School-Industry STEM Skills Partnerships

The Goals of School–Industry Partnership Professional Learning

1. To connect STEM knowledge and experience from industry and the community with the foundational STEM knowledge set out in the Australian Curriculum.
2. To make this connection in such a way as to meet the two goals and implement the seven principles of the National STEM School Education Strategy 2016-2026 (Attachment 1).
3. In particular, to have teachers and students interact with authentic STEM culture and ways of thinking and with its role in work and life, to support deeper levels of engagement with science and mathematics ideas through their reflection in engineering, technology and societal applications (ref Principle 3).

Framework for Teacher Professional Development in STEM Partnerships

Sustainable teacher professional learning and improved student outcomes through STEM partnerships requires a framework consisting of the following elements:

1. The development of a systematic school or school cluster level process for engaging industry partners that:
   a. Researches the diverse range of STEM capital in the community;
   b. Identifies that which is appropriate for partnership activities; and
   c. Develops productive dialogue with industry/community partners.

2. Recognition of the importance of identifying and aligning the disparate interests of school and industry participants, and the development and refinement of processes for achieving this in practice (Attachment 2 articulates processes based on a decade of research).

3. Clarification of the nature of the knowledge and experience that STEM practitioners can bring to schools and the curriculum, that can deepen teachers' and students' engagement with and learning of STEM concepts and practices.

4. Support for the creation of a collaborative learning environment for teachers and industry partners that engages them in targeted development of industry relevant activities and resources suitable for classroom use (lesson plans, units of work, on-line resources, etc).

5. A systematic approach for supporting teachers and industry/community partners with key enablers who will:
   a. Facilitate the translation between and alignment of school and industry perspectives, priorities and interests;
   b. Develop approaches to teacher learning associated with the translation of contemporary STEM practice into school curricula; and
   c. Provide content expertise in a variety of approaches to connect curriculum topics to industry interests and expertise.

6. Develop principles of system and school-level organisational support, recognising that individual teachers and industry partners on their own are unlikely to have the influence or breadth of expertise to establish and maintain a productive sustainable school – industry partnership (ref. Principle 4).

Attachment 1

National STEM School Education Strategy 2016-2026

Goals

1. Ensure all students finish school with strong foundational knowledge in STEM and related skills.
2. Ensure that students are inspired to take on more challenging STEM subjects.

Principles

1. Create a school culture where the importance of STEM is recognised and valued, and there are high expectations for all students to engage with STEM education opportunities.

2. Expose students (and their teachers) to a wide range of career options and information early to help increase STEM aspirations and engagement, ideally in primary school and continuing throughout high school, and involving parents and school communities where possible.

3. Build on students' curiosity and connect STEM learning to solving real world problems, including through collaborative and individual learning experiences that are hands-on and inquiry-based and support the achievement of deep knowledge.

4. Recognise that STEM education approaches work best when supported by a whole-of-school collaborative effort.

5. Encourage teachers to prioritise STEM content knowledge when determining their professional learning needs, given the rapidly changing nature of science and technology.

6. Use school demographic data and the local context to guide choices about partnership and outreach programs, and consider how best to target student cohorts less likely to do STEM subjects or see the relevance of STEM-related skills.

7. Consider how to evaluate new partnerships and learning approaches as part of program design, to determine whether change has occurred in student attitudes to STEM, and whether this translates into greater STEM achievement.

Attachment 2

Principles Governing Successful School-STEM Community and Industry Partnerships

	Schools and teachers	Industry and community partners	Facilitators/enablers
1. Identify STEM capital in the community	• Recognise local businesses and community organisations as potential resources of STEM capital; • Identify STEM expertise within the school community (parents, alumni, etc.);	• Consider STEM partnerships with schools as a means of fulfilling corporate social contracts; • Be aware of practices, knowledge and resources within your workplace which may benefit schools;	• Assist in mapping the STEM capital of potential industry and community partners to school priorities and curricula;
2. Involve a partnership facilitator	• Choose a university, industry association or other organisation with expertise in education and partnership facilitation; • Clarify their roles, aims, motivations and support structures; • Minimise potential for conflicts of interest;	• Ensure the facilitator is aware of the aims and parameters of your involvement; • Acknowledge the role of the facilitator when communicating about activities; • Minimise potential for conflicts of interest;	• Ensure partners understand your motivations and the parameters of your role; • Help develop and maintain effective communication channels and protocols; • Promote regular partnership activities to sustain connections;
3. Understand the cultures of partners	• Work towards an understanding of the culture, expectations and practices within industry and community organisations; • Appreciate the motivations of organisations and be willing to help fulfil their goals; • Integrate partnership activities into the curriculum and enrich school culture;	• Work towards an understanding of the culture, expectations and practices within schools and school sectors; • Be willing to learn about curriculum structure and language;	• Understand the particular knowledge and experience STEM practitioners can offer and how these align with school curricula and priorities; • Understand the motivations, cultures and priorities of all partners; • Have excellent communication and cultural border-crossing skills;
4. Gain and maintain support from leadership	• Gain commitment and support from principal and department heads; • Gain support from parent organisations. • Where possible, align partnerships with existing state or national policies that support STEM collaborations;	• Ensure that senior management supports the partnership and is aware of commitments made by personnel and the expectations of schools; • Gain support from colleagues and networks; • Plan contingencies for changes of leadership or policy;	• Ensure your role as facilitator is recognised and supported by supervisors and workload is adequately funded; • Maximise support by aligning your role with existing responsibilities (e.g. research, client management, school outreach, etc.);

	Schools and teachers	Industry and community partners	Facilitators/enablers
5. Develop a shared vision and achievable objectives	• Collaborate on the creation of a partnership Charter outlining aims, benefits and responsibilities of all parties; • Set achievable and flexible parameters for the partnership (e.g. subjects, Year levels, teacher PD, etc.);	• Collaborate on the creation of a partnership Charter outlining aims, benefits and responsibilities of all parties; • Recognise the importance of role-modelling with respect to underrepresented groups in STEM-related careers;	• Facilitate the creation of a partnership Charter, advising on the benefits and obstacles of partnerships based on experience; • Negotiate activities which can achieve outcomes for multiple partners; • Manage expectations of partners;
6. Align objectives with existing priorities and structures	• Ensure partnership activities are integrated into the curriculum and enrich school culture; • Communicate changes in school priorities to partners;	• Ensure aims and vision align with corporate priorities; • Ensure partnership outcomes contribute positively to corporate profile;	• Be aware of the priorities and structures of all partners, and any changes which effect these; • Suggest activities and goals which align with existing school or industry priorities;
7. Allocate adequate resourcing and suitable personnel	• Gain support from a critical mass of teachers within different subject areas; • Select a credible, energetic coordinator, and provide workload support; • Regard industry partners as a source of STEM capital and in-kind support rather than financial support;	• Nominate personnel who have enthusiasm for working with teachers and students; • Ensure personnel are supported to commit time and energy to the partnership;	• Ideally, have a background in both education and industry and credibility among industry and community groups; • Have demonstrated expertise in project management and evaluation;
8. Embed evaluation in all activities	• Collaborate on designing a long term evaluation framework to measure improvements in student and teacher outcomes from partnership activities; • Collect evidence of benefits to your school; • Celebrate achievements and publically acknowledge the contributions of partners;	• Collaborate on designing a long term evaluation framework to measure improvements in student and teacher outcomes from partnership activities; • Collect evidence of benefits to industry and community partners; • Celebrate achievements and publically acknowledge partners;	• Facilitate the objective reporting of evaluation outcomes on a regular basis; • Seek opportunities to disseminate information about the characteristics which sustain or challenge the partnership; • Ensure the evaluation informs improvements in the partnership;

These principles represent a synthesis of collective learnings from a range of projects:

Project	Institution	Funding Source
Innovation 5 in ReMSTEP (2014-2016)	Deakin	ETMST
STEM Studio (StepUp, 2014-2016)	QUT	ETMST
ASELL for Schools (Victorian Node) (2016)	Deakin	AMSPP
Queensland STEM Hubs (2016)	QUT/JCU	QLD DET
'Building teacher capacity and student engagement through partnerships in STEM' (2013-15)	QUT/Deakin, with Fed. University	OLT
Additional experience informing our expertise and models		
Evaluation of the CSIRO SMiS Program (2016)	Deakin	CSIRO
STEM Skills Project (2014-16)	AiGroup	AMSPP
A decade of studies of STEM community-school partnerships	Deakin	Victorian SIS, SiMERR, ASISTM
A decade of studies of Engineering in schools	QUT	ARC Linkage, ASISTM

The principles are also informed by:

The Australian Industry Group (2017). *Strengthening School-Industry STEM Skills Partnerships.* Final project report,.

Granovetter, M. (2005). The impact of social structures on economic outcomes. *Journal of Economic Perspectives, 19*(1) 33-50.

Traill, S., & Traphagen, K. (2015). Assessing the Impacts of STEM Learning Ecosystems: Logic Model Template and Recommendations for Next Steps. Noyce Foundation. Retrieved from http://stemecosystems.org/wpcontent/uploads/2015/11 Assessing_Impact_Logic_Model_Template_STEM_Ecosystems_Final.pdf

Tytler, R., Symington, D., & Cripps Clark, J. (2017). Community-school collaborations in science: Towards improved outcomes through better understanding of boundary issues. *International Journal of Science and Mathematics Education, 15*(4), 643-661. doi:10.1007/s10763-015-9711-9

Johnson, C. (2014). Tennessee STEM Innovation Network: Final Evaluation Report, August 2014. Vanderbilt Peabody College.

Watters, J., Pillay, H. & Flynn, M. (2016). Industry-school partnerships: A strategy to enhance education and training opportunities. QUT.