



Fostering multidisciplinary mindsets and transferable skills in a student:

The development and evaluation of an assessment framework



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Introduction

Experiment. Fail. Learn. Repeat. The innovation of this SEED project lies in the successful development of a framework that embeds fostering students' multidisciplinary mindsets and transferable skills in teaching, which can be propagated across the University of Auckland. The framework is an active learning tool, currently known as the 'Alternative Fuel Vehicle (AFV)' team project. The AFV team project helps students get to know their minds and consciously develop their multidisciplinary mindsets and transferable skills while addressing the challenges of global climate change through the lens of chemical and materials engineers.

Background

The need for employability skills in students

Before this SEED project, it was identified that CHEMMAT students need more support with improving their employability. The focus of employability is on developing a student's multidisciplinary mindset and transferable skills such as designing solutions using knowledge beyond their chosen discipline, teaming, and managing time and projects.

The development of an assessment framework for employability skills in a student

In 2019, we formed a teaching collaboration to increase student engagement. The SEED grant provided us with the financial means to upskill by becoming certified Entrepreneurial Mindset Profile® (EMP®) practitioners. The EMP® is a commercially available aptitude test for assessing personality and skill scales and identifying personal growth potential. We also purchased a set of toy-sized vehicles operated by a hydrogen fuel cell (an alternative fuel technology) that are the students' active learning tools. The fuel cell cars belong to a Year 12 science kit, are easy to use for everyone, and can be borrowed from the Multi-disciplinary Learning Spaces (MDLS) located in the Faculty of Engineering. Please contact us at andrea.kolb@auckland.ac.nz for further details.

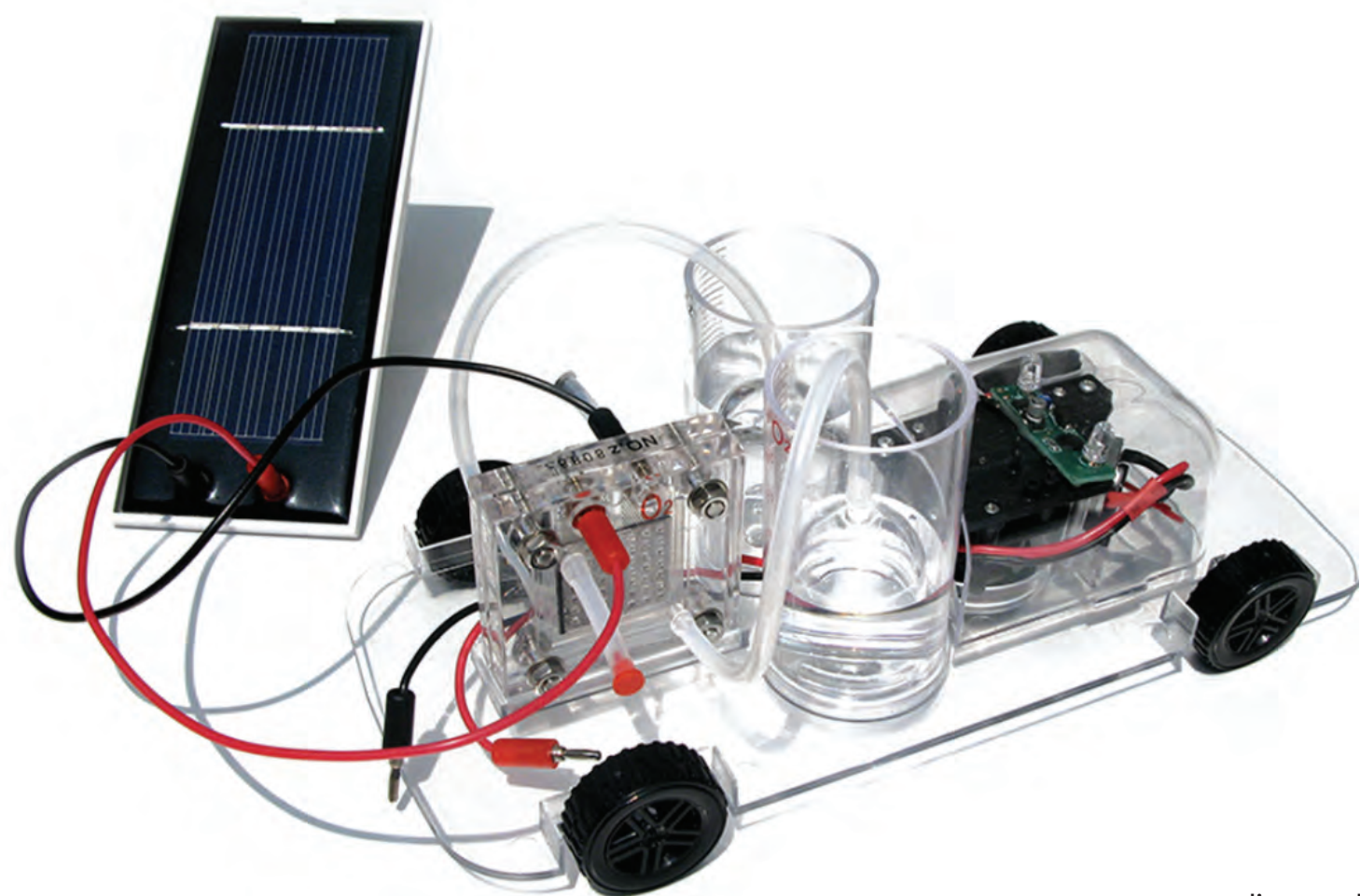


Image credit: www.horizonfuelcell.com

The framework for fostering a multidisciplinary mindset and transferable skills in a student

We have developed a generalised coursework-integrated framework for fostering a multidisciplinary mindset and transferable skills in a student. The focus is on a mindset that enables students to draw on aspects of multiple disciplines, including engineering, science, arts, and business. The transferable skills revolve around 'the what and the how'. For example, as described by the EMP®, students get to understand better and develop further their abilities to

- think beyond the immediate situation and plan for the future,
- generate multiple and novel ideas, and to find various approaches for achieving goals,
- turn visions into actionable plans; the ability to implement ideas well,
- maintain a generally positive attitude about multiple aspects of one's life and the world, and
- to bounce back quickly from disappointment and to remain persistent in the face of setbacks.

Furthermore, the framework fosters a student's general belief in leveraging existing non-disciplinary skills and talents to achieve important goals. (Eckerd College, 2019)

*"I don't measure a man's success by
how high he climbs but
how high he bounces when he hits bottom."
- George S. Patton*

The framework integrated into a student's coursework

A holistic student experience is essential. Therefore, we invested in integrating the framework into coursework of CHEMMAT 304 by aligning appropriate learning outcomes with specifically designed assessments that mimic real-world scenarios. The active learning experience enables students to develop industry-relevant skills, and the assessments allow students to demonstrate their growth as a person and a professional in the making.

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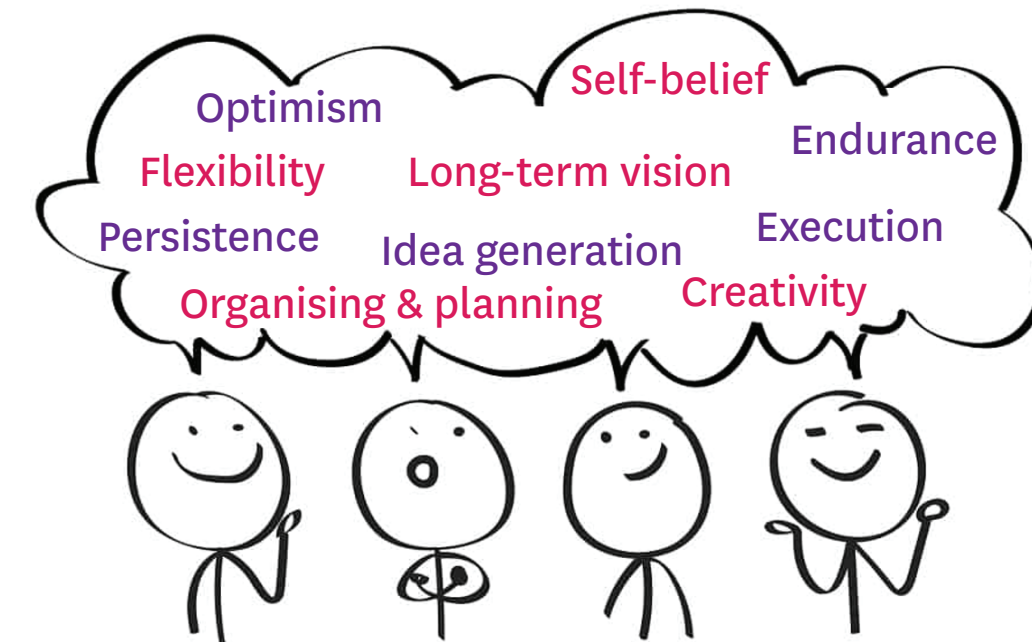
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Reference: Eckerd College. (2019). Entrepreneurial Mindset Profile® (EMP) Scales and Tips. <https://www.emindsetprofile.com/wp-content/uploads/2019/10/EMP-Scale-Definitions-and-Tips.pdf>

Methodology

In week 1, all CHEMMAT 304 students learned about their transferrable skills during two sessions with certified practitioners in the Unleash Space, including a Lego® Serious Play session. This exercise also helped students identify 4–5 partners with the same goals for teaming up.



Between weeks 1 and 11, all teams worked on their project briefs by completing assignments. The assignments included writing a project proposal, writing their team contracts, giving each other constructive feedback, submitting voicemail messages that update the instructor on the project status, and reflecting on their skill development progress. For example, the "idea generation" team needed to develop five creative yet feasible designs that safely transport a 330-ml soda on their AFV. After approval of the project proposal, the students created their design solutions using the rapid prototyping facilities in the MDLS.

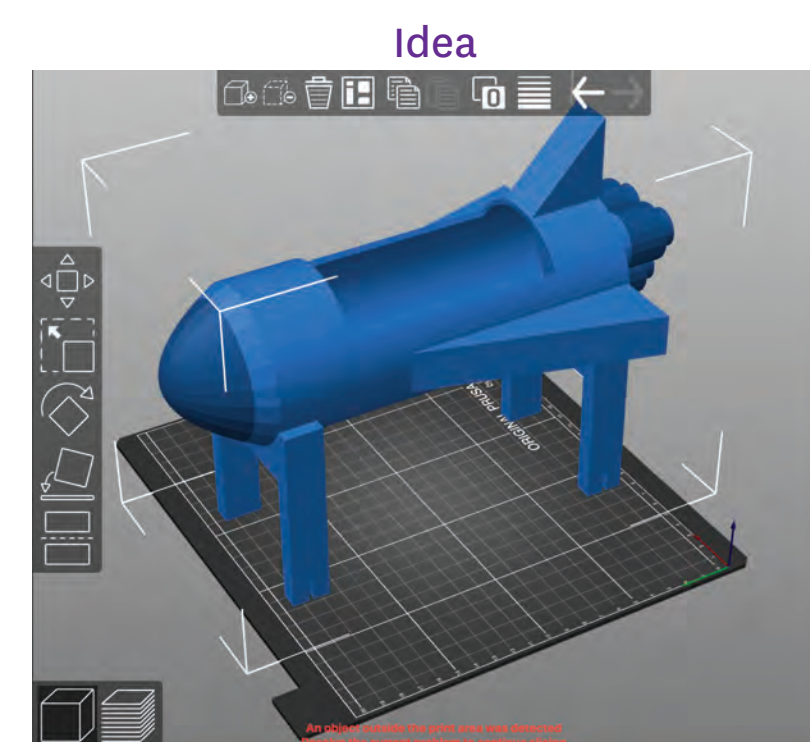


Image credit: Team 7UP (Shabaz Ali, George Anderson, D. Adam Gito, Caitlin Lam, Kevin Lee, Hayley Kim and Rubin Saini)



Throughout the semester, the students kept track of their skill development. Additionally, team leaders participated in bi-monthly meetings to update the instructor on the teams' progress.

In week 12, the teams wrapped up their projects by sharing what they have learned with the rest of the class. The overall focus is on empowerment and independence: what methods works best for developing a specific transferrable skill and the most enjoyable technical challenges.

Results, discussion and conclusion

The students' response to the coursework-integrated framework

Overall, the CHEMMAT students' feedback of the 2019-cohort was highly positive: the end-of-semester survey showed that 86% of students were likely to recommend participating in CHEMMAT 304 to a friend by giving the course a rating of at least 7 out of 10. A student who gave a rating of 10 out of 10 commented that "I have learned to develop many skills and knowledge from this course. These include critical thinking, teamwork and time management." It is noteworthy that all students confirmed that they developed or further improved at least one skill. For example, one student self-assessed the scale of their ability to maintain a generally positive attitude more than doubled from 1.2 to 3–3.5 out of 5. Also, most students confirmed that they would keep developing their skills. For example, one student said that "In the future, I plan to keep developing my multidisciplinary mindset and transferable skills by remembering the key steps that were taken during this project and applying these where appropriate."

Strikingly, this cohort was the only group of Engineering students permitted by the Deputy Vice-Chancellor (Academic) to access the MDLS during Covid-19 alert level 2, demonstrating how engaged the students were in their active learning activities and committed to their goals.

The evaluation of the new framework by the teaching team

We evaluated that the development of the framework has been a total success. We have successfully planted a generalised active learning seed that has the potential to grow into a program of substance and value that will benefit innovative and collaborative teaching and learning across the University.

Summary and outlook

The students greatly appreciated the active learning experience and identified the framework as a valuable and effective learning tool. Additionally, supervising the team projects is also fun for the instructors. CHEMMAT 304 will keep the active learning experience as part of the coursework to support future generations of engineers on their journey toward practitioners with a multidisciplinary mindset and a wide range of transferable skills. Hopefully, other courses (no matter what discipline) will also implement our framework into their coursework.