



STEM Professionals in Schools 2018-19 program impact evaluation

CSIRO

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ACKNOWLEDGEMENT:

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

Findings from this case study will inform and enhance 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:

- Mentoring style partnership
- Government combined school
- Major city location.

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 any feedback provided has been incorporated in this final version of the report.

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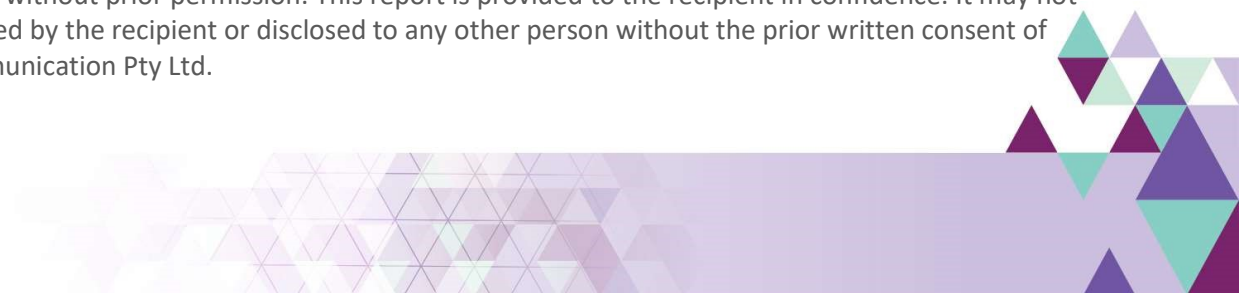


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1 Mentoring partnership case study

This case study explores the impact of the CSIRO STEM Professionals in Schools program through the experiences of a teacher and Executive Principal at a government school in the ACT. The school has approximately 2000 students enrolled in kindergarten, primary and secondary levels, to year 10. The case study occurred during June 2019 and includes the views and experiences of the Executive Principal and teacher.¹

Overall, the program was viewed as very positive and rated highly:

Although the first partnership didn't work out, our teachers still wanted to have this partnership because they really gained the value from it. It has been terrific. (2019, Executive Principal, ACT)

Recognised strengths included the partnership's flexibility with opportunities recognised in growing relationships with industry partners. However, there was a view that the program could be improved by creating more sustainable relationships at strategic and operational levels to reduce key person dependency and risks to partnership continuity.

These and other partnership aspects are discussed further in the following sections that detail the:

- challenge
- process
- outcomes
- learnings.

1.1 The challenge

At the school the STEM subjects are mandatory in year 7, allowing students to experience a broad spectrum until years 8 to 10, when STEM subjects transition into full semester electives. These electives cross a range of topics include robotics, engineering, rocketry, sustainability and project-based learning. An average of 100 students in the secondary school are participating in STEM at any point in time, with approximately 25 students per class. The diversity of content together across the years can pose a challenge for teachers:

... it's all different ... Year 8 have their own curriculum that they follow, then Year 9 and 10 have separate ones, they're completely different little subject areas. The courses are different for each year level. (2019, Teacher, ACT)

The teacher and school sought a partnership in response to recognition that while STEM exposure offers more career options for students in states where science and maths are only electives, some students only realise upon matriculation that the university study they would like to pursue requires maths/science high school subjects. To minimise the risk to students of having to do a bridging course, the school introduced STEM electives that evolved into a STEM curriculum.

Being relatively new to the school and his role, the teacher was looking for a mentor through the partnership who could assist with the generation and validation of ideas for the growing interest in, and progression of, the STEM program within the school.

... originally it was to come up with different project ideas that I wouldn't have thought of ... (2019, Teacher, ACT)

¹ The evaluation team were unable to interview the STEM professional for inclusion in this report.

1.2 The process

The partnership originated through the teacher's connection with a maths teacher from another school, who promoted the benefits of the CSIRO program and inspired him to get involved. This has resulted in three partnerships over five years. CSIRO handled the registration process well, followed-up to ensure the partnership was still running and held a couple of networking events which the teacher attended.

The STEM professional, who is allocated 40 hours by his employer to participate in community engagement, meets the teacher twice a year to collaborate and act as a sounding board regarding the school's STEM curriculum. In between, they stay in touch when necessary via email or phone.

The partnership mentoring interaction has ebbed and flowed according to the strategic requirements of the school. The STEM professionals' support was drawn upon for development of the STEM electives, while fewer exchanges were needed during the maturation stage of the project. However, the STEM professional now acts as a valuable resource to support the electives due to his broad expertise in the technology field and flexible availability.

... that's changed now and it would be good to form some industry links with the school ... to use this as a vehicle to build some bonds with our school community but also with industry ... and also provide some opportunities for some of the students who don't fit the mould of schooling ... (2019, Teacher, ACT)

The teacher is also planning for another partnership with an additional STEM professional. As a mechanical engineer, the teacher believes he will be a very good fit for the electives, whereas the current STEM professionals' skills are more applicable to general support. The teacher sees the benefit of STEM professionals' classroom involvement, provided they have the teaching skills, is the extremely high regard they are held in by students.

There are also plans to increase the STEM professional's contribution in the future due to the success of the STEM family night and as other similar vehicles are developed, to build bonds between the school community and industry within the state.

1.3 The outcomes

While being a relatively new initiative that primarily relies on a mentoring relationship between the teacher and the STEM professional, the partnership has achieved a range of notable outcomes.

Student, community and industry engagement

Recognising that engaging primary students in STEM increases the likelihood of senior level interest, the school strategically supported a STEM Family Night, leveraging the expertise available within the STEM partnership. At the same time, the school had also received funding through a government Digital Literacy grant which had stipulations, including community engagement. By combining the grant requirements with the partnership expertise, the school was able to hold a highly successful event that created a platform for additional initiatives. According to the teacher:

Parent response to that was absolutely fantastic, particularly the parents of the primary sector. (2019, Teacher, ACT)

The initiative involved families collaborating with primary and high school students in problem solving activities using technology, such as 3D printers which had been purchased using the grant.

... some STEM family nights at school where families can come in and engage with some of the different technologies ... to build things like building bridges ... kids will come in with their parents and they get to try these different technologies and solve some problems together ... (2019, Teacher, ACT)

The STEM professional contributed to producing the event and his workplace provided a financial contribution, covered catering costs and promoted the attendance of employees creating an industry presence.

The sold-out event (100 people), was complemented by the launch of after-school STEM classes for primary and high school levels. For example, coding for mechanical ‘toys’ called Beebots was introduced at kindergarten and made available to all students during breaks, along with a MakerSpace system of engineering pipes. These activities and their easy access:

... created exposure, built enthusiasm and learning through fun. (2019, Executive Principal, ACT)

Teacher knowledge sharing

The school’s leadership team’s recognition of the program value was viewed by the teacher as particularly beneficial to his operational role, which is being further supported by the allocation of a teacher dedicated to the primary STEM classes.

Although the partnership program isn’t currently communicated throughout the school, the teacher and Executive Principal acknowledged the importance of increasing exposure. As such, the school plans to incorporate STEM into its very popular teacher knowledge sharing process whereby teachers run a workshop showcasing their successes, including classroom trials, to staff at the end of every semester. The workshop is informative and builds collaboration, confidence, competence and capability:

It’s about teacher’s confidence, so the partnership idea is to build the confidence of teachers if they didn’t have it originally ... that is the worst thing for teachers, having to deal with things in their classroom which they are not 100% confident in delivering. I just think it would be a fantastic celebration if we could have everybody across our school confidently and competently and passionately delivering STEM activities in their classroom or with other teachers. When you’ve got confident teachers, you’ve got students being exposed to, or being taught, skills that they require for the future so you can see a big change in the student. (2019, Executive Principal, ACT).

The complementary nature of the program and the Digital Literacy grant, which also specified professional development, also resulted in allocation of time for non-STEM teachers to complete technology related online courses including coding and 3D design. The knowledge gained was then integrated into their subject areas, resulting in collaborations with the textile teacher now running a unit on the application of LEDs and conductive threads in clothing.

Additional mentoring of gifted students

The school plans to expand the partnership by having the STEM professional act as a student-mentor through term meetings with one or two gifted students who don’t fit within the standard educational system. According to the teacher:

... [STEM professional name redacted] might act as a mentor for one or two of these students ... meet him once every term to look at a project the student is working on. I’ve got to organise that with the student and the student’s family ... (2019, Teacher, ACT).

STEM strategic planning

The school leadership has supported the teachers and STEM professional in developing a STEM plan inclusive of a budget for activity resources, which was approved by the School Board. (Most recently the Arts have combined with the Technology Faculty resulting in an updated STEAM plan.)

1.4 The learnings

There were a range of learnings that have been gleaned from this successful long-term partnership. These are highlighted in the following sections:

- Knowledge sharing
- Partnership matching
- Partnership sustainability
- Program sustainability.

Knowledge sharing

Identifying opportunities to collaborate is hindered if neither partner has previous program experience, or the teacher is a recent graduate and therefore has minimal experience in a school environment. Developing relationship outcomes, especially in the initial stages:

... requires a lot of hard work and maturing into the role. (2019, Teacher, ACT)

At a primary level where subjects are very general, the STEM professionals' area of expertise is not as important as at high school where the subjects are very specific. The STEM professionals can lack teaching skills, often having not dealt with children in a learning environment since their own school years however, this limitation is often not considered by teachers who tend to hold the expectation that STEM professionals:

... possess superhuman intelligence and are able to do anything. (2019, Teacher, ACT)

Partnership matching

The teacher recognised the challenges in being matched to a suitable STEM professional, noting how this need can change between primary and secondary school. For example:

... it gets difficult because it's so specific ... up until primary school just having a technical person ... if you get a person who is into agriculture then you can do something with plants or with computers you can do some coding. When you get to secondary school it gets more complicated when you have teachers teaching specific subject areas ... if I was teaching coding or teaching digital technologies and I got matched with a mechanical engineer who hasn't done much programming it would be very difficult for him to contribute ... (2019, Teacher, ACT)

The first partnership ended as the STEM professional, a high-level business focused engineer who travelled interstate regularly to his home base impeding availability and he was not a good match:

... for where the students were at on their journey. (2019, Teacher, ACT)

Challenges also occurred in pairing compatibility and maintaining momentum due to the teacher's workload demands which impacted energy and availability. The pairing process required greater clarifications and alignment of partner expectations. Regardless of the quality of the pairing:

... the onus rests on the teacher to be extremely proactive in determining how to optimise and align the skillset of the professional with the school requirements. (2019, Teacher, ACT)

The second STEM professional was science based which was also not an ideal fit for the subjects offered at the time. The current STEM professional, who has been a partner since 2017, has a technical background which has resulted in much better compatibility at a strategy level, while also able to provide student mentorship. The flexibility of the current partnership works well with where the school is at. According to the teacher:

... when the partnership first started ... we were coming up with different projects that we could do and [STEM professional name redacted] helped with that and as the STEM electives have

matured there wasn't really that need for it but as we're moving into the different things with the community or some of this mentoring with the students that we want to get up and running ... we keep in touch ... (2019, Teacher, ACT)

Partnership sustainability

The availability of partners and although the school is very supportive, it can be challenging to keep the partnership running.

It's just time really. It's a challenge in schools. You're always time poor ... you get pulled in different directions ... It's very much an extra thing ... and extra things are like the cherry on top ... there's only so many hours in the day. (2019, Teacher, ACT)

The Executive Principal supported the premise that establishing an aligned partnership within the school is central to overcoming a trial and error approach:

What we have got to do is the next step, getting the primary teachers involved. Step one has all been organised by secondary and wouldn't it be wonderful if we have a group of primary teachers that can help grow that in the primary school Whoever our person is, or people are, we could have multiples as well, that this was a whole school focus and not just a silo in the secondary area. (2019, Executive Principal, ACT)

However, if the pairing is misaligned a lack of momentum ensues that is potentially not attended to until halfway through the term. At this point, the teacher is often too busy to address the issue with CSIRO until the following term, if at all. Nurturing the partnership through regular monitoring, reviewing resource requirements, addressing priorities and potential issues, will fundamentally raise the program's sustainability.

... that's what I see the role of CSIRO is, just to ensure that a partnership does continue provided the school is interested and the right personal and the right partnership's been made. I mean if that falls apart, you actually need them to say "hey can we give you someone else" ... that's the main role of CSIRO as I see it, is ensuring that you continue and it doesn't die ... (2019, Executive Principal, ACT)

Program sustainability

From a strategic perspective, the program was identified as relying on a key person dependency whereby teachers and STEM professionals form a bond, which is beneficial to the partnership commitment. However, if either participant leaves for any reason the accumulated benefits dissolve and the program loses momentum and potentially terminates which is not a good outcome for the school. According to the Executive Principal:

... actual teachers linked to the professionals form the bond if that person is right ... if either party takes leave you don't want that to fall apart so from a schools side if you've got multiple teachers involved you can cover that ... but if you only have one professional coming in then you really do need to have that partnership with the organisation so that it is sustainable. (2019, Executive Principal, ACT)

Based on prior experience with the program, the Executive Principal also acknowledged that a large school (2000 students) has a substantial number of teachers to facilitate collaboration, whereas smaller schools face much greater challenges in rolling out new initiatives:

When you are the only teacher and trying to roll something out on your own and not being exactly sure of what you are doing – to have a partnership is absolutely vital, and for the majority of schools that's what you need to make it happen. (2019, Executive Principal, ACT)

The Executive Principal recommended CSIRO consider expanding their approach by developing a strategy to support Principals initiating industry relationships and forming pipelines with partners.

While mentioning a program originating from the University of Tasmania called “Principals as STEM leaders” (akin to the current Principals as Literacy Leaders and Principals as Numeracy Leaders) which involved CSIRO, the Executive Principal emphasised the benefits of face to face workshops buoyed by passion and enthusiasm:

A couple of CSIRO representatives visited last year, and it was just lovely to see their passion and excitement. They were obviously school liaison people and experts at travelling around and helping schools that didn't have any expertise in the STEM area. (2019, Executive Principal, ACT)

Expanding the concept to showcasing workshops among schools would provide the highest level of in-depth engagement and motivation.