

Maker Space Technology Trainings: Practical Application of a Blended Training Model for Different Learning Scenarios

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INTRODUCTION

Kura Matahuna¹ is the School of Hidden Potential. It symbolises the new journey into the future that is agile and challenges the status quo.

Kura Matahuna is the indigenous Māori name gifted to the Centre for Innovation and Entrepreneurship (CIE). This name encapsulates the importance of the innovation and entrepreneurial mindset and competencies that the CIE instils, develops, and supports in students and staff at the University of Auckland (UoA).

The Centre is hosted in the business school but with a central University funding and mandate. CIE offers free co-curricular entrepreneurship development opportunities to students of all faculties and disciplines. These include educational seminars, mentorship, start-up internships, co-curricular recognition awards, curricular programming in a variety of disciplines, technology training and workshops, intensive entrepreneurial bootcamps, and CIE's flagship entrepreneurial development programme Velocity. CIE's offerings have been carefully designed to provide a range of opportunities to support students and staff at whatever stage of the entrepreneurial journey they are at.

CIE manage the University of Auckland innovation hub, Unleash Space, a 900m² facility that meets the needs of its community of makers, innovators and entrepreneurs and is an iconic hub of innovation and entrepreneurship in Auckland and New Zealand. It is the home of the CIE team, and the programmes and community we support. It offers a Maker Space, bookable meeting room, co-working and event spaces, and experts and inspiration for projects and ventures.

The Unleash Space Maker Space is a 160m² technology workshop designed to be synergistic with the CIE strategy and initiatives and is widely utilised as a learning resource for all at the UoA. It offers technology training opportunities that are relevant to encouraging playful curiosity, technology empowerment, and supporting innovation and prototyping. The Maker Space also supports formal teaching and learning, whether it be integration in an academic course or an opportunistic partnership. No matter the goal all UoA students

and staff are eligible to participate in the Maker Space's technology training offerings.

When all classes and campus activity suddenly and unexpectedly went remote due to the pandemic in March 2020 makerspace's everywhere were forced to come to terms with their commonality – that they all involve making (Sheridan et al., 2014) and are by their nature hands-on and vulnerable to lock-downs and other public health restrictions.

The outbreak of Covid-19 and the lock-downs that followed caused many challenges to education, including actors involved in education such as makerspaces (Kinnula et al., 2021). Prior to the outbreak the induction and training model of CIE's Maker Space was entirely in-person. Inductions and technology training sessions were 1-hour in duration, limited to a fix number of participants, and not scalable in size or frequency. Processing a high volume of participants with this operational model was expensive in time, energy and budget and inefficient when attendance was low. As such, the model was self-limiting and this problem was exacerbated by Covid.

CIE's response was to create new training materials and pivot its operational model in response to 'some of the most stringent COVID-19 public health measures internationally' (Radka et al., 2022) that saw UoA experience several full campus closures from March 2020 to May 2022. The result was a blended training model, utilising virtual and in-person delivery, that equipped the Maker Space with a suite of new training materials and achieved operational efficiencies. This has enabled our Maker Space induction and technology trainings to be redeveloped and applicable across a greater range of learning scenarios and become tailorable for different competency outcomes. Subsequently, the Maker Space has achieved new successes with academic partners.

We report in this paper our post-lockdown training model, lessons learned in regards to its practical application, use cases of technology trainings across different learning scenarios, and positive outcomes from their implementation. Together they highlight that the pivot has become less about an emergency response and more about creating a blended training model that can extend the reach and capacity of a makerspace to onboard people quickly and flexibly.

¹ Kura Matahuna is the name gifted to CIE when it opened the Unleash Space. It was gift at the time from the Māori leadership at the University, Rereata Makiha and Manuka Henare. The story of the name and its meaning

is detailed here <https://www.cie.auckland.ac.nz/kura-matahuna-the-journey-into-the-future/>

CONTEXT

The UoA is a research-led public university. It is the largest University in New Zealand (NZ) with over 40,000 students, of whom nearly 10,000 graduate annually, and 5,984 staff. The UoA community is diverse, including Māori, Aotearoa NZ's indigenous people, Pacific people, a large Asian population and pre-Covid, a large cohort of international students.

Unleash Space, officially launched in 2018 by New Zealand Prime Minister Jacinda Ardern, was the first truly interdisciplinary practical learning space on campus. Its inception was part of CIE's vision to create innovative and entrepreneurial learning opportunities for all students and staff at the University of Auckland. The Maker Space offers an environment in which to collide and collaborate with others of diverse subject areas and personal backgrounds, in recognition that innovation comes from diversity and the exchange of ideas and knowledge. Impressive, impactful, and highly visible, students from all faculties can come together to this innovation hub and Maker Space to be inspired, acquire new skills and competencies, and learn about innovation and entrepreneurship.

UNIVERSITY OF AUCKLAND CIE MAKER SPACE

Unleash Space is centrally located within the University of Auckland's city campus and the Maker Space, with its regular programme offerings and opening hours, is a large source of activity within the CIE community. The primary goal of the Maker Space is to support CIE's programmes and initiatives, act as an entry point for students interested in innovation and entrepreneurship and prepare students for the future of work.

The vision for the Maker Space is *a place where you can create what you can imagine, design for today and prototype for tomorrow.*

To keep barriers to entry low and help users move between developing skills, playing, making, experimenting, and prototyping the CIE Maker Space has training, hands-on support, and technology and resources available free of charge. Fourteen student Creative Technologists and one full-time Maker Space Coordinator are the public face of the Maker Space and run the day-to-day. Together they supervise the Maker Space, assist with technology and projects and deliver trainings and workshops during daily opening hours.

Access to the Maker Space is granted by completing an online induction. Once complete, users are free to enter the Maker Space and independently use the basic hand and power tools, work benches, PCs and laptops, fabrication consumables, vacuum former, photobooth and large format laminator and printer. Use of the six main equipment stations - 3D Printing, CNC Routing, Laser Cutting, Soldering and Electronics, Vinyl Cutting, Sewing – require formal training and certification of competency.

TECHNOLOGY TRAINING PROCESS

Gaining access to the Maker Space and using its technology is a two-stage process of induction and formal training. CIE

uses a blended model of online and in-person delivery to ensure new users are prepared to safely access the Maker Space and are competent to use its technology. This blended model was implemented in response to the challenges of Covid the new appetite for virtual-only or blended learning, and the different needs of co-curricular and curricular.

A. MAKER SPACE ACCESS

All students and staff new to the Maker Space are invited to complete the online safety induction. The induction is featured on Canvas – the University's Learning Management System (LMS). Completing the induction is a simple three-step process.

1. Watch a series of short videos and read our Code of Conduct
2. Complete a Health and Safety Quiz
3. Check your inbox for confirmation and proof of record

Once the health and safety quiz has been completed all new users are automatically enrolled in the CIE Maker Space Canvas course. This is a non-credit bearing course, and it is where technology training and certification begins.



Figure 1. Maker Space Canvas Course Landing Page

B. TECHNOLOGY TRAINING

Training for our six technology stations is completed in two parts – an online preparation module followed by an in-person practice session. Both parts must be completed to gain certification.

Part 1. Preparation Module on Canvas

A preparation module consists of a short video, Canvas quiz, and additional learning resources. Each module has been curated to introduce users to the equipment and prepare them for a guided in-person practice session. To pass this component of equipment training, users must get 10/10 on the embedded quiz which can be repeated.

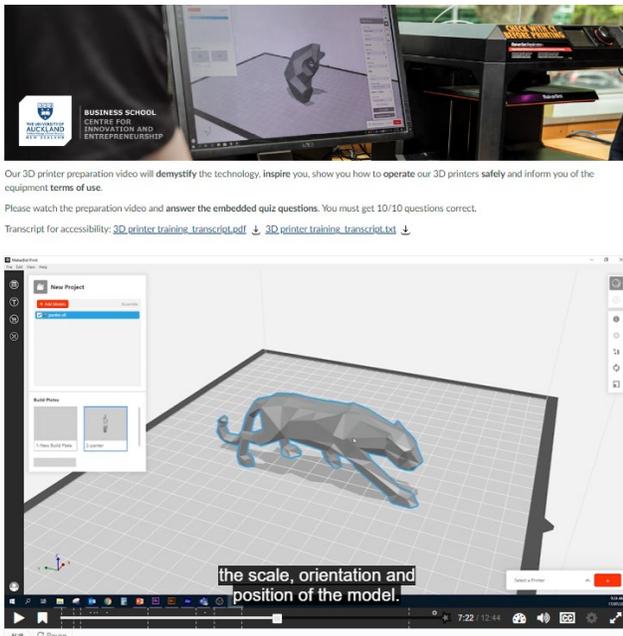


Figure 2. 3D Printer Preparation Module on Canvas

Part 2. 30 Minute In-Person Practice Session

The purpose of a 30 minute in-person practice session is to ensure that users have a practical understanding of how to use the equipment. Either the Maker Space Coordinator or a Creative Technologist will teach them how to operate the technology and answer any questions they may have. Once the instructor is satisfied that they are competent in safely operating the equipment they are marked off in a database.



Figure 3. In-Person Practice Session

TRAINING AND CERTIFICATION METHODOLOGY

CIE's methodology to certifying the technical competency of students and staff has been developed over time. It is the result of tried and tested practices since the Maker Space's soft launch in 2017 and lessons learnt from the academic community of makerspaces.

The training preparation modules have been designed to be visual walk-throughs using short, concise videos. Videos were created in-house by the CIE team and H5P – a tool for creating rich HTML5 content – was used to embed Canvas quiz questions within them. All online learning content is hosted on Canvas for accessibility and the familiarity students and staff have with it.

Our delivery approach for preparation modules and in-person practice sessions remains consistent across all six offerings. First, *demytify* the technology. Second, *inspire* participants with use-cases. Third, *empower* them to use it independently with instructions and hands-on examples. Splitting the delivery between online and in-person allows for the practice session to be a timely 30 minutes.

To generate and promote participation our technology trainings are offered daily as part of the Maker Space's core offerings. Sessions are spread across morning and afternoon and trainings are interchanged to provide flexibility of choice. Keeping the in-person practice session to 30 minutes ensures the time commitment is minimal and staff costs are feasible even with low attendance.

Low barriers to access are critical in the design of our technology trainings. In CIE's experience makerspaces and the technology and tools they offer can be initially intimidating, especially to students and staff that sit outside STEM disciplines. By utilising visual media, platforms such as Canvas and H5P, and blended delivery methods CIE has kept barriers low. The time commitment to complete both the online induction and a technology training is approximately 75 – 90 minutes, with only 30 minutes of it in-person.

CO-CURRICULAR AND CURRICULAR APPROACHES

Co-curricular and curricular differ in delivery approaches to suit their unique requirements. This is accomplished through leveraging the capabilities of Canvas.

A. CO-CURRICULAR

The CIE Maker Space Canvas Course is where technology training begins for any co-curricular activity. That is, any use of the Maker Space by a student or staff above and beyond a graded, academic requirement. If a student expresses a desire to learn about 3D printing for a personal project, a venture idea, or to understand the technology in general then they need only access the canvas course to begin their journey. Participation is entirely voluntary.

B. CURRICULAR

Curricular engagement is defined as a formal partnership with an academic course whereby CIE either delivers directly into a course, supports academic staff to incorporate CIE offerings, or provides academic stakeholders a facility and resources to deliver their own innovation and entrepreneurship initiatives.

To assist academic integration of the Maker Space all technology trainings are packaged as group or individual offerings on the Canvas Information Commons. Trainings are published as institutionally public content and visible to all academic staff. This approach allows academic partners to cherry pick from our suite of technology trainings and other learning content to suit their learning outcomes.

A chosen training can be imported directly into a Canvas course as an assignment and then customised to suite grading requirements. Importantly, students will find their technology training requirement within their academic course. This delineation between co-curricular and curricular provides a clear pathway for students that have an academic requirement and/or voluntary ambitions in the Maker Space.

ADDRESSING THE CHALLENGE

With the outbreak of Covid-19 the Maker Space’s traditional model of in-person inductions, technology trainings, workshops and staff support were severely disrupted. UoA teaching and learning went online and the Maker Space alternated between full and partial closures during the extended lockdowns and restrictions beginning March 2022 and ending May 2022.

The restrictions and subsequent challenges were not unique to the University of Auckland in New Zealand and were experienced by other makerspaces abroad. Tertiary makerspace as far from New Zealand as Minneapolis, U.S.A. (Bishoff et al., 2021) and Oulu, Finland (Kinnula et al., 2021) describe quickly closing their facilities and having to rapidly consider alternative ways of support.

The challenge to CIE’s Maker Space was four-fold:

1. Our model of running face-to-face programme offerings was severely disrupted by public health restrictions

Indoor restrictions that proceeded lockdown meant the Maker Space could not operate business as usual as the CIE team was not prepared for the rapid transition to a remote environment. This lack of preparation was shared by Bishoff et al. (2021, p.1) who describes a makerspace team that had ‘not laid the groundwork for providing virtual services’ forcing their makerspaces to close.

2. The University’s Business Recovery Strategy led to a budget reduction for our team of student Creative Technologists in 2020 and 2021

In addition, casual staff were only permitted to be used for essential teaching and learning activities. Combined with campus closures this reduced the Maker Space team to one full-time Maker Space Coordinator and one full-time Venue Coordinator for much of 2020.

3. There developed a stronger appetite from students and academic staff for virtual-only or blended learning experiences

This opened up new interaction approaches with our community but it came at a cost to the physical presence of people collaborating in our Maker Space. Antle & Frauenberger (2020) share this sentiment indicating in their research that ‘much is lost by moving design and maker activities online, particularly the share, hands-on, social experience of designing and sharing together’.

4. New partnerships for integration into curricular meant the volume of students was expected to significantly increase over the next two years

Our operational model of in-person induction and technology trainings quickly became unfeasible as there would not be enough staff hours available to deliver. Furthermore, the cost to courses to put a high volume of students through a technology training was considered unviable as-is.

These four challenges forced CIE to re-think how we operated the Maker Space. The combined need to address Covid restrictions, improve operation efficiency, offer flexible programming and be able to scale was a rationale for change. It forced a digital transformation on the Maker Space and CIE responded with the following approach to overcome them:

Challenge	CIE Approach
Full lockdown	Survey community to understand what resources would be beneficial
All formal teaching online	Trained Maker Space Coordinator and Unleash Space Venue Coordinator in media creation and virtual presentation
No access to student Creative Technologist staff	Developed a suite of virtual workshops in digital tools and creative skills
Campus buildings open with staff permitted	Offered a ‘Maker Space as a service’ option for students to submit fabrication requests for touchless collection
All formal teaching online	Developed an online home for the Maker Space on Canvas
Limited access to Creative Technologist Staff	Re-created virtual workshops as recorded video tutorials published on Canvas as ‘Unleash Space On-demand’
Campus open	Created video content that captured core elements of in-person technology trainings into online ‘preparation modules’. Published on Canvas
Students permitted on campus for extra-curricular	New blended technology trainings offered. Limited capacity for practice sessions based on social distancing
All formal teaching online	Limited general opening hours with restrictions on capacity in Maker Space.
Campus open	All Maker Space technology trainings and on-demand workshops published to

All teaching on-campus	Canvas Information Commons and made available to academic partners
Off-campus provisions for ill/vulnerable	Support provided to academic partners to design and coordinate on-campus and off-campus assessment options

LESSONS LEARNED

1. SURVEY YOUR COMMUNITY

The Maker Space team delivered over 70 virtual workshops in the first lockdown. They covered a range of digital tools and creative skills such as the 2D vector design, 3D modelling, circuit board design, creative design techniques and more. Later repackaged as “Unleash Space On Demand”, these workshops were received well and gave us insights into the pros and cons of moving maker activities online.

2. EMBRACE ALTERNATIVE PEDAGOGICAL METHODS TO TRAIN AND CERTIFY USERS

The path of pedagogical transformation was informed by discussions with other makerspace staff from Australian Universities. In particular, the University of New South Wales’ (UNSW) Makerspace Network and its ‘UNSW Making’ system of modules and digital badging (2022). While UNSW Making is a custom built solution it did provide a ‘gold standard’ exemplar amongst Australian tertiary makerspaces on giving students the autonomy to induct and prepare themselves to use equipment and technologies online.

The screenshot shows the UNSW Making Digital Badging website. At the top is a navigation menu with links for Home, About, Makerspaces, Services, Learn, and Badges. Below the menu, the page is titled "Entry Level Makerspace Badges" and lists two badges: "Makerspace Safety Induction Badge" (MS) and "Digital Fabrication Badge" (DF). Underneath, there is a section for "Additional Makerspace Badges" which includes "CNC Monitor Badge" (CNC MON), "Advanced Woodworking Badge" (AW), and "Comprehensive FDM Printing Badge" (CFP). At the bottom, there is a section for "Individual Machine Badges" with "CNC" and "DOM" badges.

Figure 4. UNSW Making Digital Badging

3. GO TO THE STUDENTS ON YOUR LMS

The outbreak of Covid highlighted how underutilised Canvas was in the management of technical workshops and labs across UoA. In collaboration with the Faculty of Engineering CIE collaborated to upskill on Canvas and share resource development. It became clear that Canvas had the potential to meet induction and certification requirements. Drawing on the web expertise of our Maker Space Coordinator we crafted an online induction and training experience on a platform familiar to students and staff.

4. PROFESSIONAL DEVELOPMENT OF STAFF IS KEY

Resource for media development is essential to create and deliver hybrid programming. The Maker Space Coordinator and Unleash Space Venue Coordinator were both recent graduates and former Creative Technologists. Despite being tech savvy they both needed considerable upskilling in filming and video editing to ensure high-quality media.

Between CIE’s capability to record, edit and produce video learning content and the power of Canvas and H5P to make the content easily accessible we knew solved the challenge of accessibility, changing appetites for online learning, and a reduced budget and team.

RESULTS

1. The Maker Space induction, traditionally 1-hour in-person, was migrated entirely online
2. Induction and preparation modules were made available for on-demand viewing
3. Technology Practice Sessions were reduced from an in-person commitment of 1-hour to 30 minutes
4. Core costs of operating the Maker Space were reduced
5. Technology trainings can be delivered more frequently and, therefore, scaled
6. A viable cost recovery model was developed for curricular partnerships and opportunistic engagements
7. Accessibility was improved with online content available on the Canvas phone app and all media closed captioned
8. Strategic relationships with academic partners and course directors were strengthened

USE-CASES OF HYBRID TECHNOLOGY TRAININGS

CIE understands the importance of skills, capabilities, and mindset that a makerspace can provide so it forms a key part of CIE’s offerings. Technological change is driving societal change, the future of work, and the digital transformation of industry (Industry 4.0). This increased uncertainty, complexity, and rapid societal changes have heightened the importance of equipping graduates with entrepreneurial mindsets and skills (Morris et al., 2013). This mindset and capability are now widely recognised as beneficial for those who want a career in start-ups and more broadly as future skills that prepare students for tomorrow. Below are use-cases of our blended technology trainings being practically applied for learning outcomes related to skills development, entrepreneurial mindset and capability, and transformative education.

CO-CURRICULAR

A. Maker Space Core Offering

Daily technology trainings are offered to the university community. Sessions are published in advance and promoted by CIE's Engagement Team.

B. Summer Lab

Summer Lab is a 4-week programme designed to ignite entrepreneurs and teach essential skills needed to turn ideas into business ventures. Students choose the trainings they need to use the Maker Space and visualise ideas and prototypes for their final pitch to panel of judges.

C. Student Engagement – Clubs, Associations and Societies

Technology trainings and Maker Space workshops are offered free of charge to student clubs and associations. The aim being to form a partnership with the student leadership teams that see benefit in using the Maker Space for their club and fast tracking training for their members. The UoA Maker Club, as an example, is dedicated to building a community of creators and regularly uses Unleash Space as the home of their events. Several student Creative Technologists are members of the Maker Club Executive and independently conduct technology training evenings for new members.

D. Co-Curricular Recognition Programme

Involvement with CIE can be formally recognised through the Co-curricular Recognition Programme. Completing all six Maker Space Technology Trainings is recognised under the Innovation Programme Path or as a Professional Development Workshop. Recognised activities are formally included on academic transcripts.

CURRICULAR

A. INNOVATE 100G – Innovation Through Design

100G is delivered in Unleash Space and was specifically re-designed to utilise the Maker Space. All students in the course are assigned the induction and at least one technology training to complete. Students are allocated marks for completing the online and in-person components of a technology training.

B. BUSINESS 112 – Managing Sustainable Growth

All students in B112 are assigned the following team assessment: *Innovative Thinking: Designing Solutions Using the Maker Space*. To prepare teams for this assignment they are assigned Maker Space induction and one technology training as graded assessments.

B112 is a large-scale course. Collaboration with the Maker Space has been contingent on our ability to flexibly deliver trainings and accommodate 1500+ students.

C. PROPERTY 384 – Property Technology

In 2021 PROP384 students participated in an experiential workshop at Unleash Space where they explored design-thinking concepts and learned practical design skills. Students were asked to complete the Maker Space induction before attending an in-person variation of the virtual Tinkercad workshop developed and delivered in lockdown. Students modelled a property of their own imagination and were then introduced to 3D Printing through which they print and envision their property.

POSITIVE OUTCOMES

The new Maker Space training model was rolled out in July 2020. Despite multiple shifts to online teaching and learning in response to Covid it was evident by June 2021 that a blended delivery model had achieved positive outcomes. They can be summarised as:

- A. A simplified user experience for teaching staff looking to integrate the Maker Space through use of Canvas
- B. An increase in leads from academic staff seeking an opportunistic engagement with the Maker Space
- C. High completion rates amongst cohorts required to complete either of Maker Space induction or training
- D. A reputation within the Business School and wider university for promoting excellence in the use of technology to achieve learning outcomes
- E. An exemplar within the University Learning Design Community for leveraging Canvas in new ways to improve the student experience
- F. Interest from various technical teams looking to migrate from legacy systems and processes for competency certifications
- G. A workshop operational model that could scale and preserve the unique feature of student-to-student training

CONCLUSION

To date the Maker Space has had over 3000 unique participants complete a technology training. Prior to the outbreak of Covid-19 over 2000 of these participants committed 2 hours in-person to gain access and use technology within the Maker Space. Particularly stringent public health limitations in New Zealand and changing attitudes towards blended delivery provided a rationale for change in CIE's Maker Space.

CIE now has a suite of new training materials and a blended model, utilising virtual and in-person delivery, for technology trainings. It is model that can scale, be presented as a teacher-friendly experience, be applied across a greater range of learning scenarios and lead to new successes with internal academic partners. With a more viable operational model CIE has also preserved the unique student-to-student teaching experience of the Maker Space. Importantly, this paper has recognized that contingency planning that is less about emergency response and more about investing in staff skills and digital platforms that can take what is traditionally done in-person and move it online in a value-add way.

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