

## Developing student capacity for Startup through integrating engaged, action and threshold learning models with a design thinking framework.

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**CONTEXT** There is a global movement for commercialising innovative ideas, approaches, research and technologies through entrepreneurial models. One of these models is startup. Within an Australian context there is considerable Federal, State and local government support available to assist with this along with opportunities for support through private, Angel Investment and Venture Funds. Many of our students at XXXX Engineering are interested in founding or working for a start up.

**PURPOSE** What learning model will best support postgraduate coursework students to develop the skills and knowledge they need to be a startup founder or to work for one?

**APPROACH** In 2016 a new course was introduced in the XXXX Graduate School of Engineering XXXXXXXX Launching a Startup. It was designed to develop student capacity for startup. It integrated engaged, action and threshold and Nexus learning models with an overarching design thinking framework. The course was iterated for a second delivery in T1 2017 and a third in T2 2017.

**RESULTS** Development of a course to support students interested in founding or working for a startup.

Identify viable student startups generated within the course and feed them into support programs on campus and across the startup ecosystem.

Assist students with existing commercialisable research to assemble a team, make appropriate connections and create their own start up.

**CONCLUSIONS** With appropriate support and guidance students can identify opportunities for a start up or commercial applications for their research. Once identified these innovations or opportunities can be developed through a structured program to be ready for launch as a start up.

**KEYWORDS** Innovation, Startup, Entrepreneurship

## Introduction

There is a global push to commercialise innovative ideas, research and technologies through entrepreneurial models. One of the models to effect this is startup and it is expected that the startup sector will inform and drive future job and industry creation. Within an Australian context there is considerable Federal, State and even local government support available to assist with startup along with opportunities for support through private, Angel and Venture Fund investment. Many of the students at XXXX Engineering are interested in founding or working for a startup. With a growing global emphasis on developing graduate capacity for entrepreneurship and a corresponding remit from the XXXX Strategy, XXXX Faculty Engineering created a graduate course called XXXXXX Launching a Startup with its first delivery in semester 2, 2016 to a cohort of 40 postgraduate students. The 2 subsequent deliveries have been to cohorts of 54 and 58 respectively. This paper documents the design, development, delivery and iteration of the course. It reflects on some of the course outcomes and how these have informed the iteration of the course content, delivery and overall student experience and outcomes.

## Developing a postgraduate course in Launching a Startup

The author has had extensive experience in developing and delivering undergraduate and postgraduate courses and programs in the areas of innovation, collaboration, entrepreneurship and startup. Their preferred approach, in the context of designing a new course, leverages user centred design principles, starting with an understanding of the needs of the students and the desired outcomes of their participation and completion. They evaluate the student experience and use a feedback loop to both co-create and iterate the student experience in a real time, responsive manner.

In the case of this course, the postgraduate students come from the various disciplinary programs across XXXX Engineering and from a range of professional backgrounds and nationalities (up to 21 in one class) providing a professionally and culturally diverse community of peers with a broad knowledge of international contexts of practice. They are the ideal type of cohort to develop a collaborative community of learning with.

### The XXXX handbook description

*Working on bringing innovative ideas or discoveries into reality, either on your own or internal to an organisation, can be a daunting task. The processes of Innovation, Startup and Entrepreneurship / Intrapreneurship require different skill sets and specialist knowledge and can be very difficult to successfully balance, particularly as an individual. This course is designed to furnish participants with an understanding of these three processes and how they differ yet support each other. Through an innovative mix of learning, teaching and assessment methods students will work in small teams, and with mentors, to identify an opportunity, innovate a solution, design a product or service and develop an entrepreneurial approach to delivering it to. Successful completion of the course should result in participants being ideal Startup founders, cofounders or team members.*

### Course Aims

The course outline explains that the course aims to develop in students a capacity to identify opportunities for innovation and capitalise on these through intrapreneurial and entrepreneurial models in cross disciplinary teams. It will provide students with the skills necessary to successfully produce and commercialise innovative ideas. It exposes them to

industry experts, successful startup founders, key theorists and XXXX staff and researchers who have either innovated, commercialised or supported the process. Through experiential learning, students develop key skills and knowledge to work in the innovation and startup space.

### **Student Learning Outcomes**

The course outline also explains that after completing the course, students should be able to:

- apply disciplinary principles and practices to new or complex environments.
- apply enquiry-based learning and ways of thinking to new disciplinary and/or professional contexts.
- investigate, generate and synthesise complex ideas and concepts at an abstract and/or applied level.
- analyse problems or issues, articulate appropriate solutions and justify propositions and/or professional decisions.
- communicate complex ideas in a variety of formats to diverse audiences.
- demonstrate an understanding of, and the ability to apply, the principles of teamwork and collaboration.
- demonstrate an understanding of international perspectives relevant to the discipline or professional field.

In addition, it states that successfully completing the course contributes to the development of the following graduate capabilities:

scholarship:

- understanding of their discipline in its interdisciplinary context
- capable of independent and collaborative enquiry
- rigorous in their analysis, critique, and reflection
- able to apply their knowledge and skills to solving problems
- capable of effective communication

leadership:

- enterprising, innovative and creative
- capable of initiating as well as embracing change
- collaborative team workers

professionalism:

- capable of operating within an agreed Code of Practice

global citizens:

- capable of applying their discipline in local, national and international contexts

### **Course Delivery and Teaching Strategies**

Whilst some aspects of innovation and entrepreneurship can be learned via traditional methods such as lectures, readings, case studies, literature review and pure and applied

theoretical approaches, research on innovation and entrepreneurship education has shown a learning-by-doing (action) approach is more effective. This course integrates the best aspects of both approaches through a strong action-learning focus scaffolded by a flipped-classroom model incorporating current academic literature and industry studies. The course is enriched with engaged learning opportunities from weekly interaction with industry and practicing entrepreneurs to tailored team mentoring sessions. It is also supported with weekly online topics based on the Lean LaunchPad and Disruptor’s Handbook methods, which are used by leaders in this space such as Stanford, Berkley and the University of Pennsylvania.

During their project, students form small teams, identify potential business opportunities and utilise enquiry based learning to innovate, create and assess the viability of their product / service / technology and business model. Upon completion of their project, students pitch their ideas and business model to an expert panel which includes potential investors, technical experts, XXXX staff and mentors in Week 13. They also reflect on their learning process through a writing activity due in Week 14.

All materials for the course, such as readings, videos, case studies, compliance and government web links, workbooks, templates and interactive forum activities are provided, in a flipped model, via a learning management system (LMS). Students access these materials at their own pace as their team moves through the development stages of their project.

The face to face components of the course are divided into weekly themes which are grouped into the four stages of the Design Council UK Double Diamond design thinking & innovation model. This is outlined below in Table 1 below.

<b>Stage 1: Discover</b>	<b>Stage 2: Define</b>	<b>Stage 3: Develop</b>	<b>Stage 4: Deliver</b>
<b>Week 1</b> Entrepreneurship, Intrapreneurship and Startup : Introduction Design Thinking: Identifying opportunities	<b>Week 4</b> Customer Development (continued)	<b>Week 7</b> Value Proposition & Channels	<b>Week 10</b> Partners
<b>Week 2</b> Tools for Innovation : Lean Canvas and BMC	<b>Week 5</b> Innovation workshop	<b>Week 8</b> Customer Relationships	<b>Week 11</b> Resources & Costs
<b>Week 3</b> Market Research & Customer Segments & Customer Development	<b>Week 6</b> MVP - Minimum Viable Product	<b>Week 9</b> Revenue Models	<b>Week 12</b> Pitch & Presentation Skills

**Table 1: The Double Diamond model as applied to xxxxx**

Each week a one hour guest lecture is provided, in line with the weekly theme. These are held as a series of open public lectures called Startup Monday and provide students access not only to industry and sector leaders and successful startup founders, xxxx staff and researchers and disciplinary experts who present, but also to other members of the XXXX,

and broader community who are interested in startup, innovation and entrepreneurship and may become mentors, investors or collaborators. The guest lectures are filmed and added to a library of resources that is building over time for all XXXX staff and students to access.

Following each guest lecturer, interactive workshops are held to reinforce concepts through action learning and provide additional examples to the class. Consultation and mentoring also occurs in these workshops and provides opportunities for targeted feedback and review. The workshop time is used to form, bond and progress teams through the development stages of their startup.

## **Assessment Strategies**

The assessment strategy allows students to demonstrate their acquisition of skills and knowledge and their ability to apply them in context over time. Care has been taken to develop assessments that acknowledge that risk and failure are almost inevitable in startup and are an important part of the learning cycle. They assess the individual's ability to be a collaborative innovator and entrepreneur, the individual's ability to be a productive part of a team and the team's ability to deliver an outcome together.

Assessment task 1 is individual and split into two parts and is worth 30% of the total grade.

The first part is a communication task in week 1 which asks students to write a LinkedIn style professional profile to position themselves as a potential collaborator, their interests, skills, knowledge, experience, motivation for studying the course, entrepreneurs they admire and any project ideas they might have. They post it in a public forum and they comment on each other's ideas, read each other's profiles and get to know who might be suitable collaborators.

The second part is due in week 14. It is a reflective writing task where students document how they have developed collaboration, innovation, entrepreneurship and startup skills over the semester, how these will be useful in their future careers, and the challenges they have overcome in the course, personally and as a team.

Assessment task 2 is a team activity with 40% and divided into 4 10% parts.

A number of different communication techniques are specified in this series of tasks to develop capacity to use all the types of communication formats that may be required in a startup context. The staged delivery of the task gives teams the opportunity to gain valuable and timely feedback across the delivery of their project from peers and from their instructor.

**Task 2a Week 4 Team & Idea Pitch:**

Teams pitch their idea and their team to the class in a 5 minute structured presentation. Describing their identified opportunity, why their team is the right one to leverage it based on skills, knowledge, experience and connections, who else they need and where they will find them. They can only use a verbal delivery.

A forum is opened for each team in the LMS and each individual student is asked to provide constructive critique of each of the teams. This provides immediate feedback to the teams and helps individuals develop constructive critique skills. Individual students are also assigned \$100,000 to invest in any way they like across the projects. This helps them develop an investor mind set.

**Task 2b Week 6 Progress Pitch: Customers and other stakeholders : Business Model.**

Teams pitch a more refined idea to the class, validating their startup. They outline who their customers are, the problem they are solving for them and the business model they have chosen to deliver the product / service to them. They are asked to may use any format they

feel appropriate and most choose to use powerpoint or similar. They are refining and honing their communication techniques.

Again a forum is opened for each team and individuals are asked to participate in constructive critique of all the teams. Individual students are again assigned \$100,000 to invest in any way they like across the projects. The feedback is used by the teams moving forward.

Task 2c      Week 9 Progress Pitch: Minimum Viable Product (MVP) and Value Proposition

Teams are asked to prepare a 3 minute video pitch outlining their Value Proposition and what the MVP they will deliver will be. They have all prototyped their MVP by this stage. They specify how they will develop customer relationships and what channels will be used for distribution and fulfilment. They upload the video to you tube or a similar platform and provide a link via the LMS for their peers participate in constructive critique of all the teams.

Task 2 d      Week 12 Report: Intellectual Property (IP), Financing and Compliance

Each team generates a report on how they will deal with the compliance and finance aspects of their startup. The resources they need, their cost considerations, their revenue model, their IP and compliance concerns? These are posted in the forum again and each individual is asked to review and critique 5 reports.

Assessment task 3

Task 3 is worth 30% and is due in week 13 it is the final Demo and Investment Pitch:

Each team pitches their startup idea to a panel of industry leaders, investors, peers and XXX staff. They prepare a 5 minute pitch and a prospectus for potential investors. Individual students are again assigned \$100,000 to invest in any way they like across the projects.

## **Applying Engaged Learning, Action Learning, Threshold Learning and Nexus Model to designing the course.**

### **Engaged Learning**

Delivering meaningful, engaged learning experiences recognises the changing needs of the 21st century student. Jones, Valdez, Nowakowski, and Rasmussen (1994) have developed a set of eight indicators of engaged learning to guide educators applying it in their practice. The application in this course is described below.

Indicator 1.

Successful, engaged learners are responsible for their own learning. The students in XXXX define their own learning goals through self selecting their projects and evaluating their achievements through peer review and reflective writing. They are solving real problems and developing capacity to be strategic in their learning, sharing and transferring knowledge to solve the problems creatively whilst being collaborative, valuing and having the skills to work with others.

Indicator 2.

Tasks for engaged learning are challenging, authentic, and multidisciplinary. It is a complex task to identify a commercial opportunity, find a product/ service or mixed model solution to it and develop a viable business model to deliver it. The process involves multiple skill sets and occurs over a sustained length of time. The XXXX learning experience is authentic in that it correspond to the tasks of workplaces of today and tomorrow. The collaboration takes place

with peers and mentors within XXXX as well as with others outside faculty. The integrated instruction approach used incorporates problem-based learning (through the project), scaffolded by the theory provided in curriculum.

#### Indicator 3.

Assessment of engaged learning involves presenting students with an authentic task, project, or investigation, and then observing, interviewing, and examining their presentations and artifacts to assess what they actually know and can do. Performance-based assessment has been designed in, particularly with respect to task 2. It is generative involving the students in generating their own performance criteria (through the peer review, reflective writing and investment activities). They play a key role in the overall design, evaluation, and reporting of their assessment. This performance-based assessment strategy connects to curriculum and instruction and is ongoing, representing all the meaningful aspects of student and team performance equitable standards that apply to all students.

#### Indicator 4.

Instructional models and strategies for engaged learning should be interactive. Instruction in XXXX actively engages the students in interactive workshops, presentations and assessment. Instruction is generative, encouraging the students to construct and produce knowledge in meaningful ways across the structure of the four stages of the Double Diamond model. The students interact generatively with their teacher and peers, involved in teaching each other interactively within and across their teams and as individuals through their weekly team workshop participation and through the peer review processes. This facilitates co-construction of knowledge and promotes engaged learning that is problem, project, and goal based.

#### Indicator 5.

The learning context of engaged learning requires the 'classroom' to be perceived as a knowledge-building learning community where members develop shared understandings collaboratively, and create empathetic learning environments that value diversity and multiple perspectives. There are a number of summative and formative activities across the semester designed to build the learning community and celebrate its diversity. They include a series of icebreaker activities in week 1, the online introduction exercises, a class lunch where everyone brings a traditional dish to share in our lunch break between the guest speaker and the workshops, collaborative problem defining and solving, constructive peer review and entrepreneurial activities.

#### Indicator 6.

Grouping for engaged learning collaborative work that is learning-centered should involve small heterogeneous teams of two or more students. By framing group formation in xxxxx students are encouraged to form teams of up to five, based on common technology interests and should include a mix of different genders, cultural backgrounds, skills, and disciplinary expertise. This brings a wealth of background knowledge and perspectives to the different team tasks and ensures increased learning opportunities between peers.

#### Indicator 7.

In engaged learning contexts the role of the instructor in the classroom shifts from information giver to facilitator, guide, and learner. As a facilitator, the instructor provides the rich environments and learning experiences needed for collaborative study and acts as a guide, incorporating mediation, modeling, and coaching into their practice. Often they become a co-learner and coinvestigator with the students. In XXXX the author, through the design of the course, positions themselves as a facilitator, co-learner and collaborator. They guide the students through all the resources, materials and activities, facilitate team formation and development, coach the team through the innovation and entrepreneurship

process and model the various methods the teams can use in their project based learning and problem solving.

Indicator 8.

The student role in an engaged learning scenario is that of an explorer. Their interaction with the physical and virtual resources, their peers, mentors, collaborators and the instructor facilitates students to discover concepts and apply skills. They are then encouraged to reflect upon their discoveries through observing and applying the thinking processes used by practitioners. They integrate what they've learned and become producers of knowledge, capable of making significant contributions to the learning community. The author provides all the course materials up front for the students to navigate and guides the students to use them in context, designing in opportunities for peers to be experts, explorers and teachers in the teams.

### Action Learning

Reg Revan introduced action learning in the mid-1940's as Director of Education for the British National Coal Board, and continued to develop and promote its principles until his death in 2003. Action learning focuses on increasing learning capacity while responding to a real-world challenge in a cross-disciplinary team. The students in XXXX all self-select real-world problems on which to work towards addressing with, technical and entrepreneurial frameworks across the semester. Reflection is an important part of the action learning experience xxxxx students reflect on their own experience, their team's work and the work of their peers. Much of their learning occurs in small, mutually supportive teams, taking advantage of their team members' experience. Knowledge and experience exchange between the team members generates fresh approaches and helps build innovation and learning capacity within the team.

The teams start with a period of strategic questioning of the problem. They set action items and goals aligned to the assessment structure and analyse their progress towards these goals. As individuals and teams they reflect upon, and document, the process and present the outcomes of their work for review.

The team are empowered and trusted with the necessary resources to take on the issue they identify with some guidance and mentoring.

There are six components in an action learning context as illustrated in figure 1 below.



Figure 1: The six components of action learning from <https://wial.org/action-learning/>



There is a group or team, supported by a coach, who undertake a learning experience whilst solving a real problem.

The context:

Action learning is intended to increase the learning capacity of a team by them resolving a real problem in an organizational context.

The context for the students is to use an enterprise model to address an identified opportunity or problem and to learn about entrepreneurship from this.

The situation:

Action learning begins with a clearly defined organisational opportunity or problem.

The student teams identify the opportunity or problem and set objectives to meet it.

The team is fully empowered to bring the challenge to a successful conclusion.

The team:

Action learning teams comprise members from diverse backgrounds, skills and experience.

The student teams are expected to first define and understand the objective,

then commit their energy and expertise to the team process to address it. They participate as equals, empowered and encouraged to contribute to a collaborative solution. They learn about fellow team members early in the experience through assessment 1a and 2a and some icebreaker exercises in class. This includes backgrounds, range of expertise and skills and how these can contribute to the objective?

Insightful questioning and reflective listening:

xxxx students used design thinking methods partnered with either the Lean or Business Model Canvas to undertake a rigorous enquiry process around the opportunity or problem.

Journaling:

Students record team and personal experiences, research, learnings and insights. The synthesise these records into their assessment presentations and reflective writing.

Action items:

Student team members divide tasks, set timelines, and individuals or sub-groups implement them. Individuals are challenged both to use their range of expertise as well as stretch their approaches to implementation.

Team mid-course reviews:

Across the semester, in line with assessments, the team assesses feedback, discusses progress, deals with problems and sets next stages of their work. They document outcomes and add to the journaling.

Team concluding reviews; institutional review:

xxx student teams and individuals reflect on performance and are provided feedback from peers, their course coordinator, mentors and assessment panellists.

Coaching:

Reg Revan, founder of action learning, believed that team members are their best coaches, facilitators or leaders. By providing structure and opportunity to students in xxxx to develop experience in reflective and group processes, as well as outside facilitators and mentors or coaches to assist the team, much as any resource can be accessed.

## **Threshold Learning**

Threshold concepts sit at the heart of a body of knowledge. They are the fundamental understandings that students need to 'get' in order for core disciplinary knowledge to make sense. In this course there are a number of threshold concepts, but not all are relevant to the entire cohort due to the mixed backgrounds and experience levels they have.

I will give an example from xxxx of each of the five characteristics of threshold concepts and how they are dealt with in the course.

**Transformative:**

Transformative concepts effect a shift in a learner's perception where their new understandings become part of who they are, how they see and feel. In xxxx one transformative concept is that of the user centred design principle of empathy for the end user of a product or service. Students embed the practice of understanding the needs of the user in order to provide the best solutions for them.

**Irreversible:**

Irreversible concepts are unlikely to be forgotten once understood and earlier behaviours and patterns are not likely to be returned to. The continual reflective review process develops the student ability to become a constructively critical, reflective practitioner and life long learner.

**Integrative:**

Integrative concepts expose students to the interrelatedness of concepts they have previously seen as unrelated. In the case of XXXX few students have previously made the connection between the roles of engineers and other experts such as legal, compliance, marketing, communication and design in the innovation and commercialisation process.

**Bounded:**

Bounded concepts border on new or other thresholds, particularly in interdisciplinary subjects such as XXXX where, in the context of founding a startup the students must consider all of the different disciplinary dimensions of running a small business.

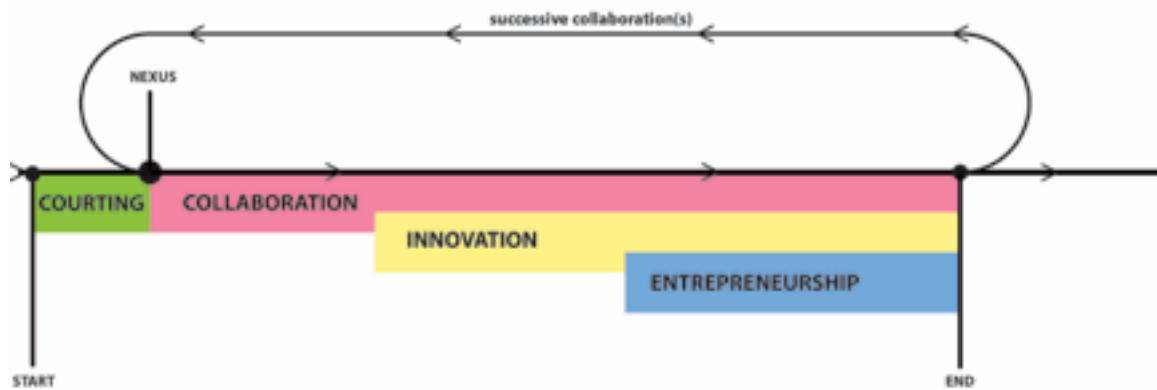
**Troublesome Knowledge:**

Troublesome knowledge refers to difficult to grasp concepts. For the students in xxxx two areas of troublesome knowledge are. 1. how to develop a business model for their startup. This is addressed through providing a weekly step by step working through the Business Model Canvas coupled with expert mentoring. 2. the need for engineers to immediately solve a problem before checking it is actually a problem and then fully understanding why it is a problem and the various options that could address it. This is solved through requiring the students to validate their business idea and to then test their proposed minimum viable product with users before finalising their solutions.

## **Nexus Model**

The NEXUS model (figure 2 below) describes the processes through which a team of collaborators may progress from the start to the finish of a project and the possible continuation of collaboration through successive future projects. It is the model used to form and guide teams in XXXX. It acknowledges that the collaboration does not always start at the point of NEXUS. It often begins before that point with a courting process which is emulated in XXXX through a number of activities where students share their ideas with their peers in class via LMS and get to know each other through LMS and class based introduction activities. The Nexus Model also acknowledges that working together does not end after one collaboration. If it is successful a collaboration should lead to successive future

collaboration(s) of the team or a subset of the team. There may not always be an innovation or an entrepreneurship component to the project. These are treated as overlays.



**Figure 2: The Nexus Model.**

## Student Outcomes

For the students, this course is delivered in a very different format to any course they are used to. Feedback suggests that this is good. Aspects of the program they really enjoy include the exposure to, and opportunity to interact with, guest speakers, finding or being assigned mentors, selecting their own real projects to work on, selecting their own teams to work in, having the opportunity to develop a business, hands on workshops, refining communication skills, peer review process, presenting to potential investors, learning design thinking methods and tools, using the business model canvas, access to all the materials via LMS. However, some students indicated they find the self determination in project and team selection daunting and would like them to be assigned.

Many of the student teams continue to work on their ideas, or a modified version of them, after the course is over. Some do so on their own, some move into incubator and accelerator programs internally at XXXX or outside in the broader ecosystem. Some find investment funding. Some take their projects back to their workplace as an internal innovation project. Some teams take their projects and present them internally and externally at pitch competitions and have been successful in gaining prizes and other rewards or support. Some students have taken their projects back home to another country and are still working on them. Some students realise, after the course is completed, that they are not the right fit for startup but enjoyed the opportunity to discover this.

## Next Steps

It is the intent of the author to develop this course further to enable it to be undertaken online, by distance students and to be scaled to be able to cater to much larger cohorts. This will require some consideration of how to develop the community of learning experiences in an online context and how to facilitate mentoring.

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