



STEM Professionals in Schools 2018-19 program impact evaluation

CSIRO

Document: Case study report – All-girls extra-curricular mathematics program

Version: Final

Date: June 2020

Acknowledgement

Tessellate Communication Pty Ltd would like to acknowledge and thank the Principal, teachers and students for their willingness and time taken to participate in the case study and share their views and experiences. We also appreciate the hospitality and support extended during our site visit.

Thank you also to the STEM professional for the time taken to participate in the case study and similarly, for sharing your views and experiences.

We acknowledge and thank NSW Education and CSIRO's Human Research Ethics Committee and for providing us with the necessary ethics approval to undertake this study as a component of the STEM Professionals in Schools program – 2018-19 impact evaluation.

The findings from the case study have informed and enhanced the final evaluation report.

Note

This is the final case study report for a partnership within the STEM Professionals in School Program. This case study was one of four purposefully chosen case studies within the 2018-19 impact evaluation which collectively provide insights into important aspects of the program. This case was selected as it includes:

- All-girls school
- Government secondary school
- Mathematics focus
- Female STEM professional and female teacher combination.

Disclaimer

The case study findings presented in this report have been determined by Tessellate Communication Pty Ltd, drawing on the data collected from case study participants based on their views and experiences in the selected program partnership. Participants have reviewed a draft version of this report and feedback provided has been incorporated in this final report.

© Tessellate Communication Pty Ltd (2020)

All rights reserved; these materials are copyright. No part may be reproduced or copied in any way or form, or by any means without prior permission. This report is provided to the recipient in confidence. It may not be used or applied by the recipient or disclosed to any other person without the prior written consent of Tessellate Communication Pty Ltd.

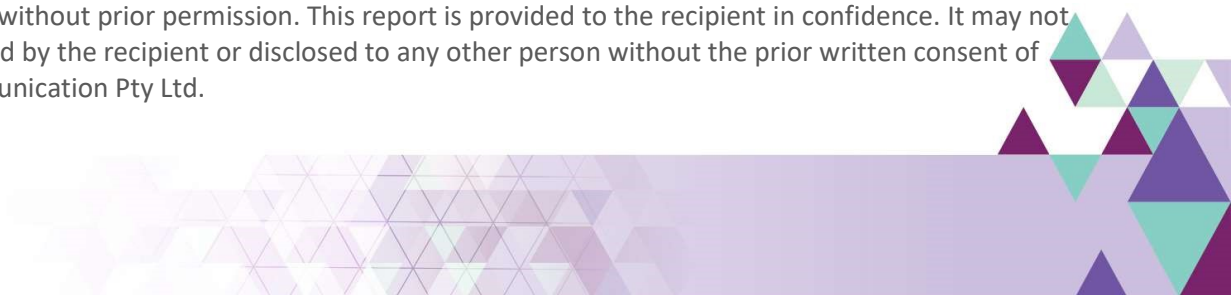


Table of Contents

1	All-girls extra-curricular mathematics partnership	3
1.1	The challenge.....	3
1.2	The process.....	4
1.3	The outcomes	4
1.4	The learnings	5
1.5	Student survey.....	7

Table of Figures

Figure 1: Student views on science.....	7
Figure 2: Student views on technology.....	8
Figure 3: Student views on engineering	8
Figure 4: Student views on mathematics.....	8
Figure 5: Student knowledge of STEM careers – subject by rating	9
Figure 6: Student knowledge of STEM careers – rating by subjects.....	9
Figure 7: Importance of STEM to future careers – subject by rating.....	9
Figure 8: Importance of STEM to future careers – rating by subject.....	9
Figure 9: Relevance of STEM to future society – subject by rating	10
Figure 10: Relevance of STEM to future society – rating by subject	10
Figure 11: Student interest in STEM subjects – subject by rating	10
Figure 12: Student interest in STEM subjects – rating by subject	10
Figure 13: Student satisfaction with STEM subject grades.....	11

1 All-girls extra-curricular mathematics partnership

This case study explores the impact of the CSIRO STEM Professionals in Schools program in an all-girls government secondary school in New South Wales which has approximately 550 students. It includes the experiences and thoughts of two teachers, 16 students, the STEM professional involved in the partnership, and the Principal of the school. The partnership includes the conduct of an extra-curricular STEM program run by the mathematics (maths) department within the school.

The case study occurred in November 2019. This included an initial site visit during which interviews with the teacher and Principal, and an online survey with the 16 students participating in the program were conducted. A subsequent interview with the STEM professional was undertaken via telephone. Data analysis and case findings were reviewed by CSIRO program representatives, the teacher and STEM professional partners and the school Principal prior to the final report.

Overall, the program partnership was viewed as positive and worthwhile delivering workshops that are practical and fun that benefit the students by increasing their interest in STEM and the exploration of STEM careers. It was noted however that the success of the partnership is very reliant on the unique relationship between those involved, with both the teacher and STEM professional being old girls of the school.

Further details are outlined in the following sections below highlighting the:

- challenge
- process
- outcomes
- learnings.

1.1 The challenge

Six years ago, the school had limited programs related to STEM. This partnership was initiated to encourage the girls to become more interested in STEM, specifically maths, and giving them the confidence that they too could have careers in engineering or other STEM related professions.

The partnership highlights the role of women in STEM, providing the students with positive role models. The partnership activities focus on Years 7 to 10 to provide an early intervention to try to get them to see what they can do with maths.

Giving them that little seed that might grow in 10 years' time, 20 years' time ... to be positive role models and show that all the stuff that we do (robotics, neuroscience) it's not a male thing, anyone can do it (2019, STEM Professional, NSW).

The Principal supports the pursuit of STEM and STEM related careers for women and acknowledges the importance of the program in the school to increase girls' interest and overcome their fear of STEM related subjects.

I'd like to see more girls picking science-based (subjects). When you look at statistics, girls in engineering, it's much more male dominant than female. Women are just as capable as men. Our mission is to get girls to overcome fear and give science a try (2019, Principal, NSW).

In this program, both the STEM professional and one of the teachers are former students of the school and have similar ideas and goals about education, stemming from their own experience. The two teachers and the STEM professional have shown a significant level of commitment having remained in the partnership for five years.

The partners acknowledged that finding the time required to prepare and participate in the partnership is a significant challenge. A further issue is the long-term sustainability of the partnership. It would be difficult to replicate the unique personal friendships that have evolved from prior school relationships and are a contributing factor to the partnership's success.

1.2 The process

The school partnership focuses on breaking down the barriers for females, to increase the attractiveness of STEM professional careers for the female students.

The partnership consists of a coordinating teacher, a maths teacher, and a STEM professional. The STEM Professional has a PhD in Electrical Engineering and is an Associate Professor at a Sydney-based university. The partnership developed out of the long-term friendship of the teachers and the STEM professional. It is one of the smaller number of partnerships in the STEM Professionals in Schools program that focus on maths.

Through the partnership, the school runs an annual, day long, workshop that involves a different focus each year. Subjects previously covered include neuroscience, programming, electronics, and robotics. The aim of the workshop is to give the students a taste of STEM. The changing topic from year to year allows students to attend the workshop in multiple years and be exposed to different aspects of STEM. The program is open to students from year 7 to year 10. The topic for the workshop is chosen by considering feedback from the previous years' workshop and looking at what is feasible at the time.

Students involved in the program are chosen on merit, with the coordinating teacher, the maths teacher and another senior maths staff member having input. Informal discussions are also undertaken with the wider staff community to ensure students who are chosen will get the most out of the day and transfer skills back to the classroom when they return. This, along with the grades that the girls are achieving, are considered in determining which students are selected each year.

We know the students [sic] quite well and we get three different perspectives of it ... because we discuss it in the staff room, the others in the room have an input as well. We look at the personality of the girls as well as we need students who will be vocal to aid in flow of the day. (2019, Coordinating Teacher, NSW)

While the annual workshop is a standalone activity, there is a considerable lead up to the day. Over a term the students get in groups and meet once a week to develop skills that they can put into practice on the day. Following the workshop, the students bring their learning back into the classroom which enables them to transfer the skills to other areas.

In 2018, the partnership introduced a new program called Music in Maths. This has led to an application to introduce a longer-term project aimed at inspiring people who may think mathematics is a little bit theoretical to be encouraged through the use music – for example, teaching fractions with music.

For a number of years, a group of us had been meeting with a pretty well-known music theorist who has done a lot of work on the mathematics in music ... because I have had a lot of interaction with [school] we thought it would be interesting to see if it worked the other way. Could we teach maths with music? [School] have a pretty amazing musical program so it seemed to be a good school to do it because they were already doing well in music. (2019, STEM Professional, NSW)

The program is well supported within the school, including financially. The certificates and prizes students receive are funded by the school and more broadly the partnership is supported by the Principal, deputies and the mathematics department. The partnership is not promoted outside the school.

1.3 The outcomes

The teachers rate the program as very successful (10/10). A key outcome the partnership was aiming to achieve was to develop confidence and skills through workshops that were practical, fun and relevant to the students' lives, and for the students to be inspired and motivated to expand their

problem-solving skills from the workshop through to other classes. The program aimed to get girls interested in STEM and give them the confidence that they can pursue STEM related careers, it aims to take away the fear factor and open their minds to what is available to them.

A unique outcome of the partnership is that it demonstrates the strong link the school and staff have with ex-students. It is inspirational for the current students to see that the STEM professional is someone who has come from the school and to see what she has achieved in her chosen field. It gives the students a strong female role model. Given the longevity of the partnership a lot of the students know the STEM professional and have heard her speak thus opening their minds to the occupations available to women in STEM. The partnership has also contributed to students exploring different STEM career options.

I would like to see more girls in careers that incorporate STEAM and by delivering these programs, I know that I've contributed to students exploring various career options. (2019, Teacher, NSW)

The feedback from students to the workshop partners over the five years has generally been positive and over time the workshop has piqued the interest of other students. The robots were extremely popular.

When we bought robots for the workshop, it was the first for our school, and the excitement our students expressed was genuine. It allowed our students to "play" with technology that they were never exposed to or believed they could. (2019, Teacher, NSW)

The teacher partner reported an enhanced appreciation and understanding for teaching real-life practical applications within the classroom had been achieved through the partnership. Another benefit the teacher identified was an increase in confidence which allowed her to positively contribute to discussions about the development/implementation of the STEAM program at the school.

The Principal had recently moved to the school and was impressed with the future-focused learning that has developed in the school. As well as this partnership, the school has programs in STEAM (Full STEAM Ahead), innovation and leadership in inquiry and problem-based learning. The school has established links with the Australian Business Community Network to expand its reach and present on its achievements.

Gradually more teachers have come on board as they have realised that the STEM workshop is a regular annual event and the school is beginning to understand that there is a need to introduce this learning to the whole school and not just a select few.

The Principal's intention is to track the broader benefits of programs such as this partnership. The strategic direction of the school is to move away from teaching students to meet targets such as NAPLAN, to developing creative thinking skills and incorporating various programs into the curriculum across the years that build a consistent STEM learning thread from year 7 to 10.

I want to make it a whole school approach where STEM is a big part of our strategic direction ... to look at ways we connect with other schools ... we're moving STEM to become a whole stage, making learning meaningful. (2019, Principal, NSW)

1.4 The learnings

The concept of the partnership is viewed positively by the STEM professional, who sees considerable merit in being able to connect and communicate with other schools.

I think there are a lot of schools who are not signed up to the program who would benefit from it. Something to be thought about would be how to communicate with other schools who don't have knowledge of it, or don't have time for someone to help them out ... (2019, STEM Professional, NSW)

However, the STEM professional noted the difficulty in connecting with other schools where the personal relationship does not already exist. More support is needed for these partnerships to succeed especially as the time required to form the partnership is a factor that needs to be taken into consideration.

... I tried and failed on more than one occasion to get the partnership started with other schools. I don't have time to chase things up ... how can we do it easily to get ourselves connected with schools without too much extra work on the teachers ... to add value to what they have to teach anyway ... we need help with keeping those relationships alive, keeping people connected. (2019, STEM Professional, NSW)

The STEM professional noted that it may work better to have the relationship with the school as opposed to the teacher and move away from having dependency on a key person and the risks associated with relationships being on a person-to-person basis.

... there is not really anything pushing us to communicate with each other except someone being enthusiastic on one end of the partnership or if you're really lucky both ends. I've had situations where it works with other schools, we are all excited in the first place but when we all get busy it gets harder ... this partnership works because I'm always in touch with [teacher]. It could work better if it wasn't just with one person ... better if it was with the school. (2019, STEM Professional, NSW)

The CSIRO brand is very strong and is perceived as providing legitimacy to the partnership. At the start of the partnership, the CSIRO connection was also seen to give the program a title and make it official. However, aside from the help with the working with children check for the STEM professional, no further support has been accessed from CSIRO because of the pre-existing relationship between the teacher and the STEM professional.

It gave it a title and made it seem official. We wanted to work with [STEM Professional], so this is the way we're going to do it. It encapsulates everything we wanted to do. Did we take it any further? No, we didn't. Maybe because we felt so comfortable in what they were doing we didn't want to take it any further. (2019, Coordinating Teacher, NSW)

The relationship with CSIRO also provides an opportunity to further expand STEM in schools and move beyond teaching only the syllabus, it takes the teaching beyond the classroom and brings real world learning to the students. The partnership was seen to benefit the students and allow the teacher to bring in resources that they otherwise would not have access to.

... I saw it as another workshop where a group of students is going to benefit and develop their skills ... when we do the STEM subject, like I've now got in Year 8, I'd like to see more of that connection with somebody coming in and making it more concrete, it's not just that we are doing now and lets create this but, what you are doing led to this invention ... and then having somebody coming in and saying "this is what I work as" or take a group of girls out on a bus and show them ... (2019, Principal, NSW)

The program is however seen to be at risk of being in competition with universities who are seeking to attract the best and brightest to their own courses.

One of the biggest problems is the universities themselves running programs. It becomes less of a need to have someone come in because they are getting lots of exposure and a lot of schools themselves are starting their own STEM programs. I don't know if the program can continue in the midst of everything that is around now. (2019, STEM Professional, NSW)

1.5 Student survey

About the students

Seventeen students participated in the case study survey with complete surveys received from 16 students. All students were in Year 10 (5 students), Year 9 (6 students), or Year 8 (5 students). English was the main language spoken at home for six of the students (38%). For most students (56%) English was not the main language spoken at home, with other languages including Vietnamese, Marathi, Arabic, Urdu, and Punjabi. One student preferred not to respond.

Most students (88%) indicated they were either 'very likely' (7 students) or 'likely' (7 students) to select STEM subjects in higher years. The remaining two students were undecided on their future subject selection at the time of the survey. Maths was most likely to be studied, selected by 13 students. This was closely followed by science (11 students) and then engineering (8 students) and technology (7 students).

The industry/s that students indicated that they may work in were 'health care and social assistance', selected by nine students, and 'education and training'; 'information, media and telecommunications'; and 'professional, scientific and technical services', each selected by six students. Other industries of interest to students for future careers were:

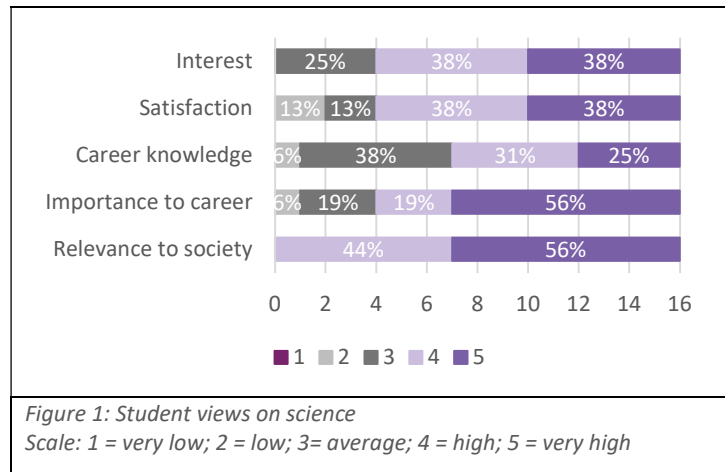
- arts and recreation services (4)
- administrative support services (2), financial and insurance services (2)
- accommodation and food services (1), rental hiring and real estate services (1)
- other services (2) – aviation.¹

A summary of student views on STEM subjects

The following section provides a summary of student views on STEM subjects.

Students views on science

Figure 1 shows that 76 percent of students rate their interest and satisfaction and the importance of science to their career as 'high' or 'very high'. All students felt the relevance of science to society in the future is 'high' (44%) or 'very high' (56%). Only 56 percent of students had more than an average level of knowledge of science careers.



¹ Two students selected 'other' and one of these students noted this included teaching and helping children. Figures for 'education and training' and 'health care and social assistance' have been adjusted to reflect these choices.

Students views on technology

Figure 2 shows that 75 percent of students rate their interest in technology as ‘high’ or ‘very high’. Less than 70 percent of students rate their satisfaction (69%) and career knowledge (63%) highly (4 or 5 rating).

All students felt the relevance of technology to future society was ‘high’ (19%) or ‘very high’ (81%), making it the subject most relevant to society.

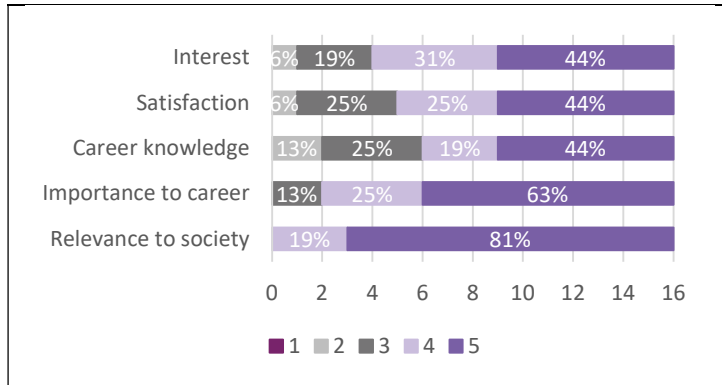


Figure 2: Student views on technology
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

Students views on engineering

Figure 3 shows engineering rated lower across most categories, then any other STEM subject. It was the only subject rated a ‘very low’ (1) score for any category, being importance to career. It was also the only subject rated ‘average’ or less for its relevance to society, with 21 percent of students rating it a 3 or lower. Students had the lowest knowledge of engineering careers, with 50 percent rating their knowledge average or lower.

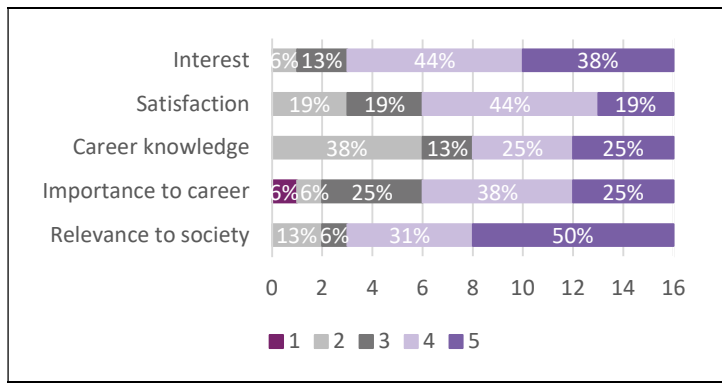


Figure 3: Student views on engineering
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

Students views on mathematics

Figure 4 shows that 100 percent of students rated maths highly (4 or 5 rating) for both its importance to their future career and its relevance to society. More than 80 percent of students indicated maths had a very high importance to their future career. Of all the STEM subjects, maths received the least amount of ‘average’ and ‘low’ ratings. These results may be influenced by the program being run by mathematics teachers.

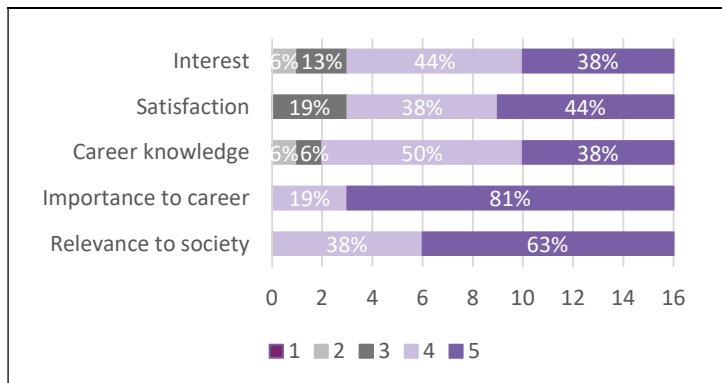


Figure 4: Student views on mathematics
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

What level of knowledge did the students have about STEM related careers?

Figure 5 and Figure 6 show that maths is the subject that students feel they have the most knowledge of, with 14 students rating either a 4 (high) or a 5 (very high). This may be influenced by the program being run by mathematics teachers.

Students also indicated higher levels of knowledge of technology, rating the most (7) ‘very high’ ratings.

Engineering was the subject that students felt they had the least knowledge about, with six students rating their knowledge of engineering careers at a low (2) level.

More students (6) rated engineering a two, than the other three STEM subjects combined (4 students).

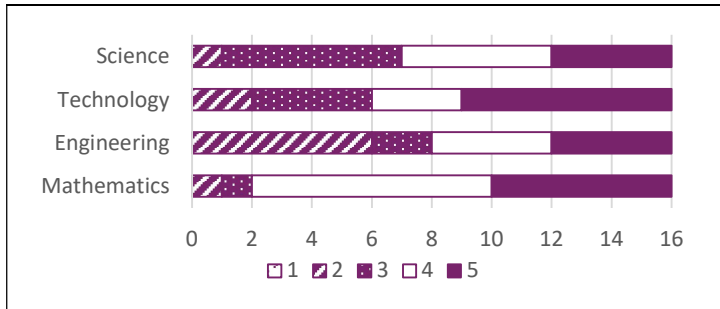


Figure 5: Student knowledge of STEM careers – subject by rating
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

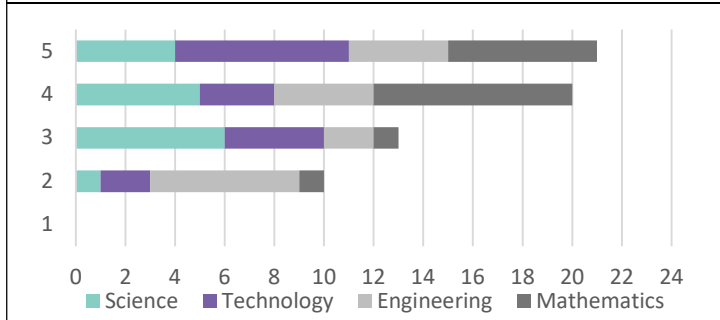


Figure 6: Student knowledge of STEM careers – rating by subjects
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

How important did students think STEM was to their potential future careers?

Figure 7 shows that maths was the only subject identified by all students as being of ‘high’ or ‘very high’ importance to their future careers.

Technology was the next most important subject to future careers identified, rating average or higher by all students.

Figure 8 shows that students thought most STEM subjects were of ‘very high’ importance to their future careers. The least number of students (4) saw engineering as being of very high importance, compared with 13 students for maths.

Science and engineering were the only two subjects to rate a lower than an average importance score for future careers.

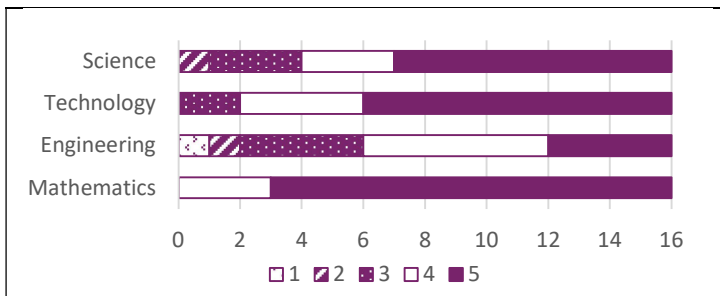


Figure 7: Importance of STEM to future careers – subject by rating
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

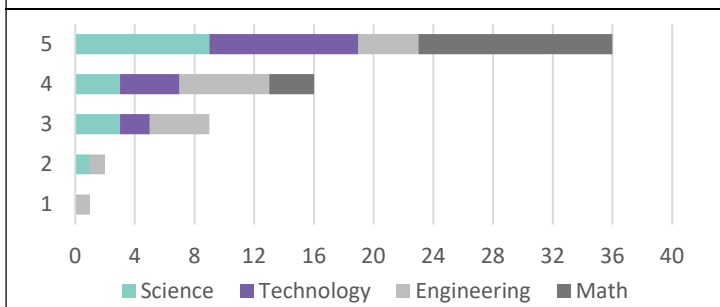


Figure 8: Importance of STEM to future careers – rating by subject
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

How relevant did students think STEM is to future society?

Figure 9 and Figure 10 show that the three STEM subjects of science, technology and maths were seen by students as being very relevant to future society, rated a '4' or '5' by all students.

Students thought technology was the most relevant subject to future society being of 'very high' (13 students) or 'high' (3 students) relevance.

Mathematics and science were also thought to be relevant, with 10 and nine students rating them 'very high' or 'high', respectively.

Engineering was the only subject students rated as 'average' (1 student) or 'low' (2 students) relevance.

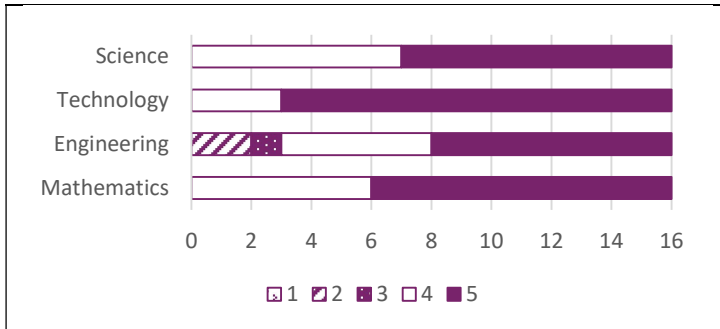


Figure 9: Relevance of STEM to future society – subject by rating
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

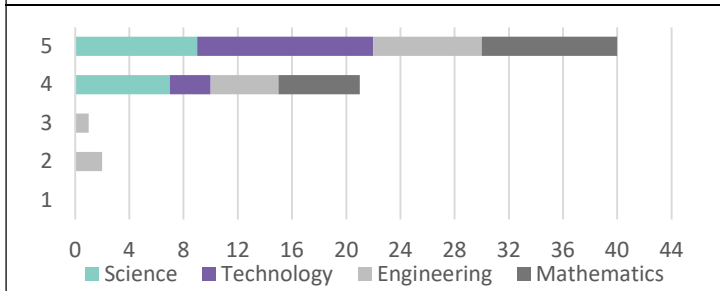


Figure 10: Relevance of STEM to future society – rating by subject
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

How interested in STEM subjects were the students?

Figure 11 and Figure 12 show that science was the STEM subject that students were most interested in, with 75 percent of students rating it 'high' or 'very high'. All students rated their interest in science average or higher.

Student interest levels in technology and maths were similar, with only one student in each subject rating their interest level less than average.

Technology had slightly more students rating a 'very high' interest (7 students) compared to six students for maths.

Engineering had slightly lower levels of interest from students with two students rating it of below average interest.

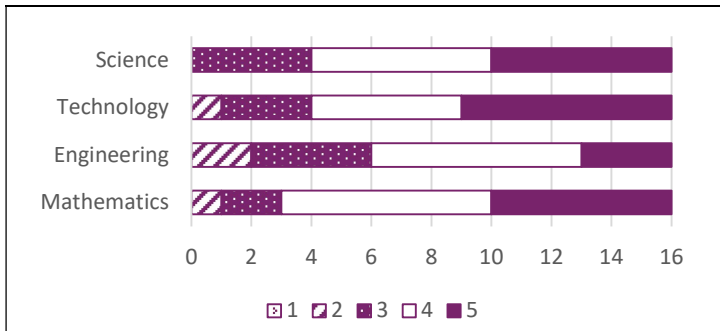


Figure 11: Student interest in STEM subjects – subject by rating
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

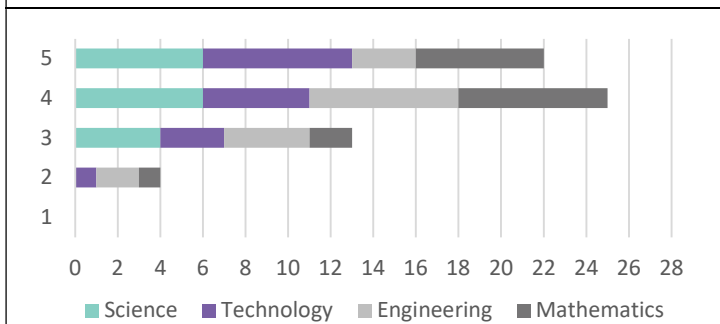


Figure 12: Student interest in STEM subjects – rating by subject
Scale: 1 = very low; 2 = low; 3= average; 4 = high; 5 = very high

So, what would make STEM more interesting for students?

Students said STEM would be more interesting if lessons and activities were more practical and hands-on, if they were able to spend more time on the subjects, if schools provided greater access to STEM subjects, and if the subjects were more clearly linked to future career paths. Comments from students included:

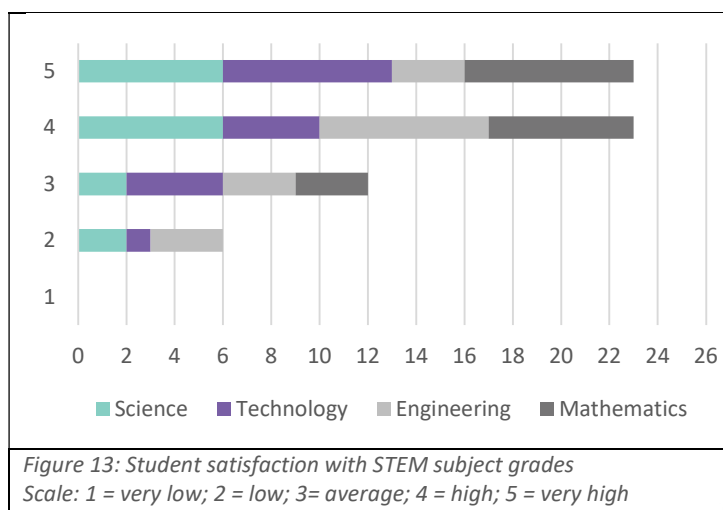
- Making STEM more hands-on, practical and applied lessons and activities
 - More excursions increase my interest in STEM subjects. (Student ID 2231498)*
 - If the activities were kind of related to things like music. (Student ID 2231559)*
 - Maybe doing more practical tasks to show students how to understand it better. (Student ID 2231578)*
 - More interactive activities that teach us directly about the subject, giving us more knowledge. (Student ID 2231584)*
- Being able to spend more time on STEM subjects
 - Investing more time in these subjects. (Student ID 2231501)*
 - Have more free classes to upgrade my skills in STEM subjects. (Student ID 2231517)*
 - Being involved in more of the programs. (Student ID 2231554)*
- Providing greater access to STEM subjects at school
 - More emphasis on stem and STEAM at school. (Student ID 2231587)*
 - Having more stem subjects to pick at school. (Student ID 2231599)*
 - Having more STEM programs in our school and outside of school. (Student ID 2231562)*
- Making greater links to careers and how STEM subjects link to the real world
 - If a focus more on what path I will choose because it might help me because I have a lot of curiosity but still confused and not able to choose. (Student ID 2231615)*
 - It would increase my interest in STEM subjects if the career paths were more stable and certified for a high yearly income and the amount of jobs available. (Student ID 2231602)*

How satisfied were the students with their STEM subject grades?

Students were most satisfied with their grades in maths, science, and technology, although maths was the only subject to rate ‘average’ or higher.

More than 80 percent of students rated their satisfaction with maths ‘high’ or ‘very high’.

For science this was the case for 75 percent of students.



What did students think would improve their STEM grades?

Students indicated that improvements in their STEM grades would require changes in the teaching methods within school, and greater effort and practice on their part. They also reinforced the link between STEM interest and learning. Student comments included:

- Teaching methods
 - Excursions :))) (Student ID 2231498)*
 - More practical activities but also an in-depth theory lesson for STEM subjects would be interesting. (Student ID 2231538)*
 - More practice in School regarding STEM and STEAM in school. (Student ID 2231587)*
 - If I do more practical exercises and focus more on importance of STEM subject in society. (Student ID 2231615)*
 - A better understanding and more time to better know the subject, as well as more help. (Student ID 2231584)*
- Personal effort / involvement
 - More time in practicing. (Student ID 2231501)*
 - More experience. (Student ID 2231537)*
 - I think a more detailed and certain information on future career paths would increase my result in the future as I know exactly what aspect to improve in. (Student ID 2231602)*
- Linking interest to results
 - If I'm really interested, I would be more into it. (Student ID 2231530)*
 - Putting more interest into the work. (Student ID 2231554)*

What would make the students more likely to choose STEM subjects in the future?

Students highlighted that their likelihood of choosing a subject in the future is influenced by factors such as being interested in a subject, whether the subject is relevant to future careers, and the subject delivery and content. This was evident in student comments such as:

- Link between interest and STEM subject selection
 - Because they interest me. (Student ID 2231501)*
 - If I really enjoy subjects that include STEM. (Student ID 2231530)*
 - If I find them interesting. (Student ID 2231559)*
 - That I love something that deal with technology and engineering. (Student ID 2231562)*
- Link to future careers and real-world relevance
 - Have more opportunities to experience how we can work with it in the future. (Student ID 2231517)*
 - It would assist my career and interests in my future career path to study STEM subjects in the future. (Student ID 2231602)*
 - If my dream job includes these STEM skills, I will need to study them. (Student ID 2231554)*
- Method of delivery
 - If they were held outside of school grounds and involved more hands-on activities. (Student ID 2231537)*
 - If the different subjects are strongly interconnected. (Student ID 2231587)*
 - Apart from all the STEM programs, I'd rather be shown all the possibilities of me in the STEM environment rather than hearing "there are so many opportunities." (Student ID 2231538)*

What did students think would improve their STEM classes?

Reinforcing themes raised in other questions, students indicated that their STEM classes could be improved by increasing the regularity and time spent on STEM opportunities. However, students also indicated that their classes could be improved by making them available to a wider range of students, starting at younger ages. The benefit of having improved technology facilities was also identified. Student comments included:

- Increasing the regularity and time spent on STEM opportunities
 - That they should have more workshop for STEM. (Student ID 2231562)*
 - Maybe by doing more programs and giving others the same opportunity. (Student ID 2231578)*
 - Interactive lessons and to give time to students and help them more instead of working fast. (Student ID 2231584)*
 - If they happen more often. (Student ID 2231587)*
 - Having more options. (Student ID 2231599)*
- Providing STEM opportunities to more students at younger ages
 - Have STEM classes integrated into every year group, so every year group can experience the environment that STEM instils. (Student ID 2231538)*
 - Instead of engaging the higher students, include the lower classes. (Student ID 2231501)*
 - If they included more people. (Student ID 2231530)*
 - Including more activities that involve most students. (Student ID 2231554)*
 - If they were talked about more. (Student ID 2231559)*
 - I think a variety of STEM subjects such as IST and Programming should be taken in school from earlier years since 1st year of high school would improve the rates of students choosing STEM subjects in the future and to be more decisive in their career paths. (Student ID 2231602)*
- Better facilities
 - Better technology; better computers or laptops. (Student ID 2231538)*
 - More resources such as fast wi-fi or computers. Or opportunities from universities. (Student ID 2231517)*

What did students think would make their teachers more effective in teaching STEM?

Students indicated teaching effectiveness would be improved by having teachers that were more experienced and specialised in their teaching of STEM and were able to spend more time with students to improve their learning. Student comments included:

- Teachers being specialised in STEM teaching
 - More experience in their field. (Student ID 2231537)*
 - Better classes and more variety. (Student ID 2231547)*
 - Teachers who have had experience in different area of stem but also specialised in at least one part. (Student ID 2231587)*
 - Different teachers with specifics subjects should teach certain categories. since it would improve the focus in one class and category of a STEM subject. (Student ID 2231602)*

- Teachers understanding and responding to student ability better

Have motivated students and have competitions in STEM so teachers are more determined and are able to explore teaching methods and create bonds with students. (Student ID 2231538)

Focusing more on group teaching and group work. (Student ID 2231599)

Giving us more practical exercises. (Student ID 2231615)

Adding enthusiasm into the lesson. (Student ID 2231554)

So, how is the partnership helping students?

What benefits from the STEM partnership did the students see?

Some students (30%) felt they had received benefits from their teacher's participation in the program. The benefits identified by students included the students learning more about STEM and getting answers to their STEM questions, getting access to more advanced information in later classes, and potentially contributing to getting STEM subjects into the school. The remaining 70 percent were not sure if benefits came from their teacher's partnership participation.

What else did students let us know?

Nine students provided additional insights about STEM that they thought could inform the evaluation. These comments reinforced themes including the link to careers and the real-world, that STEM is fun and interesting, and that participation in the program helps to gain greater clarity in STEM. Student comments included:

- STEM and the real world

I believe STEM is very beneficial, considering the growing jobs and careers in technology and mathematics. (Student ID 2231501)

I think learning in more detail about certain careers would help improve our perspective and view on STEM related subjects and careers. (Student ID 2231602)

STEM really provided me with new information about its importance in daily life and it is challenging but the important thing is to have the needed determination. (Student ID 2231615)

- STEM is fun and interesting

STEM is really fun, and I thoroughly enjoy participating in the programs. (Student ID 2231517)

This program is fun and interesting. (Student ID 2231530)

The program helped us get to know more people by doing ice breakers, we learnt about each other and had fun. (Student ID 2231554)

It is very enjoyable, and I enjoy doing workshops like this. (Student ID 2231578)

- Exploring and understanding STEM

Students may be interested in STEM but are unsure as to how they could work and progress into the future with a STEM course. (Student ID 2231538)

STEM allows us to explore the different ways in which the different subjects come together to form a solution. (Student ID 2231587)

Students were also asked how the survey could be improved for future use. We appreciate the time taken by students to participate in the survey and thank the students for their participation and for providing additional feedback to improve the survey. This will be considered for future surveys.