Curriculum Transformation with Students as Partners

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Introduction

8732142. That was my student ID as an undergraduate (now one of the authors).

It was a number, not a name. It distinguished students from professors and all other teaching staff and, in a symbolic way, reminded us all of our firm place as students, as learners. There was a big power differential between students and teachers in the 1980s. What we learned was prescribed, transmitted and tested in implicit ways (no rubrics or marking criteria in those days) and rarely were our *skills* tested – just what we knew and could *recall* at a given time.

Sometimes people say that teaching is an *act*. Indeed, *sage on the stage* suggests this precisely. But being a student is also an act. Students also assume roles and personas.

If we want curriculum transformation, we seek to put a stop to acting – to engage students and staff in *authentic learning*.

MIDAS is our curriculum transformation project in the Faculty of Engineering and Information Technology (FEIT) at UTS – More Innovative Design-Able Students. In MIDAS, we want students and teachers to be their authentic selves in a true teaching and learning partnership. MIDAS seeks mutual respect in people, not the fulfilment of roles.

MIDAS doesn't see students as numbers, but as partners, as people who can learn, contribute, inspire, teach and create … and it sees teachers as people who also learn, contribute, inspire, teach and create.

MIDAS – More Innovative Design-Able Students

MIDAS is a 5-year cultural transformation project that is reinventing curricula, learning and teaching practices, through student and stakeholder engagement, to prepare graduates for the new world of work in the 21st century, requiring a focus on innovative design practices.

Many reviews of engineering education in the last 15-20 years have urged transformation of engineering education (D. Beanland & R. Hadgraft, 2014; Carnegie Foundation for the Advancement of Teaching, 2009; Institute for the Future, 2015; R. King, 2008; National Academy of Engineering, 2004, 2005; S. D. Sheppard et al., 2008; N. Spinks et al., 2006).

These international reviews recommended several issues to be addressed such as: complex challenges, interdisciplinarity, creativity and invention, leadership, sustainability, global ethics, and lifelong learning (R. G. Hadgraft, 2017). Curriculum changes suggested included: a professional spine, teaching for connection between topics, approximate engineering practice, use case studies, situate problems in the world. The Henley Report (N. Spinks et al., 2006) recommended three different kinds of engineers: the technical specialist, the integrator and the change agent.

Through the MIDAS project, staff and students are engaged as partners in activities and conversations to build capacity for a better learning experience, one that prepares students and staff for these challenges in the future workforce.

The Learning Design Team in FEIT is building a sense of urgency to improve the student experience. How might staff create shared values – to discover, engage, empower, deliver,

sustain? The team aims for heightened awareness and traction – traction for transformation of mindset, beliefs, values and behaviours.

In every conversation we have, in every action we take and in all our endeavours, we aim to create a place where students are at the centre of these transformative conversations. Together we aim to graduate students as successful engineers and information technologists of the future, who are more innovative in their approaches, who use design thinking at the core of their practices.

In summary, the key principles underpinning MIDAS are:

1. A student-partnered curriculum, creating a vibrant and exciting student experience that matches the Engineering and IT professions, with a focus on innovation and entrepreneurship.

2. Student-centred learning with e-portfolios, learning contracts, project-based studios and online learning as key ingredients of this new learning environment.

3. A new, responsive curriculum structure that reflects the changing nature of engineering professions, driven by AI, automation, data analytics, climate change, etc. Cross-disciplinary learning needs to be a common practice.

4. Connected teaching and research, so that our research centres run inspirational studios and capstone projects at senior levels of our programs to draw students into their research programs.

5. A collaborative environment where students, academics and external stakeholders work together for the benefit of all parties, the faculty and university as a whole.

The University Context

How did MIDAS come about?

In 2014, UTS embarked on a university-wide initiative to reform its teaching practices (UTS, 2017). Each subject in the university must embrace key teaching and learning principles that are neatly summarised as ABC:

A. Active and Authentic Learning and Assessment – real world tasks and projects
B. Blended/Flipped learning – put lecture materials online, where possible, and have students come ready to class to engage in problem solving using:
C. Collaborative learning

Subject outlines have been revised across the university through 2014-17, resulting in many difficult conversations and reconceptualisations in our Faculty of how technical topics might be taught. What has become clear is that many academics have never really thought much about *why* a subject, or a topic within a subject, needs to be learned or, indeed, what its end purpose might be. Getting them to think about a real design task that would embody the theoretical ideas has been quite difficult in some cases. Getting them to take action has required courage. Nevertheless, once that has been achieved, the academic has often seen their subject from a whole new direction and has become energised to engage the students in real problem solving. Students benefit from the real-world projects because they place the difficult theoretical ideas into context.

Why Studios?

Engineering and Information Technologists use design processes to solve complex problems and to develop new product opportunities (B. Koen, 2003). The Faculty's *Graduate Attributes,* adapted from I. Cameron and R. Hadgraft (2010), embody the capabilities necessary for professional practice. A graduate is expected to be able to:

A. Investigate the client's *needs*,
B. Use a systematic *design* process,

C. Apply disciplinary *technical* skills,
D. *Communicate* and *coordinate* tasks with co-workers and stakeholders,
E. *Self-manage* tasks, projects and career development,
F. All within a *global context*.

Although there has been a history of project-based learning in the Faculty for many years, we are now planning to take this to the next level, shifting the emphasis from Projects to Student Learning. Studios embody that shift (R. Hadgraft et al., 2016), with each semester having a studio component of 25-50%, surrounded by more traditional teaching of skills.

Studios provide students with open-ended project opportunities to develop the full range of professional capabilities. Each student defines a set of intended outcomes in a learning contract and then works to satisfy them, which they then document in a personal *e-portfolio*. Studios require graduate attribute E in action – self-management and self-learning.

A challenging task requires first an understanding of its *context*, the system in which it is embedded, the client *needs* must be identified, and formally recorded as the *requirements* to be delivered (point A above). These authentic project tasks will usually be developed with industry partners.

Students use the *design* process (point B), empathising with the stakeholders to understand the problem as deeply as possible. The initial focus is on problem definition. Is the problem clear? Are the requirements clear and deliverable? (T. Brown, 2008; IDEO, 2017; Stanford University d.School, 2017)

In the process of developing a set of potential solutions and in evaluating them against the requirements, various kinds of technical (abstraction and modelling) skills will be required (point C).

Engineering and IT rarely happens as individual activity – *teams* are required almost always. *Communication* and *coordination* are key skills (point D), likely the most important skills across a career (J. Trevelyan, 2014). EIT professionals spend around 60% of their time communicating both within the team and across team boundaries.

Self-management (point E) is the key ingredient. Engineers and IT professionals must be able to manage their work, learning and time to become reliable and productive team members. The studios require students to maintain a reflective journal that will help them to identify strengths and weaknesses, to shape their learning across technical and non-technical capabilities.

Finally, studios will help students to see the global nature of engineering and IT practice (point F), both in the context of problems and design opportunities but also in the nature of the teams in which they will work, blending cultural and disciplinary perspectives.

The studio is the vehicle for each individual's learning, as part of their overall career development at the university. Their personal e-portfolio will be a record of their achievement of the graduate capabilities and of their readiness to step into the world of work, or even define their own work world. It will contain many examples that might be discussed at a job interview, demonstrating the graduate is work-ready. Importantly, development of an e-portfolio requires self-reflection, a key professional capability.

Student Involvement

The key part of the MIDAS project is involving students as partners in their own education. Things get done *to* students in the current university environment. We want to change that.

The core MIDAS team is working with the University Innovation Fellows (UIFs), four students from third, fourth and fifth years across different engineering disciplines. They are the first students to be selected as part of a Stanford University program empowering students to become agents of entrepreneurial change at their universities using *design thinking* as a tool

(d.School, 2017). Each of these students undertook online training in Feb 2017, followed by a week of immersion in design thinking at Stanford in March.

The UIFs have so far encouraged student feedback from different cohorts about Faculty programs. They work alongside academic and professional staff to bring about changes students want, such as forums and workshops. The UIFs have also accepted the task of drafting a proposal to repurpose a designated student learning space in our building, finding out how students want to use it and what needs to be added and changed. This is a very exciting and growing enterprise.

Another initiative is *Learning about Learning*, which aims to meet the learning needs of students in the Faculty, working with the Student Promotional Representatives of UTS (SPROUTS), students who are pivotal in gaining other students' engagement in conversations.

The UIFs, the SPROUTS and individual students from various study programs and professional backgrounds are also coming together as partners with teaching and learning staff to interpret student feedback surveys. They provide insights into improving specific learning areas and the wider student experience.

The MIDAS team has invited the UIFs and friends of UIFs to participate in conversations pertaining to Curriculum Renewal Projects including a new Mechanical and Mechatronics Program, a new Civil Engineering program and related sub-majors, a new Master of Engineering (Robotics), Renewed Core subjects, Innovation studios, and a Student Communication package.

Our Faculty has for two years now, insisted on student participation at retreats, workshops and forums. This year, 12 students attended the Faculty's Teaching and Learning Advance in September working alongside about 80 academic and professional staff in articulating stories of success and achievement. All have committed to continuing the work in learning partnerships with academics.

In the next section, students tell their side of this partnership in more detail.

Student Run Workshops using Design Thinking

To uncover the hidden pains and unfulfilled desires of students within our current education system an adaptation of the *Design Thinking* Process (Empathise, Define, Ideate, Prototype, Test) has been used in student-led forums and workshops. These forums are developed and run by student leaders in an effort to engage their peers and allow them to pinpoint key elements of the current university experience that need improvement. By allowing students to manage these workshops, a friendly and casual environment is established allowing honest thoughts and ideas to be uncovered and discussed – a crucial element to the success of the workshops thus far. A typical one hour workshop takes the following form:

1. *Empathise* – Participating students are asked to pair up with someone else in the room and converse over a given topic. For example: "Your First Year Experience at University" or "How You Travelled to University Today". The topic of this first activity is tailored to the group or focus of the forum. During their conversation, students are encouraged to ask "5 Whys" and follow up questions to their partner's statements in order to coax out the underlying reasoning behind their thoughts. Anything that the students find to be interesting, painful or unexpected is written down on post-it notes and dumped on butchers' paper.

2. *Define* – With a collection of post-it notes from the interviews, students then form larger groups and discuss what they uncovered. As a team, they must now choose one or a related combination of "pain-points" or interests from the collection which they must use to create a "Problem Definition". This problem definition must take the form of "How might we…". For example, "How might we help students form stronger friendships in their first year of university?" or "How might we help students feel safe on their way home from

campus?". Stating the problem definition in this way allows joint ownership of the set task and opens the problem up to have a large number of solutions.

3. *Ideate* - In the same groups, students are asked to use the "Yes and…" mentality to rapid-fire idea generation surrounding their chosen problem definition. In this portion of the workshop anything goes and no idea is dismissed or discussed at length. Students are all encouraged to stand (not sit) and to contribute to a collection of post-it note ideas.

4. *Prototype* – At the conclusion of the idea generation phase the groups must now sort through all of their post-it notes and either as a standalone idea or as a combination, propose an intervention to their chosen problem definition. This intervention must then be turned into a physical/visual prototype by any means. Examples include storyboarding, role play and physical models made from craft materials.

5. *Test* – The groups must now show their prototypes to another group and have the other group experience the solution that has been created. With valuable feedback from rapid real-world testing, design iterations can be performed on any of the design stages until a satisfactory proposal has been developed.

The data gathered from these workshops has been invaluable in uncovering some true desires of the students. It also allows students to take ownership of problems they are facing and gives them the power to generate solutions within the space of the one hour session, resulting in a sense of pride, satisfaction and productivity.

This design process can be viewed on a much larger scale and forms a core process within the MIDAS project. By working with students as partners, a very deep level of empathy is able to be achieved as the students themselves are creating solutions to problems they are facing. In essence, it can turn the university experience into an open resource platform where students are provided with resources they need to conduct their studies and projects. Students are able to develop a greater understanding of their own thoughts and allows for reflection of situations in which they are faced.

Outcomes from Student Run Workshops

Student run workshops have uncovered numerous problems which students consider of high importance at UTS:

1. The need for **increased study spaces** on campus for both quiet study and for (noisier) group activities
   - One group proposed a coloured signalling system in the library to identify vacant study spaces for waiting students.

2. Desire for a **greater university-social balance**
   - Some students have proposed "chill out zones" to allow students to take a break from study and to socialize with friends.
   - "Nap pods" have been requested by groups of students who travel long distances to get to university and believe a nap would help them maintain focus later in the day.

3. **Greater support for student entrepreneurs**
   - Some students have discussed a desire to start their own businesses or look into the "start-up culture" but are unsure how they could pursue these avenues without affecting their studies.

4. **Project based learning**
   - Many students have expressed high interest in increased project based learning both in the forms of practical classes/ assessments and in internship/work experience opportunities.

Overall one of the biggest insights into the current student mindset is that students are eager to learn and have a large desire to be challenged and to do well in their studies but they feel as though they are sometimes lacking the resources and necessary support. Resources

such as face to face time with lecturers, hands on projects, clear instructions, flexible assessments and increased space to undertake study have all been repeatedly named.

With this comes some surprises, however, as many students are also unaware of some of the opportunities and resources already available to them. It is possible that one of the key outcomes from these workshops is that resources need to be more visible and actively promoted to students to give them the greatest opportunity to make use of what is available.

The second biggest insight from these workshops is the interest that students take once they are exposed to the design process. Once they have gone through a few iterations of the process many have been very eager to participate in following sessions and are open about their desire to continue shaping the university to suit their needs. This again comes back to the core principle of MIDAS – having students as partners.

A university is much more than a business selling education, although some of the same principles apply. When developing any product or selling any service, the business will flourish if its customers are satisfied and they feel as though they are the company's number one priority. If students can see that they are being put first and that the university is there to benefit them and grow with their needs, the success of those students and the reputation of the institution as a whole will follow.

Further Exploration of Student Issues

We also have the good fortune to have an external facilitator working with us on the change management processes behind MIDAS. Greg Jenkins tells how he has been running World Café (World Café, 2017) conversations for a few weeks now. The aim of these conversations has been to get at the heart of the issues that trouble both students and staff: how can we create a learning and teaching environment that is more satisfying for us all?

Here's Greg's brief explanation of the process:

The genius in the World Café approach is that it makes it safe to have conversations that matter in groups of 3-5 around small tables. However, doing something once never gets to the real depth of an issue. It's no surprise that nothing much changes without a regular chance to dig deeper into issues – to find the elephant in the room. In my experience, it is also vital that a member of the management team be present at every conversation, so that key issues can be progressed.

To what extent does a corporate process like this translate into working with university students? Culture is complex anywhere. In a large university, there is a whole new dimension to understanding the really deep issues, the elephant in the room.

There seem to be a huge number of surface issues about teaching and learning and student engagement and leadership that look impossible to understand let alone resolve and there are not a lot of deep conversations between students and teachers, between teachers themselves, and between university leaders and teachers and students. Everyone seems too busy to have those extended conversations. There is also plenty of feedback from students to teachers and to the university through formalised student feedback surveys. With so much communication happening, why have another methodology?

There is a problem with aggregated feedback in that it is all either *from* individuals or *to* individuals: one to many or many to one. It's hard to get heard no matter how good the feedback or how powerful the communication. There is just so much to take in that it's hard to get attention.

That's why we are trying the World Café conversations with students. We have now conducted more than 10 of these small table conversations Each weekly session takes an hour.

What's going well: The attending students are fully engaged and thoughtfully contributing to the conversation. Each innovation café goes deeper from the previous conversation. These

are high quality conversations that have the opportunity to put issues in a different light. I'm confident that we are getting closer to the 'elephant in the room'.

One issue that consistently emerges is CARE – academics caring about students and about creating a good learning environment, students caring about their learning, and everyone caring about sharing honest feedback with each other. This theme of caring aligns well with the intended outcomes of MIDAS – to create a learning environment where students can own their own learning and develop themselves in a safe environment.

Summer Studios

Summer studios are one opportunity to simultaneously address student dissatisfaction at having few subject offerings over a summer term and also to launch the MIDAS project. To date, over 360 students have expressed an interest in participating in a studio experience.

What are summer studios?

Summer studios are designed to be high energy, high collaboration, project-based subjects where students can engage in real-world challenges. They are facilitated by a mixture of academic experts, industry and community partners. Using a design thinking framework, students regularly engage in pitching and critiquing work among peers.

Academics, students and industry partners have proposed a range of projects broadly clustered into the following areas:

- Meeting future human needs in cities and developing countries
- Data science and artificial intelligence
- Design and build amazing devices

Students as partners is seen in this initiative in two key ways. First, the design of the studio is pedagogically student-centred and fosters relevance, which has been another key area of concern for students.

Second, four senior undergraduate engineering students have taken leadership of individual studios and will be lead facilitators – humanitarian engineering, smart cities, a Vivid lighting installation and space engineering.

Conclusions

MIDAS is about the future state of engineering education at UTS. We believe education strategies and practices need to continuously adapt to a rapidly changing world. Our new curricula will be based on transformative, collaborative and continuous renewal.

Our studio-based curricula embody the key ideas from the international reviews: a professional spine of projects modelled on engineering practice, using real scenarios from industry and community partners.

In MIDAS, students and academics will get to be their true and authentic selves. Our students and academics will engage in genuine, mutual and authentic partnerships. MIDAS respects that students and academics are on a journey together, both seeking meaning and both teaching and both learning. This is a process of continuous and transformative change for everyone.

MIDAS aims to build the support system required to enable the drivers of our future education. It has a positive vibe that harnesses and attracts staff and students and the wider community. Together, we rely on the design thinking process to help us achieve remarkable feats.

Just as NASA placed a man on the moon and SONY put a music player in our pockets, so MIDAS aims for *transformation*. We focus on the a-ha moments. We've all had them, mixed with feelings of fascination, inspiration, discovery, challenge and success. We remember

them. There's a connection. Something feels unlocked. It sticks with us. What we're looking at suddenly seems very different. We share our stories about them. Creating sticky stories and storytelling is one way to help unite this culture of continuous change in the Faculty and we have found that student stories are often the most urgent and compelling.

References

Beanland, D., & Hadgraft, R. (2014). *Engineering Education: Transformation and Innovation*. Melbourne: RMIT Publishing.

Brown, T. (2008). Design Thinking. *Harvard Business Review*(June).

Cameron, I., & Hadgraft, R. (2010). *Engineering and ICT Learning and Teaching Academic Standards Statement*. Retrieved from Sydney: http://disciplinestandards.pbworks.com/w/page/52657697/FrontPage

Carnegie Foundation for the Advancement of Teaching. (2009). Carnegie Calls for Transformation of Engineering Education. Retrieved from http://www.carnegiefoundation.org/press-releases/carnegie-calls-transformation-engineering-education on

d.School. (2017). University Innovation Fellows. Retrieved from https://dschool.stanford.edu/university-innovation/university-innovation-fellows on 8 Nov 2017

Hadgraft, R., Prior, J., Lawson, J., Aubrey, T., & Jarman, R. (2016). *Redesigning Engineering Curricula around Studios*. Paper presented at the Australasian Association for Engineering Education, Coffs Harbour, Australia.

Hadgraft, R. G. (2017). *Transforming Engineering Education: DESIGN must be the Core*. Paper presented at the 45th SEFI Conference, Azores, Portugal.

IDEO. (2017). Design Thinking. Retrieved from https://www.ideou.com/pages/design-thinking on 14 June 2017

Institute for the Future. (2015). Future Work Skills 2020. Retrieved from http://www.iftf.org/futureworkskills/ on 1 Sep 2016

King, R. (2008). Addressing the Supply and Quality of Engineering Graduates for the New Century. Retrieved from http://www.olt.gov.au/resource-addressing-supply-quality-engineering-graduates-uts-2008 on 19 June 2012

Koen, B. (2003). *Discussion of the Method*: Oxford University Press.

National Academy of Engineering. (2004). The Engineer of 2020: Visions of Engineering in the New Century. Retrieved from http://books.nap.edu/catalog/10999.html on 17 Jan 2007

National Academy of Engineering. (2005). Educating the Engineer of 2020: Adapting Engineering Education to the New Century. Retrieved from https://www.nap.edu/read/11338/ on 29 April 2017

Sheppard, S. D., Macatangay, K., Colby, A., & Sullivan, W. M. (2008). *Educating Engineers: Designing for the Future of the Field*. San Francisco: Jossey-Bass.

Spinks, N., Silburn, N., & Birchall, D. (2006). Educating Engineers in the 21st Century: The Industry View. Retrieved from http://www.raeng.org.uk/news/releases/henley/pdf/henley_report.pdf on

Stanford University d.School. (2017). A Virtual Crash Course in Design Thinking. Retrieved from https://dschool.stanford.edu/resources-collections/a-virtual-crash-course-in-design-thinking on 14 June 2017

Trevelyan, J. (2014). *The Making of an Expert Engineer*. London: Taylor & Francis.

UTS. (2017). What is Learning Futures?   Retrieved from https://www.uts.edu.au/sites/default/files/article/downloads/What-is-learning-futures_0.pdf on 8 Nov 2017

World Café. (2017). The World Café Method.   Retrieved from http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/ on 9 Nov 2017