STEM Links

Insights: The role of industry partners in 2024

Generation STEM

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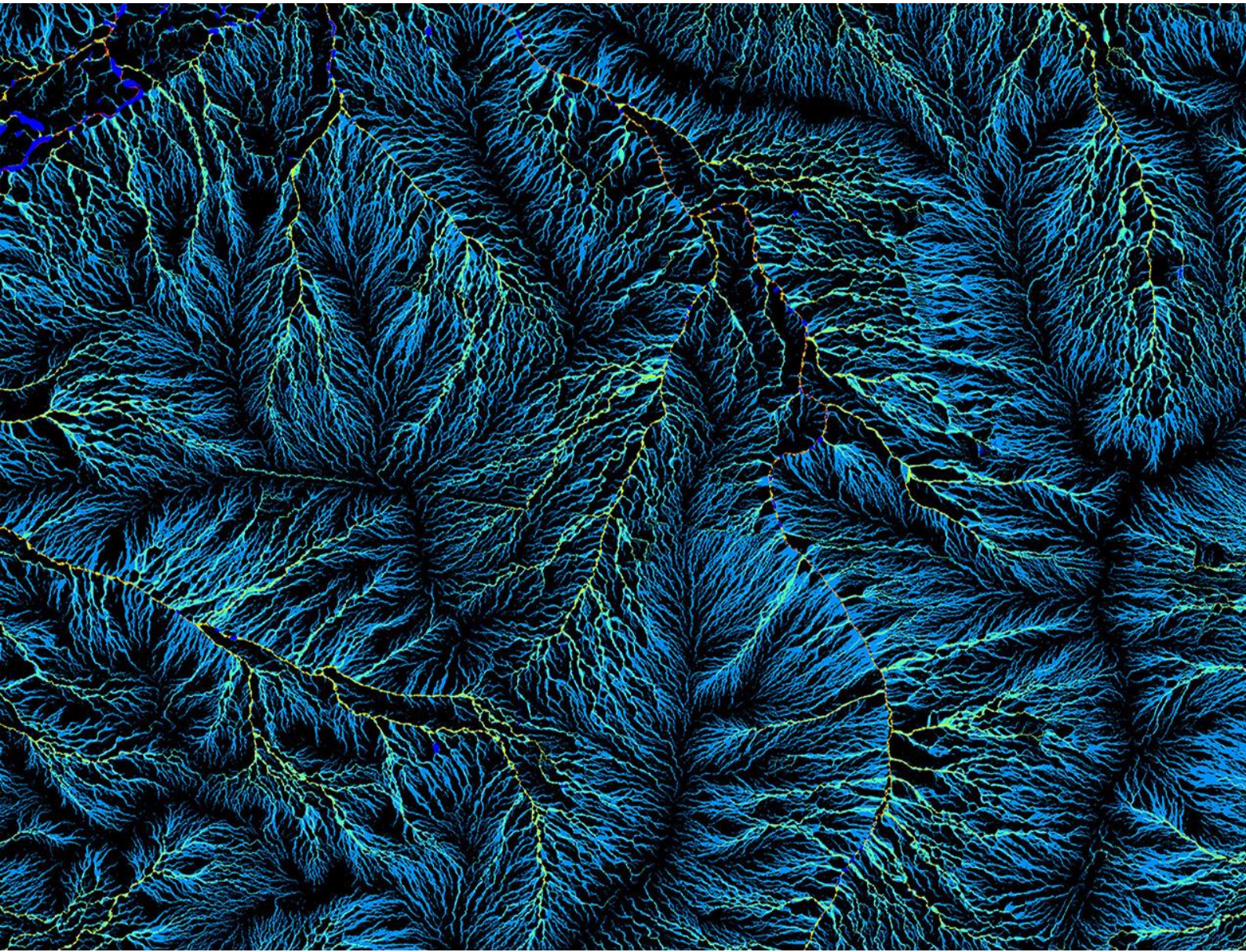

Executive Summary

Generation STEM Links is a paid internship program that pairs NSW students in their later years of study in STEM tertiary-level qualifications, with industry organisations. The internship placements provide opportunities for students and industry organisations to connect, learn, and innovate. The program is co-delivered by two CSIRO teams, combining an education focus with an industry and enterprise focus - the CSIRO Education and Outreach and SME Connect teams, respectively.

Tertiary graduates are facing new challenges as they transition to the contemporary workforce, which is increasingly casual and unstable, and can involve significant mismatches between skills and jobs, and therefore requires employee agility.

This report explores the role and experience of industry partners as they host student interns through the Generation STEM Links program, utilising three successful industry partnerships as case studies. While these experiences and outcomes cannot be generalised across the program without further evaluation, the three cases provide valuable insights about the critical role of industry in supporting the STEM education and career pathways of tertiary students as they face the challenges of a contemporary STEM workforce.

Findings in this report are based on operational data from 2024 and interview data gathered in the second half of 2024, with five students and three supervisors or executive staff from three STEM Links industry partners. A literature scan informed the analysis of program evidence.

The following common roles were identified across the three cases and discussed to provide further explanatory insights. The role of industry partners to

1. Provide a short-term employment experience for students through paid placements
2. Model the next way of learning – from the classroom to the workplace
3. Facilitate the development of professional networks that increase future career opportunities
4. Increase the diversity of the STEM workforce
5. Broaden students' STEM career awareness

Participants also described several program design components that contributed to their stated benefits, such as:

- Industry partners are investing in students through a minimum wage, elevating their value and contribution during the placement
- Industry partner needs and priorities shape the placement, providing more flexibility for industry to engage with students
- Students are guaranteed a minimum wage, easing financial pressures and increasing accessibility to a broader range of students underrepresented in STEM
- Students are assessed against a capability-based criteria, with academic transcripts only discussed after the shortlisting stage, enabling a more wholistic match to the project, as well as their fit within the workplace and its culture.
- A transparent, independent short-listing approach is applied providing confidence for participants and reducing unconscious bias through the selection process.
- Independent support and debriefing are accessed by placement participants to mitigate any placement issues.

More detailed findings about what works, in what circumstances, and for whom, will form part of the final evaluation report planned for 2026, including a full analysis of the extent to which the program has achieved its expected outcomes.

Introduction

The purpose of this report is to explore Generation STEM Links' model of work integrated learning (WIL) and the critical role played by STEM industry partners in strengthening the education and career pathway of tertiary STEM students in New South Wales (NSW). This case study evaluation report builds on the insights presented in the Generation STEM evaluation report 2019-2021[1] and the STEM Links Insights Report 2023[2].

Tertiary graduates are facing new challenges as they transition to the contemporary workforce, which is increasingly casual and unstable, and can involve significant mismatches between skills and jobs, and therefore requires employee agility. WIL is an accepted mechanism to improve the 'job-readiness' of graduates, yet a workable approach for industry, universities, and students has yet to be adopted consistently across jurisdictions in Australia. Generation STEM Links is one model that favours capability over merit-based student assessment and attempts to elevate the role of industry partners compared to other WIL initiatives.

By ensuring students are paid a minimum wage and that internships respond to business needs as opposed to being tied primarily to tertiary curriculum requirements, the program aims to position students as an integral part of a longer-term investment in their business. The intended corollary of this elevated student intern status is an enhanced industry investment in contributing to the STEM education and career pathway of students.

The intention is that industry provides capability-matched students through a more realistic and embedded workplace experience, accelerated workplace learning environment, the development of genuine professional networks that students can access throughout their careers and an increased likelihood of employment at the end of their placement.

This report explores the role and experience of industry partners as they host student interns through the Generation STEM Links program, utilising three successful industry partnerships as case studies. Common themes are identified across the three cases and discussed to provide further explanatory insights. While these experiences and outcomes cannot be generalised across the program without further evaluation, the three cases provide valuable insights about the critical role

[1] Banks C, O'Brien M, and Miller K (2023) Generation STEM evaluation report 2019–22: Generation STEM. Canberra, Australia: CSIRO

[2] Cherry, K. (2024) STEM Links Insights: 2023 Generation STEM. Canberra, Australia: CSIRO

of industry in supporting the STEM education and career pathways of tertiary students as they face the challenges of a contemporary STEM workforce.

Case Study methodology

The purpose of the case study is to explore the concept of work-integrated learning within the STEM Links program and assess the role of industry partners in supporting the education pathways of tertiary STEM students. The approach taken to gather and analyse data for this report was therefore multi-method, including exploratory, descriptive, and explanatory.

The following key evaluation questions were posed to guide the case study interviews and analysis.

1. What types of roles industry can play in supporting the STEM education pathways of tertiary students?
2. What are examples of effective industry partnerships in practice, and what are the barriers, enables, and contextual factors that make a difference?
3. What is the most effective role industry can play?

Interviews were undertaken with industry supervisors and students at three different workplaces to gather insights from each placement. Questions posed to participants explored the roles of industry in student education experience and pathways; current and future STEM workforce needs across STEM industries and region in NSW and student experiences and outcomes with the objective of gaining insights to inform an overall synthesis of the STEM Links work-integrated-learning model, the most effective roles industry partners play within this model and indicators of success.

Findings in this report are based on interview data gathered in the second half of 2024, with five students and three supervisors or executive staff from 3 STEM Links industry partners and operational data from 2024. A literature scan informed the analysis of program evidence.

More detailed findings about what works, in what circumstances, and for whom, will form part of the final evaluation report planned for 2026, including a full analysis of the extent to which the program has achieved its expected outcomes.

What is the Generation STEM Links program?

Generation STEM Links is a paid internship program that pairs NSW students in their later years of study in STEM tertiary-level qualifications, with industry organisations. The internship placements provide opportunities for students and industry organisations to connect, learn, and innovate. The

program is co-delivered by two CSIRO teams, combining an education focus with an industry and enterprise focus - the CSIRO Education and Outreach and SME Connect teams, respectively.

The internship structure is flexible and runs for a minimum of 200 hours (5-6 weeks full time to a maximum of 25 weeks part time). As part of the internship, students are employed by the business to participate in real-world projects and are paid a minimum of $25 per hour + superannuation. Industry partners receive a $2,500 grant for each student after completion of the internship as a contribution to cover the student's wage The program is implemented with a significant focus on the recruitment and matching of industry partners and student interns to achieve a successful placement. Student academic transcripts are not used in the shortlisting process, instead a capability-based assessment is applied. A capability-based approach considers the integration of knowledge, skills, and personal qualities such as confidence, adaptability, attitude, use of judgement and commitment (Stephensen, 1998 cited in Dean et al., 2024). Ongoing monitoring and support of each placement is provided.

Work integrated learning context

In Australia, WIL is described in the research and practice literature as constituting a diverse range of activities (Edwards, Perkins, Pearce & Hong, 2015). The vocational education and training (VET) sector include a well-known, renumerated apprenticeship and traineeship component, whereas the university sector incorporates a highly varied approach of mostly unpaid activities (Department of Education, 2024; Uni of SA, 2013). In the higher education sector, these range from work-based activities such as internships, practicums, placements; virtual or class-based project work or consultancies; and campus-based activities, such as client projects, industry panels, mentoring programs, and incubators (Jackson & Bridgstock, 2021; Jackson, 2024). These can be co-curricular, embedded as part of a core or elective subject, with assessments and course credit; or extra-curricular, organised externally, and undertaken by students with no formal involvement from their university (Jackson & Bridgstock, 2021).

Overall, a broad definition of WIL applicable to many Australian universities is: 'any arrangement where students undertake learning in a work context for credit towards their course requirements' (Department of Education, 2023, p. 98).

The Generation STEM Links 200-hour internship doesn't fit neatly into one work integrated or work-based learning typology described in the literature. Instead, Generation STEM Links could be classed as a hybrid model brokered by a third party and characterised by the following key elements: a medium-term, extra-curricular, work-based, and curriculum related paid placement. Generation STEM Links' purpose 'to provide high-quality internships to help tertiary students gain workplace skills and transition to STEM jobs after graduation' does however, align closely with the overall purpose of the WIL sector in Australia.

Despite the heterogeneous collection of descriptors, an Australian Council for Education Research Report (2015) argued that the purpose of WIL activities represents a shared vision, which is consistently described across the literature, as 'the intention to develop graduates' work readiness skills to industry standards and to enhance their employability' (Ferns & Moore, 2012; Jackson, 2013 cited in Edwards et al., 2015, p. 11). The potential benefits and outcomes of WIL are also consistently described as resulting in graduates who are appropriately skilled, work ready, and employable (Mahalinga-Iyer et al., 2004 cited in Edwards et al., 2015, p. 11).

While most research in this area refers to 'work-integrated-learning' as the central concept for analysis, the definitions used across referenced publications vary slightly, reflecting the diverse

range of activities available to students. For this report, research referring to ‘work integrated learning’ ‘work-based learning’ (Atkinson, 2016; Comyn & Brewer, 2018) and ‘employability and professional experiences (Lin-Stephens et al., 2024) has been reviewed and referenced, noting that the Generation STEM Links program does not fit neatly within just one of these categories. For ease of reading, the term WIL is used as an umbrella term for these activities, with critical differences or concepts highlighted where relevant.

Policy direction and implementation challenges

Data from 2014, focusing on STEM-related WIL in Australian universities highlighted that despite the vast differences in tertiary STEM studies across universities and the extent to which WIL was incorporated in the curriculum, there was widespread agreement that more WIL should be embedded into the curriculum and that ‘WIL activities are useful in developing learning outcomes and improving the work readiness of university students’ (Edwards et al., 2015). In 2014, a National WIL Strategy was commissioned and this sentiment continued in Australian Government policy, reflected in the 2020 Job-ready Graduate Package reforms to higher education (including the National Priorities and Industry Linkage Fund (NPILF)) and more recently in the Australian Government’s Universities Accord interim and final report in 2023).

Collectively, these policies prioritised increasing the number of internships, more innovative approaches to WIL, and increased cross-sector collaboration. While the NPILF advocated for increasing the number of STEM skilled graduates and their employment outcomes, the Universities Accord represented a shift towards more student focused policy, such as addressing the financial pressures experienced by tertiary students and an improved equity of participation in higher education. These policy objectives are seen as necessary to ‘ensure that students are graduating with the specific skills required to do the jobs that are required of them’ (Department of Education, 2023, p. 56).

For students, universities, and industry, the realities of accessing flexible and valued WIL activities can present challenges. While almost all Australian universities have some kind of WIL internship or placement program, these can be highly competitive, restrictive in their application, and even include costly oversees components (Edwards, Perkins, Pearce & Hong, 2015; Jackson et al., 2024). Placements for science students Science placements, can often be delivered in an ad hoc manner, driven by a single academic or a small team of academics, relying on their passion in WIL activities and without centralised corporate support or an overarching coordinated program. (Edwards,

Perkins, Pearce & Hong, 2015). Similarly, industry experiences a range of barriers to hosting WIL activities, including a lack of capacity for supervisory and mentoring arrangements and perceptions of high administrated burdens associated with the process and a commitment from corporate leadership to the initiative (Jackson, 2018).

Jackson (2024, p. 76) argues that a lack of funding in Australia has led to 'an imbalance between the supply and demand of WIL opportunities and the normalisation of unpaid work-based WIL.' This lack of funding also highlights a tension for higher education across a number of pressures such as, the cost of WIL, which is acknowledged to be more than traditional academic units of study; university capacity to ensure every faculty student is placed; and 'the debate about how far universities should be geared towards the needs of employers' (Edwards, Perkins, Pearce & Hong, 2015, p. 41). Building effective cross sector partnerships between universities and industry takes time and effort, including to identify a mutually beneficial approach to engaging within the WIL space (Atkinson, 2016).

Small to medium enterprises (SMEs) are not frequently mentioned in the WIL literature, however, Li and Hardy (2024) argue that their lack of scale and often stretched resources can inhibit SME capacity to access WIL opportunities or influence university-industry collaboration. Jackson (2024) argues that SMEs can be at a disadvantage in the WIL space where regulations and other restrictions may limit their participation. Australian and NSW Government policy positions aim to mitigate this and support SMEs to participate more equitably in the business community (Productivity Commission, 2023). Data from the Australian Small Business and Family Enterprise Ombudsman (June, 2023) emphasises the value of small businesses to the Australian economy, reporting that almost 98 per cent of businesses in Australia are small businesses, accounting for one-third of Australia's GDP, which was equivalent to $506 billion in 2021-2022.

Diversity in STEM courses and the workforce

Data from 2021 demonstrates that diversity within STEM 'far from reflects the diversity of Australia's population with only 36 per cent of STEM university students identified as female; around 5 per cent of people studying university STEM subjects living with a disability and less than 1 per cent of First Nations people held a university STEM qualification' (Department of Industry, Science and Resources, 2024, p. 21).

Previous to this, in 2020, The Office of the Chief Scientist report on Australia's STEM workforce (2020, p. 25) stated that 'in 2016, 57 per cent of people with a university STEM qualification were born outside of Australia, (a greater proportion that in the general population)' yet the unemployment rate was higher for this cohort, compared to the unemployment rate of STEM qualified people born in Australia. Similarly, in 2016, females experienced higher unemployment rates than males across all STEM fields and levels of qualification, and Aboriginal and/or Torres Strait Islander people with STEM qualifications experienced higher rates of unemployment than non-Indigenous people at the VET and university levels of qualification (Office of the Chief Scientist, 2020, p. 36).

Jackson (2024) argues that in some circumstances, WIL can exacerbate these inequalities, potentially failing to support students who most need to develop cultural and social capital to enhance their career achievements. This is intensified for unpaid WIL, which becomes part of the informal economy, heightening the risk of social exclusion for those who cannot afford lengthy periods of unpaid work or who do not have the contacts to obtain the 'best' internship (Stuart & Owens, 2013).

The job seeking experience for people with a culturally and linguistically diverse (CALD) background and other underrepresented groups in STEM can be diminished by discrimination and bias, creating additional barriers for this underemployed group and likely limiting opportunities in STEM careers. Recently, the Working future: The Australian Government's White Paper on Jobs and Opportunities highlighted that discrimination and unconscious bias can adversely affect migrant employment outcomes (Commonwealth of Australia, 2023). It revealed that many employers, particularly in STEM fields, were less likely to offer interviews to women and people from certain ethnic backgrounds.

The National Science and Technology Australia STEM Career Pathways Report (2023, p. 52) reported on an extensive survey of people with STEM qualifications, finding that 'twenty-nine per cent of survey respondents who spoke a language other than English reported experiencing racial or cultural discrimination'.

When interviewed about their job seeking experiences, participants revealed perceptions that 'both universities and private sector employers can be conservative institutions which can (sometimes unconsciously) exclude people who don't fit into a traditional model of what a STEM researcher or professional looks like' (Science and Technology Australia, 2023, p. 40). The report identified STEM

workers who spoke a first language other than English, and people who identified as having a disability or being neurodiverse, as experiencing more challenges to start new jobs or progress in their careers.

This perspective is reinforced in other recent publications, where research participants 'often described incidents of very apparent racial and ethnic bias which prevented them from progressing based solely on their name or the image attached to their application. Others stated examples of people making assumptions about their English proficiency that were belittling.' (Anti-Discrimination New South Wales, 2024, p. 32; Engineers Australia, 2021)

Generation STEM Links case studies

The following three case studies were identified with program staff to highlight and explore themes that emerged from the literature scan. The scan highlighted themes related to Australia's STEM workforce and potential roles for industry partners to support student pathways into STEM jobs. Key themes included:

- Developing the workforce in emerging and high demand areas
- Increasing employment opportunities for underrepresented students
- Responding to skill shortages by developing skills and knowledge in students, that is specific to workplaces and not covered in tertiary studies.

For a case study to be included in the report, both the industry supervisor and student at each business needed to participate in an interview. Each case study describes industry and student outcomes, the role played by the industry partner in supporting student pathways, and participant experiences with STEM Links and similar WIL programs.

Calyx.eco

Calyx.eco, a proudly female founded SME based in Sydney, has been in operation for about two years, providing innovative and comprehensive sustainability advice and solutions to the food and beverage industry in NSW.

At the time of the case study, Calyx.eco were 120 hours through their first intern, a student in her final semester of a Bachelor of Sustainable Communities at the University of Wollongong. This student was subsequently employed on a casual basis following her placement.

This case study highlights industry's role in maintaining student engagement in STEM, not only through the opportunity to apply and build on their tertiary education with local projects, but to combine theory with a business and commercialisation lens to drive impact, a component of learning that doesn't lend itself to the classroom. The internship supervisor and student were interviewed separately as part of this case study.

Industry and student benefits

From Calyx.eco's perspective, they described their student as a valuable resource, capable of working on a range of activities, and over the course of her placement, developed skills and knowledge that were considered a longer-term asset to the business. The supervisor noted: 'she's very adaptable, so it's been great that we can give her different things, there's a lot of knowledge there, so for her to leave and us to get someone else in – let's keep that knowledge'. Calyx.eco's supervisor also commented that knowing that there was an option to offer their student employment following the internship allowed them to invest in the student with a longer-term view for their business.

Calyx.eco's internship supervisor also acknowledged the student intern brought skills and capacity to help with their priority projects, creating productivity benefits for the business by allowing them to 'expedite some of the work that we do'.

Despite no direct contact with the student's university, the placement generated new insights for Calyx.eco about how universities are teaching sustainability and provided an opportunity to connect with their own supply chain in a different way, when they participated in their student's curriculum-based project work. 'Sustainability is an evolving space, so it's really it's been really interesting to hear how universities are promoting that and the courses that they have'.

From a student perspective, the placement was a perfect fit for the intern's Bachelor of Sustainable Communities degree, providing 'really great insights into a professional world'.

Interning in a small, agile business provided the student with a broad range of real-world experiences, and a more complete understanding of the sustainability sector in NSW, '…you get exposure to a lot more; that's the business side and the sales side and the actual technical side around sustainability and the methodology.'

This dynamic operating environment may have contributed to the rate of learning experience by the student, compared to her progress through tertiary subjects, 'I was most surprised by the accelerated learning that you do in the workplace, so I did feel like I'd spent three years learning things [at university] that when I went into Calyx.eco, I sort of did in two weeks'.

For the student intern, this workplace-based learning translated to a sense of familiarity with the language of sustainability and an increased confidence to apply this back to her tertiary studies.

I went into this subject, and I realised that pretty much the whole subject, I had a really good handle on from just doing very limited few months with Calyx. It gave me more confidence in the classroom, I was a little more ready to give a different perspective because of my experience. I was more confident in tutorials because I could see how exactly the theory was applied, because I'd experienced it in the real world. Student intern

A general increased awareness of STEM roles and employment types in the sustainability field were also reported by the student intern because of her placement:

I actually didn't realise the plethora of jobs that are in sustainability that are super niche and super different. You just couldn't think of these jobs and yet there's someone that has this title or something really niche that I wouldn't have any idea what it is unless I had done an internship and worked with people in the field and through my experience. Student intern

Calyx.eco's role in their student's STEM pathway

Calyx.eco described a multifaceted role in their contribution to the education and career pathway of their STEM student. This included exposing students to the commercial realities of SMEs; working in an innovative and emerging field such as sustainability; as well as building STEM student employability and influencing their decision to continue into the STEM workforce.

Understanding the realities of successfully applying ideas and theories in a commercial setting is important to Calyx.eco as a core part of their business model and a key principle to share with interns as they prepare to transition from university to the workforce. Calyx.eco acknowledges that exposure to academic knowledge and research over the course of a degree doesn't always translate seamlessly to the workplace, so understanding the whole business model from product or service design to impact is important to Calyx.eco when guiding students through an internship: 'there's some brilliant ideas out there, but they never become a business because…they don't always have to be a for-profit business, but there has to be some sort of goal or return that they're looking for…so I think just understanding the mechanics of how business works are really beneficial.'

For their student intern based in Wollongong, Calyx.eeco provided a very contemporary workplace experience, with the team working to a hybrid model of face to face and remote working. Several face-to-face meetings were coupled with weekly virtual check ins. 'It's very different to anything I've

ever done before, and it feels very modern and fresh and everyone's excited to be in the field. I've never worked from home, it's all very new.'

The student intern described a positive learning environment, with a flexible placement arrangement that enabled her to feel valued by the company. The student explained that embracing the learning mindset was beneficial to her and the business 'Calyx had all the time for my questions - a two-way relationship where we are helping each other'.

> *Being an intern is similar* [to university] - *you don't know everything and that you're there to learn so. If I had gone out and was seeking full time employment, I wouldn't be as open to asking questions or seeming like I don't know what I'm doing, there is more at stake, and you feel like you have something to prove. Having the pressure off makes it much easier to engage with what you're doing and learn from your mistakes.* **Student intern**

Calyx.eco see a role in supporting STEM student employability by 'contributing to them being able to get future work' as well as a focus on developing professional networks as a form of social capital. 'Networks are so important because it becomes so important as you go through your career; there's lots of opportunities to utilise those'.

Calyx.eco identified some key business values that underpin their approach, include the benefits created through diverse perspectives in their workforce, and accessing the input of young people who as a cohort are often driven by sustainability issues. 'I think that crossover between the youth being passionate about, you know what their future planet will look like, but also, diversity and technology; I think this is a great combination of where people coming out of university can really add value.'

The student intern agreed that her placement at Calyx.eco provided the engagement she needed to continue into the STEM workforce and that it was well timed, at the end of her degree to 'ease that jump' into the workforce.

> *I am passionate about sustainability because I think at university when you're bogged down in all these assignments and you do start to crave that industry insight and that real world feeling like you're making a difference, I think the passion was dwindling. And then when you do get insights, it becomes very real, you're re-ignited with excitement at what's out there and careers. It's not the end of the road at university and then you then you go into a career for the*

rest of your life. It's definitely made me much more passionate about following a career in the broad sustainability field since working in it.' Student intern

Engaging with STEM Links and other WIL programs

For Calyx.eco, participation in the program went ahead when the timing to host a student intern was right, and an appropriate project presented itself. They shared that having the STEM Links program staff managing the advertising, interviewing and shortlisting meant they could bypass the time-consuming recruitment process. 'The process was really simple. It really helped doing that up front heavy lifting for us'. This was particularly relevant for a small, agile business, as they reported being 'conscious of resources.'

Calyx.eco also reinforced the need for industry partners to identify their business needs, core business values and the expectations of the role, and to clearly articulate these through the internship recruitment process. They acknowledged that it's important to take the time to scope out the student project or work 'to get the end result you want'.

Calyx.eco described several attempts to engage with universities around student interns, however reportedly found it 'difficult to navigate collaboration' with the sector, coming across a mismatch of needs and an inflexible curriculum approach, where tertiary offerings didn't quite fit the business needs, or the universities were unable to respond to the presented business needs.

Prior to participating in this placement, the student intern had only engaged in informal learning opportunities and expressed that she couldn't afford to undertake an unpaid placement. The internship hours were varied and could be completed around her existing work and university commitments. Fortunately, the student explained that she was able to turn her internship into a subject 'which reduced my study load'. The student also noted that within her faculty, few students engage in placements, stating that 'it's not clear that they're valuable'.

Alternatively, without the program, access to paid placements can be challenging, with this student identifying that opportunities often occur through existing social networks. 'People sort of fall into the internships, so they will work really close with the professor and then they there's something that will pop up a research project and then they end up going, oh, would you like to work with me on this? And then they have an internship'.

Planet Protector

Planet Protector are a SME start up with an objective to be market leaders in sustainable thermal packaging that is environmentally responsible. Based in Sydney and New Zealand, at the time of this case study the business was undertaking expansion activities into India and Victoria. The enterprise has a diverse workforce, with 56% of their current workforce from diverse backgrounds. As a start-up company, Planet Protector are currently working with CSIRO's India Australia Rapid Innovation and Startup Expansion (RISE) Accelerator program to support cross market innovations around sustainable technologies.

At the time of this case study, Planet Protector had just completed internships with two students studying a Bachelor of Environmental Management; and Bachelors of Business and Sustainability & Environment after previously hosting a student intern in 2022. At the time of publication, both recent students were employed at the company. All three student interns have culturally and linguistically diverse backgrounds, and the two current students are young women.

This internship case study highlights industry's role in supporting diversity in STEM, by challenging assumptions that limit opportunities for underrepresented young people in STEM. This case study emphasises the value of a paid placement program to improve industry's access to a broader range of meritorious students. The industry supervisor was interviewed separately to the two students as part of this case study.

Industry and student benefits

Planet Protector's supervisor agreed that when it comes to potential employees, the benefits of employing a new graduate with work-based experience and an understanding of the commercial operating environment are obvious, stating that 'it's better and easier for us to work with someone who is coming from this experience'.

From a workforce perspective, Planet Protector cited several advantages to hosting STEM Links students including the broad range of students they have access to across tertiary institutions, and the transparent recruitment process to identify the candidate that will best fit their role and business.

Because this programme works with so many amazing leading universities, there's always surety that you get those skilled students and it's a very merit-based programme, so that's something that's also a plus point for us. Industry supervisor

The industry supervisor described more project specific outcomes from the two current internships, including a noticeable improvement in student confidence and 'the biggest improvement in communication skills.' The two current students were engaged across multiple projects and were in regular communication 'with our stakeholders, whether it's our suppliers or customers, and internally in the team'.

The two students confirmed that the internship enabled them to establish strong professional networks through their engagement with a wide range of stakeholders. One of the students explained,

> *I have definitely created networks, when the business connects with other businesses, we get to join those calls and follow up with a connection on LinkedIn and keep up to date on what's happening in their worlds. It's also been good because they are smaller businesses so we've been able to go to conferences with them and award ceremonies and if they have a really good connection, they'll always introduce us and involve us in their meetings, from there you can develop a good connection with a few specific people as well. It's an ongoing connection and established, so that's been valuable.*

While the industry supervisor identified improvements in the students 'communication skill, interpersonal skills and their organisational and time management skills' through their work in 'such a dynamic and very fast-paced environment', the students shared about their improved applied knowledge and project management experience.

One of the students identified the area of certification which was a gap in her university curriculum. 'Certification tasks were challenging...all of the new standards that you can measure your business against, I wasn't learning that in my degree'. The second student relayed that while her course curriculum included studying industry related frameworks and roadmaps, the opportunity to put these into practice, towards implementing sustainability objectives 'gave me reassurance that what I learn at university is actually applicable in a workplace'.

Both students agreed the internship provided ‘a good extension of knowledge of the environmental sustainability field, where it's at and what the regulation's like’. Both students valued their roles as project managers identifying this as a significant and positive learning curve for them. ‘We definitely enjoyed the project management role, you can say that you’ve done so many tasks, you can come out of it saying that I know how to do a few new things. I actually coordinated an [interstate] move for the company. We're more confident.

Sustainability is an emerging professional field, and both students reported that the internship broadened their awareness of career options in the sector. One student stated, ‘I got to experience how sustainability roles might exist outside the scope of what my degree provided.’ While the other student shared:

> *The internship has opened my eyes to other avenues within sustainability, I've got to know about a lot of roles that I wouldn't have even known existed and I've got to experience them. Before this, I didn't necessarily have a good understanding of what a sustainability role would look like and now I've seen multiple, so it's been really good.*

The Planet Protector supervisor also viewed this placement experience as providing a competitive advantage for the student, stating;

> *If you have some kind of commercial experience, whether it's through an internship or even a short-term project with an organisation or a company, I think you get that sense of working in that similar environment and it's easier to adjust when you move to a full-time job after your degree.*

Planet Protector’s role in their STEM students’ pathway

Planet Protector has a small team, embedding principles of sustainability in all aspects of the business. The industry supervisor described a strong industry role in connecting with the strengths of student interns, around their values, passion and drive. Their workforce strategy prioritises employees underrepresented in STEM, with a passion for sustainability, and a focus on engaging women in this STEM field. This is led by the business founder who is passionate about ‘supporting women, female entrepreneurs and disadvantaged groups’.

This New South Wales based SME is also driven to support the younger generation to be leaders in this field and prefers to recruit young people with a passion for the field of sustainability and with

‘values aligned with the team’. This is reflected in their current small workforce where ‘most of the team that we have are very young and very passionate towards what they're doing and we like people who are interesting and also they want to work here, not just because they have to.’

Both current student interns are completing double degrees and have demonstrated a strong alignment with business values and objectives. One student commented,

> *I always wanted to learn how to reduce emissions for businesses in their value chain and this was perfect because the packaging solution is sustainable. This is something people can implement. I was following the company for a while* [on social media] *before I saw* [the internship] *on Seek.*

Planet Protector’s industry supervisor acknowledged the newness of the sustainability sector in Australia and internationally ‘there are so many countries who are still coming up with the sustainability related degrees. It's just very slow.’ This reinforces industry’s role to attract, train and retain the next generation workforce; by contemporising the knowledge and skills students gain through existing tertiary degrees while they’re still studying.

The industry supervisor noted that through the placement, ‘students can build up their skills much quicker and aligned to what’s really required while they’re still in university’ to complement what they’re studying at university and mitigate the gap ‘especially in building up skills’.

Participation in STEM Links and other WIL programs

Being a small company presents the biggest recruitment challenges for Planet Protector, with limited resources to comprehensively review and short list candidates for internships or employment opportunities. Lack of recruitment capacity is coupled with a lack of human resources skills to accurately match candidates to their roles. The industry supervisor commented that STEM Links filled both human resource gaps in their business,

> *The biggest support that we have received through this programme is just to make that entire recruitment process easier because we are a small company and not everyone has much time to look for the right people to join. It cuts down a lot of steps for us; we don't really have a proper HR team that we can, delegate to and just look for people to join the team.*

The industry supervisor further explained, ‘if we advertise a post and then we get a lot of applications then we struggle to really evaluate the skills of the students.’ They described challenges to assessing candidate capabilities and skills, and how it can result in an unsuccessful outcome, ‘when they start working, we don't think their values align to the business and it can be a struggle.’

Both students described their appreciation for the program as a way to access STEM work integrated learning opportunities. One student shared that ‘STEM related internships are a bit daunting so having the program is definitely beneficial to get more people into it.’ A balance between autonomy and feedback across a diverse range of projects created a positive learning environment for the students and they agreed that the support and feedback received from their team leaders, has been invaluable.

> *We had two team leaders, and they were great. They helped us a lot. They provided us with feedback and still are. It's really ongoing and that's been good because even though we get to have a bit more autonomy and responsibility of how we might start a task, or how we might develop it. Then we get feedback almost continuously which helps guide us. it was like learn as you go, and I can make mistakes and learn from those mistakes.*
>
> **Student intern**

The students also discussed that being paid a minimum wage for their contribution increased their level of motivation and commitment to excellence. One student explained, ‘I think it really does add that extra motivation, and it makes them give you better tasks and you're more reliable to give tasks. It's more valuable than you just shadowing someone. I know other people, they've gone into their unpaid internships now, and you just shadow the boss or you're just scanning things.’

Planet Protector have formed collaborative partnerships where possible to leverage additional resources to grow their business, particularly in research and development. They have engaged positively with several universities in NSW and more recently in Victoria, as part of their expansion, however the industry supervisor interviewed commented that for student placements, this program [STEM Links] has been much better compared to any other that we have been part of’ due to CSIRO’s ability to ‘bridge the gap from both the university and corporate side’.

The Planet Protector supervisor and the students interviewed agreed that access to student interns and internships was not a significant barrier, however identifying the best student candidate and accessing paid internships were the primary challenges. For industry, having access to a program similar to STEM Links across jurisdictions to support their expansion was important, 'we have established our facility in Melbourne, and we are looking for some people to work over there as well, specifically some technical interns who can support quality and are in R&D team, but this program is not available in Victoria.'

For the student interns, they were advocates for internships to be part of bachelor studies and believed that WIL opportunities were not hard to find, however paid placements and the high value learning experience that went along with a paid placement were rare. One student stated, 'I found it not so much trouble getting an internship but getting a paid internship. That's a real difficulty and also getting your hands on a lot of things and actually getting to experience and work on a very large range of tasks. We got a really broad experience in this job which has been really good.'

Smart MCs

Smart MC's is a small start-up based in Sydney, specialising in bespoke biomaterials and microfluid solutions, attracted to solving complex biological challenges. Their website highlights that their work enables scientists and industry innovators to accelerate their work, while minimising waste and environmental impact. Smart MCs collaborate with universities and other stakeholders as part of their research and development focus.

At the time of the case study, two students were interning, one of these students was studying a Bachelor of BioMed Engineering (Honours) with a Bachelor of Environmental Science and the other student was studying a Bachelor of Engineering and Advanced Science. The students were at different stages of their placements, with one just a month in, while the other was finishing their placement. Smart MCs has hosted a total of nine STEM Links students since 2022 to the time of publication. Of these nine students, over half (5) were culturally and linguistically diverse and just under half (4) were women.

This internship case study highlights industry's role in supporting diversity in STEM, by challenging assumptions that limit opportunities for underrepresented young people in STEM and the role of

industry in enhancing student work readiness to transition into emerging, high demand STEM workforce areas.

Industry and student benefits

Smart MCs described their student interns as an investment, with the return increasing, depending on the outcome of their projects. The company were interested in identifying ways to retain student expertise and knowledge, either through PhD work, or engaging previous student interns as contractors or future employees, benefiting 'the heart of the company'.

Smart MCs' CEO reported that the student interns are bringing valued talent and expertise, fitting into their business model in a long-term way and responding to short-term project needs, explaining,

> *The biggest value we got out of these internships, it's the exposure to these great talents…from the three students we were referred, hiring any of them would have not been the wrong choice even though we might have had preferences, but I think this is an extremely, extremely valuable it's just like a very good way of finding talents and then try to build up on them for the future as well. from our end, definitely there was a need.*

One example of this is an Artificial Intelligence project that the business was seeking expertise in, taking the opportunity to appoint a short-listed student intern (who applied for a different position) to the project. Utilising their university connections to provide technical supervision to the student, the CEO described a positive experience, 'the student was confident enough to continue [with university-based supervision] and the outcome was really good. They added a lot of knowledge to our company in terms of the AI side and machine learning.'

Smart MCs relayed that STEM Links is a potential longer term workforce strategy, potentially allocating budget to rolling project work to meet their business needs and at the same time, provide students with a work-based learning experience in a STEM field, 'sometimes there are some new areas that you don't want to go hire anyone, you don't want to go around and spend time yourself, but having this fresh mind, interns who are energetic, they learn more about this…that gives you an insight of what this field would be like essentially.'

Both students described career pathway benefits such as learning more about themselves as future STEM professionals, exploring applications of their knowledge and the understanding that their STEM skills are applicable to a broader range of career options than they realised. One student commented, 'what I found is that I really enjoy talking to the clients, communicating and problem solving, so now in my career I'm looking to go more towards a business analyst rather than the developer path'. This student went on to share,

This internship is actually really helped me think about what sort of career path I want to go down, especially working at Smart MCS, which is a startup, I feel like I've had a lot of independence and experience along the whole project and [at] *bigger companies I might be doing, just the analysis part, or I might just be talking to the clients. Since I've started this internship, I've learnt that [as a software engineer] even though you're not focused on coding, these skills are really flexible, and you need them in technology areas.*

For the other student, this industry placement offered an opportunity to step out of her academic research work and sample areas of interest to apply her tertiary knowledge, reporting that 'thinking through the lens of like a commercial application has changed the way I do my research for this.' This student went further to explain how this placement is contributing to her STEM education and career pathway, exploring avenues to apply her academic experience,

The way that my degree is structured, I haven't had a lot of opportunity to look into the environmental side of things and the commercial or the industry applications in the environmental science, and I would really like to have some exposure to that as well, because I'd like to use the degree and I think that the field work part is really fun. I haven't found anything in the industry yet that I really, really want to do.

One student relayed an improved sense of confidence to transition to the STEM workforce, underpinned by the realisation that they aren't confined to the more obvious disciplines defined by their tertiary course. Instead, the placement has demonstrated that their STEM skills are transferrable across a range of roles, not previously known to or considered by then. The student commented,

This programme and this placement have made me feel a lot more confident in my skills and my abilities and the direction that I want to go in. So, before this internship I had zero experience I just had time working at university and that was it, so I was a little bit uncertain but after participating in this internship, I've seen that a lot of my skills are pretty transferable.

Both students discussed the opportunities to connect with STEM professionals to establish networks and seek career guidance. One of the students, who was just finished her placement commented,

The cofounder of our company is a professor in bioengineering, which is really cool and that is an area that I'm pretty interested in so it's good having a connection with him and I've had a couple of really interesting conversations with him, even with my colleagues, other interns, it's good to have a chat with them and there's this other intern [with] *a little bit more experience, especially in AI and he was able to really show me where to go, what to look at, which is helpful.*

The other student, who is only several weeks into their placement shared that her time in the laboratory had already connected her with peers and STEM professionals with experience to share. ‘I have spoken to a lot of people in my lab who have come from different career paths and had lots of career changes and that's been really inspiring to learn about, the different pathways there. I think the main take away was to stay open minded to learning new things and to not make assumptions about what it is I want to do’.

Smart MCs’ role in their STEM students’ pathways

Smart MCs described their role for STEM students, as one that supports improved self-awareness, and teaching essential industry specific skills and knowledge, leading to increased employability. The CEO highlighted that their work placements often bridge not only workplace skill gaps, but foundational lab skills as well. ‘At some universities, a lot of students, including some of our employees…they don't get taught what they need to in a good level that at least we would require some basics like cell culture or some basics on the engineering side. Students in biology have less knowledge compared to engineering or software or programming, because the students can learn a lot at home and online, but for biology you need a laboratory.’

The CEO noted that new graduates, without workplace learning experiences like STEM Links, often have ‘a lack of self-awareness’ and a narrow view of their career trajectory, that can be enhanced through time spent in actual workplaces, exploring their options, and experiencing their profession outside university, ‘they get a different experience, they learn about a biomaterial startup, they know what research is like now, and I think that makes a difference because a lot of times when you hire somebody right out of university, they have no idea of the job.’

Part of this experience is understanding how knowledge is applied and built on within a work setting. The students discussed the process of regular check ins, project presentations, and learning about the value of drawing on the expertise and skills of colleagues. One student shared her two-way learning experience while on placement,

> *I have spoken to a lot of people; I think that was really valuable and quite even motivating as well. The fact that something that I'm not just working for an assignment, mark, but that I was making the product that clients or the biologists would actually be using every day in the lab. To see that it's actually being used is really rewarding. I've learnt that it's really valuable to be able to have a chat with people who are more experienced, and I've learnt a lot about, how to self-learn, and that you don't always need to do a university course to learn about something.*

Smart MCs also demonstrated their role in a research collaboration between industry and the tertiary sector and how it can translate to a viable student placement, through their research work with the University of Sydney. The student engaged on this project described how this arrangement appealed to her, 'the reason why I was so attracted to something with an industrial application or a commercial application was because that's how the world works and that's the point of my degree to create tech that helps people, so the attractive part was doing the research through a commercial lens and understanding how commercial pressures, time pressures and project management effects research, which is something that I didn't have to do before.'

Participation in STEM links and other WIL programs

At the time of the interview, Smart MCs had hosted nine students to date. The CEO talked about CSIRO's role as an independent broker, delivering the student internship program, explaining that the organisation 'is not a company to make money, it's not a HR company'…there's more trust' that the students short listed will be preferred candidates.

As a small start-up research company, the Smart MCs cofounder and CEO explained that participating in the STEM Links program provided recruitment resources to reduce pressure to assess and short list student candidates while at the same time, offering confidence that high value candidates from across the NSW university sector would be attracted to the positions. The CEO stated that 'when we advertise from Smart MCS, it's a limited channel, but when you [CSIRO] advertise, I think you are getting a broader student and better kind, when you are part of the CSIRO Links program, it's a more prestigious thing on your CV'.

Further to this, the CEO explained that it can 'be very hard to filter through' the applications received for a position, and felt that through the STEM Links process, the quality of candidate is better than if the company ran their standardised recruitment process, stating that 'from the students we got, they might have not ever been picked through a such system, but they've been picked very well through CSIRO.'

Since working with multiple student interns, Smart MCs adapted their approach, to prioritise flexibility and accountability. Implementing flexible workplace conditions as much as practical, to respond to student university and other commitments and complementing that with mechanisms to support accountability are seen as effective. The CEO described how this came about, 'we

encourage flexibility in work hours on most projects, so after some confusion for the student who wanted to know their set hours, we implemented a time sheet. There is flexibility during exam periods, and general work hours flexibility, so having that timesheet record and check-ins about work completed improved after that'.

Flexibility is also about understanding that each student has different capability, and that 'some students are much more independent, they can just go on and take things themselves, some are less – it depends on the nature of the project' and then managing this accordingly.

Without STEM Links, paid internships were not part of Smart MCs approach with the CEO confirming that they 'most likely would have not gone out to pay students' and further confirming that the perception of establishing and managing student internships is that they are resource intensive and may not provide adequate benefits to the company. The CEO explained that despite knowing there are talented students available, if 'nobody kind of pushes you towards it or advertises it for you, you don't get around to it, you're busy with many things, it doesn't happen.'

From the student perspective, participating in a paid internship was highly valued, with one student feeling 'more motivation and it feels like a proper job' whereas the other student couldn't consider unpaid WIL, due to financial responsibilities like paying rent, explaining that financial considerations underpin her education decisions, 'paid internships are really competitive and hard to come by, which is why I'm very grateful for this experience. Most of the things I have chosen were motivated by at least having some renumeration, even if it is sub minimum wage'.

This can prove difficult to achieve, with one student explaining that paid placements are rare and among her networks, are regularly offered to students by people in their own social networks.

> *The paid ones are really hard to come by and I have heard that 80% of positions aren't even publicly listed because they're just given to connections, or they're made for connections or things like that. So yeah, having an option that's a bit more, I guess merit based. The University of Sydney has an internal internship that's unpaid, so I couldn't do it because I need to pay my bills. Student intern*

Smart MCs is well connected with the tertiary sector through collaborative grant projects and believe that this can be a trigger for engaging the interest of lecturers as well as creating PhD projects, however these relationships don't automatically translate to productive student internship

opportunities, and without STEM Links, the CEO believes they wouldn't have hosted this volume of interns, instead estimating the number at one or two, potentially as part of a capstone subject.

Their experience of managing this independently was a drain on resources, however, the structure provided by a program with established terms and conditions 'takes that uncertainty out of it' and results in what the CEO describes as 'a much better job than any other companies I've seen who have been trying to hire interns themselves'.

From the student perspective, broadening your STEM career awareness is challenging on your own, and one student reported that it was 'actually pretty difficult' to explore broader options for careers in your degree, just through desktop research, and without first-hand experience of the workplace. For these students, work-integrated learning alternatives to the STEM Links program included a professional engagement program as part of their university's core units or unpaid WIL. One student described the pressures related to the mandatory WIL, as part of a core subject,

> *By the end of a certain unit, we have to have an internship to progress on and we are put on an academic warning if we can't [arrange this over] multiple times. So, it would have put me in a bit of a dilemma. We also can't enrol in a semester without enrolling in [this program], so that was kind of my worst-case scenario in my disaster planning that I had in my head because I couldn't find one. It's been a big struggle for a lot of people.*

Discussion

The value of WIL programs

In Australia, work integrated learning (WIL) is supported by key stakeholders for its contribution to 'ensure students develop work relevant skills for employment after their study' (Australian Collaborative Education Network, 2014; Department of Education, 2024, p. 19). Despite this, Australian work-based learning initiatives vary in their structure across the higher education sector, and a lack of documentation and large-scale empirical evaluations make their actual value difficult to compare and assess against the concept of employability (Comyn & Brewer, 2018; Jackson & Dean, 2022).

To date, published empirical studies show mixed results on WIL's impact on employment post-graduation, depending on the structure and quality of the WIL (Ahmed et al., 2024). Finding the

most valuable WIL formula for STEM students and key stakeholders is challenging, however an ACER report (Edwards et al., 2015) described sustainable and good practice WIL as having explicit links with course theory, strong industry engagement, a well-articulated expectation of participants, including a clear induction and mechanisms for support and reflection. Studies have found that paid employment increases the likelihood of fulltime work (Jackson & Collings, 2018) whereas Bathmaker et al. (2016), argues that embedding activities into the curriculum may allow less privileged students to participate.

The WIL in STEM in Australian Universities report (Edwards et al., 2015) documents the varied WIL formats offered by universities to accommodate the broad range of STEM degrees and curriculum requirements, despite the comparatively expensive teaching and learning approach work placements require, related to standard course delivery (Smith, 2012) and argue the need for additional resources to be invested to find sufficient placements for students.

Research confirms that students experience significant benefits through their participation in WIL programs. These include the effective development of their professional identity, self-confidence and professional skills (Jackson et al., 2024; Jackson & Bridgstock, 2021) therefore, 'differentiating themselves in the job market and gaining a higher return on their education investment' (Edwards, Perkins, Pearce & Hong, 2015).This has been demonstrated through WIL resulting in strong labour market outcomes for undergraduates (Lin- Stephens et al., 2024).

However, research literature documents barriers that impact how students engage in WIL, reducing accessibility and utility, including student specific barriers such as other work obligations, financial limitations, and health concerns including mental health; and universities providing inadequate support or enforcing restrictive eligibility rules, and narrowly defining scheduling and delivery formats (Jackson et al., 2024).

The critical role of industry partners in STEM Links

There has been less focus on industry partner feedback in WIL studies and subsequently industry has taken a more passive role in the development of WIL programs. A lack of evidence from this key stakeholder limits our understanding about how industry can engage more meaningfully with tertiary students in their final years of study. Recent studies confirm that primary motivators for industry to participate in WIL include to access a pipeline of future talent (Navqi, 2024) and to contribute to organisational objectives (Ahmed et al., 2024). Jackson and Li (2022) argue that

industry have a vested interest in developing appropriately skills employees, as a skills mismatch can negatively impact an organisation's productivity and staff retention rate.

The STEM Links model prioritises up front, one-on-one engagement with industry partners with the aim of creating a mutually beneficial placement for industry and students. Interviews with program staff describe an approach that includes strong engagement with industry partners to discuss business and project needs, expectations around working with students, and what to expect during the placement. Student degree, interests, abilities and personality are then matched to the placement.

The role industry partners have in supporting STEM students' education and career pathway cannot be underestimated and the three case studies show a range of roles played by industry partners that support STEM students' transition from classroom study to employability in a contemporary STEM workforce.

The following program insights are drawn from the three case studies and discuss how an elevated industry role within the program design can facilitate a successful student internship.

Role: providing a short-term employment experience through paid placements

Following the recent Australian Universities Accord report (2024) recommendations to reduce 'placement poverty', the Commonwealth implemented financial support for mandatory tertiary placements in several vocational degrees. This policy change highlights the importance of reducing financial pressures for students undertaking WIL programs, most of whom are not being paid for their contributions. It's difficult to know the number of STEM students that participate in a paid WIL experience during their studies, however a recent study by Jackson and Brigstock (2021) surveyed just over 500 graduates from creative and business industries, finding only 17.3 per cent had participated in paid work relevant to their career during their studies. In contrast to many WIL programs, the STEM Links program requires the industry partner to pay the student a minimum wage, subsidised by the program.

Case study participants shared that a wage not only relieved financial pressures but elevated the status of student interns to create a more invested role from industry partners and a more valuable experience for students. The students interviewed, made connections between being paid and a

more valuable internship, feeling that they were experiencing the full complement of a workplace. One student talked about the typical experience of her peers in unpaid work placements, saying, '…they might not know what to give unpaid interns or they don't want to give them that much responsibility so it can end up being a dead-end task or boring. So, it's been good for us to really get our hands into the new fields.'

Industry partners interviewed highlighted that they aligned student placements with priority projects and business needs to create productivity benefits for the business. This was often expressed as part of how they reinvested in their business, increasing workplace skillsets and future workforce planning. The experience the students gained while on these paid placements meant the industry partners interviewed saw them as valued future employees with the majority offered employment or ongoing work through PhD projects. This perspective is supported by national graduate data, showing 'significant evidence that paid employment in the final year of study improves the fulltime employment outcomes of new graduates' (Jackson & Collings, 2017, p. 406).

> *I would say other people didn't do internships, and other people who found internships that I know didn't get a paid internship, they had to do them unpaid whereas we were lucky to score a paid internship. It is hard. I've got a lot of friends now doing the internships as part of their degrees and they're focused on maybe one project throughout the whole time there.* ***Student intern***

A lack of paid internship opportunities at start-ups was noticed by students, with one student lamenting this and preferring the start-up work environment for her internship, where 'they can be exposed to lots of different niches in the kind of commercial landscape'. This student was able to compare her experience with the alternative experience of friends that find paid internships primarily in larger companies, having a relatively more narrow learning experience, based in more specialised, siloed teams, 'they'll be allocated to a single team, they'll do a project in a single team and there is kind of intersection coordination but depending on the capacity of the team to coordinate with them.'

Role: Modelling the next way of learning – from the classroom to the workplace

Across the case studies, both students and supervisors commented on student exposure to new ways of learning, differentiating this from their familiar classroom-based experiences. For students, a conscious shift to learning within the workplace included understanding the value of collaborating

across a team, undertaking independent research, applying initiative and independent ideas. This change was noted by industry supervisors, who viewed this as a positive step towards more independent and critical thinking and increased student employability.

Recent studies have explored the need for graduates to be increasingly career-ready and to leave university as readily employable. Employability is increasingly broadening in its definition, relating to more than just work skills, but student identity, sense of self, ability to manage their careers across the lifespan and development of relationships with others (Jackson et al., 2024). A recent Productivity Commission report (2023, p. 10) argued that 'lifelong learning to update skills in response to changing technologies and occupational demands' is essential and that businesses play an important role, in equipping their employees to do so.

Students described the realisation that learning continues past their degree and commented on 'accelerated learning', as well as different sources of knowledge they could draw on, including online sources, and from their colleagues. Multiple students described very collaborative ways of working across teams, including 'checkpoint presentations' to 'get some feedback' with a view to publishing their findings. Another student commented that their workplace peers 'had all the time for my questions' and felt part of 'a two-way relationship where we are helping each other'.

> *I really enjoyed the fact that it was very independent, which means that I had to do a lot of planning by myself, which I didn't figure out straight away. I sort of picked up on the way that there's no one telling me this is due tomorrow or get this part done by next week. So, I had to set those deadlines by myself, which is a little bit challenging in the beginning since plans always change.* ***Student intern***

This learning curve seemed to intensify in the startup and SME environment, where the industry partner role provided a more dynamic, whole of business experience for students. Some industry partners described their workplace environments as 'a different way of doing business' explaining, 'everyone has to roll up their sleeves and get their hands in and go to where the business priorities are' and 'we work on a lot of ad hoc projects…we have to pivot ourselves… it's a very exciting and dynamic place to work and every day is like a different day, you know, you're just not doing the same thing again and again.'

One supervisor explained how this environment shaped their approach to work, including with student interns,

> *They've been very involved in everything that we do and because we are such a small team, everyone knows everything that's going on in the company. Everything we work on is a collaboration, a team effort, it's not one person working on something on their own, so we get together and we complete that project to its end.*

Another industry partner felt that this their way of working, as a SME and start up would be appealing to some young people and exposing them to this through the student internships was beneficial, 'The future of our workforce will be very different, we look to a different way of doing business, a different type of leadership, to challenge the status quo and I think there's a lot of younger people that that would resonate with'.

Role: Facilitating the development of professional networks positioned as bridging or linking forms of social capital[3]

For graduates, social capital in the form of professional networks and relationships outside university are critical for maximising employability (Bridgstock & Tippett, 2019). Unfortunately, studies discussed in English et al. (2019) argue that students tend to delay developing professional networks until after graduating and lack experience using social media to network professionally. For students interviewed in the case study, all placements included a strong focus on facilitating students to develop professional networks.

In all three case studies, the students described very purposeful introductions to external stakeholders, and support for developing strong working relationships with colleagues internally. One student commented,

> [My supervisor] *brings me in on meetings all for my benefit, to build my networks, even if I don't directly work with them. It's made me realise how many people are in this web of*

[3] The Institute for Social Capital defines Bridging Social Capital as connections across typical social divisions such as different cultural backgrounds, socioeconomic backgrounds or ages; Linking Social Capital is defined as when people interact across explicit, formal or institutionalised power or authority levels.

sustainability it's just incredible to see how many people that they connect with, not just in Australia, but they have a lot of connections globally and it's been quite an eye opener to see.

Role: Increasing the diversity of the STEM workforce

Research literature describes a concerning lack of diversity in STEM fields (Department of Industry, Science and Resources, 2024) and that WIL can also be inaccessible for some of the same groups that are underrepresented in STEM, including CALD, regional students, and students with a disability (Hay & Flemming, 2024). Jackson and Dean (2022) argue that lower levels of perceived employability exist for marginalised groups including women and the benefits of work-based WIL must be readily accessible for these cohorts to support equity in graduate employability. Burke et al. (2020) adds that less privileged students may be unaware of what's required to proactively develop their employability through programs like WIL.

Research also proves that a focus on diversity is not at the expense of a focus on merit, but that a lack of diversity is partly fuelled by institutionalised bias and discrimination within the recruitment process in Australia (Anti-Discrimination New South Wales, 2024; Department of Industry, Science and Resources, 2024; Romanis, 2021; Science and Technology Australia, 2023)

The STEM Links program incorporates a transparent, capability-based student short listing process, (supporting a more wholistic assessment of student-industry partner match, including the student's attitudes, skills and knowledge, not just qualifications and academic scores) with one industry partner in the case study volunteering that 'they are the top students.' This level of industry satisfaction is also reflected in overall program data reflecting a 78 per cent rate of employment offers to students following the completion of their placements.

Recent STEM Links program data on the diversity of students placed with industry partners demonstrates the difference an independent merit based matching process can have to increase diversity, compared to a fast tracked processes of appointing students already known to the

industry partner though existing networks.[4] In the latter case, the low diversity rate is indicative of that found in the general STEM workforce population.

Industry partner participants in this case study hosted diverse students, with all being an underrepresented gender, culturally and linguistically diverse, or both. Two industry partners talked with conviction about their focus on building a diverse workforce, as an organisational value and evidence-based strategy to strengthen their operations. For industry partners invested in supporting a more diverse STEM workforce, the STEM Links program is potentially more accessible to underrepresented groups in STEM, than Industry is, through their own recruitment processes.

Role: Broadening students' STEM career awareness

Although studies suggest that good practice WIL should be explicitly aligned with the students' curricula (Edwards et al., 2015), research demonstrates that students are not fixed in their career trajectory as they progress through university and may benefit from being exposed to similar or adjacent STEM fields. Using a Career Registration Methodology to track over 1,600 students from Australian universities, Lin-Stephens et al. (2024, p. 11) found that fluctuations occur around student career thinking, identifying 'variation in the state of students' career planning from year to year, reflecting the dynamic nature of career development and decidedness over time.' This finding builds on analysis of graduate students in the UK by Quinlan and Corbin (2023, p. 771) that found 61 per cent of students changed their career interests between the start of their studies and graduation, and only 13 per cent reported the same level of decidedness throughout that time.

Hume et al. (2024) found that students often lacked career awareness, with many students changing their perspectives on career pathways after interactions with industry. One case study student interviewed explained that the internship highlighted the transferability of her STEM skills across previously unconsidered fields of work,

> *There's a lot of different areas to go into, there's so many other areas that I can go into and with the skills that I've learnt from this internship, such as talking to the clients and getting*

[4] Program monitoring data from 2024 shows that a higher proportion of underrepresented STEM students are awarded placements by the STEM Links team compared to when industry partners seek to host students already known to them via existing networks, through the program.

requirements, setting up proper problem statements and then being able to turn that into goals for my program. That's been a skill that's pretty new to me, but that I've actually enjoyed a lot, so that's pretty much another area that I can get into as well. So now with job searching in the future, I know that I'm not only limited to developer roles, but to all these other analyst roles as well.

STEM Links program evaluation data from 2024 found that seventy-five percent of students survey agreed the internship had influence future decisions about their careers. Most of these students described different ways their placement broadened their awareness and interests within STEM, others were encouraged to continue in their chosen field, while a small number of students confirmed areas they didn't want to pursue within the STEM workforce.

Not all case study students reported an internship aligned explicitly with their curriculum; however, all students described a range of learning opportunities and broader benefits. For these students, Brooks and Youngson (2014) argue that a process of reflection and debriefing within the placement process, can result in a positive learning experience for the student.

I got to experience how sustainability roles might exist outside the scope of what my degree provided. I hadn't actually gone into depth with sustainability before in my degree. So that was really interesting. I would say also for me it showed me what my degree didn't include, that it would have improved on. ***Student intern***

Future considerations

Recent studies suggest multiple areas for improvement across WIL programs in Australia, often requiring increased funding and generally underpinned by a more proactive partnership approach between industry and higher education to 'develop curricula that aligns with contemporary labour market demands' (Jackson & Li, 2022). The STEM Links model presents an alternative, third party broker model, with a focus on matching students and industry partner workplaces and projects. More research is needed to fully understand the comparative benefits of each approach; however, this case study has highlighted key features within this model that could contribute to participant benefits:

- Industry partners are investing in students through a minimum wage, elevating their value and contribution during the placement
- Students are guaranteed a minimum wage, easing financial pressures and increasing accessibility to a broader range of students underrepresented in STEM
- Industry partner needs and priorities shape the placement, providing more flexibility for industry to engage with students
- Students are assessed against a capability-based criteria, with academic transcripts only discussed after the shortlisting stage. This supports a more wholistic match to the project, as well as their fit within the workplace and its culture.
- A transparent, independent short-listing approach is applied providing confidence for participants and reducing unconscious bias through the selection process.
- Independent support and debriefing are available to placement participants to facilitate a successful placement experience

Several students suggested that universities have room to improve by better aligning their curriculums with local STEM workforce requirements. One student suggested that when her university encourages students to participate in internships and work experience, it was beneficial, however doing it without a program for support 'is a bit daunting'. Case study participants also shared their ideas for the STEM Links program:

- STEM Links could be available to PhD students or a precursor to starting a PhD position
- Students being eligible for multiple placements
- Establish a STEM Links student peer network

An opportunity to talk with other students who are in this STEM links programme would be helpful and that could be more opportunities for networking and learning about opportunities in different sectors for people who have similar skills. I think that would be pretty interesting to see where other people have gone, what other work they've been doing. ***Student intern***

Conclusion

This report highlights the pivotal role of Generation STEM Links' work integrated learning (WIL) model in addressing the challenges faced by tertiary STEM graduates transitioning to an increasingly complex and unstable workforce. By prioritizing capability-based student assessment, fostering industry-driven internships, and ensuring fair compensation for student interns, the program promotes meaningful collaboration between STEM students and industry partners. This approach not only equips students with vital workplace skills and professional networks but also deepens industry investment in the long-term development of STEM education and career pathways. The case studies presented offer valuable insights into the program's impact and the critical contribution of industry partners, reinforcing the importance of such initiatives in preparing students for the demands of the contemporary STEM workforce.

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