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How entrepreneurial skills can strengthen your STEM program

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With a current push for Australian industry to translate innovative ideas into developed products, entrepreneurial education has the power to transform. Adding it to STEM programs in schools provides students with crucial future-ready skills and an array of new career possibilities.

Monash STEM experts Lucas Johnson and Jennifer Mansfield explain.

While the popularity of STEM education in Australian schools is rising, implementing STEM has been a challenge, partly due to a lack of clarity around what it looks like in the real world.

Adding enterprise and entrepreneurship programs in schools, particularly in STEM contexts, can help students become aware of future career opportunities through creating business start-ups.

Enterprise programs bring learning to life and develop future-ready entrepreneurial skills, attributes and dispositions.

> **"It's really opened the doors to my future about what courses I choose, especially at university. It means I have the confidence to say, 'OK, I can go out and start my own business if I chose to'."**
> *Mitchell, entrepreneurship student, The Knox School*

Entrepreneurship provides a real context for STEM learning

Entrepreneurs translate innovative ideas and develop them into products and services. This process requires critical and creative thinking, problem solving, flexibility, resilience, a growth mindset and the ability to manage risk and uncertainty – attributes also integral to STEM endeavours.

These transferable skill sets are increasingly essential for students faced with an uncertain future where the nature of work is set to change dramatically.

Entrepreneurship stimulates economic and social growth and leads to more job opportunities. This has led calls for youth empowerment through entrepreneurship education in schools across the world, including Europe (https://www.na.org.mk/tl_files/ docs/eplus/eurydice/2016pub/195EN.pdf), Mexico (https://www.sciencedirect.com/sci ence/article/pii/S0742051X17302858#bib13) and Africa (https://journals.co.za/content /sl_jeteraps/4/5/EJC145165).

Preparing students to fill Australia's entrepreneurial gap

There is a push for Australia to continually innovate and keep up with the highly competitive knowledge-based global economy.

The Global Innovation Index recently found a significant missing link between creativity and productive output in Australian industries. Australian industry rates highly for developing new ideas, but less highly for realising those ideas into products or services.

A greater focus on developing entrepreneurial attributes in schools may help bridge this gap.

The Knox School Entrepreneurial Program

Developing future-ready skills in students

Schools in Australia are already embracing the benefits of entrepreneurship programs.

A team of students from The Knox School, who developed and patented an EFTPOS machine with fingerprint security, recently won the top award at the prestigious international Conrad Spirit of Innovation Challenge (https://www.conradchallenge.org). Their biometric fingerprint credit card chip is patented in Australia and is pending in America.

> **"I really wanted to see students develop some critical thinking, creativity, I want them to collaborate … During the challenge they had to write a business plan, they had to do a video pitch and they had to speak on stage."**
> *Michelle Mitchell, teacher, The Knox School*

Darren Irvine, Learning Specialist in Entrepreneurship at Templestowe College, explains the inclusion of an entrepreneurial program is "about understanding the skills that students will use and experience that is valued beyond their first university offer."

The introduction of the general capabilities to the Australian Curriculum has presented new opportunities for embedding transferable skills necessary for successful entrepreneurship, such as critical and creative thinking, ethical reasoning and inter- and intrapersonal skills.

Teachers and schools face a challenge in how to effectively assess these skills – although this raises questions about whether all skills and dispositions worth developing in young people need to be assessed and reported on. Emphasis is often placed on prioritising things which can easily be assessed, sometimes at the expense of skills which are considered worthy of development, such as creativity, but which are more difficult to measure.

Introducing entrepreneurial programs in schools

Introducing an entrepreneurial program offers scope to develop enterprise skills, competencies and knowledge such as

- financial literacy
- creative problem-solving
- planning and resource management
- discipline-specific knowledge
- empathy
- social, cultural and ethical awareness
- interpersonal skills (teamwork)
- decision-making
- managing risk, uncertainty and failure.

Nurturing these attributes requires an understanding of the conditions teachers can create to enable students to develop and flourish with these skills. This can be difficult for teachers and schools when it is unclear what this might look like in reality.

> **"It can be really tough to get an entrepreneurship up and running, if you don't realise the time commitment involved and the resourcing that's required behind it."**
> *Michelle Mitchell, teacher, The Knox School*

Starting, however, can be as simple as beginning to develop an entrepreneurial spirit by drawing attention to and integrating enterprise skills or developing a dedicated co-curricular program. Research also recommends gradually introducing entrepreneurial spirit from the early years of schooling with a focus on transferable skills and inclusion of personal and social values (insert link to citation?).

Schools are positioned well for gradually introducing enterprise skills and attributes as they offer a supportive, risk-reduced environment where students can develop empathy, and develop resilience by viewing failures as opportunities for learning.

Provide real-life opportunities for students to develop empathy

Empathy is often referred to as 'walking in someone else's shoes'. Developing empathy can be a powerful means of increasing student engagement. To understand the impact of new products and services, students must be able to empathise with their clients and build a greater understanding of their needs.

Empathy becomes even more valuable as students undertake social enterprise programs where they can begin to understand the impact of products and services on the lives of others in positive ways.

Developing empathy is a key stage in many design-thinking models, such as the Stanford d.school (https://dschool.stanford.edu/). The real-life context offered through enterprise programs provides an authentic opportunity for students to apply specific knowledge, particularly in STEM disciplines, and develop a greater understanding of consumer needs.

Providing opportunities for developing empathy may seem daunting. However, partnerships with industry or educational institutions can be very effective in providing real-world examples or alternative locations to school-based contexts.

Building resilience – it's okay to fail, in fact it's essential

Innovative thinking necessarily involves uncertainty and taking risks. When setting out to discover something new, there is no recipe to follow. The journey is fraught with failure and uncertainty, from which we learn important lessons.

Although failure is often considered undesirable, it is actually an opportunity for learning. Successful entrepreneur Sir James Dyson took 15 years, spent all his savings and created 5,126 failed models before he came up with his first working prototype for a bagless vacuum cleaner.

The engineering industry also values failure as an important step in any product design process with products and structures often designed with previous failures in mind.

Although not all failures are good – for example if they result in a loss of productivity or customers – they should not be ignored.

McGrath's 7 principles for putting failure to work

Hiding or ignoring failure is detrimental, and can lead to failure aversion, according to Rita Gunther McGrath, a Professor of Management at the Columbia Business School. Writing in the Harvard Business Review she suggested adopting a growth mindset of 'intelligent failure' can enable businesses to be more agile, better at taking risks and more adept at organisational (collaborative) learning.

She offers seven principles to help leverage learning from failure.

Principle 1: Decide what success and failure would look like *before* you launch an initiative.

Principle 2: Convert assumptions into knowledge.

Principle 3: Be quick about it – fail fast.

Principle 4: Contain the downside risk – fail cheaply.

Principle 5: Limit the uncertainty. Build from a base of what is already known.

Principle 6: Build a culture that celebrates intelligent failure.

Principle 7: Codify and share what you learn.

Develop a culture of learning by viewing failure as an opportunity

An entrepreneurial program run in the classroom offers students a safe space to be able to learn from failure without serious repercussions. These seven principles can be applied to enterprise programs in schools to develop a culture of productive learning through intelligent failures. Viewing failure as an opportunity is an important step towards developing a growth mindset.

> **"We failed continuously, over and over again. There were different problems that came up and we had to find solutions to it and overcome it. If you fail, it's not the end of the world, you learn from your mistakes."** *Victoria, entrepreneurship student, The Knox School*

Talking about the struggles of others, such as scientists who have failed, helps students identify with them and can lead to improved learning outcomes.

Showcasing the struggles and success of entrepreneurs, such as Ruslan Kogan, the Australian entrepreneur who started Kogan from his parents' garage, might have similar positive influences on humanising the struggles of budding entrepreneurs.

The teacher's role as facilitator and cheerleader

With increased ease of access to information and push for skill development, the role of the teacher is changing. Students are not limited by the extent of their teacher's knowledge. With a shift towards student-centred learning approaches, the teacher's role is shifting to that of facilitator, supporter and mentor.

In an entrepreneurial program at The Knox School, Manager of Strategic Implementation and teacher Michelle Mitchell explained that her involvement in her school's entrepreneurial programs has challenged the way that she thinks about her role as the teacher.

"I think I've grown as a teacher, I see myself as a support person, as someone who works with the students rather than telling them everything that they need to know."

Michelle says she has seen the benefits of adapting her teaching practices to be more of a facilitator to assist the continued growth of students in her entrepreneurship programs.

"I don't think I've seen this kind of difference in students before, but I'm hoping to really see it again."

One of The Knox School's new entrepreneurial programs is a student-run burger bar.

Resources

Entrepreneurial learning South Australia Government (https://www.education.sa.gov.au/teaching/curriculum-and-teaching/entrepreneurial-learning)

The Paradigm Shifters: Entrepreneurial Learning in Schools Research Report (https://apo.org.au/sites/default/files/resource-files/2017/11/apo-nid119861-1200476.pdf)

Entrepreneurial learning and doing NSW Government (https://education.nsw.gov.au/about-us/educational-data/school-research-and-evaluation/research-and-evaluation-projects/past-research-projects/entrepreneurial-learning-and-doing)

STEMPowered Victoria Government (https://www.education.vic.gov.au/about/programs/learningdev/techschools/Pages/STEMPowered.aspx)

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