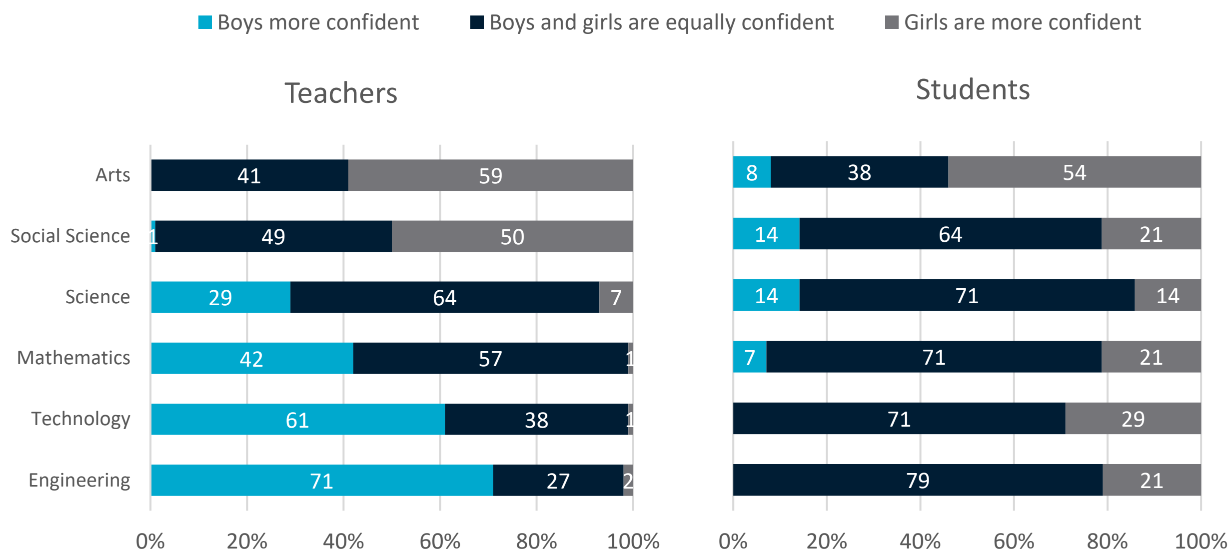
Another teacher also highlighted the importance of relating digital technologies to real world applications, to impact students' attitudes towards digital technologies subjects:

> "Relevance by connecting it to real word issues in their circle/community. When it is relatable, students have increased confidence in understanding the skills and outcomes. I have enjoyed teaching using project based learning in a student-centred approach to a local issue of erosion. Students engaged with their local council and presented their solutions to the local concern of erosion and inundation using a minimum of three forms of digital technology to communicate their suggested solutions - including a rebuild of the community coastline on Minecraft with embedded signage with costings and avatars to lead the audience through their proposals."

Teacher and student perceptions

The teacher survey also asked respondents to rate females' and males' levels of confidence in particular subjects[1] . Subjects included engineering, technology, mathematics, science, social science and art, and teachers were asked to select one of three categories for each subject: boys are more confident, boys and girls are equally confident, and girls are more confident. Students were also asked to provide their perspective on subjects using a similar categorical scale of response in the student forums. Figure 6 compares teacher ratings with student ratings (note that science was split into separate subjects for student ratings and physics is used for comparison purposes). See the Appendix for other student ratings of individual science subjects.

Figure 2.6 Perceived confidence of students in learning different subjects (Teachers N=129, Students N=14)



*Note 'science' is physics for student ratings.

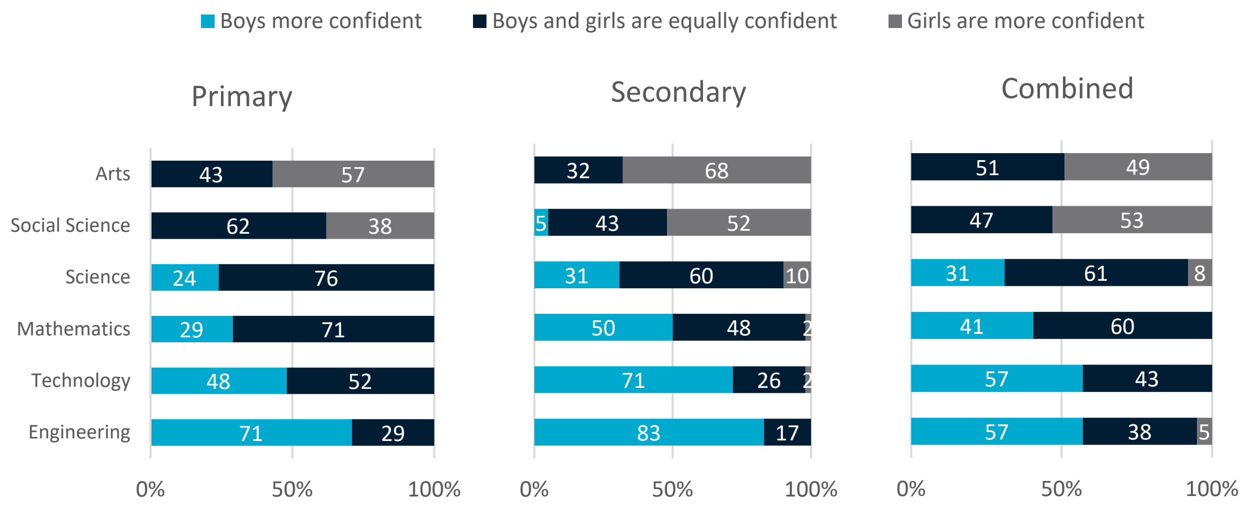
Most teachers rated boys as more confident in engineering (71%) and technology (61%). In contrast, most teachers also rated girls as more confident in arts subjects (59%) and social science (50%; note that 49% of teachers also rated boys and girls as equally confident in social science). Students rated boys as more confident in engineering (79%) and technology (71%) and rated girls as more confident in arts subjects (54%). Sixty-four per cent of teachers rated girls and boys as equally confident in science and fifty-seven per cent rated boys and girls as equally confident in mathematics (however, 42% of teachers also rated boys as more confident in mathematics). Students rated boys and girls as equally confident in science and

mathematics (71% each), with only 7% rating boys as more confident in mathematics. Twenty-one percent of students rated girls as more confident in mathematics.

When teachers' responses were differentiated according to school type, a higher percentage of secondary teachers (83%) perceived boys as more confident than girls in engineering than primary teachers (71%) (see Figure 7). Similarly, a higher percentage of secondary teachers (71%) perceived boys as being more confident than girls at technology than primary teachers (48%) (and 57% of combined school teachers).

[1] Items in the questionnaire where 'boys' are listed before 'girls' are based on tested items used in other studies.

Figure 2.7 Perceived confidence of students in learning different subjects by school type (N=129)



The percentage of teachers that perceived girls as more confident than boys in technology, mathematics, science, social science and art was higher for secondary teachers than primary teachers. For example, none of the primary teachers surveyed rated girls as being more confident than boys at technology, mathematics or science, however, two percent of secondary teachers rated girls as more confident than boys at technology and mathematics, and 10% of secondary teachers rated girls as more confident than boys at science (see Figure 7).

When comparing the ratings of teachers at primary, secondary and combined schools in relation to subjects at which boys and girls were perceived as being equally confident, a higher percentage of primary and combined school teachers rated equal confidence for all the subjects represented in Figure 7 (engineering, technology, mathematics, science, social science, arts) than secondary teachers.

Teacher and student perceptions

Open-text responses indicated that some teachers did not equate confidence with ability.

> "A lot of this is speculative from my perspective as a digital technologies teacher. A large amount of the confidence I've observed in the Technology space often feels misplaced, where confidence is not backed up by ability."

Similarly, one teacher felt that this perceived confidence was a gendered issue instilled by society.

> "Girls are trained from a very early age to disparage their own abilities and celebrate the success of others. Boys are encouraged to take pride in their abilities and bluff over-confidence. My female students have amazing abilities but low confidence"

Two teachers also noted the stark difference in the confidence of female students between primary and secondary years.

> "I am a primary school teacher, and I have actually found that the confidence levels in most subjects are very similar. However I am a STEM teacher, and the girls I have are very confident in science, technology. In addition, they are also very engaged."

and

> "I teach young children and their motivation to learn subjects and content is not influenced by their gender yet. The influence is on their own perspective. I understand this changes as they get older and the external influences take effect. Younger classes do not have the same access to resources as older classes and this is a shame as the younger students are more receptive to learning STEM and are less influenced by opinions. They are yet to form many opinions about themselves and are less afraid of taking risks with their learning."

Students also noted that confidence plays a part in female students' subject selection choices. They suggested that if a female student hasn't had prior experience of a subject, they won't consider choosing this subject as they don't have the confidence to step into uncertainty.

> "Females do not like getting into areas that they have not had exposure to from early on…avoiding the uncertainty."

2.2.4 Barriers

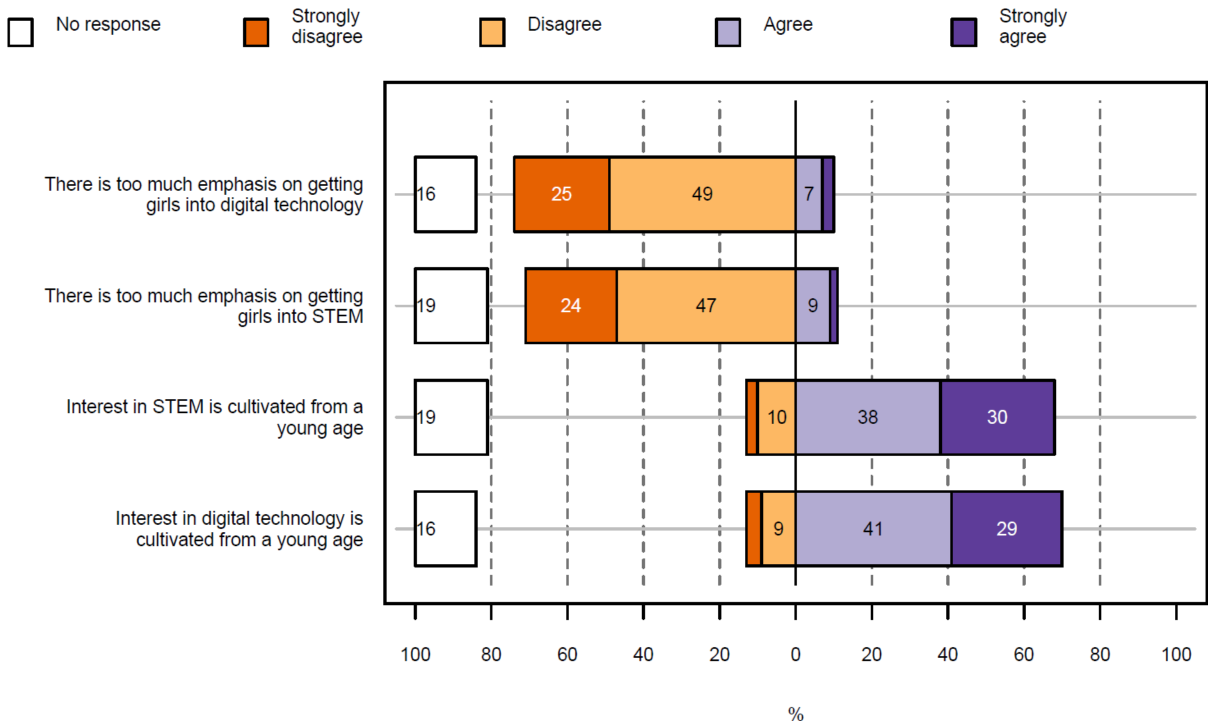
In Part One of this research project, enablers such as parent's influence and early exposure to digital technology were emphasised as important factors that impact on participation and engagement with digital technologies. Barriers such as gender stereotypes were also found to play a significant role in discouraging females from taking part in digital technology programs. This section of the report explores data collected that highlights student and teacher perceptions on barriers to females' engagement in digital technology studies.

Teacher perceptions

Teachers were asked to rate their level of agreement with the statement 'There is too much emphasis on getting girls into Digital Technology'. Twenty-five per cent of respondents strongly disagreed with the statement and 49% disagreed. Teachers were also asked to rate their level of agreement with the statement 'Interest in Digital Technology is cultivated from a young age'. Twenty-nine per cent of respondents strongly agreed with the statement and 41% agreed.

Figure 8 illustrates these data along with results when the same statements were presented to teachers in relation to STEM. The distribution of agree/disagree responses for digital technology and for STEM were similar.

Figure 2.8 Agreement levels for teachers regarding digital technology and STEM emphasis and cultivation (N=129)



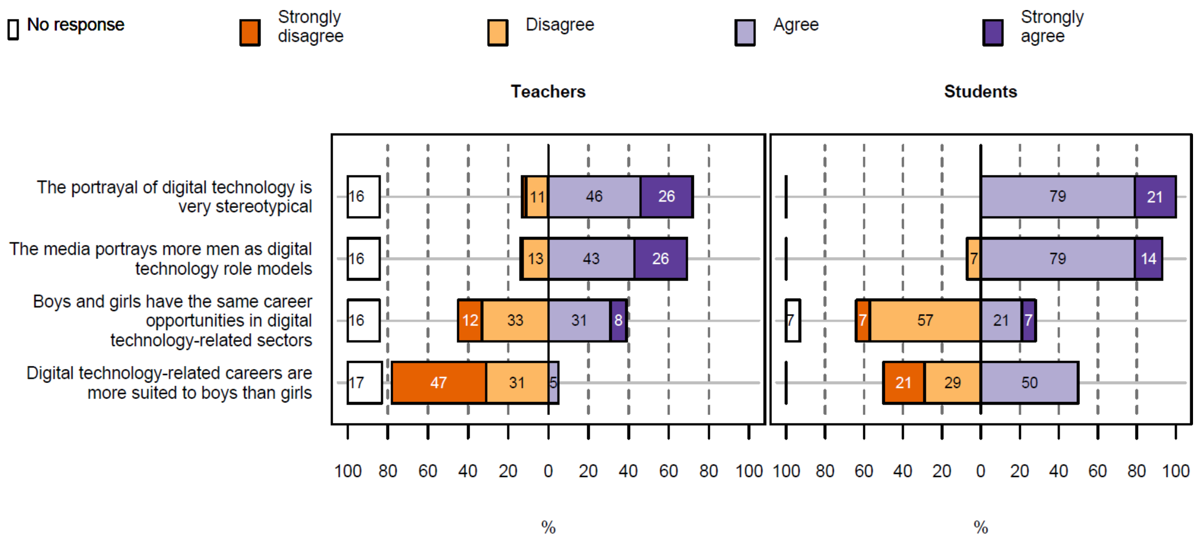
Teacher and student perceptions

Teachers and students were asked to rate their level of agreement with the statements 'The media portrays more men as Digital Technology role models' and 'The portrayal of Digital Technology is very stereotypical (e.g. IT nerds)'. Twenty-six per cent of teachers strongly.

agreed with both statements compared to 14% and 21% of students, respectively. No students disagreed with the statements 'The portrayal of digital technology is very stereotypical'.

Figure 9 shows the distribution of responses from teachers and students for these statements.

Figure 2.9 Agreement levels regarding digital technology stereotypes and careers (Teachers N=129, Students N=14)



Teachers and students were also asked to rate their level of agreement with the statement 'Boys and girls have the same career opportunities in Digital Technology-related sectors' [2] . Only 8% of teachers strongly agreed with the statement and 31% agreed. Larger percentages of teachers disagreed or strongly disagreed (45%) with the statement. Comparatively, 64% of students disagreed or strongly disagreed with the statement.

No respondents strongly agreed that boys are more suited than girls to Digital Technology-related careers and only 5% of teachers agreed with the statement. However, 50% of students participating in the workshops agreed that boys are more suited than girls to Digital Technology-related careers. These responses are also shown in Figure 9.

The teacher survey and student workshops also provided respondents an opportunity to provide elaborations on the findings highlighted above. One teacher reported that:

> "I think media imagery of girls and women involved in STEM and digital technology is an ongoing important reinforcing imperative. A clear career pathway to university and work is also important to emphasise."

This was emphasised in other teachers' responses with one teacher suggesting that interventions targeted at primary students might prevent stereotypes from forming:

[2] Items in the questionnaire where 'boys' are listed before 'girls' are based on tested items used in other studies.

"From what I observe, students tend to 'lump together' Digital Technology, STEM, Mathematics and Science subjects with each other as well as with a perceived notion of "smart" or "more academic". This seems to have a negative effect on student's willingness to engage or pursue these subjects. One possibility is that access to positive, creative, open-ended problem-based projects at an early age (i.e. primary) might help remove this stigma."

Another teacher commented on the lack of standalone IT classes along with the lack of female teachers of Digital Technology as barriers to engaging young women in Digital Technologies:

"The attempt years ago to integrate Information Technology into all subjects led to the loss of IT classes. It was never well integrated, primarily due to the low skill level of teachers in other discipline areas. Unfortunately, once the IT classes were gone, room was no longer seen to be available to accommodate the Digital Technology curriculum through standalone subjects. At best, they were offered as elective subjects. The shortage of female teacher role models in Digital Technology has a big influence on female students' willingness to give elective Digital Technology subjects a try".

Students gave clear thoughts around media stereotypes:

"Media – in movies a lot more females in English, Humanities career roles, if a female character is a mathematician often a make-over is needed to make them 'likeable' – so it is like the outlook or appearance is more important".

and

"Social media – making female empowerment seem a massive task – not normalising it, portrayal of "nerdiness" for people interested in STEM, or even interested in school-work – 'girl who likes maths'".

and

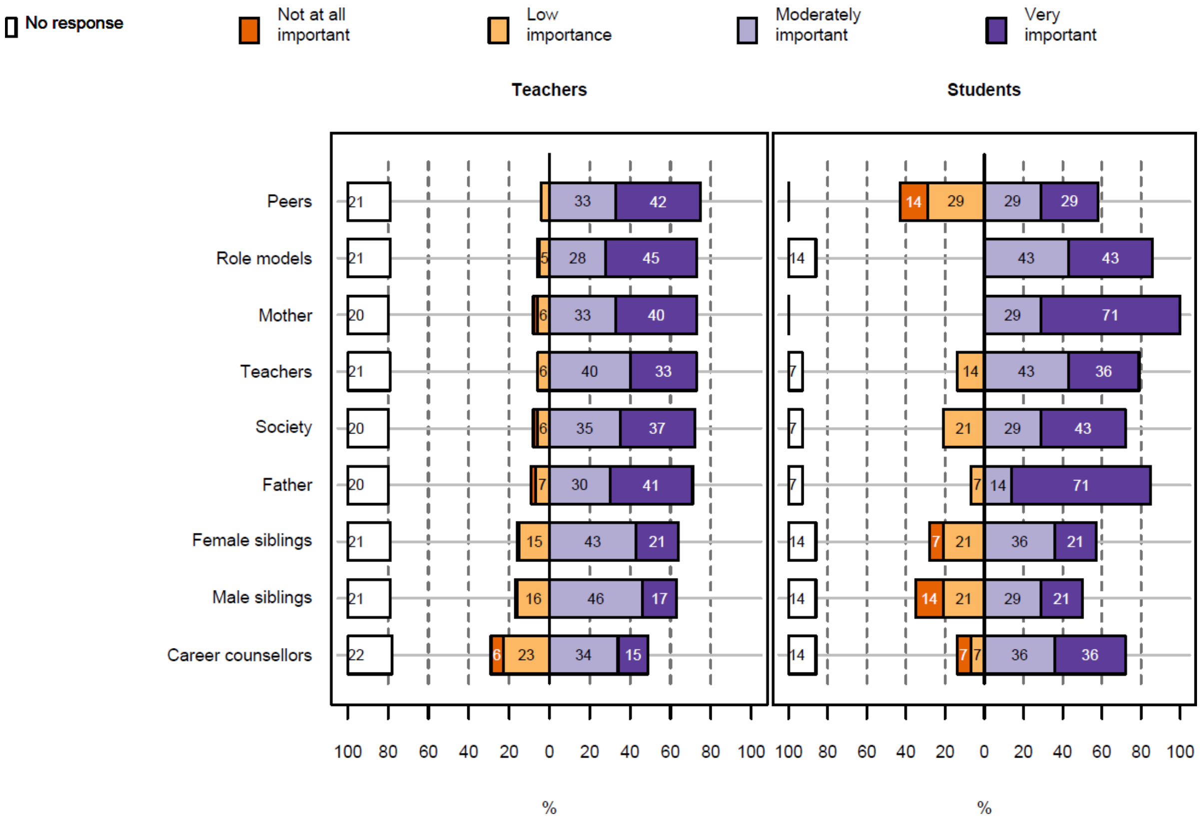
"Females are stereotyped as not needing much in terms of having a career that is satisfying for them, like being a waitress is enough when in their head it might not be".

and

"Media … enables a toxic masculinity to boys – makes boys think they should be doing building/hard jobs, 'prove' they are manly".

Teachers and students were asked to rate the importance of different influences on students' attitudes towards Digital Technology subjects. Teachers rated peers (75% teachers rated these influences as very or moderately important), role models (73%), a students' mother (73%), and teachers (73%) as the most important influences on a students' attitude towards Digital Technology, closely followed by the influence of society (72%) and a students' father's influence (71%). As shown in Figure 10, students' responses were slightly different. Students rated their parents as being the most important influence on their attitude towards Digital Technology subjects (71% rating the influence of their mother or father as very important). Similar to teachers, students also rated role models as an important influence on their attitudes with 86% rating this influence as very or moderately important. Students also rated in-school influences of teachers and career counsellors as important influences (36% of students rated both these influences as very important). However, students had mixed views on the influence of peers on their attitudes towards Digital Technology subjects with 58% rating peers as very or moderately important and 43% rating them as low importance or not at all important.

Figure 2.10 Agreement levels regarding factors that are important in attitudes towards digital technology (Teachers N=129, Students N=14)



One of the greatest influences on a students' attitude towards digital technology was perceived to be the students' interest and passion, which 64% of teachers and 79% of students agreed was very important. The ability/skills of the student were also seen to be a very important influence on their attitude towards digital technology, with 42% of teachers and 79% of students agreeing this was very important.

Again, teachers and students had the opportunity to construct responses around factors they believed were important to students' attitudes to Digital Technology. One teacher respondent stated that gaming and Digital Technology were often conflated and though a student may be interested and passionate about gaming this does not necessarily translate to a passion for Digital Technology:

> “Students often equate digital technology subjects to gaming - they can quickly become disillusioned when they find that they need to learn basic problem-solving skills and logical thinking to these subjects. Access to good resources is a problem in many schools. Most young women don't see themselves as likely to go down a technology/engineering/scientific pathway”.

This perception was also reinforced in one of the student workshop groups where the conflation between gaming and Digital Technology was apparent:

> “We (girls) don’t like ‘coding’, however if friends are doing it we would join in as a team thing. Girls see digital technology as boring. Girls don’t feel like it comes naturally to them. Yes, might get involved if the content was interesting, and the outcome made a difference. If there was more real-world context (rather than coding) they can look up on computer (i.e. complete research)”.

One teacher noted the importance of both early exposure and the influence of skilled teachers:

> “Success in early years of education - students need to have highly skilled teachers in primary to ensure that they come into senior subjects prepared and engaged. By year 7, the majority of students have already decided that digi tech is boring or too hard (and quite often both)”.

This was also reinforced by another teacher who related this to larger systemic issues in relation to staffing around digital technology education in schools.

> “At a systemic level there is a view, supported by the highlighting of NAPLAN, OLNA etc to school outcomes and student progress, that there is ‘important’ learning, and everything else.
>
> At the school level, many teachers have no formal training in Digital Technologies related fields (undergraduate, industry experience, or in-depth professional learning), and school leaders (principals, deputies) lack understanding of the curriculum and what teaching it entails. Combined with Digital Technology being a new compulsory subject, staffing classes can be left to whoever is most suited or most available at the expense of quality of learning for students. If students don't see their teachers invested in the subject, they are less likely to be invested themselves, or not exposed to information that allows them to make more informed decisions for themselves. This flows on to information being fed back to parents and the community about what students are and should be learning.”

Students in the workshops emphasised the importance of school influences such as skilled teachers, the school environment, and the way school counsellors (and other adults) can push female students into ‘female career’ choices.

> “Even if the subject is not something a student is highly interested in, the teacher could be the catalyst for getting those students to take it. Same is true for the other way round, students lose interest in a subject when the teacher is not well liked.”

"[It's] determined by how a school portrays a subject. Some schools don't highlight all subjects, some are hidden away. If not a popular subject, it is not obvious, sometimes you find out if it is any good by someone else."

"[There are] stereotypes where people (adults) expect females to choose certain subjects or follow certain career paths… School counsellors / advisors / other adults [in schools] suggesting career choices that are more for 'females'… [It's as if] females are stereotyped as not needing much in terms of having a career that is satisfying for them, like being a waitress is enough when in their (female's) head it might not be".

3 Tertiary Perspectives

3.1 Approach to tertiary interviews

To ascertain the barriers and enablers that impact female students participating in digital technologies programs at the tertiary level, and if these factors were consistent with patterns found in other data collected, educators in the tertiary system were interviewed. These interviews were conducted online during December 2022.

The interviews were focused on:

a. undergraduate attrition and gender disparity, and

b. barriers to students choosing to embark on tertiary postgraduate pathways.

Five tertiary educators participated in the interviews. The participants were all tertiary educators from three different universities located either in Victoria or Queensland. The participants ranged from Master's students who tutored computer science classes, computer science unit co-ordinators, and heads of digital technologies research groups involved in teaching and supervision of PhD students. An effort was made to recruit female tertiary educators to participate in the tertiary interviews, however, the few that were able to be contacted did not respond to the request and as such none of the participants identified as female.

The interviews were semi-structured and each lasted approximately 30 minutes. All participants were initially asked six questions, shown in Table 4. These questions formed the structured framework of the interview, and participants were then asked to elaborate on aspects of their responses. Notes were taken during the interview and read back to participants to verify accuracy.

Table 4 Questions asked in tertiary interviews

1	How would you define Digital Technologies and its importance to education and/or society?
2	How would you define your role in digital technologies and/or STEM education?
3	What do you perceive as the issues and/or barriers to encouraging students to study digital technology subjects at the undergraduate level?
4	What do you perceive as the issues and/or barriers to encouraging students to study digital technology at the postgraduate level?
5	What do you perceive as the main causes of attrition from digital technologies courses at the undergraduate and postgraduate level?
6	Have you noticed any gender disparity in digital technologies subjects at the undergraduate and/or postgraduate level? If so, what are your thoughts on the reasons for these disparities?

Two independent coders conducted thematic content analysis to find overarching themes that emerged from the data. The data were interrogated to explore (a) undergraduate attrition and gender disparity, and (b) barriers to students choosing to undertake a postgraduate pathway. Coders used a key to distinguish subthemes in participants' responses.

3.2 Findings from tertiary interviews

Before discussing the overarching themes arising from the tertiary interviews, the contextual backdrop of participants' understanding of digital technologies is provided. Participants viewed digital technologies as anything relating to computers and information processing technology, and a technology that aides the development of knowledge.

As one participant stated,

> "Digital technology is almost anything that involves transistors! Any technology where the processing goes by 0s and 1s…"

All participants agreed that digital technologies are important to education. In particular, they highlighted the importance of digital technologies to (1) support students and educators to deliver and find information and resources (e.g. search engines, learning management systems), and (2) facilitate interactions with peers and experts over large distances (e.g. delivering lectures by Zoom). They also highlighted that digital technologies can be used by and are useful for everyone.

Interestingly, two participants linked learning digital technologies to the development of critical thinking skills.

> "Foundations of digital technologies and thinking (logic, proof) need to be taught at school. Those that miss that teaching at school are at a disadvantage."

Four out of five participants commented on a noticeable gender disparity in undergraduate digital technology courses. Participants noted that enrolments in dedicated, high-level computer science units tended to be 75% male students and 25% female. In some fields, like data science and artificial intelligence, participants noted that this ratio continued into postgraduate study. One participant noted that only 10% of students enrolled in robotics subjects were female.

> "Attrition is not the problem in terms of gender. The primary problem is encouraging the female students to embark on the degree."

This quote highlights an important issue noted by 4 out of 5 participants; that is, participants had not seen a greater proportion of female students than male students dropping out of tertiary digital technologies subjects or related courses but had concerns about the lower proportion of female students choosing to enrol in these subjects or courses, and subsequently pursue a career in this area.

3.3 Identifying barriers to digital technologies engagement in undergraduate and postgraduate courses

A thematic content analysis found three overarching themes related to barriers engaging with tertiary digital technologies study. The most dominant theme related to **representation and inclusivity**. Other overarching themes were related to **prior exposure to digital technologies education and related STEM disciplines**, and **financial barriers**. Interview narratives included a range of examples, typically stories shared by students or perceptions of what participants saw in the tertiary classroom context.

3.3.1 Representation and inclusivity

The theme of representation and inclusivity captured a common thread in participant responses that females may not be studying digital technologies because of a lack of female representation in the area (including the absence of female role models) and the impact of active cultural biases and stereotypes that influenced how inclusive the learning environment was for female students.

Representation

One of the key factors that participants attributed to females choosing not to enrol in tertiary subjects and/or courses in digital technologies was a lack of female representation. Lack of representation was discussed as a lack of visible females successfully studying and/or pursuing digital technology careers (such as teaching digital technologies at the tertiary level). Four participants believed that some female students chose not to take on undergraduate digital technologies programs as they didn't feel represented in IT.

> "There is a picture of a student in their head, perhaps a male as opposed to the spectrum of other possibilities. This can lead to situations where they don't feel their choice is represented well."

One participant noted a lack of female academics at their university. The lack of female academic staff meant there were not many female academics available to supervise PhD students. Two participants hypothesised some females might not see themselves as the right person to undertake postgraduate digital technologies study due to an absence of female academics/role models in the digital technology space. One participant recounted a discussion he had with a secondary teacher at an innovation fair:

> "She was dissuaded from doing a PhD as she thought the mentors/academics would all be male."

One participant felt that if the number of female academics in digital technologies increased, this would in turn increase the number of females interested in enrolling in both undergraduate and postgraduate degrees.

> “Staffing in the academic field is also predominantly men. If about one third were female, this may encourage female participation in terms of enrollment, and maybe more females in academia”

Lack of representation was also discussed in relation to peer networks. One participant stated that students’ decision to study digital technologies at the tertiary level was heavily influenced by peer interests. If friends were not interested in an undergraduate degree in digital technologies, the participant believed this would impact on the individual student’s choice to pursue a digital technology degree upon secondary graduation.

Inclusivity

Smaller numbers of female students choosing to enrol in digital technologies degrees was also attributed to a learning culture that is not as inclusive of females, with an emphasis on the impact of stereotypes and culture biases. Two participants felt female students were discouraged from studying digital technologies at the tertiary level, due to IT and engineering having a reputation of being male-dominated subjects.

> “Robotics has the perception of being blokey. The tools and the environment are stereotyped that way. Engineers in general still struggle with gender disparity, as many people think of a male when they think of an engineer.”

Three participants felt that one reason students were not pursuing digital technologies at the tertiary level was due to avoiding or not being exposed to these subjects during secondary school. In particular, one participant noted that technical subjects often come with a ‘nerd’ stigma that would be more difficult for female students to cope with.

> “Nerd stigma – a sizable section of the population thinks IT is uncool…Nerd stigma for women is often worse than for guys. There is a big challenge of acceptance, creating a culture where pursuing technological studies is appropriate for everyone.”

Four out of five participants acknowledged that there is an unconscious, societal expectation that males are more suited to studying engineering and technology subjects than females.

Participants also reflected on the theme of inclusivity through discussion of the culture of digital technology learning in the tertiary context. One participant, who was a tutor of a tertiary digital technology course, expressed their view that though they felt their classrooms were inclusive, female students did not ask for the same level of support.

> “Class was welcoming to females. Students were treated equally in terms of time from tutors, all students were asked how they were going. Guys would say what they were struggling with. Girls tended not to be as open, did cover up struggles, so tutors did not know how much help they needed.”

While this participant felt there was an inclusive culture in their classrooms, less help-seeking behaviour and openness to showing learning struggles could indicate that the environment was less comfortable for female students and/or that gendered ideas about how females "should" engage in classroom learning were prevalent.

Participants also discussed lack of inclusivity and gender bias in terms of the way secondary students were recruited into tertiary degrees. Two participants felt that the university marketing and open day recruitment materials were not inclusive of all genders. For example, one participant stated that:

> "One popular engineering undergrad activity is related to race cars. Car technology is presented as car racing to be more engaging to prospective students, but there could be other activities that engage females more. The selected activity might not be the most engaging for everyone."

While another participant noted that activities that some people thought were not typically enjoyed by females, e.g. car racing, were actually very popular with female students.

> "The university motorsports team had about 30% female, more than undergrad. So societal pressure that girls do not like motorsports, rather than something they don't actually like."

One participant also felt the course materials could be gendered, especially in robotics and similar engineering courses. For example,

> "Support materials for training are often put together by males e.g. health and safety videos, sometimes the resources themselves reflect the stereotype."

Discussion with participants highlighted existing conflicts between what academics perceive might engage a diverse demographic of students, and what actually engages students. The discussion also highlighted that more work needs to be done on ensuring a wide range of open day activities, and checks to ensure that materials presented both at open days and in the classroom are inclusive of the diverse range of students' backgrounds and interests.

3.4 Prior exposure

The second overarching theme illustrated in participants' responses was the idea that a barrier to females choosing undergraduate digital technologies education was lack of exposure to digital technologies and specialist mathematics in secondary school. The lack of exposure was seen to be due to two factors: lack of facilities and lack of access to teachers of these specialties. As stated by one participant,

> "The main barriers we discussed were that people in remote communities don't have access to the same platforms, quality of internet connections and mobile networks. As soon as you are away from the coastline the connection is patchy. Though this should not be assumed, as some urban areas also have poor connections. Connections can also be a problem for metropolitan areas and regional towns."

Another participant stated,

> "Mathematics background – it becomes a socio-economic issue about who has access to specialist mathematics at high school. Students are starting from a position of disadvantage if they haven't completed specialist mathematics."

The high level of mathematical rigour required to successfully complete an undergraduate digital technology course was often seen as a barrier to students, both male and female, if they had not completed advanced mathematics at secondary school. As one participant stated,

> "The difficulty of the content can be a barrier. Algorithms at the start of the course e.g. sorting, searching, optimization, p vs np, invariant analysis. The fundamental building blocks of computer science are pure mathematics. It requires rigorous mathematics."

One participant noted that tertiary students were often surprised at the high level of mathematics needed to successfully complete an undergraduate digital technologies degree and that this response would not occur if students were exposed to more digital technology content as part of their secondary education. The same participant also highlighted that more digital technology subjects offered as university electives could highlight to students the potential of digital technology education and encourage more students to embark on double degrees or change major.

Two participants felt that even though digital technologies were being taught at secondary school, the way the subject was being taught might not be as engaging for all students, particularly female and First Nation students. There was an emphasis on using multiple methods of teaching, rather than purely traditional teaching methods, to ensure that the teaching of digital technologies at secondary school accounted for cultural differences and/or rural and remote environments.

One participant highlighted the need for universities to bring back mathematics pre-requisites to send a signal to both secondary teachers and students, the pivotal role mathematics plays in digital technologies courses at the tertiary level.

3.5 Financial

The final theme and significant barrier mentioned by four out of five participants, for all genders, was financial. Participants highlighted that a major barrier to students undertaking postgraduate pathways in digital technologies was the lack of financial incentive. Unlike science disciplines, digital technology graduates can earn similar money from completing only the undergraduate degree as opposed to obtaining postgraduate qualifications. The opportunities to obtain a job are also high after finishing an undergraduate degree. As one participant stated:

> "Workforce opportunities are already high after finishing undergraduate, fewer students do postgraduate when the job market is booming."

Two participants highlighted that government subsidies to make STEM courses cheaper could potentially encourage more enrolments, from all genders.

4 Key findings and strategies for the future

The research findings in this report highlight the factors associated with young female students' engagement with digital technology and trace this pathway from primary through to tertiary education. Across the different data sources collected, including the perspectives of secondary students, primary and secondary teachers, and tertiary educators, several key themes emerged. These are presented below and then linked to recommendations in the Part One report.

4.1 Representation and digital technology in schools, tertiary institutions, and the media

The theme of representation was illustrated across the data collected in the project in several ways. The importance of female students being exposed to positive, female role models in digital technologies was considered vital by all research participants to promoting participation in the subject area from the early years into tertiary education. This included role models in media, in the classroom and in academia with a lack of female representation identified as a considerable barrier to young female students' choosing to study digital technologies subjects.

Representation was also highlighted in relation to the way that digital technologies curriculum was implemented and taught in secondary education. The majority of students that participated in the student forums could not recall or believed they had not studied digital technologies at school. This suggests that the content had either not been covered yet in their pre-Year 8/9 education or that they did not remember the content that had been taught to them. Open-text responses from teachers also reinforced the variability of curriculum implementation across schools. Ways put forward to improve the representation of digital technologies curriculum in schools included elevating its status in secondary education (e.g., as a stand-alone subject that students must complete), and ensuring that it is taught by confident teachers, and discussed and understood by school leadership and career counsellors as a valuable area to pursue professionally.

Lastly, the important impact of mothers and fathers on students' attitudes towards digital technology was reported by both teachers and students. Thus, and recognised in the Part One report, the way that digital technologies are represented/discussed and accessed in the home is crucial in shaping young people's engagement and participation with the area.

4.2 Inclusivity and the culture of learning in digital technologies education

Active cultural biases and stereotypes around females and digital technologies (e.g. girls and gaming/female tertiary students and robotics) and their negative impact on female students' engagement with the subject area were emphasised in data collected from students and educators at all levels. This was illustrated by student voices that endorsed some of these stereotypes, by teachers' perceptions of gendered confidence patterns in technology and engineering (i.e. a high percentage of teachers, particularly secondary educators, reported male students were more confident in these subject areas than female students), in suggestions that the reputation of digital technologies in tertiary education is male-centric, and in the recruitment strategies utilised by some tertiary institutions.

Interestingly, teachers' responses highlighted that negative stereotypes, biases and stigma may not be as prevalent or as impactful on female students' engagement in the primary years. The importance of creating inclusive digital technologies curriculum in primary education that includes real-world contexts was emphasised as a way to promote better student engagement with the subject area in general. However, inclusive curriculum in secondary and tertiary education would also address concerns/issues raised by secondary and tertiary educators about curriculum barriers to female students' engagement.

Actively working to recognise and dismantle negative stereotypes around girls and gaming etc… were also highlighted and is important for all levels of education. Working with peer groups in secondary school could be beneficial given the large influence that peers were reported to have on students' attitudes. Reducing stigma and gender stereotypes around females and STEM in general would also be useful in helping to increase young female students' engagement with mathematics, which was highlighted as an important enabler for tertiary study in digital technologies.

4.3 Supporting teachers running CEdO programs

Only a small number of respondents to the teacher survey had participated in CEdO programs. However, 28% of these teachers had not accessed any of the resources available to them during their participation in the programs. Around 40% to 50% of teachers had used teacher resource sheets (for Bebras), website resources and/or solutions guides (for Bebras). While these results are only for a small sample of teachers involved with the programs, they may indicate there is an opportunity to develop new resources or new methods to engage teachers with the program resources available.

4.4 Connecting research findings with Part One recommendations

Table 5 builds on the findings and recommendations of the Part One report to link these with the dominant themes from the primary research findings discussed in this report.

Table 5 Summary of recommendations from Part One of the project linked to Part Two findings

CATEGORY	PART ONE RECOMMENDATION	LINKS TO PART TWO RESEARCH FINDINGS
Recommendations that can be acted on now	Expanding the locations where CEdO programs are advertised and promoted (e.g with DATTA Vic, DATTA Queensland, QSITE and ICTENSW)	NA

	Engaging parents through participation (e.g. as Bebras Coordinators) and by linking to cybersafety resources (see resources developed by the e-safety Commissioner: https://www.esafety.gov.au/kids)	Mothers and fathers were rated as key influencers that shape students' attitudes towards digital technologies.
	Developing brief information sheets for teachers about the impact of parental cybersafety concerns on digital technology access and participation	As above. Parents may be more comfortable to engage in positive discussions about digital technologies pathways for their daughters when given resources to address cybersafety concerns. They could also be key advocates for change and help dismantle negative stereotypes.
	Developing brief information sheets for teachers to better engage female students	Inclusive curriculum that better engages all students using real- world contexts was highlighted as an important factor for promoting student engagement.
	Developing brief information sheets for teachers to address stereotypes and stigma	Active cultural biases and stereotypes were identified, particularly in the secondary and tertiary space, as barriers to female students' engagement with digital technologies.
Recommendations for the short-term	Curriculum mapping programs to the content descriptions of the Key Learning Areas and continua of the General Capabilities of the Australian Curriculum	This recommendation may better support teachers that engage (or are considering engaging) in CEdO programs.
	Enhancing the role of mentors and expanding mentor recruitment strategies (e.g. considering remote mentorship options, recruiting through the STEM Professionals in Schools program with organisations such as Data61, and inviting university students completing digital technology programs to be mentors)	Role models were highlighted as an important influence on students' attitudes towards digital technologies.
	Expanding the representation of young female students and students from diverse backgrounds in visual imagery associated with CEdO programs (e.g. in newsletters, on social media platforms and in publications like the annual report)	Lack of female representation was emphasised as a barrier to female students' engagement with digital technologies.
	Reviewing task content, where possible (e.g. within the constraints of each program, examining ways that task content could be modified to be more inclusive)	Inclusive curriculum that better engages all students using real- world contexts was highlighted as an important factor for promoting student engagement.
	Investigating current gender stereotypes and stigma around females and digital technology in Australian early adolescent peer culture to enhance and refine resources developed to dismantle these negative attitudes	As above. Research findings reinforce the need to address negative stereotypes, stigma and cultural biases at all levels of education.
	Partnering with First Nation businesses and communities (e.g. the Indigenous Digital Excellence (IDX) Initiative, InDigiMOB, Willyama and Baidam)	As above. Representation and the importance of role models was highlighted in the research findings.

Long-term recommendation	Building new supporting resources for Bebras that are more inclusive for all students, are aligned to the Australian Curriculum, build student confidence and engagement, and scaffold students into participating in the Bebras competition rounds	Inclusive curriculum that begins in the primary years and better engages all students using real- world contexts was emphasised as way to address negative stereotypes, stigma and cultural biases and increase female students' engagement and participation in digital technologies.

Appendix A Teacher Survey Frequencies

A.1 In which State or Territory is your school located?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	ACT	5	3.9	3.9	3.9
	NSW	29	22.5	22.5	26.4
	NT	1	.8	.8	27.1
	QLD	19	14.7	14.7	41.9
	SA	8	6.2	6.2	48.1
	TAS	3	2.3	2.3	50.4
	VIC	42	32.6	32.6	82.9
	WA	22	17.1	17.1	100.0
	Total	129	100.0	100.0	

A.2 In which sector is your school?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Catholic	29	22.5	22.5	22.5
	Government	64	49.6	49.6	72.1
	Independent	36	27.9	27.9	100.0
	Total	129	100.0	100.0	

A.3 What type of school is it?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Combined	45	34.9	34.9	34.9
	Primary	26	20.2	20.2	55.0
	Secondary	57	44.2	44.2	99.2
	Special	1	.8	.8	100.0
	Total	129	100.0	100.0	

A.4 Who is answering this survey? (Please select all that apply)

A.4.1 Cases

VALID	MISSING	TOTAL

	N	PERCENT	N	PERCENT	N	PERCENT
role[a]	126	97.7%	3	2.3%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		
		N	PERCENT	PERCENT OF CASES
Who is answering this survey? [a]	Principal or Acting Principal	6	4.4%	4.8%
	Member of the leadership team	33	24.1%	26.2%
	Member of the teaching team	94	68.6%	74.6%
	Member of the administration/ICT team	4	2.9%	3.2%
Total		137	100.0%	108.7%

a. Dichotomy group tabulated at value 1.

A.5 What year levels are you teaching this year? (Please select all that apply)

A.5.1 Cases

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
years[a]	129	100.0%	0	0.0%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		
		N	PERCENT	PERCENT OF CASES
What year levels are you teaching this year?[a]	Reception/Prep/Kindergarten	11	2.5%	8.5%
	Year 1	16	3.6%	12.4%
	Year 2	17	3.8%	13.2%
	Year 3	15	3.4%	11.6%
	Year 4	20	4.5%	15.5%
	Year 5	21	4.7%	16.3%
	Year 6	25	5.6%	19.4%
	Year 7	50	11.3%	38.8%
	Year 8	54	12.2%	41.9%
	Year 9	59	13.3%	45.7%
	Year 10	51	11.5%	39.5%
	Year 11	50	11.3%	38.8%
	Year 12	43	9.7%	33.3%
	None - I have no teaching responsibilities	11	2.5%	8.5%
Total		443	100.0%	343.4%

a. Dichotomy group tabulated at value 1.

A.6 Do you teach digital technology?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Yes**	85	65.9	65.9	65.9
	No	44	34.1	34.1	100.0
	Total	129	100.0	100.0	

Appendix B CSIRO program awareness

B.1 Which of the following CSIRO programs/activities related to Digital Technology have you participated in? (Please select all that apply)

B.1.1 Case Summary

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
q1[a]	129	100.0%	0	0.0%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		
		N	PERCENT	PERCENT OF CASES
Which of the following CSIRO programs have you participated in?a	**CyberTaipan**	6	4.5%	4.7%
	Bebras	29	22.0%	22.5%
	None of these	97	73.5%	75.2%
Total		132	100.0%	102.3%

a. Dichotomy group tabulated at value 1.

B.2 To what extent did these Digital Technology programs/activities have a positive impact on your practice?

B.2.1 CyberTaipan

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**No impact**	2	33.3	40.0	40.0
	Low impact	1	16.7	20.0	60.0
	High impact	2	33.3	40.0	100.0
	Total	5	83.3	100.0	
Missing	**System**	1	16.7		
Total		6	100.0		

B.2.2 Bebras

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**No impact**	2	6.9	7.1	7.1
	Low impact	13	44.8	46.4	53.6
	Moderate impact	12	41.4	42.9	96.4

	High impact	1	3.4	3.6	100.0
	Total	28	96.6	100.0	
Missing	System	1	3.4		
Total		29	100.0		

B.3 What impact has participating in CSIRO programs/activities had on your professional identity and confidence to?

B.3.1 Engage all students

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	No impact	5	15.6	16.1	16.1
	Low impact	10	31.3	32.3	48.4
	Moderate impact	14	43.8	45.2	93.5
	High impact	2	6.3	6.5	100.0
	Total	31	96.9	100.0	
Missing	System	1	3.1		
Total		32	100.0		

B.3.2 Ensure students think critically and talk about what and how they are learning

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	No impact	2	6.3	6.7	6.7
	Low impact	12	37.5	40.0	46.7
	Moderate impact	13	40.6	43.3	90.0
	High impact	3	9.4	10.0	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		
Total		32	100.0		

B.3.3 Effectively include students in my classes, whatever their needs, strengths and identities

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	No impact	3	9.4	10.0	10.0
	Low impact	13	40.6	43.3	53.3
	Moderate impact	12	37.5	40.0	93.3
	High impact	2	6.3	6.7	100.0
	Total	30	93.8	100.0	
Missing	System	2	6.3		

Total		32	100.0		

B.3.4 Create opportunities for all students to experience productive struggle

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**No impact**	2	6.3	6.9	6.9
	Low impact	7	21.9	24.1	31.0
	Moderate impact	16	50.0	55.2	86.2
	High impact	4	12.5	13.8	100.0
	Total	29	90.6	100.0	
Missing	**System**	3	9.4		
Total		32	100.0		

B.4 Which CSIRO resources have you used as part of your participation in CSIRO programs/activities? (Please select all that apply)

B.4.1 Case Summary

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
q4[a]	29	90.6%	3	9.4%	32	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		PERCENT OF CASES
		N	PERCENT	
Which CSIRO resources have you used as part of your participation?a	**Teacher professional learning sessions**	8	9.5%	27.6%
	Program information webinars	5	6.0%	17.2%
	Website resources	14	16.7%	48.3%
	Solutions guides (Bebras)	14	16.7%	48.3%
	Teacher resource sheets (Bebras)	15	17.9%	51.7%
	Printable cards for classroom activities (Bebras)	10	11.9%	34.5%
	Student worksheets or workbooks (Bebras)	7	8.3%	24.1%
	Practice round (CyberTaipan)	4	4.8%	13.8%
	Other	1	1.2%	3.4%
	None	6	7.1%	20.7%
Total		84	100.0%	289.7%

. Dichotomy group tabulated at value 1.

Appendix C Digital Technology in your school

C.1 How much do you agree or disagree with the following statements regarding support for Digital Technology?

C.1.1 Teachers have ready access to ongoing day-to-day support in my school

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	13	10.1	10.7	10.7
	Disagree	37	28.7	30.6	41.3
	Agree	50	38.8	41.3	82.6
	Strongly agree	21	16.3	17.4	100.0
	Total	121	93.8	100.0	
Missing	**System**	8	6.2		
Total		129	100.0		

C.1.2 If needed, support is readily available to me from external agencies such as CSIRO

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	13	10.1	11.0	11.0
	Disagree	48	37.2	40.7	51.7
	Agree	52	40.3	44.1	95.8
	Strongly agree	5	3.9	4.2	100.0
	Total	118	91.5	100.0	
Missing	**System**	11	8.5		
Total		129	100.0		

C.1.3 The support I receive is easily transferable to my work as a leader of learning

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	9	7.0	8.0	8.0
	Disagree	34	26.4	30.4	38.4
	Agree	58	45.0	51.8	90.2
	Strongly agree	11	8.5	9.8	100.0
	Total	112	86.8	100.0	
Missing	**System**	17	13.2		
Total		129	100.0		

C.1.4 Experimentation with new ideas is encouraged and supported in my school

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	5	3.9	4.3	4.3
	Disagree	13	10.1	11.3	15.7
	Agree	73	56.6	63.5	79.1
	Strongly agree	24	18.6	20.9	100.0
	Total	115	89.1	100.0	
Missing	**System**	14	10.9		
Total		129	100.0		

C.1.5 Our school leaders are active participants in our Digital Technology programs/activities

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	17	13.2	14.9	14.9
	Disagree	51	39.5	44.7	59.6
	Agree	37	28.7	32.5	92.1
	Strongly agree	9	7.0	7.9	100.0
	Total	114	88.4	100.0	
Missing	**System**	15	11.6		
Total		129	100.0		

C.1.6 How confident are you in teaching Digital Technology-related subjects?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Very confident**	42	32.6	37.5	37.5
	Somewhat confident	42	32.6	37.5	75.0
	Slightly confident	17	13.2	15.2	90.2
	Not confident	11	8.5	9.8	100.0
	Total	112	86.8	100.0	
Missing	**System**	17	13.2		
Total		129	100.0		

C.1.7 How confident are you in connecting Digital Technology content to relevant, real-world applications and career examples

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Very confident**	39	30.2	34.8	34.8
	Somewhat confident	39	30.2	34.8	69.6
	Slightly confident	23	17.8	20.5	90.2
	Not confident	11	8.5	9.8	100.0

	Total	112	86.8	100.0	
Missing	System	17	13.2		
Total		129	100.0		

C.1.8 When discussing skills and career opportunities with students, where do you place yourself on the following scale?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Digital Technology skills are important to everyone, no matter what job you plan to do	53	41.1	49.5	49.5
	2	22	17.1	20.6	70.1
	3	24	18.6	22.4	92.5
	4	3	2.3	2.8	95.3
	5	0	.0	.0	95.3
	6	0	.0	.0	95.3
	7	3	2.3	2.8	98.1
	8	1	.8	.9	99.1
	9	1	.8	.9	100.0
	Digital Technology skills are only important if you're going into a STEM career	0	.0	.0	100.0
	Total	107	82.9	100.0	
Missing	System	22	17.1		
Total		129	100.0		

C.1.9 In your opinion, how important is it for your students to have Digital Technology skills in order to get a good job in the future?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Low importance	5	3.9	4.6	4.6
	Moderately important	34	26.4	31.2	35.8
	Very important	70	54.3	64.2	100.0
	Total	109	84.5	100.0	
Missing	System	20	15.5		
Total		129	100.0		

Appendix D Barriers and Enablers to Participation

4.5 How much do you agree or disagree with the following statements related to Digital Technology participation?

D.1.1 The media portrays more men as Digital Technology role models

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	.9	.9
	Disagree	17	13.2	15.7	16.7
	Agree	56	43.4	51.9	68.5
	Strongly agree	34	26.4	31.5	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		
Total		129	100.0		

D.1.2 Digital Technology skills are important when considering employment options

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	.9	.9
	Disagree	4	3.1	3.7	4.6
	Agree	53	41.1	48.6	53.2
	Strongly agree	51	39.5	46.8	100.0
	Total	109	84.5	100.0	
Missing	System	20	15.5		
Total		129	100.0		

D.1.3 There is too much emphasis on getting girls into Digital Technology

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	32	24.8	29.6	29.6
	Disagree	63	48.8	58.3	88.0
	Agree	9	7.0	8.3	96.3
	Strongly agree	4	3.1	3.7	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		
Total		129	100.0		

D.1.4 Interest in Digital Technology is cultivated from a young age

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	5	3.9	4.6	4.6
	Disagree	12	9.3	11.1	15.7
	Agree	53	41.1	49.1	64.8
	Strongly agree	38	29.5	35.2	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		
Total		129	100.0		

D.1.5 Boys and girls have the same career opportunities in Digital Technology-related sectors

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	15	11.6	13.9	13.9
	Disagree	43	33.3	39.8	53.7
	Agree	40	31.0	37.0	90.7
	Strongly agree	10	7.8	9.3	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		
Total		129	100.0		

D.1.6 It is easier to engage boys with Digital Technology subjects than other subjects

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	5	3.9	4.6	4.6
	Disagree	49	38.0	45.4	50.0
	Agree	41	31.8	38.0	88.0
	Strongly agree	13	10.1	12.0	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		
Total		129	100.0		

D.1.7 The number of jobs requiring Digital Technology skills is growing

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Disagree	2	1.6	1.9	1.9
	Agree	34	26.4	31.5	33.3
	Strongly agree	72	55.8	66.7	100.0
	Total	108	83.7	100.0	
Missing	System	21	16.3		

Total	129	100.0		

D.1.8 The portrayal of Digital Technology is very stereotypical (e.g. IT nerds)

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	2	1.6	1.9	1.9
	Disagree	14	10.9	13.0	14.8
	Agree	59	45.7	54.6	69.4
	Strongly agree	33	25.6	30.6	100.0
	Total	108	83.7	100.0	
Missing	**System**	21	16.3		
Total		129	100.0		

D.1.9 Digital Technology skills are important for everyday life

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	2	1.6	1.9	1.9
	Disagree	4	3.1	3.7	5.6
	Agree	37	28.7	34.6	40.2
	Strongly agree	64	49.6	59.8	100.0
	Total	107	82.9	100.0	
Missing	**System**	22	17.1		
Total		129	100.0		

D.1.10 Digital Technology-related careers are more suited to boys than girls

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	60	46.5	56.1	56.1
	Disagree	40	31.0	37.4	93.5
	Agree	7	5.4	6.5	100.0
	Total	107	82.9	100.0	
Missing	**System**	22	17.1		
Total		129	100.0		

D.1.11 Digital Technology skills are important for the Australian economy

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	2	1.6	1.9	1.9
	Agree	31	24.0	29.0	30.8
	Strongly agree	74	57.4	69.2	100.0
	Total	107	82.9	100.0	
Missing	**System**	22	17.1		

Total	129	100.0		

4.6 How much do you agree or disagree with the following statements related to STEM participation?

D.1.12 The media portrays more men as STEM role models

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	.9	.9
	Disagree	22	17.1	20.8	21.7
	Agree	53	41.1	50.0	71.7
	Strongly agree	30	23.3	28.3	100.0
	Total	106	82.2	100.0	
Missing	**System**	23	17.8		
Total		129	100.0		

D.1.13 STEM skills are important when considering employment options

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	1.0	1.0
	Disagree	5	3.9	4.8	5.7
	Agree	59	45.7	56.2	61.9
	Strongly agree	40	31.0	38.1	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.14 There is too much emphasis on getting girls into STEM

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	31	24.0	29.5	29.5
	Disagree	60	46.5	57.1	86.7
	Agree	12	9.3	11.4	98.1
	Strongly agree	2	1.6	1.9	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.15 Interest in STEM is cultivated from a young age

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	4	3.1	3.8	3.8
	Disagree	13	10.1	12.4	16.2
	Agree	49	38.0	46.7	62.9
	Strongly agree	39	30.2	37.1	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.16 Boys and girls have the same career opportunities in STEM-related sectors

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	12	9.3	11.5	11.5
	Disagree	43	33.3	41.3	52.9
	Agree	39	30.2	37.5	90.4
	Strongly agree	10	7.8	9.6	100.0
	Total	104	80.6	100.0	
Missing	System	25	19.4		
Total		129	100.0		

D.1.17 It is easier to engage boys with STEM subjects than other subjects

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	6	4.7	5.7	5.7
	Disagree	49	38.0	46.7	52.4
	Agree	38	29.5	36.2	88.6
	Strongly agree	12	9.3	11.4	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.18 The number of jobs requiring STEM skills is growing

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	1.0	1.0
	Disagree	2	1.6	1.9	2.9
	Agree	38	29.5	36.2	39.0
	Strongly agree	64	49.6	61.0	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		

Total		129	100.0		

D.1.19 The portrayal of STEM is very stereotypical (e.g. white lab coats)

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	3	2.3	2.9	2.9
	Disagree	28	21.7	26.7	29.5
	Agree	48	37.2	45.7	75.2
	Strongly agree	26	20.2	24.8	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.20 STEM skills are important for everyday life

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	1.0	1.0
	Disagree	3	2.3	2.9	3.8
	Agree	49	38.0	46.7	50.5
	Strongly agree	52	40.3	49.5	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.21 STEM-related careers are more suited to boys than girls

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	55	42.6	52.9	52.9
	Disagree	44	34.1	42.3	95.2
	Agree	4	3.1	3.8	99.0
	Strongly agree	1	.8	1.0	100.0
	Total	104	80.6	100.0	
Missing	**System**	25	19.4		
Total		129	100.0		

D.1.22 STEM skills are important for the Australian economy

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	1.0	1.0
	Agree	28	21.7	26.9	27.9
	Strongly agree	75	58.1	72.1	100.0
	Total	104	80.6	100.0	

Missing	System	25	19.4		
Total		129	100.0		

4.7 How much do you agree or disagree with the following statements related to STEM participation?

D.1.23 The media portrays more men as STEM role models

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	.9	.9
	Disagree	22	17.1	20.8	21.7
	Agree	53	41.1	50.0	71.7
	Strongly agree	30	23.3	28.3	100.0
	Total	106	82.2	100.0	
Missing	System	23	17.8		
Total		129	100.0		

D.1.24 STEM skills are important when considering employment options

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	1.0	1.0
	Disagree	5	3.9	4.8	5.7
	Agree	59	45.7	56.2	61.9
	Strongly agree	40	31.0	38.1	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.25 There is too much emphasis on getting girls into STEM

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	31	24.0	29.5	29.5
	Disagree	60	46.5	57.1	86.7
	Agree	12	9.3	11.4	98.1
	Strongly agree	2	1.6	1.9	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.26 Interest in STEM is cultivated from a young age

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	4	3.1	3.8	3.8
	Disagree	13	10.1	12.4	16.2
	Agree	49	38.0	46.7	62.9
	Strongly agree	39	30.2	37.1	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.27 Boys and girls have the same career opportunities in STEM-related sectors

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	12	9.3	11.5	11.5
	Disagree	43	33.3	41.3	52.9
	Agree	39	30.2	37.5	90.4
	Strongly agree	10	7.8	9.6	100.0
	Total	104	80.6	100.0	
Missing	System	25	19.4		
Total		129	100.0		

D.1.28 It is easier to engage boys with STEM subjects than other subjects

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	6	4.7	5.7	5.7
	Disagree	49	38.0	46.7	52.4
	Agree	38	29.5	36.2	88.6
	Strongly agree	12	9.3	11.4	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		
Total		129	100.0		

D.1.29 The number of jobs requiring STEM skills is growing

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Strongly disagree	1	.8	1.0	1.0
	Disagree	2	1.6	1.9	2.9
	Agree	38	29.5	36.2	39.0
	Strongly agree	64	49.6	61.0	100.0
	Total	105	81.4	100.0	
Missing	System	24	18.6		

Total		129	100.0		

D.1.30 The portrayal of STEM is very stereotypical (e.g. white lab coats)

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	3	2.3	2.9	2.9
	Disagree	28	21.7	26.7	29.5
	Agree	48	37.2	45.7	75.2
	Strongly agree	26	20.2	24.8	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.31 STEM skills are important for everyday life

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	1.0	1.0
	Disagree	3	2.3	2.9	3.8
	Agree	49	38.0	46.7	50.5
	Strongly agree	52	40.3	49.5	100.0
	Total	105	81.4	100.0	
Missing	**System**	24	18.6		
Total		129	100.0		

D.1.32 STEM-related careers are more suited to boys than girls

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	55	42.6	52.9	52.9
	Disagree	44	34.1	42.3	95.2
	Agree	4	3.1	3.8	99.0
	Strongly agree	1	.8	1.0	100.0
	Total	104	80.6	100.0	
Missing	**System**	25	19.4		
Total		129	100.0		

D.1.33 STEM skills are important for the Australian economy

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Strongly disagree**	1	.8	1.0	1.0
	Agree	28	21.7	26.9	27.9
	Strongly agree	75	58.1	72.1	100.0
	Total	104	80.6	100.0	

Missing	System	25	19.4		
Total		129	100.0		

4.8 Please select the degree to which you believe the following factors are important in your students' attitudes to Digital Technology subjects.

D.1.34 Mother's influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	2	1.6	1.9	1.9
	Low importance	8	6.2	7.8	9.7
	Moderately important	42	32.6	40.8	50.5
	Very important	51	39.5	49.5	100.0
	Total	103	79.8	100.0	
Missing	System	26	20.2		
Total		129	100.0		

D.1.35 Father's influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	2	1.6	1.9	1.9
	Low importance	9	7.0	8.7	10.7
	Moderately important	39	30.2	37.9	48.5
	Very important	53	41.1	51.5	100.0
	Total	103	79.8	100.0	
Missing	System	26	20.2		
Total		129	100.0		

D.1.36 Male siblings' influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	1	.8	1.0	1.0
	Low importance	20	15.5	19.6	20.6
	Moderately important	59	45.7	57.8	78.4
	Very important	22	17.1	21.6	100.0
	Total	102	79.1	100.0	
Missing	System	27	20.9		
Total		129	100.0		

D.1.37 Female siblings' influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	1	.8	1.0	1.0
	Low importance	19	14.7	18.6	19.6
	Moderately important	55	42.6	53.9	73.5
	Very important	27	20.9	26.5	100.0
	Total	102	79.1	100.0	
Missing	System	27	20.9		
Total		129	100.0		

D.1.38 Peer influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Low importance	5	3.9	4.9	4.9
	Moderately important	43	33.3	42.2	47.1
	Very important	54	41.9	52.9	100.0
	Total	102	79.1	100.0	
Missing	System	27	20.9		
Total		129	100.0		

D.1.39 Teachers' influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Low importance	8	6.2	7.8	7.8
	Moderately important	51	39.5	50.0	57.8
	Very important	43	33.3	42.2	100.0
	Total	102	79.1	100.0	
Missing	System	27	20.9		
Total		129	100.0		

D.1.40 Career counsellors' influence

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	8	6.2	7.9	7.9
	Low importance	30	23.3	29.7	37.6
	Moderately important	44	34.1	43.6	81.2
	Very important	19	14.7	18.8	100.0
	Total	101	78.3	100.0	
Missing	System	28	21.7		
Total		129	100.0		

D.1.41 Role models' influence

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all important**	1	.8	1.0	1.0
	Low importance	7	5.4	6.9	7.8
	Moderately important	36	27.9	35.3	43.1
	Very important	58	45.0	56.9	100.0
	Total	102	79.1	100.0	
Missing	**System**	27	20.9		
Total		129	100.0		

D.1.42 The influence of society in general

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all important**	2	1.6	1.9	1.9
	Low importance	8	6.2	7.8	9.7
	Moderately important	45	34.9	43.7	53.4
	Very important	48	37.2	46.6	100.0
	Total	103	79.8	100.0	
Missing	**System**	26	20.2		
Total		129	100.0		

D.1.43 Lower level of difficulty in studying the subjects

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all important**	7	5.4	6.9	6.9
	Low importance	37	28.7	36.6	43.6
	Moderately important	34	26.4	33.7	77.2
	Very important	23	17.8	22.8	100.0
	Total	101	78.3	100.0	
Missing	**System**	28	21.7		
Total		129	100.0		

D.1.44 Their own ability/skills

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all important**	1	.8	1.0	1.0
	Low importance	8	6.2	7.8	8.7
	Moderately important	51	39.5	49.5	58.3
	Very important	43	33.3	41.7	100.0
	Total	103	79.8	100.0	
Missing	**System**	26	20.2		

Total		129	100.0		

D.1.45 Their interest/passion

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	1	.8	1.0	1.0
	Moderately important	20	15.5	19.4	20.4
	Very important	82	63.6	79.6	100.0
	Total	103	79.8	100.0	
Missing	System	26	20.2		
Total		129	100.0		

D.1.46 Greater chance of pursuing these subjects in college/university

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	5	3.9	4.9	4.9
	Low importance	19	14.7	18.6	23.5
	Moderately important	61	47.3	59.8	83.3
	Very important	17	13.2	16.7	100.0
	Total	102	79.1	100.0	
Missing	System	27	20.9		
Total		129	100.0		

D.1.47 Greater chance of employability

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	5	3.9	4.9	4.9
	Low importance	21	16.3	20.4	25.2
	Moderately important	46	35.7	44.7	69.9
	Very important	31	24.0	30.1	100.0
	Total	103	79.8	100.0	
Missing	System	26	20.2		
Total		129	100.0		

D.1.1 Higher pay in the future

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all important	5	3.9	4.9	4.9
	Low importance	19	14.7	18.4	23.3
	Moderately important	48	37.2	46.6	69.9
	Very important	31	24.0	30.1	100.0
	Total	103	79.8	100.0	

Missing	**System**	26	20.2		
Total		129	100.0		

4.9 If you consider there are any subjects boys study more than girls, which subjects do boys study more than girls? (Please select all that apply)

D.1.2 Case Summary

Cases

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
q13[a]	93	72.1%	36	27.9%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		PERCENT OF CASES
		N	PERCENT	
Boys study more than girlsa	**Engineering**	83	26.6%	89.2%
	Mathematics	59	18.9%	63.4%
	Science	37	11.9%	39.8%
	Sport	53	17.0%	57.0%
	Technology	68	21.8%	73.1%
	Other	12	3.8%	12.9%
Total		312	100.0%	335.5%

a. Dichotomy group tabulated at value 1.

D.1.3 Other subject boys study more than girls

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid		1	8.3	8.3	8.3
	Design Technologies	1	8.3	8.3	16.7
	Economics	1	8.3	8.3	25.0
	Higher level mathematics	1	8.3	8.3	33.3
	Physics	7	58.3	58.3	91.7
	Woodwork/metalwork	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

4.10 If you consider there are any subjects girls study more than boys, which subjects do girls study more than boys? (Please select all that apply)

D.1.4 Case Summary

Cases

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
q14[a]	92	71.3%	37	28.7%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		PERCENT OF CASES
		N	PERCENT	
Girls study more than boys[a]	Arts	79	31.5%	85.9%
	Engineering	3	1.2%	3.3%
	English	65	25.9%	70.7%
	Mathematics	3	1.2%	3.3%
	Science	16	6.4%	17.4%
	Social Science	65	25.9%	70.7%
	Sport	4	1.6%	4.3%
	Technology	4	1.6%	4.3%
	Other	12	4.8%	13.0%
Total		251	100.0%	272.8%

a. Dichotomy group tabulated at value 1.

D.1.5 Other subject girls study more than boys

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Biology	3	25.0	25.0	25.0
	Dance, Netball (specialist programs)	1	8.3	8.3	33.3
	Education	1	8.3	8.3	41.7
	Food science, drama	1	8.3	8.3	50.0
	Home economics, textiles and psychology	1	8.3	8.3	58.3
	Languages	1	8.3	8.3	66.7
	Music	1	8.3	8.3	75.0
	Nursing, Law, Teaching	1	8.3	8.3	83.3
	Psychology	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

4.10.1 Who do you believe are more confident in the following subjects?

Arts

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Boys and girls are equally confident	41	31.8	41.4	41.4
	Girls are more confident	58	45.0	58.6	100.0
	Total	99	76.7	100.0	
Missing	System	30	23.3		
Total		129	100.0		

Engineering

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Boys are more confident	71	55.0	71.0	71.0
	Boys and girls are equally confident	27	20.9	27.0	98.0
	Girls are more confident	2	1.6	2.0	100.0
	Total	100	77.5	100.0	
Missing	System	29	22.5		
Total		129	100.0		

English

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Boys and girls are equally confident	47	36.4	47.0	47.0
	Girls are more confident	53	41.1	53.0	100.0
	Total	100	77.5	100.0	
Missing	System	29	22.5		
Total		129	100.0		

Mathematics

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Boys are more confident	42	32.6	42.0	42.0
	Boys and girls are equally confident	57	44.2	57.0	99.0
	Girls are more confident	1	.8	1.0	100.0
	Total	100	77.5	100.0	
Missing	System	29	22.5		
Total		129	100.0		

Science

	FREQUENCY		PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Boys are more confident	29	22.5	29.3	29.3
	Boys and girls are equally confident	63	48.8	63.6	92.9
	Girls are more confident	7	5.4	7.1	100.0

	Total	99	76.7	100.0	
Missing	**System**	30	23.3		
Total		129	100.0		

Social Science

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Boys are more confident**	2	1.6	2.0	2.0
	Boys and girls are equally confident	48	37.2	48.5	50.5
	Girls are more confident	49	38.0	49.5	100.0
	Total	99	76.7	100.0	
Missing	**System**	30	23.3		
Total		129	100.0		

Sport

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Boys are more confident**	58	45.0	58.6	58.6
	Boys and girls are equally confident	41	31.8	41.4	100.0
	Total	99	76.7	100.0	
Missing	**System**	30	23.3		
Total		129	100.0		

Technology

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Boys are more confident**	60	46.5	61.2	61.2
	Boys and girls are equally confident	37	28.7	37.8	99.0
	Girls are more confident	1	.8	1.0	100.0
	Total	98	76.0	100.0	
Missing	**System**	31	24.0		
Total		129	100.0		

5 STEM in the workplace

Women currently hold a smaller proportion of STEM roles in industry and in the government and are less represented in academic positions in maths, science and engineering at universities. The following factors are sometimes given as a reason for this difference.

D.2 How valid do you think each of these reasons are?

D.2.1 Boys and girls tend to receive different levels of encouragement for developing scientific interest

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all valid**	18	14.0	18.0	18.0
	Somewhat valid	28	21.7	28.0	46.0
	Mostly valid	32	24.8	32.0	78.0
	Completely valid	22	17.1	22.0	100.0
	Total	100	77.5	100.0	
Missing	**System**	29	22.5		
Total		129	100.0		

D.2.2 On average, men and women differ in their willingness to devote the time required by such high-powered positions

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all valid**	48	37.2	48.5	48.5
	Somewhat valid	26	20.2	26.3	74.7
	Mostly valid	17	13.2	17.2	91.9
	Completely valid	8	6.2	8.1	100.0
	Total	99	76.7	100.0	
Missing	**System**	30	23.3		
Total		129	100.0		

D.2.3 On average, men and women differ in their willingness to spend time away from their families

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Not at all valid**	18	14.0	18.4	18.4
	Somewhat valid	39	30.2	39.8	58.2
	Mostly valid	25	19.4	25.5	83.7
	Completely valid	16	12.4	16.3	100.0

	Total	98	76.0	100.0	
Missing	System	31	24.0		
Total		129	100.0		

D.2.4 On average, men and women differ naturally in their scientific interest

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all valid	73	56.6	73.7	73.7
	Somewhat valid	14	10.9	14.1	87.9
	Mostly valid	11	8.5	11.1	99.0
	Completely valid	1	.8	1.0	100.0
	Total	99	76.7	100.0	
Missing	System	30	23.3		
Total		129	100.0		

D.2.5 On average, whether consciously or unconsciously, men are favoured in hiring and promotion

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all valid	16	12.4	16.0	16.0
	Somewhat valid	26	20.2	26.0	42.0
	Mostly valid	25	19.4	25.0	67.0
	Completely valid	33	25.6	33.0	100.0
	Total	100	77.5	100.0	
Missing	System	29	22.5		
Total		129	100.0		

D.2.6 There is a greater proportion of men than women with the very highest levels of mathematic ability

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Not at all valid	62	48.1	62.6	62.6
	Somewhat valid	20	15.5	20.2	82.8
	Mostly valid	10	7.8	10.1	92.9
	Completely valid	7	5.4	7.1	100.0
	Total	99	76.7	100.0	
Missing	System	30	23.3		
Total		129	100.0		

D.3 A little bit about you

5.1.1 What is your gender?

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Female**	63	48.8	64.3	64.3
	Male	33	25.6	33.7	98.0
	Other or prefer not to answer	2	1.6	2.0	100.0
	Total	98	76.0	100.0	
Missing	**System**	31	24.0		
Total		129	100.0		

5.1.2 What is your age?

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Younger than 25**	1	.8	1.0	1.0
	25-29	4	3.1	4.0	5.1
	30-39	17	13.2	17.2	22.2
	40-49	36	27.9	36.4	58.6
	50-59	30	23.3	30.3	88.9
	60 years or older	11	8.5	11.1	100.0
	Total	99	76.7	100.0	
Missing	**System**	30	23.3		
Total		129	100.0		

5.1.3 How many years teaching experience do you have?

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	**Less than 1 year**	2	1.6	2.0	2.0
	1 to 2 years	4	3.1	4.0	6.0
	3 to 5 years	8	6.2	8.0	14.0
	6 to 10 years	17	13.2	17.0	31.0
	11 to 15 years	16	12.4	16.0	47.0
	16 to 20 years	16	12.4	16.0	63.0
	More than 20 years	37	28.7	37.0	100.0
	Total	100	77.5	100.0	
Missing	**System**	29	22.5		
Total		129	100.0		

5.1.4 What is the highest teaching qualification you have completed?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Diploma or Associate Diploma	1	.8	1.0	1.0
	Bachelor Degree	30	23.3	30.0	31.0
	Graduate Diploma or Graduate Certificate	31	24.0	31.0	62.0
	Master's Degree	34	26.4	34.0	96.0
	Doctoral Degree	3	2.3	3.0	99.0
	Other	1	.8	1.0	100.0
	Total	100	77.5	100.0	
Missing	System	29	22.5		
Total		129	100.0		

5.1.5 What is the major field of study in your teaching qualification?

FREQUENCY			PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	Primary	29	22.5	29.3	29.3
	Middle-School	1	.8	1.0	30.3
	Secondary	62	48.1	62.6	92.9
	Combined F-12	5	3.9	5.1	98.0
	Other	2	1.6	2.0	100.0
	Total	99	76.7	100.0	
Missing	System	30	23.3		
Total		129	100.0		

5.2 As part of your teaching qualification, what was your area of specialisation? (Please select all that apply)

5.2.1 Case Summary

Cases

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
qual[a]	100	77.5%	29	22.5%	129	100.0%

a. Dichotomy group tabulated at value 1.

		Responses		
		N	Percent	Percent of Cases
As part of your teaching qualification, what was your area of specialisation?[a]	**Science**	31	20.3%	31.0%
	Mathematics	47	30.7%	47.0%
	Technology	33	21.6%	33.0%
	Generalist	15	9.8%	15.0%
	Other specialisation	27	17.6%	27.0%
Total		153	100.0%	153.0%

a. Dichotomy group tabulated at value 1.

Other specialisation description

	Frequency		Percent	Valid Percent	Cumulative Percent
Valid	**No response**	1	3.7	3.7	3.7
	Art/Arts/Arts Specialist/Visual Art	4	14.8	14.8	18.5
	Chemistry	1	3.7	3.7	22.2
	Drama & English	1	3.7	3.7	29.6
	English	2	7.4	7.4	33.3
	English and History	1	3.7	3.7	37.0
	English, Drama, SEN	1	3.7	3.7	48.1
	Gifted Education	3	11.1	11.1	51.9
	HASS	1	3.7	3.7	55.6
	Health Sciences	1	3.7	3.7	59.3
	History	1	3.7	3.7	63.0
	Languages	1	3.7	3.7	66.7
	Languages/English	1	3.7	3.7	70.4
	Literacy	1	3.7	3.7	74.1
	Music	1	3.7	3.7	77.8
	PDHPE	1	3.7	3.7	81.5
	Physical Education and Behavioural Studies	1	3.7	3.7	85.2
	Physics	1	3.7	3.7	88.9
	Prior Engineering qualification	1	3.7	3.7	92.6
	Teacher librarian	1	3.7	3.7	96.3
	Teaching English as a Second Language	1	3.7	3.7	100.0
	Total	27	100.0	100.0	

5.2.2 Did you have any of the following qualifications or experiences related to STEM prior to working in the education sector? (Please select all that apply)

Case Summary

Cases

	VALID		MISSING		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
prior[a]	97	75.2%	32	24.8%	129	100.0%

a. Dichotomy group tabulated at value 1.

		RESPONSES		PERCENT OF CASES
		N	PERCENT	
Did you have any of the following qualifications/experiences related to STEM prior to working in the education sector?a	Certificate or diploma related to STEM	8	5.8%	8.2%
	Undergraduate degree related to STEM	40	29.0%	41.2%
	Postgraduate qualification related to STEM	21	15.2%	21.6%
	STEM subject(s) covered within a non-STEM VET/university qualification	3	2.2%	3.1%
	Career/job in STEM related field	31	22.5%	32.0%
	Other prior STEM qualification or experience	6	4.3%	6.2%
	None of the above	29	21.0%	29.9%
Total		138	100.0%	142.3%

a. Dichotomy group tabulated at value 1.

Description of other prior STEM qualification or experience

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Valid	No response	1	16.7	16.7	16.7
	A Grade Electrical Mechanic	1	16.7	16.7	33.3
	Actuarial science	1	16.7	16.7	50.0
	Geology summer school	1	16.7	16.7	66.7
	I was the STEM/ICT teacher for a number of years	1	16.7	16.7	83.3
	Taught STEM topics with maths classes	1	16.7	16.7	100.0
	Total	6	100.0	100.0	

5.3 Student forum counts (14 students)

5.3.1 What is your gender?

		FREQUENCY
Valid	Female	12
	Male	1
	Other/prefer not to answer	1

	Total	14

5.3.2 What year level are you in this year?

		FREQUENCY
Valid	**Year 8**	1
	Year 9	13
	Total	14

5.3.3 Do you study digital technology at school?

		FREQUENCY
Valid	**Yes**	4
	No	5
	Don't know	5
	Total	14

5.3.4 How much do you agree or disagree with the following statements regarding studying STEM and Digital Technology subjects?

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
At school				
I like mathematics.	1	7	5	1
I like science.	0	5	8	1
I like Digital Technology.	0	7	6	0
I am curious about mathematics.	0	8	5	1
I am curious about science.	0	4	9	1
I am curious about Digital Technology.	0	8	5	1
I do well in mathematics.	1	5	6	2
I do well in science.	1	1	11	1
I do well in Digital Technology.	0	4	5	0
Future plans				
I wish to continue studying mathematics.	0	6	6	2
I wish to continue studying science.	0	3	8	3
I wish to continue studying Digital Technology.	2	5	5	0
I am interested in a career involving mathematics.	1	7	5	1
I am interested in a career involving science.	0	8	3	3
I am interested in a career involving Digital Technology.	3	5	5	1

Beliefs				
It is important to study mathematics because it will help me for my future.	0	1	6	7
It is important to study science because it will help me for my future.	0	0	7	7
It is important to study Digital Technology because it will help me for my future.	1	2	9	2
It is important to study mathematics because it is useful in my daily life.	0	2	8	4
It is important to study science because it is useful in my daily life.	0	1	9	3
It is important to study Digital Technology because it is useful in my daily life.	1	2	8	3

5.3.5 How much do you agree or disagree with the following statements related to Digital Technology and STEM participation?

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
Digital Technology				
The media portrays more men as Digital Technology role models	0	1	11	2
Digital Technology skills are important when considering employment options	0	2	10	1
Boys and girls have the same career opportunities in Digital Technology-related sectors	1	8	3	1
Boys find Digital Technology subjects easier than girls	2	5	6	0
The number of jobs requiring Digital Technology skills is growing	0	1	11	2
The portrayal of Digital Technology is very stereotypical (e.g. IT nerds)	0	0	11	3
Digital Technology-related careers are more suited to boys than girls	3	4	7	0
Digital Technology skills are important for the Australian economy	0	2	9	3
STEM				
The media portrays more men as STEM role models	0	3	7	4
STEM skills are important when considering employment options	0	2	9	3
Boys and girls have the same career opportunities in STEM-related sectors	0	6	7	0
Boys find STEM subjects easier than girls	4	4	5	0
The number of jobs requiring STEM skills is growing	0	0	10	3
The portrayal of STEM is very stereotypical (e.g. white lab coats)	0	1	10	3
STEM-related careers are more suited to boys than girls	2	8	4	0
STEM skills are important for the Australian economy	0	2	11	1

5.3.6 Please select the degree to which you believe the following factors are important in your attitude to Digital Technology subjects.

	NOT AT ALL IMPORTANT	LOW IMPORTANCE	MODERATELY IMPORTANT	VERY IMPORTANT	NOT APPLICABLE
Mother's influence	0	0	4	10	0
Father's influence	0	1	2	10	1

Male siblings' influence	2	3	4	3	2
Female siblings' influence	1	3	5	3	2
Peer influence	2	4	4	4	0
Teachers' influence	0	2	6	5	1
Career counsellors' influence	1	1	5	5	2
Role models' influence	0	0	6	6	2
The influence of society in general	0	3	4	6	1
Lower level of difficulty in studying the subjects	1	3	4	4	2
My own ability/skills	0	0	1	11	2
My interest/passion	0	0	1	11	2
Greater chance of pursuing these subjects in college/university	0	1	4	9	0
Greater chance of employability	0	1	4	7	2
Higher pay in the future	0	0	5	6	3

5.3.7 Who do you believe are more confident in the following subjects?

	BOYS ARE MORE CONFIDENT	BOYS AND GIRLS ARE EQUALLY CONFIDENT	GIRLS ARE MORE CONFIDENT
Arts	1	5	7
Biology	0	11	3
Chemistry	1	9	4
Engineering	11	3	0
English	0	6	8
Geology	4	10	0
Mathematics	1	10	3
Physics	2	10	2
Social Science	2	9	3
Space Science	6	8	0
Sport	8	6	0
Technology	10	4	0

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csiro.au

For further information

C**SIRO Education and Outreach**
Chris Banks
Manager, Impact and Evaluation
chris.banks@csiro.au
csiro.au/education