PUC, Chile

Case Study Part B – Institutional context

Undergraduate engineering student intake (1st year cohort 2020/21):	**≈ 800**
Number of engineering faculty:	**≈ 170**
Duration of Bachelor of Science in Engineering:	**4 years**
Duration of professional engineering degree:	**5.5 years**

1. Defining features of PUC's engineering education

Like engineering schools across Chile, the Pontifical University of Chile's Engineering school (PUC Engineering) has historically delivered long (seven-year) undergraduate engineering programmes that were dedicated almost exclusively to mathematical and scientific fundamentals. The past decade, however, has seen a radical shift in the school's educational approach.

A shorter five-and-a-half-year undergraduate curriculum has been developed. While academic rigour remains at its core, three major new themes have emerged. Firstly, there is a stronger focus on interdisciplinary learning, with the introduction of new interdisciplinary programmes, activities and majors in areas such as sustainability and AI. Secondly, there is a greater emphasis on what is termed 'care', built both within the student and faculty communities (via a suite of support and mentorship programmes) and through connectivity with the regional and national community (with many curricular and non-curricular activities linked to external communities to address challenges and innovations in Chilean society and industry). Thirdly, greater prominence is given to design, entrepreneurship and innovation, whose prominence has grown significantly in the past five years. For example, the school has established a suite of opportunities to develop students' capabilities in technology-based entrepreneurship both within and outside the curriculum, including a 'sister' course to Engineering Challenges in the third year of study, where multidisciplinary student teams from across the engineering school work with regional entrepreneurs to develop and launch technology-based start-ups.

Educational technology has not played a prominent role within the PUC Engineering undergraduate curriculum. However, since 2015, the school has offered subsidies for faculty to create Spanish-language massive open online courses (MOOCs) across a range of topics to support engineering learning across Latin America. Since the transition to 'emergency' online learning in November 2019, the school's priorities for MOOCs' development have shifted: funding is now directed at MOOCs and associated online material that can be utilised within the PUC Engineering undergraduate programmes.

2. PUC's experience of emergency teaching in engineering

2.1. Emergency teaching restrictions

Due to social unrest across the country, the university first pivoted online in November 2019. Shortly after these emergency teaching measures were eased, they were reinstated due to the COVID-19 restrictions from mid-March 2020. The imposition of COVID-19 restrictions coincided with the start of the academic year and the start of the Engineering Challenges course, which, like all other courses in PUC Engineering, was taught 100% online.

2.2. Managing the transition to emergency teaching

The school took a decentralised approach to the online pivot. Faculty and teaching teams were asked to develop an online/remote version of their courses in whatever way worked best for their subject, students and areas of expertise. The only stipulation set by the Dean was that the approach must not disadvantage any student group, particularly those without access to fast/reliable internet or other equipment. So, for example, the Electrical Engineering department posted circuit components to their students, but did not penalise those unwilling to use the kit due to concerns of infection risk. Some interviewees noted that the online pivot at PUC Engineering benefitted from the MOOCs that many of the school's faculty had previously prepared; although never intended for delivery to undergraduates in the school, much of this material could be easily adapted to curricular courses and activities.

Interview feedback pointed to a number of benefits to student learning of this online pivot. Levels of student engagement with the online courses and materials were reported to be higher than pre-2020, with many students reviewing online materials multiple times in advance of synchronous classes. A "*closer relationship between professors and students*" was also reported, with a wider range of students willing to ask questions and post ideas through anonymous 'chat' functions than would have been willing to do so in person within a lecture theatre.

2.3. Addressing the challenges of emergency teaching

Interview feedback pointed to two major challenges faced by the school in its online pivot.

The **first challenge** was in student evaluation: the practicalities of administering mid- and end-of-semester synchronous tests and examinations, particularly where many students experienced intermittent or slow internet access. In response, the school moved away from large-scale exams at the mid-point and end of semester and instead instigated continuous assessments through, for example, weekly testing of students.

The **second challenge** was around students' mental health: both their exhaustion from dedicating long days working onscreen and their anxiety in coping with the uncertainty and impact of both the national social unrest and the COVID-19 pandemic. The Dean of the school instituted weekly meetings – open to the full undergraduate community – to allow students to raise and discuss the problems they were

facing. Mid-semester student surveys of a number of courses, including Engineering Challenges, captured feedback on students' wellbeing and ability to work. As a result of the feedback received, a series of changes and adjustments were made to alleviate these difficulties. These included the introduction of a 'recess week' in the middle of the fall 2020 semester, where no additional work was set, and the appointment of additional psychologists to the school to offer students one-to-one mental health support.

3. Impact of emergency teaching on PUC's educational approach

The school's experience during its two periods of emergency online teaching – due to the social unrest in late 2019 and early 2020, as well as due to COVID-19 – is likely to have a considerable impact on its educational approach once face-to-face learning again becomes possible. As outlined below, four sets of changes are currently under discussion:

- **pedagogical approach.** Following the lifting of the COVID-19 restrictions, it is envisioned that many of the online delivery modes and associated pedagogical approaches will be maintained. For example, many courses will retain a flipped classroom approach, where online material will be delivered in advance in the form of short videos, and synchronous in-class time is dedicated to group-based or peer-to-peer learning. Courses involving hands-on learning will also retain a strong emphasis on 3D modelling and testing, as mechanisms to allow students to refine and iterate ideas further before embarking on the physical production of a functional prototype. In addition, much greater use will be made of videoconferencing when asking students to connect and interact with external stakeholders.
- **connectivity with society.** The school is looking at ways in which it can position itself even more explicitly – in both its research and educational activities – as an engine for positive societal and economic change in Chile. PUC Engineering is looking at ways to further build its external connectivity and take students' learning into the community.
- **'care' for students.** Since 2018, PUC Engineering has placed an increasing focus on 'care' for students – through offering personal support and establishing an 'emotionally safe' environment for learning – with a line item of the school's budget dedicated to these activities. The school's Engineering Education Unit is also conducting research into the 'care' practices currently delivered by the school and how these might be developed in the future. The experience of COVID-19 and emergency teaching has brought the issues of students' mental health into sharp focus and interviewee feedback suggested that the issue of 'care' for students would only become a more prominent component of the school's approach in the future.
- **graduate attributes.** The school is considering a reform to its stated graduate attributes, with a new and explicit focus on building students' resilience and ability to navigate uncertainty and change in both their personal and working lives.

Source of evidence

The case study for PUC (including Part A, the review of the Engineering Challenges course, and Part B, this review of the 'institutional context') drew upon one-to-one interviews with 12 individuals: PUC Engineering Dean; the PUC Engineering Director of Engineering Education; two leaders from the Engineering Challenges course; and eight PUC Engineering undergraduates (which included four undergraduate teaching assistants).

Further information about the methodology for development of CEEDA case studies is given at the project website[1].

[1] CEEDA case study structure and approach: https://www.ceeda.org/about#case-studies