Inclusive Teaching & Learning Case Studies in Engineering, Architecture & Affiliated Disciplines

Case Studies from
UCD College of Engineering & Architecture

UCD Access & Lifelong Learning
Edited by Lisa Padden, Conor Buggy & Elizabeth Shotton

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- Padden, Lisa, Tonge, Julie, Moylan, Therese and O'Neill, Geraldine (Eds) (2019) Inclusive Assessment and Feedback: Universal Design Case Studies from IADT and UCD. Dublin: UCD Access and Lifelong Learning.
- Kelly, Anna and Padden, Lisa. (2018) Toolkit for Inclusive Higher Education Institutions: From Vision to Practice. Dublin: UCD Access & Lifelong Learning
- Padden, Lisa, O'Connor, John and Barrett, Terry Eds. (2017) Universal Design for Curriculum Design: Case Studies from UCD. Dublin: UCD Access & Lifelong Learning

Welcome

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The Editors

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Lisa Padden

Dr Lisa Padden, Programme Manager, UCD Access & Lifelong Learning.

University for All is UCD's whole-institution approach to student inclusion encompassing strategy and policy, teaching, learning and assessment, student supports and services, the built environment and technological infrastructure. Lisa worked with AHEAD to develop the Digital Badge for Universal Design in Teaching & Learning as part of the National Forum's Professional Development Framework. Lisa has edited two previous collections of UDL Case Studies and also co-wrote the Toolkit for Inclusive Higher Education Institutions. Lisa's research interests include Universal Design for Learning, widening participation, equitable access to education, and student inclusion.

Conor Buggy

Dr Conor Buggy Assistant Professor of Occupational and Environmental Studies, UCD Centre for Safety and Health at Work.

Conor is a scientist / engineer that has over a decade of academic experience at UCD and is the Programme Director for the Masters in Occupational Safety and Health at the UCD Centre for Safety and Health at Work. He is also an Adjunct Lecturer (Climate Change and Development) at TCD. Conor has a number of college and university teaching awards (individual and team) and has a keen interest in pedagogy innovation. Prior to academia Conor worked in civil engineering project management with a focus on environmental sustainability and construction management. Conor's primary research interest lies in the impact innovative education has on organisations to promote positive behavioural change and safety culture. Additional research focuses on the health and wellbeing of marginalised communities and healthcare accessibility. Conor has also been heavily involved in initiatives supporting equality, diversity and inclusion in UCD as well as for the National LGBT Federation (NXF).

Elizabeth Shotton

Associate Professor Elizabeth Shotton, UCD School of Architecture, Planning & Environmental Policy.

Elizabeth is a registered architect and educator, who has taught construction technology and design studio at UCD since 2003, with an emphasis on sustainable building and development. Her research is closely linked to teaching, with a focus on the sustainable use of material resources through advances in materials, construction technologies and design processes. She is currently leading a study on Ireland's Minor Harbours (https://digital.ucd.ie/view/ucdlib:255666), examining the evolution of maritime engineering in small harbours along the coast of Ireland from the seventeenth century to the present. Until September 2020 Elizabeth represented the College of Engineering & Architecture as Vice Principal for Equality, Diversity & Inclusion. As part of the role she successfully chaired the College application for the Athena Swan Bronze Award in 2019, involving a gender equity review of the six schools within the college and chaired the College Gender Equality Implementation Team.

Foreword

Mark Rogers

Professor Mark Rogers is the Registrar and Deputy President of UCD prior to which he was Dean of Science. He graduated from Trinity College Dublin with a first-class honours degree in genetics and completed a PhD in genetics in the University of Glasgow. Awarded fellowships from the European Molecular Biology Organization (EMBO) and the John Douglas French Foundation for Alzheimer's Research, he spent five years as a researcher in prion diseases in the Laboratory of Nobel Laureate Professor Stanley Prusiner.

Professor Rogers' research is in the field of Scrapie in sheep and Bovine spongiform encephalopathy (BSE) in cattle. He successfully licensed immunodiagnostic technologies that have been employed in BSE diagnosis, resulting in over €2 million in royalties accruing to UCD.

With over twenty-years teaching experience at all levels from undergraduate to PhD supervision, Professor Rogers strongly promotes a student-centred and student-led approach to education that encourages independent learning. As Dean of Science and subsequently as Registrar and Deputy President, Professor Rogers has recognised the need for research-informed and research-led educational programmes. Focussing on enhancing opportunities for students, he has simplified entry routes, promoted a student-centred approach across the University, has moved the University to an outcomes-based curriculum focus.

Foreword

Inclusive teaching in Engineering and Architecture

Diversity and inclusion are core to UCD values. We seek to attract students from a wide range of social and economic backgrounds and students who reflect the true diversity of the country. And as a global university, UCD attracts international students from over 100 countries. This diversity enriches our campus, and the experience of our students. The University's strategy 2020-2024 'Rising to the Future' also recognises the importance of inclusion and diversity, in seeking to "provide an inclusive educational experience that defines international best practice and prepares our graduates to thrive in present and future societies."

However, an inclusive educational experience will not be achieved by simply creating diversity in the student body. It requires that we adjust our approach in everything we do to support and encourage our students' success. We have clearly articulated in our strategy, and further emphasised in our Education and Student Success strategy, that our goal is to "equip all our educators with the tools and resources required to embed Universal Design for Learning on an institution-wide basis.

It is in this context, that I was delighted to support the pilot study in inclusive teaching in the College of Engineering and Architecture which brought together a group of committed faculty and staff to explore the potential for inclusive design in professional disciplines. The case studies present a number of insights: inclusive design can be applied even where curriculum is regulated by professional bodies, the importance of flexibility in modes of learning and assessment, the role of clear communication with students on how a module will be taught and assessed, and to recognise the range of preferred learning styles of students and how learning modes can adapt to those styles. An important and perhaps counterintuitive outcome is that this shift in approach does not have to lead to a heavier teaching and assessment burden for faculty or students, and in fact, with careful and thoughtful planning, it can reduce the work associated with assessment and feedback.

While the pandemic disrupted the pilot, perhaps making it more challenging to distinguish the impact of the enforced move to online teaching and learning from those associated with promoting inclusive learning directly, it also provided for, even necessitated, more ambitious and innovative adaptation of modules. The pilot further provides a portfolio of approaches to aid in the inclusive design of teaching. I look forward to the addition of modules across the College and more widely in the University using the Universal Design Framework so that we truly can deliver on the ambition of our strategy.

Professor Mark Rogers,
Registrar and Deputy President, UCD

Aoife Aherne

Professor Aoife Ahern is the College Principal for the College of Engineering and Architecture, and Dean of Engineering in University College Dublin. She is the first female Dean of Engineering and the first female College Principal of Engineering and Architecture in UCD, and leads the largest Engineering and Architecture School in Ireland.

Aoife graduated from Trinity College Dublin (TCD) with a first class honours degree and gold medal in civil engineering in 1998. From there, she went on to do a PhD in University College London (UCL), where she was in receipt of a British Council Chevening Scholarship and a UCL scholarship. Her research looked at how new public transport infrastructure could promote a shift from car to sustainable modes.

Prior to joining UCD, she was a lecturer in the School Civil, Structural and Environmental Engineering in TCD from 2000-2003. She joined UCD as a lecturer in September 2003. From 2013-2016, she was Head of Teaching and Learning in the Schools. She was the Head of School in the School of Civil Engineering, from 2016-2019, and the first female head of School in the College of Engineering and Architecture in UCD. Her research interests are in 2 main areas: creating opportunities and infrastructure for sustainable, accessible and inclusive travel and critical thinking in education, and she has been involved in both national and international projects in both areas. Most recently, she was involved in a large-scale European Horizon 2020 project looking at how critical thinking could be introduced into university curricula for different disciplines, including, amongst others, economics, engineering and medicine.

She is a Fellow of the Institute of Engineers of Ireland, and a Fellow of the Irish Academy of Engineering.

Foreword

The College of Engineering and Architecture was awarded the Athena SWAN Bronze Award in 2018, an achievement of which the College and its constituent schools are very proud. However, the conferring of this award marks the beginning of a process of change in the College, to improve those aspects of the College that do not lead to better gender equity, and to ensure that we implement the Action Plan that was developed during the Athena SWAN self-assessment process.

One element of that Action Plan was to implement activities that would create a more inclusive environment for all our students, as it had been identified during the self-assessment that this was an aspect that was lacking in the College and schools. As such, the College embarked upon a pilot study, involving all the Schools, to introduce inclusive teaching into our professional disciplines. The pilot study ran over 2 years and resulted in 6 case studies. Three of the 6 schools within the College were included in these case studies: the School of Architecture, Planning and Environmental Policy, the School of Civil Engineering and the School of Electronic and Electrical Engineering, with both postgraduate and undergraduate modules represented.

Within each case study, the principles of Universal Design were implemented, and feedback was collected from students to assess communication, engagement material, learning support and assessment.

The case studies have a diverse range, from looking at how to use inclusive, collaborative working with environmental engineers to getting students to think about inclusivity in their own designs of urban spaces, while encouraging different learning styles; from using a diversity of technological solutions, such as video and bespoke textbooks, to promote accessible learning for undergraduate electronic engineers to helping students to bring their own experiences and agency to their learning in design classes.

The lessons learned from these diverse case studies have been very important. In particular, it is important that students understand what is being done and why, and comprehend the module structure. These ways of learning may be new for many students and clarity on what they learn, how they will learn and how will they will be assessed is vitally important. For assessment, flexibility of assessment and projects is most likely to recognise and take account of the different learning styles of students and create a more inclusive environment for those students.

Going forward, the challenge for the College now will be to bring the important lessons that have been learned to a wider audience within the College and to facilitate the introduction of more inclusive teaching practices, engagement, and assessment more broadly across all our modules. The ambition within the College is to create an environment where all our students, in Engineering and Architecture, can learn, which is especially important in our increasingly diverse community.

Professor Aoife Aherne,
College Principal and Dean Of Engineering,
UCD College of Engineering and Architecture
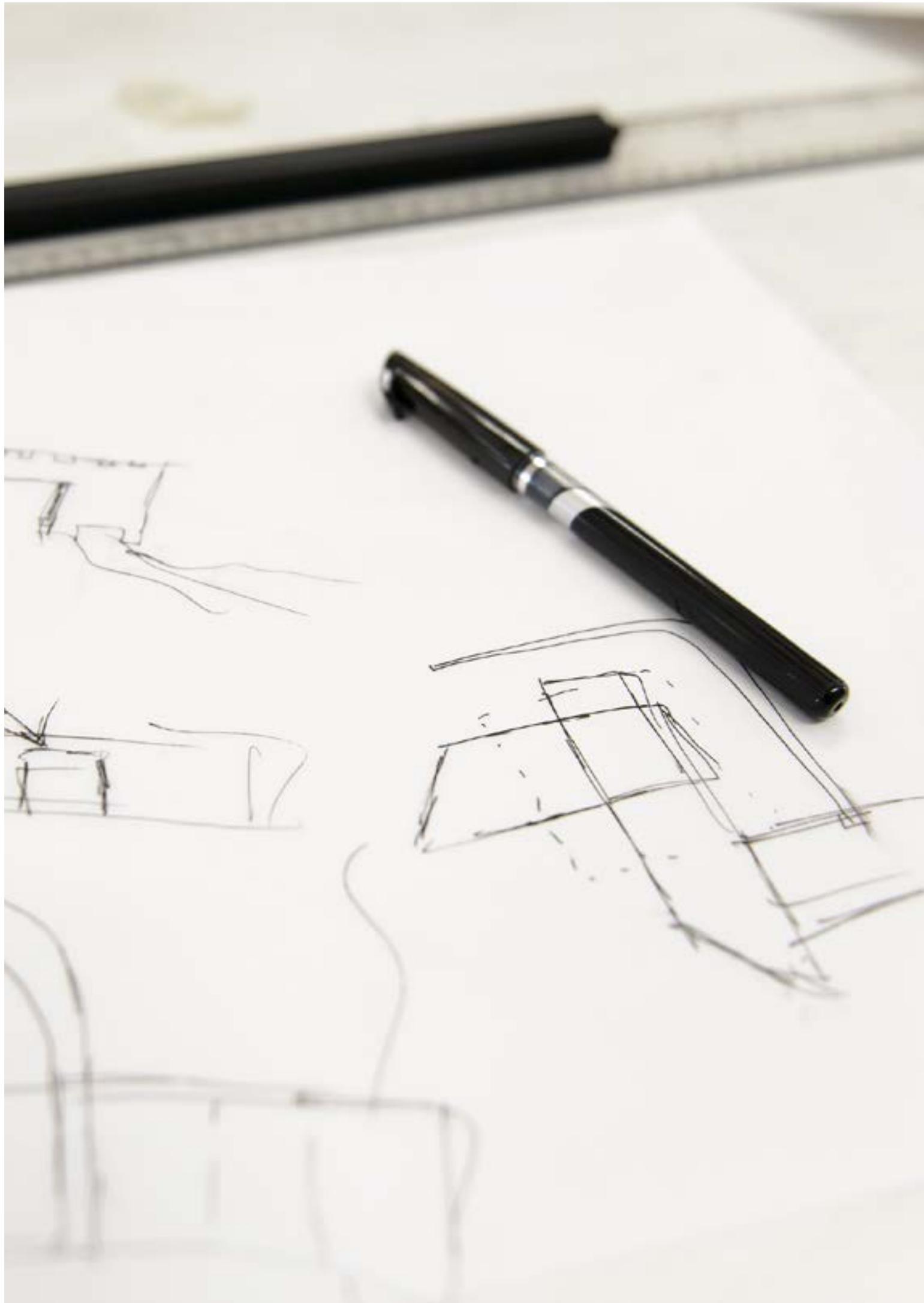
Introduction

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Introduction

Early in the spring of 2018 the College of Engineering & Architecture at University College Dublin began the Athena SWAN self-assessment process. This involved reviewing both the college structures as well as the six schools within the college, five of which were engineering sub-disciplines and the sixth representing the disciplines of architecture, planning, landscape architecture and environmental policy, all of which encompassed a large range of programmes (Table 1). It was an intensive 18 month process, undertaken by a diverse committee of 22 individuals representing the college and six schools with cohorts recruited from across the academic, professional, and technical staff as well as the student body. The work resulted in the award of an Athena SWAN bronze designation for the College and its schools in the autumn of 2019. This is when the real work began under the leadership of the College Principal Aoife Ahern, to implement the lengthy Action Plan developed by the self-assessment committee.

The Athena SWAN programme is intended, in the first instance, to lead to better gender equity in academic institutions, for both students and staff. In this context the review was critical for the college as, despite a relative gender balance in some schools, particularly the School of Architecture, Planning & Environmental Policy, many of the engineering schools lacked this balance in both staff and student cohorts and, even in well-balanced schools, some amount of gender discrimination was reported by staff and students. Thus many of the action points were targeted to address these issues. What was unexpected, given the underlying mandate of the Athena SWAN programme and thus its review structures, was an underlying sense of exclusion expressed by some students in surveys and focus groups, which was not entirely based on gender. It was this student feedback that inspired this pilot study on Inclusive Teaching in the College of Engineering & Architecture.

The principles of inclusive teaching are not new and have for the most part been borne from the principles of universal design, which were first developed to address the learning needs of students with disabilities. The tactics used to support this cohort of students have been shown to support all students, by offering flexibility in how students can develop and demonstrate their learning. UCD Access and Lifelong Learning has been at the forefront of developing and promoting these teaching and learning principles, and have published previous case studies on the topic of inclusive teaching and learning (Padden et al. 2017; Kelly & Padden 2018; Padden et al. 2019), which served as a baseline for how we would begin to shape our own study. The Toolkit for Inclusive Higher Education Institutions, published in 2018 (Kelly & Padden 2018) was especially useful to our initial discussions. Also of critical value was the participation of Dr Padden, editor of each of these case study publications, and Dr Conor Buggy, involved as a participant in both the 2017 and 2019 case study projects on Universal Design for Curriculum Design and Inclusive Assessment and Feedback respectively, who graciously agreed to participate in our study as part of the coordination team.

Table 1: Summary of Degrees

School	Undergraduate	Postgraduate Taught	Postgraduate Research
Architecture, Planning & Environmental Policy	• BSc (Architectural Science) • BSc (Landscape Architecture) • BSc (City Planning & Environmental Policy)	• Masters of Architecture • Masters of Landscape Architecture • Masters in Regional and Urban Planning • MSc Environmental Policy • Professional Diploma (Architecture) • MArchSc (Conservation and Heritage) • MArchSc (Sustainable Building, Design & Performance) • MSc (Urban Design & Planning) • MArchSc (Landscape Studies)	Masters of Urban & Building Conservation • MSc (Research) • MLitt • Phd
Biosystems & Food Engineering		• ME (Biosystems & Food Engineering) • MSc (Sustainable Energy & Green Technologies) • MSc (Environmental Technology) • MEngSc (Food Engineering)	MSc (Research) PhD
Chemical & Bioprocess Engineering	• BE (Chemical & Bioprocess Engineering)	• ME (Chemical & Bioprocess Engineering) • MEngSc (Biopharmaceutical Engineering) • MEngSc (Chemical Engineering)	
Civil Engineering	• BSc (Civil Engineering) • BSc (Structural Engineering with Architecture)	• ME (Civil, Structural & Environmental Engineering) • MEngSc (Structural Engineering) • MEngSc (Water, Waste & Environmental Engineering)	
Electrical & Electronic Engineering	• BE or BSc (Electrical & Electronic Engineering) • BSc (Biomedical Engineering)	• ME (Electrical Energy Engineering) • ME (Optical Engineering) • ME (Biomedical Engineering) • MEngSc (Electrical and Electronic Engineering) • MEngSc or ME (Electronic and Computer Engineering)	
Mechanical Engineering	• BE or BSc (Mechanical Engineering)	• ME (Materials Science & Engineering) • ME (Mechanical Engineering) • ME (Engineering with Business) • ME (Energy Systems Engineering) • MEngSc (Engineering Management) • MEngSc (Materials Science and Engineering)	

☐ Common first year entry

What becomes clear from a review of these documents, and the general literature on inclusive teaching and learning, is that the vast majority of the research in this field has been in arts, humanities and social sciences. The educational content of professionally-accredited programmes in engineering, architecture, landscape architecture and planning are, in contrast to most humanities-based subjects, very precisely governed by their affiliated professional bodies, leaving limited scope for evolving, altering or adding to the core content required to be taught.

Engineering, by its nature, is quite a difficult subject matter to tackle, as its content is science-based and provides little obvious scope for addressing inclusivity through a change in content. There is an absence of research, guidance and case studies in the field of engineering to draw upon when considering how best to make teaching and learning more inclusive. In contrast, the disciplines of architecture, landscape architecture and planning are driven by problem-based learning in design studio settings. Problem-based learning is one of the hallmarks of making learning more inclusive, often discussed in the literature as a contrast to exam-based assessments of learning. Yet design studio culture can create its own very specific issues relative to inclusivity, not least of which is the culture of the critique. Relative to the dearth of research in engineering subjects, there have been sporadic offerings in the design fields, such as "Case Study 10: A Scaffolded Approach to Teaching Design and Design Techniques to Reluctant Designers" from the 2019 Inclusive Assessment & Feedback (Padden et al. 2019) as well as offerings from architecture schools further afield (McClean & Hourigan 2013).

Nevertheless, authoritative guidance is slight, not only for engineering but for design-based disciplines as well. It was on this basis that this pilot study on inclusive teaching in our professional disciplines was undertaken. We began our study by first introducing the concepts of inclusive teaching and learning through short presentations to school committees and the College Council in the spring of 2019, with the gracious assistance of Dr Anna Kelly, Director, UCD Access & Lifelong Learning, and Dr Conor Buggy, from the UCD School of Public Health, Physiotherapy and Sports Science, who had considerable prior experience in this field of teaching and learning. Development of the initial structure of the intended study was a collaboration between the College Vice Principals (VP) for Equality, Diversity & Inclusion (EDI), (Associate Professor Elizabeth Shotton) and Teaching & Learning (T&L), (Associate Professor Amanda Gibney), Dr Anna Kelly and Dr Lisa Padden from UCD Access & Lifelong Learning, and Dr Conor Buggy. The College Widening Participation representatives, Dr Mark Flanagan and Associate Professor Brendan Williams, and the new College VP of Teaching & Learning, Associate Professor David Timoney, helped this group to finalise the shape of the pilot study workshops. The Office of the Registrar and UCD College of Engineering and Architecture co-funded the pilot study.

Recruitment of volunteers to participate in the study began in earnest in the autumn of 2019, with considerable assistance from the College VP of Teaching & Learning and the Teaching and Learning representatives for each school. At its inception we had hoped to have two modules from each of the six schools in the college. By November 2019 we had successfully recruited 12 modules into the pilot study, representing all six schools, though with an over-representation from the School of Architecture, Planning & Environmental Policy, where 4 module coordinators were eager to contribute. The study supported the volunteer module coordinators in identifying critical issues to address in a series of 4 workshops throughout the course of the pilot in addition to surveys pre - and post-module changes. These activities were supported with individual discussions largely facilitated by Dr Lisa Padden and Dr Conor Buggy.

Although our first workshop, to introduce the principles of inclusive teaching and learning, proceeded as planned in January 2020, the Covid-19 pandemic resulted in a shift to online workshops after March 2020. Though most volunteers remained engaged, the pressures of the pandemic on teaching led to several participants withdrawing from the study, though a number intend to complete their studies in the coming year. The study also gained traction among other module coordinators who are interested in testing these principles in their own modules, so the pilot will be extended for at least an additional year. For this reason the current publication, covering six of the case studies, has been produced in digital format to allow for additional case studies to be added in coming years.

The final set of six case studies represent contributions from the School of Civil Engineering (2), the School of Architecture, Planning and Environmental Policy (3), and the School of Electrical and Electronic Engineering (1), the last two schools being 2 of the 3 largest schools in the College. Of these, 3 modules are at postgraduate taught level, with a class size of 30 students or less, 2 are undergraduate modules with class sizes of 50-70 students, and one is an undergraduate module in architecture and civil engineering with more than 150 students. The diversity of class sizes helps to position the lessons learned relative to the cohort of students taught, the level at which they are taught, as well as the student mix, which provide readers with a range of solutions tailored to very specific contexts.

Module	Discipline	Coordinator	Class Size
CVEN10060 The Engineering and Architecture of Structures 1	Civil Engineering Architecture	Dr Daniel McCrum Dr Jennifer Keenahan	155
ARCT10020 Into Practice	Architecture	Daniel Sudhershan	65
CVEN20030 Environmental Engineering Fundamentals	Civil, Structural and Mechanical Engineering	Dr Sarah Cotterill	56
ARCT40660 Urban Design	Open to all disciplines	Dr Miriam Fitzpatrick	30
EEEN40620 Biomedical Imaging	Biomedical Engineering	Dr John Healy	18
ARCT40870 Design Build/Agency	Civil Engineering Architecture	Tiago Faria	30

Impact of Covid-19

The urgency with which academics had to alter and adapt their teaching style as the global pandemic came into being was both disruptive and transformative at the same time. As lockdowns commenced globally, higher education by necessity, for its continuation, became remote and online at a time when most academics were not prepared for online teaching. Students in desperate need for some semblance of normality in their lives at a time of monumental global and local disruption, looked to their teachers to continue teaching in a manner that would work for them. While it may be considered somewhat selfish and naive of students to think that the teaching role of their universities could continue exactly as normal but in an online format, for most academics that is what was strived for – allow for as much normality as possible at a time when everything academics did from teaching to research to administration was now being done from kitchens, living rooms, bedrooms and sheds that had a Wi-Fi connection. It must be acknowledged that academics were however, for the most part, without the collegiality and in person support needed on a day-to-day basis to deliver effective and impactful teaching that would normally be at their disposal. Academics were in their homes juggling their teaching commitments alongside their family commitments at a time of great fear and anxiety in societies that were effectively locked down for months on end.

In such disruptive times, risk-taking alongside innovation and ideation can bring forth new and surprising solutions that can bring novelty and engagement in ways never thought possible. For teaching, the pandemic and the necessity to keep students engaged with their studies and perhaps a lifeline to normality allowed academics to take risks and experiment with their teaching and their assessment in ways that they may never have had the opportunity to do before the pandemic. In many ways the need for urgency to implement changes to teaching delivery and assessment procedure may have removed some of the more onerous bureaucratic oversight procedures which are usually considered when new pedagogies and assessment methods are proposed under more normal circumstances. Alacrity allowed for adaptations rooted in necessity rather than aspirations of innovation, but innovate they did nonetheless.

As academics moved to ZOOM, MS Teams, Google Hangouts and Collaborate to interact with their students, to deliver teaching as well as pastoral care, many academics were flung headfirst into an emergent live online teaching process of which most had no experience. Some academics were well used to delivering pre-recorded e-lectures using various types of software including Camtasia and Articulate Storyline as well as the simpler recording function in MS PowerPoint, but for the most part most academics, even those with online pedagogical skills and knowledge were inexperienced with real-time synchronous online teaching. Many academics thrived while some struggled to get to grips with the necessity to be skilful with online live delivery.

Given time, most academics would be capable of prodigious and wonderful online lectures; however, time was the resource academics globally did not have. The pandemic necessitated a virtual overnight switch to online teaching which meant for many academics, panicked usage of online technologies without necessary support to deliver effectively. However, the students for the most part were understanding and empathetic as it was as new to their learning as it was to their teachers. In effect both teacher and student were learning about synchronous online learning as a duality with teaching and learning becoming so intermingled that for most people involved it was exhilarating, exhausting, anxiety inducing and satisfying all at the same time. Academics had to learn that in-class pedagogies are difficult to replicate in online formats even when the software allows for breakout rooms and chat functions. Frenzied upskilling in online pedagogies and new forms of assessment that didn't rely on examination halls was the discussion of choice at faculty teaching and learning committees.

For many students the realisation that their lecturers would now know their names individually by their nametag on the screen and the fact that they could no longer hide at the back of the classroom (even turning off the camera proved ineffective) to avoid class participation led to the realisation in many students that learning is not a unidirectional and anonymous process, there has to be more interaction between teacher and students. The academics are not just there to funnel information in, they are there to guide the student on their learning journey. That interaction allowed for greater equity in the online environment whereby students that may have been reluctant to engage in a classroom now found themselves somewhat more protected by the virtual space and they could ask questions in chat functions more easily, they could raise their virtual hand and express themselves by turning on their mics. Academics also forget how easily they can be intimidating to their students, but students now had the opportunity to ask questions in a more comfortable environment and seeing academics fumble and fuss as they attempted to navigate their teaching in an unusual and unfamiliar environment somehow made them more human to their students.

As academics learned to get to grips with the software and the reality that this online new normal would be present for quite a while, many realised they also had an opportunity to do some updating of their learning materials and assessment strategies which they may not have had the chance to do otherwise. Many students found they had more time to absorb material with it being online, live synchronous lectures were often supplemented with more specified learning activities, recorded e-lectures and readings than academics would previously have provided. Many academics felt that they needed to give a lot more learning materials to students than they normally would as they feared students were missing out on peer learning from their fellow students so much they could be falling behind. In terms of assessment, academics were able to move away from more traditional forms of assessment such as in person exams in favour of online timed open-book examinations, presentations, learning portfolios and projects. This allowed students to demonstrate their learning outcomes in more impactful and authentic ways than merely regurgitating at speed in a three-hour essay paper in a stress-filled examination hall.

Academics and students were also forced to engage with one another in ways that were inconceivable for many prior to the pandemic. Delivering lectures from home with cats walking across cameras, children and partners making appearances, untidy bedrooms, attics and sheds being used for teaching and learning – all allowed academics and students to become more authentic to one another. They experienced each other's lives much more intimately than thought possible as the lines between home and work and study blurred through the isolation and distancing from one another. The distinct possibility exists that many academics and students became more aware of each other simply as fellow citizens struggling through the pandemic rather than as the defined roles of teacher and pupil. In effect online teaching as a result of the pandemic may have humanised higher education at a time it really needs to look at itself and its way forward.

The cork cannot be put back in the bottle and moving forward many academics will now see the benefits of online teaching and how they can incorporate it into their teaching and assessment to create better and more interactive learning environments for their students. Students will see how online learning can give them new opportunities to engage in learning and engage with their teachers and fellow students in a more equitable learning space where all involved can learn together. From a pedagogical perspective the pandemic may be the greatest shake up to teaching, learning and assessment in recent decades. The urgency of adaptation in the short-term has led to long-term impacts on teaching and learning demonstrating that the virtual learning environment and online learning is not only here to stay but will be an important and sustainable part of higher education moving forward.

Universal Design for Learning

Universal Design for Learning (UDL) is based on research in neuroscience and fundamentally espouses flexibility in teaching, learning and assessment design in order to provide equitable educational experiences to our diverse student populations. In recent years Universal Design for Learning has become increasingly popular in Higher Education Institutions, both in Ireland and internationally. UDL is now embedded in many policies across Ireland, including the Guiding Framework for Embedding Study Success developed by the National Forum for the Enhancement of Teaching & Learning in Higher Education (2021). As access and widening participation has achieved significant success we have seen increasing numbers of students with disabilities, mature students, students from socio-economically disadvantaged backgrounds gain access to higher education as a result of a number of successful programmes to improve access for all groups traditionally underrepresented in Higher Education (HEA, 2018).

In order to take access and inclusion to the next stage, the National Access Policy recommends that "the next step is to integrate the principle of equity of access more fully into the everyday life of the HEIs so that it permeates all faculties and departments, and is not marginalised as the responsibility of the designated access office" (HEA, 2015, p. 25). However, the pace of success with improving access to higher education for all students has not been matched with the pace of change to everyday educational practice in Ireland's Higher Education Institutions. In most cases HEIs have remained wedded to traditional modes of lecturing and timed examinations. In fact, it was those most wedded to these traditional forms of teaching and assessment who had the greatest challenge when we were all forced to adapt when all teaching went online. UDL provides a necessary and practical framework to increase the rate of change to adapt our universities to be inclusive of all of our communities.

The UDL framework is based primarily on flexibility and the key principles are to provide multiple means of:

Engagement

Representation

Action and Expression
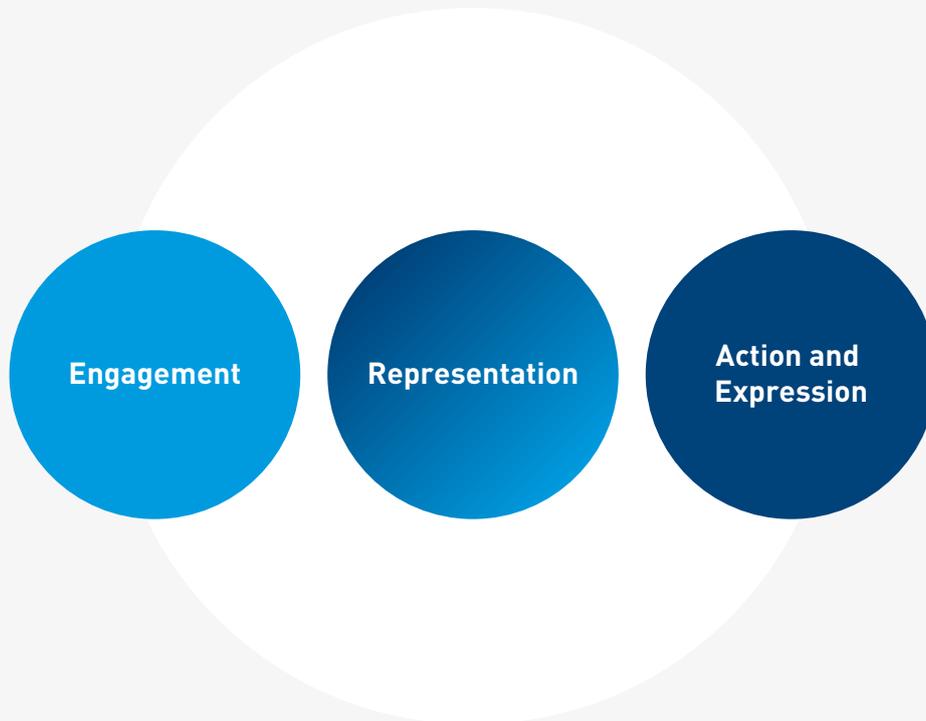
UDL does not ask educators to throw out all of their practice and start again. Most good practice can be viewed through the lens of UDL including, for example, the problem-based learning approach discussed above. The first step in embedding Universal Design for Learning is to engage in serious reflection which the methodology of this study facilitated for participants.

Methodology of Study

This methodology for this pilot programme was developed by the project team in collaboration with the VP EDI and VP T&L from the UCD College of Engineering and Architecture and the College Widening Participation Representatives.

Pre and Post Student Feedback

UCD has a longstanding student feedback system where students are asked to answer five core questions using a likert scale. Lecturers also have an opportunity to add to these questions. These questions are necessarily broad and student engagement in the process is not optimal so it was determined that additional feedback would be required to aid in the targeted redevelopment of the modules in this pilot study and to more accurately measure the impact of the redesigns on student experience and perception of the modules. Feedback was gathered before redesign to ascertain student experience and also after redesign to establish the impact of changes implemented. The questions were formulated based on the principles of inclusive teaching and learning in the Universal Design for learning Framework as outlined above (CAST, 2018).

Feedback Questions

1. **Clear communication:** Were the learning outcomes and rationale for the learning modes (projects, presentations, discussions, labs, etc) and assessments made clear?
2. **Engaging students:** Did you feel able to participate in class and other learning activities, or were there barriers to engagement?
   Flexibility:
3. Was the teaching material and its delivery (lectures, online material, in-class discussions, etc.) sufficiently diverse to support your learning?
4. Was learning supported by a variety of learning modes (projects, presentations, discussions, labs, etc), or do you feel there were other ways to enable your learning that could be offered as alternatives?
5. Did the assessment strategy build in flexibility and variety to address different learning styles?

For modules which took place in Autumn 2019 the feedback sessions were conducted in person by members of the project team with the module coordinators outside of the classroom to ensure students understood the confidentiality of the process and to encourage full and frank provision of feedback. Students were provided with a short input from the project team covering the context of the pilot project and explaining the five questions which were asked and students were then provided with post-its on which to provide their answers.

We planned to repeat this post-it survey for all before and after feedback sessions. However, the impact of Covid and the move to remote learning meant that we had to switch to using an anonymous online survey embedded in the Virtual Learning Environment and emailed to students. To replace the explanation provided in classes we created a video which provided the context of the pilot and explained the questions to student participants. As expected, engagement with this online survey was relatively low compared to the full class engagement we saw in our in-person sessions which were built into classes. As the pilot progresses with additional modules we hope to return to in-person feedback sessions.

Redesign of Modules

The feedback gathered was used as the basis for the redesign of the modules. Feedback was provided digitally (in-person feedback was transcribed) with any identifiable information removed. The feedback was provided to module coordinators in advance of a meeting with the project team to discuss the feedback and explore ideas for redesigns which would address any identified areas for improvement. Module Coordinators also based their redesigns on broader student feedback and their own observations and learning. These one-to-one meetings allowed for the feedback to be discussed in context and module coordinators were tasked with coming up with specific ideas for changes to the next iteration of their modules. To assist with this development we hosted four workshops which included an input on Universal Design for Learning and facilitated brainstorming between module coordinators. Ultimately the changes were implemented in the following academic year, although the interruption of Covid had an impact on which changes could be made as all teaching moved online.

Case Studies

In this publication you will find six case studies describing the key changes made to teaching, learning and assessment in nominated modules as a result of this pilot project. We plan to add to these case studies as the pilot expands its reach in the coming years and those changes put on hold due to Covid are implemented. Our goal in providing these studies is to demonstrate real world evidence-based examples of inclusion in these disciplines. The case study authors provide numerous practical and replicable approaches which other educators could easily embed in their own teaching to embed inclusion. You will find rubrics, activities, assessment briefs and many other items which you are free to adapt and use in your own teaching. We encourage you to look at all of these case studies as you'll find useful take-aways in each one.

Case Study 1

**Daniel McCrum &
Jennifer Keenahan**

Recognising stereotypes and the shared habitus of Engineers and Architects: Developing interdisciplinary teamwork and communication skills for first year students in an inclusive environment.

In this case study Dr Daniel McCrum and Dr Jennifer Keenahan outline a successful approach to interdisciplinary teaching which focuses on assisting the student to develop effective communication and interdisciplinary team working skills. Aligned closely to the skills required by both architects and engineers in practice this module seeks to address an area often overlooked. This case study offers an excellent example of Universal Design in practice using a problem-based learning approach in a module with a very diverse student body. The impact of the changes made in this module resulted in high attendance, more active learning and a comprehensive introduction of flexibility to learning modes and assessments.

Case Study 2

Daniel P. Sudhershan

Using inclusiveness to introduce professionalism in the early stages of a career

In this case study Daniel P. Sudhershan outlines his approach to inclusion in a module which seeks to introduce first year architecture students to the notion of being a professional and the professional ethics which form part of any professional role. This module promotes collaboration and an interdisciplinary focus through group work, peer review, collaborative learning, active learning as well as reflective writing. This case study outlines the changes made to address issues often encountered by students across every discipline i.e. lack of clarity around assessment and engagement levels below those desired or expected. In particular, the approach to peer review and feedback is very useful here with interesting examples of that peer review process included.

Case Study 3

Sarah Cotterill

Diversity of teaching and assessment modes in Environmental Engineering

In this case study Dr Sarah Cotterill outlines how she successfully expanded the opportunities for student learning in a stage two engineering module through the inclusion of collaborative group work and practical-based applications of calculations. If you are seeking to move your teaching beyond lectures, this case study provides a roadmap to do this while keeping inclusion at the heart of your practice. The methods introduced (e.g. workbooks, co-developed rubrics and virtual labs) are replicable with varying levels of time and the case study provides clear evidence of an extremely positive impact on student engagement and learning.

Case Study 4

Miriam Fitzpatrick   **Street Life, how to study it and improve it.**

In this case study, Dr Miriam Fitzpatrick, demonstrates how inclusion and accessibility can go beyond learning modes and assessment to the very content being taught. In the urban design module described you'll see how students were engaged, learning through lectures on urban design and methods of observation. Students documented life on a street within easy reach of their home during lockdown and gained agency by suggesting design interventions and improvements from their close-in view. The module performed a twin role making public space more accessible while encouraging choice in representation, action and learning styles. This case study demonstrates how inclusive transformation of teaching, learning and assessment can link authentically with content and subject.

Case Study 5

John Healy

Diversifying assessment: project based learning in a module

In this case study, Dr John Healy, outlines the range of changes he made to a stage 4 module offered to both undergraduate and graduate students. The transition from a previously lecture driven mode of delivery to a focus on inclusion and accessibility both in delivery and materials is described with many useful artefacts and examples. Using technology solutions, you'll learn about how interaction and engagement was enhanced for all students using a bespoke textbook, MATLAB code demonstrations including video, and video lectures. This case study also outlines significant changes to assessment, some of which were as a result of covid-related restrictions. Again, group work is the focus here and useful reflections on size and nature of groups is provided.

Case Study 6

Tiago Faria

Seeking to engage students in their work, beyond the reward value of a marking system

In this case study Tiago Faria outlines a practical, uniquely authentic multi-discipline module which gives students hands-on experience in bringing a project to life through effective teamwork, planning, problem solving and ultimately construction. With a focus on development of student agency, this case study outlines how inclusion in the module delivery was adopted through increased focus on diversity in group formation and provision of additional assessment rubrics and feedback for all students. You'll find some excellent examples and photographs of student learning brought to life in this case study.

Inclusive Teaching in Engineering and Architecture: Key Findings

The structure and content of each of the case study modules was highly varied, which provided opportunities to experiment on what inclusive teaching and learning might look like in engineering, architecture and their allied disciplines, such as urban design. Though the abrupt shift to online formats during the pandemic resulted not only in increased workloads but some occasional loss in ambitions in the case studies, it is equally true that it facilitated a rapid change to alternative formats for teaching and learning resources, such as virtual labs and video lectures, a greater exploitation of the tools offered on the UCD VLE system Brightspace, and a different approach to assessments than may have happened otherwise. To sum up what key lessons have been learned in this pilot study requires a recognition of the profound, and occasionally positive, impact the pandemic had on the studies.

We have learned key lessons from these studies which can address inclusive teaching and learning within our disciplines, which do not require undermining or altering the core content so necessary to our professionally accredited programmes.

First and foremost, across all modules, was the ambition to provide **clarity to the structure of the module** from the outset of the trimester, as it enables students to grasp the manner in which they will learn, the tools available to facilitate this, and to better appreciate how they will be assessed. The provision of a handout detailing the module calendar week by week (Fitzpatrick) or the uploading of lecture material in advance (Fitzpatrick, McCrum/Keenahan), are both useful in this regard.

A more explicit and intentional use of **module-specific rubrics** also proved invaluable in providing students with more clarity about the manner in which they would be assessed (Fitzpatrick) and in two case studies, to encourage more engagement or 'buy-in' to assessment through early exercises to **negotiate appropriate rubrics with the students** (McCrum/Keenahan, Cotterill). It is interesting to note, in this regard, that Fitzpatrick's use of the online rubric tool in Brightspace also "had the advantage of grading being objective and transparent [and] feedback was therefore less cumbersome, timely and actionable so students could use it for their next submission."

Flexibility in projects or assessment by expanding the assessment types to address a diversity of learning styles was also a strategy that worked well in several modules, from offering choices regarding a visual or written essay (Fitzpatrick) to allowing students to negotiate the weighting of certain aspects of an assignment (Healy). These strategies enable students to demonstrate how they have learned the module material in a manner which best addresses their learning style and strengths, improving student engagement and performance.

Even how the **management of group work** is handled can influence student engagement and learning. The dynamic of individual relationships within sub-groups was given more formality in one study, with a "team expectations agreement" so students would have a shared understanding of their roles and responsibilities (Keenahan/McCrum). In another, involving a single shared project across the class, the standard sub-groups "received an added layer of interaction, when a general coordination group was formed, to oversee the entire endeavour and the overlaps between independent elements of the work. This generated new roles and overlaps within the cohort, which were particularly useful" (Faria).

The advance upload of material before a class also allowed module coordinators to **'flip' their classrooms, creating more variation in teaching and learning modes**. Because students could absorb the content prior to class, the in-class time could be more effectively used for active learning activities such as student presentations or discussions (Fitzpatrick) or Group project work (McCrum/Keenahan).

The necessary shift to online lecturing drove innovations in how to offer video lectures to students on Brightspace, by **breaking the lectures into much shorter thematic pieces**, which enabled more engagement from students (Healy, Cotterill). Like the ease of grading with online rubrics, these short lecture videos also have a benefit for the instructor as their thematic nature makes them easier to maintain and reuse.

The shift to an online format also drove **innovations in variable teaching and learning modes**, which provide a more inclusive learning experience. From virtual labs (Cotterill), to MATLAB demos which will be further developed to include interactive components (Healy) or the introduction of peer-led assessments on PeerScholar (Sudhershan), these all offered different modes of learning to the students. Appropriating the potential of the VLE Brightspace was also significant in identifying the simple means by which all content uploaded to a module site can be made machine-readable and thus translated into audio format (Healy), to address different learning styles.

We have learned some tactics to use in our disciplines to help shape a more inclusive environment in which our students can better thrive. It simply requires letting go of some of our conventional patterns of teaching, something the pandemic has helped us with. One of the most striking comments within the case studies was Dr John Healy's description of conventional teaching practice:

'Lecturing is a medieval solution to a medieval problem: in a time when a printed book might cost as much as a house, lecturing was the most cost-efficient method of transmitting information from a lecturer to a student'.

In one short, pithy sentence, Dr Healy sums up why we should all think anew about practices that have become ingrained in our system of teaching. A reconsideration of our teaching practice is long overdue. And the lessons so aptly learned by many during the pandemic and through these thoughtful case studies offer us new ways to consider how we teach, and how best to facilitate all our students to learn, in an increasingly diverse community.

Inclusive Teaching in Engineering and Architecture Key Findings

Provide clarity in the structure of the module from the outset

Use module-specific rubrics

Negotiate appropriate rubrics with the students

Provide flexibility in projects or assessments

Inclusivity

Manage Group Work Expectations

'Flip' the classroom

Break lectures into short thematic pieces

Embrace variable teaching & learning modes

References

CAST (2018). **Universal Design for Learning Guidelines version 2.2.** Available at: udlguidelines.cast.org

HEA. (2015). **National Plan for Equity of Access to Higher Education**, 2015-2019. Dublin: Higher Education Authority.

HEA. (2018). **Progress Review of the National Access Plan and Priorities to 2021**. Dublin: Higher Education Authority.

Kelly, A.M. & Padden, L. (2018). **ToolKit For Inclusive Higher Education Institutions: From Vision to Practice**. Dublin: UCD Access & Lifelong Learning.

McClean, D. & Hourigan, N. (2013). **Critical Dialogue in Architecture Studio: Peer Interaction and Feedback**, Journal for Education in the Built Environment, 8:1, 35-57.

National Forum. (2021). **Guiding Framework for Embedding Student Success**. Dublin: National Forum.

Padden, L., O'Connor, J. and Barrett, T. (2017). **Universal Design for Curriculum Design: Case Studies from University College Dublin**. Publication No. 1 - University for All Publication Series. Dublin: UCD Access & Lifelong Learning.

Padden, L., Tonge, J., Moylan, T., and O'Neill, G. (2019). **Inclusive Assessment & Feedback: Universal Design Case Studies from IADT and UCD**. Publication No. 3 - University for All Publication Series. Dublin: UCD Access & Lifelong Learning.

"Lecturing is a medieval solution to a medieval problem: in a time when a printed book might cost as much as a house, lecturing was the most cost-efficient method of transmitting information from a lecturer to a student"

—Dr John Healy, p. 156

CASE STUDY

1

Recognising stereotypes and the shared habitus of Engineers and Architects: Developing interdisciplinary teamwork and communication skills for first year students in an inclusive environment

Case Study 1

Dr Daniel McCrum and Dr Jennifer Keenahan

Recognising stereotypes and the shared habitus of Engineers and Architects: Developing interdisciplinary teamwork and communication skills for first year students in an inclusive environment

Daniel McCrum

Dr Daniel McCrum is an Assistant Professor in Structural Engineering at the School of Civil Engineering, University College Dublin. Daniel is the Programme Director for the ME in Civil, Structural & Environmental Engineering and has previously been the Head of Teaching and Learning at the School of Civil Engineering. In 2012, he completed a PhD in structural engineering from Trinity College Dublin, Ireland under an Irish Research Council Scholarship. Daniel then joined Queen's University Belfast as a lecturer in structural engineering in 2012. In 2017, he joined University College Dublin. He is a chartered structural engineer with the Institution of Structural Engineers (2016). Daniel is a fellow of the Higher Education Authority, United Kingdom, has a Postgraduate Certificate in Higher Education Teaching and is a published author in engineering education.

Jennifer Keenahan

Jennifer is an Assistant Professor in the School of Civil Engineering at UCD and has been Head of Teaching and Learning there since 2018. She completed the UCD Professional Diploma in University Teaching and Learning in 2021. Jennifer received a Digital Badge in Universal Design for Learning from the National Forum as part of their national rollout in Autumn 2020 and was appointed as a UCD Faculty Partner to support and accelerate the implementation of Universal Design for Learning throughout the University. In July 2021, she was awarded funding under the Academic Advising Project to establish and expand Academic Advising in the School of Civil Engineering. She was invited to support the University Working Group looking at Online Assessment in Spring 2021. Jennifer is module coordinator on three undergraduate modules for mixed groups of Engineers and Architects in first, second and third year, and she has interests in a wide variety of areas including interdisciplinarity, student-centred learning, and integrating the sustainable development goals into curricula.

Outline

Title

Recognising stereotypes and the shared habitus of Engineers and Architects: Developing interdisciplinary teamwork and communication skills for first year students in an inclusive environment.

Abstract

Engineers and Architects require effective communication and interdisciplinary team working to be successful throughout their career, which is often overlooked during formal undergraduate education. This case study disseminates the novel design and evaluation of an inclusive module on communication and interdisciplinary team working in the combined teaching of undergraduate Engineering and Architecture students. An interdisciplinary problem-based learning approach was used and several Universal Design approaches were successfully adopted.

Module Name

CVEN 10060/ ARCT 10150
The Engineering and Architecture of Structures 1

Discipline

Engineering and Architecture

Level

Stage 1, 5 credits

Student numbers

160

Introduction and Context

This module is a new Stage 1 module, created in the 2017/18 academic year. The module is core to the Stage 1 architecture students and an optional module for Stage 1 general engineering students. The aim of this module is to showcase the creative and important relationship between structural engineers and architects, but also to develop effective communication skills and teamwork skills between engineers and architects. The intervention proposed in this case study is to use a Universal Design approach to develop communication skills and teamwork skills between the engineering and architecture students. Due to the interdisciplinary nature of this module, we wanted to implement Universal Design approaches so the key learning outcomes were clear to students, the assessment was flexible, the diversity of background was considered, engagement in learning activities improved and ultimately, students could better achieve and understand the learning outcomes.

The purpose of our involvement in this Universal Design case study is to create a module that takes into consideration the shared habitus, history, and different cognitive styles to best align the learning outcomes of dialogue, communication and interdisciplinary team working with learning strategies. Teamwork and communication skills are developed in this module through hands-on problem-based learning (PBL); however, architects and engineers have a special diverse relationship that needs to be understood (by each other) to aid constructive alignment of learning outcomes with learning strategies. From Figure 1 it can be seen that there is a diverse demographic of students who were registered to this module over the past 4 years (2017-2020). Based on our observations about student performance, we believed that implementing Universal Design principles would support students in achieving the learning outcomes.
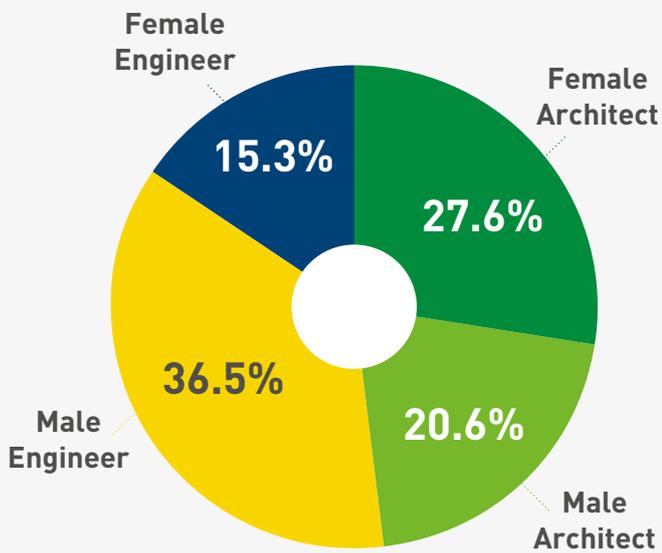
Figure 1. Demographics of students who were registered to this module over the past 4 years (2017-2020)

Design and Implementation Description

The learning outcomes for this module have been created with the recognition of the significant difference in backgrounds, talents and cognitive abilities of the Engineering and Architecture students who take this module. They have been prepared recognising the nine principles for Universal Design for Learning (UDL), using Bloom's taxonomies of learning (Bloom, 1956) and are also in line with University College Dublin's (UCD) code of practice (UCD, 2015). They have also been written cognisant of the existing knowledge and previous experience of students. Engineering students will have entered Year 1 at UCD with a C grade (55-69%) or better in their final second level state-wide examinations higher level maths, as well as one or more science subjects. Most of the Architecture students, however, have only completed Leaving Certificate or equivalent examination ordinary level maths, and possibly no science subject. Taking all the above into account, the learning outcomes for this module are as follows:

1. Differentiate the role of the Engineer and the role of the Architect through group discussion;
2. Develop effective communication skills through role-play, debates and group discussion;
3. Identify, draw and label forces in Engineering structures;
4. Describe and compare the available materials, and their properties for Civil Engineering Projects. Defend the choice of material for a given context;
5. Assess structural forms and describe why they have been designed the way that they have;
6. Assess the stability of different structural systems and subsequently visualise, design and create your own structural model; and
7. Describe structural failures and how Engineers and Architects learn from these failures.

Given that a key learning outcome of this module was to support the development of effective communication and collaboration skills of Engineering and Architecture students, (1) interdisciplinary teamwork and (2) flipped-classroom activities are key learning strategies for this module. In this context, flipped classroom is a form of blended learning where students complete readings at home and work on live activities during class time, which aims to increase student engagement (Schell and Mazur, 2015, Mazur, 2013). The flip-classroom activities are designed as problem-based learning activities, and the principles of Universal Design are used throughout. Further details on our module are described in (Keenahan and McCrum, 2020, Keenahan and McCrum, 2018).

1. Interdisciplinary Team Working:

Teamwork provides students with opportunities to interact and collaborate with others and to develop a community of learners, one of the nine key principles of UDL. It also fosters collaboration which helps to sustain effort and persistence, one of the principles of UDL. Teamwork is used throughout this module and supports students in meeting the learning outcomes. The Architecture and Engineering student teams are tutor-formed, rather than letting students self-select, so teams would have an even mix of Architecture and Engineering students. Students are split into teams of 5, each with a mixture of two to three Engineering and Architecture students. The teams are formed during the first lecture of the trimester and do not change throughout the trimester. To support effective teamwork, students are engaged in team activities in the first week of term, described in latter sections of this case study.

2. Flip Classroom Activities:

The following is a description of the formative flip-classroom activities in which interdisciplinary teamwork and communication skills are encouraged in the students. These activities provide students with multiple means of action and expression, one of the cornerstones of UDL. The activities encourage deep learning by students on concepts of structural analysis of buildings and they are carefully designed to support student engagement with the assessment activities. All activities have summative feedback, whilst all Projects have formative feedback.

Statement of Inclusivity:

Many students find it difficult to approach academic staff to discuss their learning needs. To help facilitate disclosure, a Statement of Inclusivity has been added to course materials, which aligns with the principle of providing an instructional climate in the principles of UDL. This statement is discussed in the first class of the trimester and provides students with clear instructions on the best ways of getting in contact as suggested by (Pedelty, 2003). The statement of inclusivity encourages tolerance of diversity in the classroom and should reassure those who would like to disclose information about their learning needs that this information will be treated with confidentiality and respect.

Activity 1: Hitchhikers Essay

A lecture was created in which the term 'hitchhikers' (team members who refuse to do their share of the work, or domineering team members) is explained to all of the students. Students are presented with a short essay on 'hitchhikers' and an individual reflection is requested from each student on this as suggested in (Oakley et al., 2004). Students submit the reflection online through Brightspace. This activity set enabled each team member to understand group dynamics and how a member of the group not doing work affects the entire group.

Activity 2: Ice Breaker

Given that students will spend the trimester working in their teams, time is set aside at the start of the trimester to allow team members to get to know each other through Ice-breaker activities (not assessed).

Activity 3: Team Expectations Agreement

Within their interdisciplinary teams, students were requested to prepare, sign and submit a 'team expectations agreement', as suggested in (Oakley et al., 2004). The agreement serves as a pseudo-legal document to prevent anyone from making invalid claims about what they were supposed to do. It is intended to unite the team with a common set of realistic expectations that the members generate and agree to honour. In preparing their agreement, students are encouraged to consider outlining team roles and their responsibilities, procedures for working on submitting assignments, strategies for dealing with uncooperative team members, effective team functioning, and expectations for team meetings.

Activity 4: Role Play

Role play allows students to explore realistic situations they will encounter in their future careers. Each set of Architecture students, and separately each set of Engineering students, are presented with a description of a role they need to act out in relation to a building project. Each set of Architecture and Engineering students are allowed 3-5 minutes to discuss the arguments they are going to make. When they are ready – they then engage in a debate about what they should do. The purpose of this task is to encourage students to play out their roles in an educational environment to support their learning and understanding of interdisciplinary teamwork and communication. It is an authentic task and thus aligns with the principles of UDL.

Activity 5: Interactive Development of Rubrics

Rubrics were created for all assessment tasks during lecture time with students (Figure 2 is for Project 1). Students spend time within their interdisciplinary teams deciding the criteria and respective weighting to be used in the rubric. This approach achieves buy-in from students in the assessment process, a greater understanding of the expectations for the assessment, as well as getting students started much earlier (Gibbs and Simpson, 2005). This approach also supports students engaging in a discipline that is less familiar to them, i.e. Architecture students experience more engineering types of concepts and practices. Furthermore, the activity achieves the objectives of being transparent, inclusive and empowering students to be self-regulated learners. This aligns with best practice in inclusive assessments as students are supported as partners in assessment as they are given some control of the design of rubric (National Forum, 2016).

Choice of Images

Level of complication, and correct assessment of forces in the groups' chosen 'show-stopper' photograph

Sketching and Images

Appropriate use of high quality images and sketches to communicated to the viewer.

Technical Understanding

Information provided is relevant and provides appropriate explanation to the viewer. Demonstrates clearly the student learning and understanding of forces, equilibrium, supports and self-weight that has taken place.

Presentation, Layout and Typography

Quality of presentation, layout and typography: was the poster well laid out, was it clear, did it look coulorful and interesting?

Figure 2. Sample of rubrics created for Project 1

Activity 6: Timeline of Buildings

One of the key pieces of content in this module is for students to have an understanding of the evolution of structure and form throughout the eras of architecture. Students are given a reading to complete between lectures, which is then supported by an activity in class. In groups, students are invited to organise the Padlet Timeline (Figure 3) so that the structures are in order of architectural era from left (earliest) to right (most recent). This activity promotes discussion, supports learning and also provides variety in delivery of learning material, key principles of UDL.
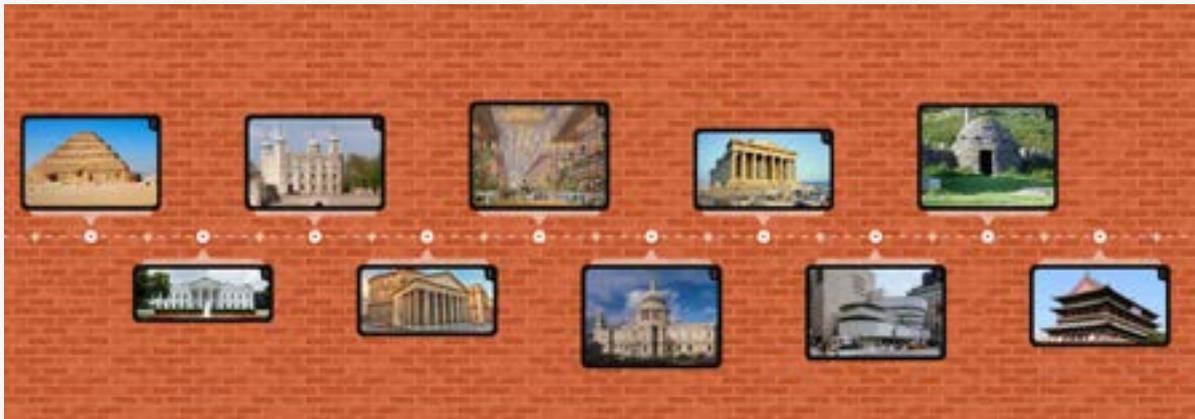
Figure 3. Activity using Padlet timeline

Virtual Learning Environment (VLE) for UDL

Effective use of the virtual learning environment (VLE), Brightspace, is made to support universal design for learning. The VLE model is organised into weeks and each week contains a checklist of items students must complete or engage in. This scaffolding helps to provide multiple means of engagement for students, a key element of universal design for learning. Students are offered content in a variety of formats (e.g. written and video format) which maximises learning opportunities. A discussion thread is provided to facilitate FAQs which supplies background information and promotes understanding of new information. It also allows questions around assessment to be replied to by the lecturers and everyone in the module able to see the responses. These align with providing multiple means of representation, a key aspect of universal design for learning. All learning materials are provided in advance of lectures which facilitates equitable use and flexible use of learning materials and low physical effort by students. To provide variety in learning styles, some of the lectures in the second half of the module are delivered live and recorded.

To create the opportunity of developing a shared habitus between Engineering and Architecture students, students participate in four separate interdisciplinary teamwork summative projects during this module. The assessments are designed to align with best practice in the design of inclusive assessments. The assessments are highly authentic in that they are based on real-world tasks (National Forum, 2017). All projects are submitted and assessed as a team.

Project 1:

For the first project (see Figure 4), students work in their interdisciplinary teams to prepare a poster containing five free-body diagrams. The project deadline is in Week 3. These free-body diagrams are to depict the forces shown in photographs. The photographs are chosen by the team members, thus offering students an element of choice in their assessment which aligns with the principles of inclusive assessment (O'Neill, 2017, O'Neill, 2011). Furthermore, this assessment is scaffolded using the activities described earlier (Padden et al., 2017). Students are taught how to complete the assessment, and this is built into the curriculum (Padden et al., 2017).
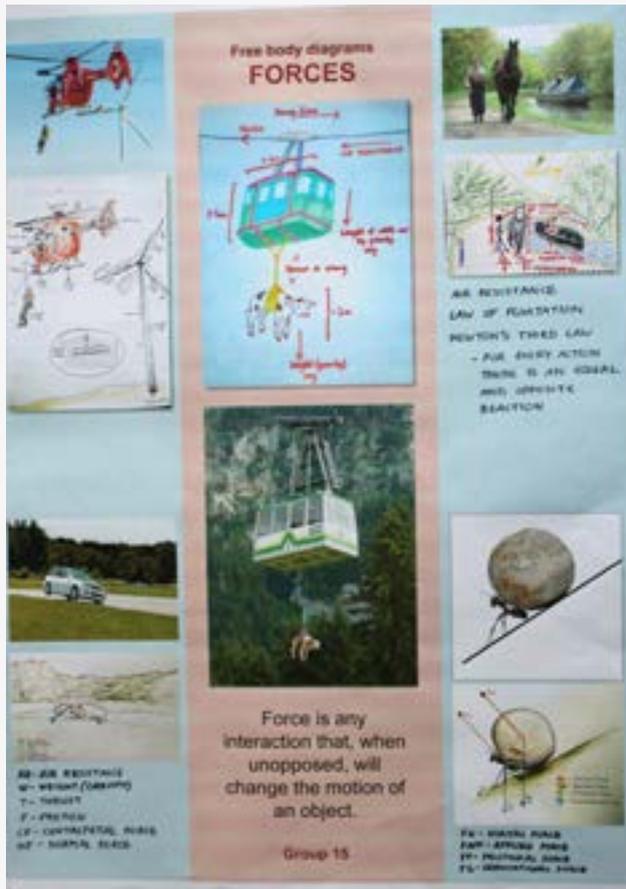
Figure 3. Sample of poster submission in Project 1

Project 2:

For the second project, students participate in a table quiz that takes place in Week 6. Questions for the table quiz are drawn from all content delivered to the students in the first half of the semester. The quiz offers students the opportunity to debate their answers amongst team members, as would occur in any typical table quiz. This promotes the opportunity for developing dialogue and a shared habitus between Architecture and Engineering students. After Project 2, the content of the activities becomes more technical in nature. At this point, the first lecturer finishes and the second lecturer takes over.

Activity 7: Bending moment and shear force diagrams

This activity helps students understand how structural engineers describe the stresses in the structural elements. This activity requires students to have some basic understanding of the lecture content and allows them to better understand what the stresses are in simplistic structural forms. The activity links directly to the learning outcomes of Project 1 (free-body diagrams) and content knowledge from lectures, particularly the use of physical models in lectures to explain complex ideas (McCrum, 2017), as shown in Figure 5.

Figure 5. Foam beam bending model with gridlines to indicate compression and bending stresses

Activity 8: Load path exercise

Each group of students performs a load path exercise where they must sketch the path of external loads through the structural elements. The groups must apply content knowledge from lectures. The skill of sketching is reinforced in this activity as students must sketch the structure and remove any non-structural elements. Students each sketch the load paths for a different structure and then explain their solution to their group.
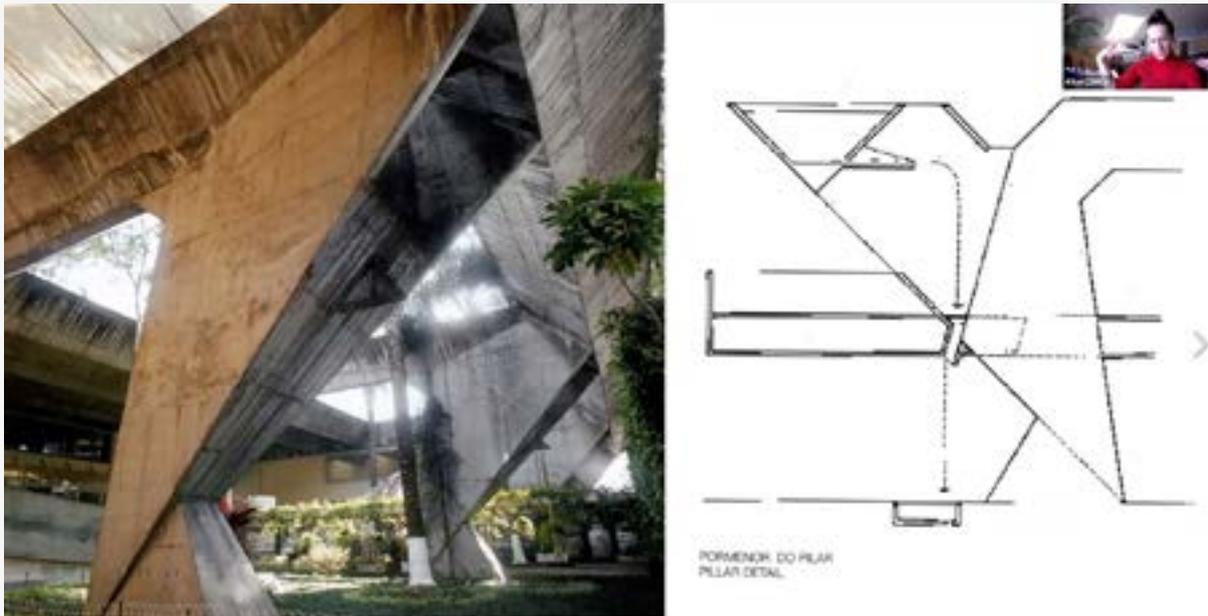
Figure 6. Slide from Architecture lecture given by Dr Alice Clancy

Architecture Lecture:

An Architecture lecturer (Dr Alice Clancy) came into the module for the first time this year to introduce architectural design concepts in relation to structures (see Figure 6). Feedback from a student survey in the previous academic year raised this point about the lack of an architectural perspective on the module. This lecture offered the Engineering students a different means of engagement and different means of presentation from an architecture lecturer.

Project 3:

The third project involved students preparing a video in their interdisciplinary teams that investigates and demonstrates understanding of how the loading, layout and Architecture of a structure or part of a structure influences the final structural design. This submission was a poster and not a video in the previous academic year. As a poster submission, it was too similar to the Project 1 submission (in style) and therefore this year it was changed to a video submission. The video submission provided a different means of expression for the students, a key principle of UDL. The deadline for the third project is Week 9. This year, we also created consistency between all of the rubrics for each assessment, so Project 3 and 4 had the exact same rubric style and layout as Project 1. Keeping the assessment style and rubrics consistent is a key principle of UDL. A portion of the rubrics for Project 3 can be seen in Figure 7. An example of a student's submissions can be seen in Figure 8.

ARCT 10150/CVEN 10060 - Rubric for Project 3				
Definition of Criteria	Excellent	Good	Fair	Poor
Precedent Study Level of complication, and correct assessment of structural forms in the precedent study is required. One of the five structural forms should be discussed in greater detail	- The structural forms chosen were an advanced choice demonstrating a high level of student learning - The structural forms chosen very unique and very different to all other images shown in class - Accurate assessment of likely forces in free-body diagram - Highly relevant reason for selection of structural forms given	- The structural forms presented a good choice demonstrating a good level of student learning - The structural forms chosen were reasonably unique with some differences to those shown in class - Good assessment of likely forces in free-body diagram - Very relevant reason for selection of structural forms given	- The structural forms presented an average choice demonstrating a modest level of student learning - The structural forms were quite similar to those shown in class and demonstrates limited additional learning - Average assessment of likely forces in free-body diagram - Reasonably relevant reason for selection of structural forms given	- The structural forms presented were a poor choice demonstrating a low level of student learning - The structural forms were nearly identical to other free-body diagrams presented in class - Poor assessment of likely forces in free-body diagram - No relevant reason for selection of structural forms given
T**echnical Understanding— Bending and Shear** Information provided is relevant and provides appropriate explanation to the viewer. Demonstrates clearly the student learning and understanding of bending moments and shear forces. Accurate description of moments and forces	- Demonstrates full knowledge and information related to subject - Provides relevant explanations/ elaboration/ assumptions/ examples/ equations/ calculations/ and/ or facts that support the shear force and bending moments - Excellent evidence of student…	- Demonstrates good knowledge and information related to subject - Provides some explanations/ examples/ assumptions/ equations/ calculations and/or facts that support the shear force and bending moments - Good evidence of student…	- Somewhat uncomfortable with information related to subject - Provides weak examples/ facts, which do not adequately support the subject; includes very thin evidence supporting the shear force and bending moments - Some evidence of student…	- Does not have a grasp of information - Information provided is weak and does little to support understanding of the subject gives insufficient support for the shear force and bending moments - Less than adequate evidence of student…

Figure 7. Partial rubrics for Project 3
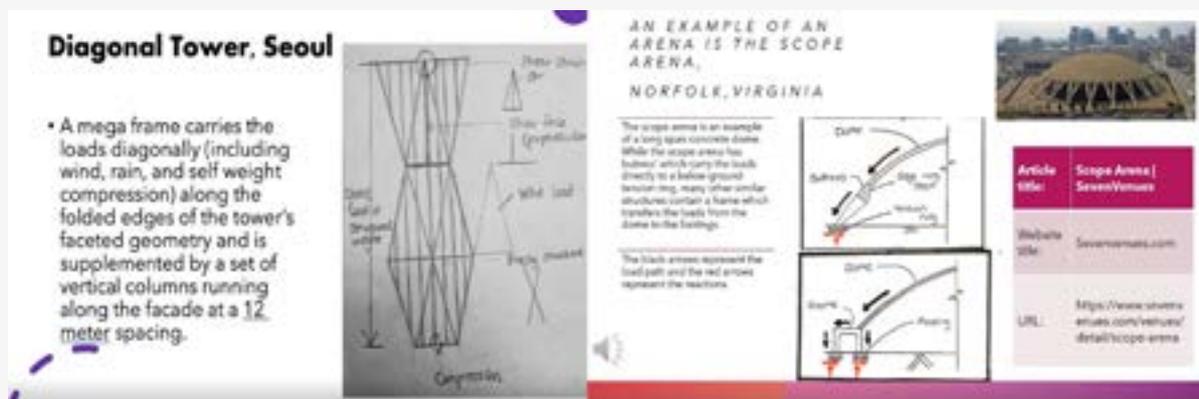
Figure 8. Two screenshots of example of video submissions in Project 3

Activity 9: Spaghetti tower challenge

The final activity was the spaghetti tower challenge, where students had to work in their groups to create a spaghetti tower that supported a marshmallow. This activity was performed online, but is typically done in person and is always very successful. This team exercise is structured, and guidance is provided before the task, following Universal Design Principles. A sample of the submissions are shown in Figure 9. Feedback was given immediately after the challenge by the lecturer in terms of which models worked well and why, and which did not meet the criteria. The student engagement was excellent, even though this took place online.
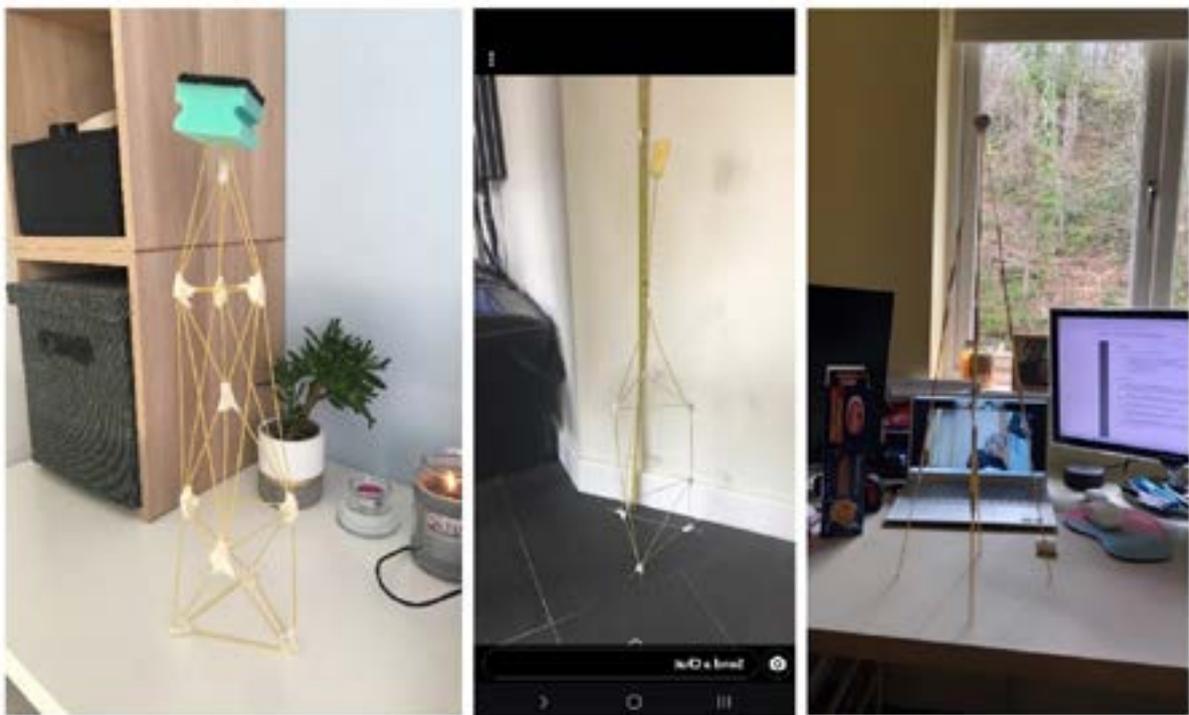
Figure 9. Three samples of spaghetti tower challenge submissions

Project 4:

The final project involves each team designing and physically testing a scaled model of a tower and to demonstrate how the lateral and gravity loads are transferred to the foundations in the structure. Project 4 is submitted at the end of the 12 weeks. The timber model is made using the laser cutter in the Civil Engineering laboratory (see Figure 10). The students must achieve the tallest, lightest and most load resisting structure possible. Students must prepare a report detailing a precedence study for their structure, and details of their design. The report must also include a reflection on how both sets of students communicated with each other and what they thought of the approach of the other discipline. Project 4 is intended to bring together all the learning outcomes of this module and to further reinforce the importance of effective interdisciplinary teamwork and communication between Engineers and Architects. The testing of the towers offers students a way to physically demonstrate their learning in a different way to the previous three projects (a principle of UDL). It also builds on the skills they physical model building skills learned during the spaghetti tower challenge in Activity 9.

Figure 10. Photographs of laser cut model towers being load tested in Week 12 in the Civil Engineering Laboratory (from 2019/20)

Other practical approaches taken:

— The lecturers used breakout rooms as much as possible in order to give groups as much group time as possible.

— The lecturers increased their active learning content on the module from the previous academic year to prevent lecture boredom on Zoom.

— The lecturers provided recorded videos explaining each of the submissions so students could review in their own time.

— The lecturers promoted the use of the chat function in Zoom and found positive levels of student engagement (better than traditional lectures in the past).

— The lecturers provided additional learning material (out of interest) that was not accessible e.g. information of sustainability and the UN Sustainable Development Goals. It appears some students liked to extend their knowledge i.e. not just study the module, but gain an insight into the bigger picture.

— The lecturers introduced the assessment and related rubrics before they covered the content. This meant students knew what was ahead of them in terms of assessment, so could focus on the learning material/activities within this context.

— Recording all the relevant learning material worked well in terms of flexibility for students.

— Activities were all structured and guidance was provided well in advance.

Results and Impact

— Impact of the implemented UDL approaches was assessed through the end of module survey. There were 89 respondents out of 160 students (response rate of 56%) in the survey in 2020/21.

— High attendance was observed throughout with typically 120-130 students every lecture/activity. Engagement was excellent during lectures and activities. This suggests the Universal Design approach was implemented well as students felt there was enough variety and learning approaches used to enable engagement. There was a 91% positive rate from student feedback when asked "did you feel able to participate in class and other learning activities, or were there barriers to engagement?"

— Approaches such as the flipped classroom, team expectations, reflective exercises, spaghetti tower challenge, etc all ensured the students understood the learning outcomes. In the survey, 94% positive response was given to the following question: Were the learning outcomes and rationale for the learning modes (projects, presentations, discussions, labs, etc) and assessments made clear?

— Assessment, in terms of rubrics and how assessment expectations were described for all four projects were almost the same. All assessments had a recorded video from the academic staff explaining the content. It was felt that having two different teaching styles helped to make the delivery more interesting and stimulating for the students. In the survey, 90% positive response was given to the following question: Did the assessment strategy build in flexibility and variety to address different learning styles?

— The learning material and assessment material was kept consistent in style on the VLE throughout the module e.g. step by step approach to the module content to allow flexibility in learning. Both lecturers were very aware of Zoom fatigue and attempted to deliver as many active learning tasks. Student feedback appreciated the live delivery of lectures also as they could interact and ask questions live on the chat function. In the survey, 94% positive response was given to the following question: Was the teaching material and its delivery (lectures, online material, in-class discussions, etc.) sufficiently diverse to support your learning?

— More active learning tasks/exercises and the flipped classroom approach had a positive impact on the module. We also performed live lectures and recorded them, as well as the flipped classroom approach. The use of practical/hands-on activities e.g. sketching, tower building, and bringing an architecture lecturer on to the module to deliver a lecture, all improved the variety of learning modes. In the survey, 89% positive response was given to the following question: Was learning supported by a variety of learning modes (projects, presentations, discussions, labs, etc), or do you feel there were other ways to enable your learning that could be offered as alternatives?

Impact of COVID:

— In some instances, the switching to online during COVID helped engagement. Students could privately ask questions on the chat in Zoom, it was easy to include polls during lectures and then groups could be created in Zoom to perform activities etc by themselves.

— Other aspects, such as Project 4 could not take place during COVID (laser cut tower in the lab) and therefore some of the learning outcomes, from a technical perspective, and enjoyment of the students, was reduced somewhat.

— In the feedback, it was found that some students felt the academic staff did the best they could in relation to COVID and appreciated that some of the activities would have been better in person.

Things that didn't work:

— Both lecturers attempted to use Google Jamboard to create interactive responses to questions live during Zoom sessions and one student kept playing a game using the drawing function (the game was tic tac toe). So, we had to drop this!

— The groups had to be partially added manually in breakout rooms, that was frustrating for the lecturers and time consuming.

Recommendations and Advice for Implementation

The following should be considered by others wanting to implement Universal Design in an interdisciplinary problem-based module. We found these approaches helped improve the learning experience for students and helped them achieve the learning outcomes, which was shown through survey results.

— **Expectations:**
- In group work, it is important for each team to set teammate expectations.
- Describe what is required in each assignment in terms of assessment as early as possible. Preferably before the learning material content is covered.
- All activities had guidance and were discussed well in advance (typically in the previous lecture) to help improve engagement.
- All assessment had video recordings of what was required so that the expectations of the lecturer could be easily referred to by the students in their own time.

— **Consistency**
- Keep the online format of the learning material consistent.
- Keep the assessment criteria consistent.
- Keep the feedback delivery consistent and timely.

— **Flexibility**
- Use as many modes of delivery as possible.
- Provide recorded material describing what is required in assessment.
- As the module was online, all lectures were recorded. Students appreciate being able to review lecture content in their own time. This may not be possible in face to face teaching.
- Students can choose their own assessment weightings.

— **Variety of learning**
- Flipped classroom, active learning tasks, problem-based learning tasks, live lectures, recorded lectures etc. all provided variety for students.
- Bringing in a lecturer from architecture helped to provide a different perspective and variety.
- Having two main lecturers on the module with two different styles 'freshened up' the module when the handover occurred in Week 6.
- Group Work was essential in achieving the learning outcomes for this module.
- Different modes of assessment were used for each of the four assessments in the module; poster, quiz, video and report.

References

Bloom, B. S. (1956). **Taxonomy of educational objectives**. Vol. 1: Cognitive domain. New York: McKay, 20, 24.

Gibbs, G. & Simpson, C. (2005). **Conditions under which assessment supports students' learning**. Learning and teaching in higher education, 3-31.

Keenahan, J. & McCrum, D. **Aligning Learning Outcomes to Improve Communication and Learning Skills in an Interdisciplinary Problem-Based Learning Environment**. Civil Engineering Research in Ireland 2018 (CERI 2018), University College Dublin, Ireland, 29-30 August 2018, 2018. CERAI.

Keenahan, J. & McCrum, D. (2020). **Developing interdisciplinary understanding and dialogue between Engineering and Architectural students: design and evaluation of a problem-based learning module**. European Journal of Engineering Education, 1-29 %@ 0304-3797.

Mazur, E. (2013). Peer instruction.

McCrum, D. P. (2017). **Evaluation of creative problem-solving abilities in undergraduate structural engineers through interdisciplinary problem-based learning**. European Journal of Engineering Education, 42, 684-700.

National Forum (2016). **Assessment OF, FOR, AS Learning: Students as Partners in Assessment**. National Forum for the Enhancment of Teaching and Learning, Assessment Enhancement Theme.

National Forum (2017). A**uthentic Assessment in Irish Higher Education**. National Forum for the Enhancement of Teaching and Learning, Assessment Enhancement Theme.

O'Neill, G. (2011). **A Practitioner's Guide to Choice of Assessment Methods within a Module**. UCD Teaching and Learning.

O'Neill, G. (2017). **It's not fair! Students and staff views on the equity of the procedures and outcomes of students' choice of assessment methods**. Irish Educational Studies, 36, 221-236 %@ 0332-3315.

Oakley, B., Felder, R. M., Brent, R. & Elhajj, I. (2004). **Turning student groups into effective teams**. Journal of student centered learning, 2, 9-34.

Padden, L., O'Connor, J. & Barrett, T. (2017). **Universal Design for Curriculum Design**. UCD Access and Lifelong Learning.

Pedelty, M. (2003). **Making a statement. Curriculum transformation and disability: Implementing Universal Design in higher education**, 71-78.

Schell, J. & Mazur, E. (2015). **Flipping the chemistry classroom with peer instruction**. Chemistry Education: Best Practices, Opportunities and Trends. Willey Online Library.

UCD. (2015). **UCD Code of Assessment Practice for UCD Staff**. Available: www.ucd.ie/registry/assessment/staff_info/UCD_Assessment_Code_of_Practice_2015-2016.pdf.

2

Using inclusiveness to introduce professionalism in the early stages of a career

Case Study 2

**Daniel P.
Sudhershan**

**Using inclusiveness to introduce professionalism
in the early stages of a career**

Daniel P. Sudhershan

Daniel joined UCD as a full-time faculty member in September 2004 to coordinate the undergraduate Architectural Technologies. He is Assistant Professor (tenured) in Architecture and active in teaching, research and administration. He held positions of Associate Dean (2009 - 20) and interim Head of Architecture (2017-18). In the past he also coordinated the BSc-ArchSci, BArchSc, BArch and the MArch degree-programmes. Daniel held a visiting professor position at the University of Stuttgart and took the external critic role at the Lund-University, FH-Darmstadt, Bauhaus-University and the Welsh School of Architecture. Currently, Daniel is representing UCD Architecture at the Board of Architectural Education at the RIAI.

Outline

Title

Using inclusiveness to introduce professionalism in the early stages of a career

Abstract

This case study discusses changes made to stage one, semester one core module for the architecture students with focus on promoting interdisciplinarity and discussing professional ethics topics at the early stages of their career. These changes were made in light of an inclusive teaching pilot and included among other things: incorporating diverse assessment strategies (such as group work, peer review, collaborative learning, active learning as well as reflective writing); using a variety of tools to enable students to choose presentation topics and to present the results of their work; and making all the learning materials available online.

Module Name

ARCT10020 - Into Practice

Discipline

Architecture

Level

Stage 1, 5 credits

Student numbers

65

Introduction and Context

This first-year / first-semester core module for Architecture students **Into Practice** (ARCT10120) was first introduced in September 2012 in response to the project organised by UCD Registry and T&L titled "Enhancing First Year: The First Year Experience" which I took part in for Architecture in 2011 and which involved attending a number of meetings / workshops. As a result of that, Architecture was selected for the first round of **Focus on First year Workshops** organised by Professor Bairbre Redmond. Subsequently, UCD Architecture took part in a workshop organised by UCD T&L focusing on student workload and learning outcomes for our five-year professionally accredited programme based on Royal Institute of British Architects' accreditation requirement. At the end of that workshop I decided to develop a module to introduce the profession of Architecture and other disciplines in the very early stages of architectural education, which led to the launch of this core module for Architecture in September 2012 with its aim to promote interdisciplinarity and collaboration, to help students to understand what it means to be a professional and to engage with professional ethics topics and also introduce them to other (less) closely related subject areas (e.g. Business, Civil engineering, Conservation, Landscape Architecture, Law, Planning, and Urban Design). The latter objective has been strengthened by the fact that students from many other disciplines, for example Agriculture, Archaeology and Medicine, also took this module as an elective.

In addition, the intention behind the module is to highlight the importance of inclusive teaching and learning methods at an early stage of their education / career. As the module coordinator, I wanted to not only increase student engagement through open discussion, peer review and critical thinking, but also to help students develop the ability to learn to respect other views. I also hoped to give all students an opportunity to flourish by identifying their own strengths and weaknesses and build on / work on them respectively, which should help them throughout their education and career, e.g. by developing confidence in their own judgement.

At the end of the academic year 2019/20, a detailed student survey was conducted by Dr Lisa Padden in class as a preparation for the pilot project to introduce inclusive teaching and learning methods. A number of issues in relation to inclusive teaching and learning were identified as a result and I tried to resolve these issues when the module was offered again in the academic year 2020/21.

2019/20 - Student survey at the end of the semester - a summary of the main issues identified:

— **Communication:**
Many students gave positive feedback on the module. One of the areas requiring further consideration that arose out of the survey concerned the fact that professionalism is such a complex topic. Until we received this detailed feedback from the students, we were not aware of many issues they face, even though all possible efforts were made to discuss such difficulties. In addition, it was difficult to make it clear to the first-year students why they need to know about other professions as their interest lies in a very specific programme, i.e. Architecture.

— **Engagement:**
The feedback on engagement was positive and most students liked the lecture format followed by an engaging discussion with each lecturer. However, as the subject matter changed every week, that posed some difficulties for Year 1 / Semester 1 students coming directly from a structured school environment.

— **Flexibility - Teaching:**
The students thought the module was too Ireland-focused and wished it were focused on issues outside Ireland too. In addition, they suggested we should make student submissions available from previous years earlier in the course.

— **Flexibility - Assessment:** As far as this aspect is concerned, the students suggested submitting Learning Journals online to save paper and wanted more clarity about the Learning Journals (e.g. the format, submission, grading etc).

In addition, a sample learning journal at the start of the semester was asked for.

Based on the survey results, we had a detailed discussion with Dr Padden about the above mentioned short-comings and possible improvements to make this module an inclusive teaching and learning module.

Design and Implementation Description

The design:

In the academic year 2020/2021 the module was lecture-based and each week the students were introduced to a new profession. The student cohort composition (65 students in total) was as follows:

— Core students: 61 (Architecture - Stage 1); and

— Elective students: 4 (3 from BSc in City Planning and Environment Policy - Stage 2 and 1 student from in Liberal Arts and Sciences programme - Stage 2).

Based on the information provided by the permanent country code, the cohort consisted of participants from:

— Ireland (52);

— USA (3);

— Poland (3);

— China (2);

— Romania (2);

— Hungary (1);

— Sweden (1); and

— UK (1).

Out of the 65 participants:

— Four were mature students

— 6 students availed of disability support including academic and exam accommodations .

Based on the information provided by the permanent country code, the cohort consisted of participants from:

1 SWEDEN

52 IRELAND

3 USA

3 POLAND

2 ROMANIA

2 CHINA

1 UK

1 HUNGARY
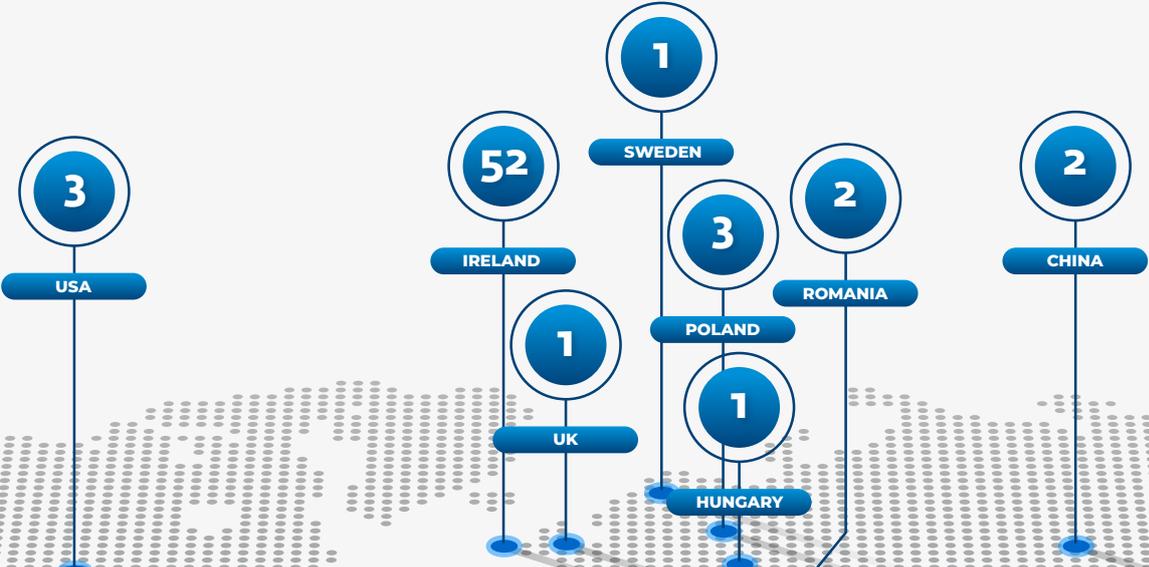
Out of the **65** participants

4 were mature students

6 students availed of disability support

Implementation:

As a result of the survey of 2019/20, the following changes were implemented in the academic year 2020/2021:

1. On the first day the module structure was explained in detail and the students were encouraged to ask questions.
2. Before and after every lecture the students were likewise encouraged to ask questions; those were not limited to the topic discussed that week.
3. The students were given the option to structure the learning journal with more flexibility, e.g. include drawings, images etc with text. Examples of work could be shared with the class and through Brightspace.
4. The students were asked to find both the interesting as well as not so interesting parts of the given topic through discussions with their peers (critical analysis) to help them structure the learning journal.
5. The students were allowed to choose the poster presentation with more flexibility, i.e. they were able to use any tool that they were comfortable with e.g. drawings, images, videos, text.
6. All live lectures were recorded and uploaded to Brightspace with the slides for future reference.
7. All the learning and supporting materials were available throughout the semester in Brightspace.
8. Lecture topics of each week and any related information were communicated by email (InfoHub)
9. Due to the pandemic, the group feedback requirement for the poster presentations was removed.
10. Students received a grade for the peer review.
    My concern prior to the module start was that the students might not be able to see each other's work due to pandemic. Under normal circumstances architecture students spend most of their time in the studios, which supports the process of looking at and commenting on each other's work (not limited to design studio work).

Fortunately, in September 2020/21 UCD IT Services (Educational Technology Services) offered a Peer Assessment tool - peerScholar - as a pilot study. I volunteered to be part of peerScholar trial programme and was accepted. I used the "classic version" of the peerScholar ("A typical individual peer-assessment assignment where individual students submit their work, assess each other and then receive and reflect on their feedback"*) in this module. This tool allowed students to read, assess submissions (in weeks 1 to 4) of four examples of their peers' work and also reflect on the feedback they received. It was great compensation for not being able to see each other's work in person which would have been the case under normal circumstances. The tool was greatly appreciated by the class as it allowed the participants to edit and improve their learning journals for the final submission.

* Source: www.ucd.ie/itservices/ourservices/educationaltechnologies/ virtuallearning-brightspace/brightspaceinstructors/assessments/peer/

11. The final group poster presentation was changed to a group presentation. The groups were able to choose any relevant topic and also the way they wanted to present it (e.g. with PowerPoint, videos, text).

12. The assessment was divided into three parts that included the weekly journal, peer review and group presentation to allow more flexibility. The amended assessment strategy was as follows:

Assesment Strategy

Description	Timing	Open Book Exam	Component Scale	Must Pass Component	% of Final Grade
Assignment: Peer review of Learning Journal	Throughout the Trimester	n/a	Graded	No	20
Assignment: Group presentation	Unspecified	n/a	Graded	No	30
Assignment: Learning journal/Critical Reflection	Throughout the Trimester	n/a	Graded	Yes	50

Figure 1. Assessment Strategy 2020-2021

Lecture Schedule:

University College Dublin
School of Architecture, Planning and Environmental Policy (APEP)
ARCT10120 - Into Practice - Semester 1 - 2020/2021
Lecture Programme
Session times: Wednesdays: 14:00 - 15:50 Venue: Online using Zoom

30 Sep 2020	Introduction to the module and the school by Daniel P. Sudhershan (Module Coordinator – Asst. Professor) and Eileen Fitzgerald (Asst. module coordinator – Design Fellow) — Daniel P. Sudhershan - Reflective Practice and Reflective Writing — Orla Hegarty, Asst. Professor Architecture, School of APEP - Introduction to the Profession of Architecture — Dr. Lisa Padden, Project Lead - University for All, UCD Access & Lifelong Learning Centre - Inclusive Learning
07 Oct 2020	Paul Arnold Asst. Professor School of APEP - Applied ethics in Conservation and Heritage
14 Oct 2020	Dr. Karen Foley Asst. Professor Landscape Architecture School of APEP - Landscape Architecture as a discipline history and structure
21 Oct 2020	Dr. Alan Mee, Asst. Professor School of APEP - Applied ethics in Urban Design
28 Oct 2020	Dr. Jennifer Keenahan Asst. Professor School of Civil Engineering - Civil Engineering and Architecture - date changed
04 Nov 2020	Professor Hugh Campbell & Asst. Professor Michael Pike School of APEP and two recent graduates (Iseult McCullough and Hugh Ivers) - The Architect in practice
11 Nov 2020	Professor Mark Scott, Planning, School of APEP - The Planner in practice, and as a member of the Design Team
18 Nov 2020	Dr. Michael MacDonnell, Asst. Professor, School of Business - Applied ethics in Business
25 Nov 2020	Dr. Emer Hunt Lawyer, Asst. Professor Sutherland School of Law - Applied ethics in the legal context
02 Dec 2020	Group Poster Preparation
09 Dec 2020	Group Poster Presentation

Figure 2. Lecture schedule - academic year 2020/2021

The student cohort was divided into groups of ~8 and the students stayed in their groups throughout the semester. At the end of each lecture, the groups met to discuss it and the students were encouraged to be reflective and critical. They also received a handout on how to structure the discussion as an aid. The students selected a different Chair, Scribe and Timekeeper every week, which allowed all group members to take on all these roles at least once.

Structure of the Discussion

Reflective Questions for 25 Minutes discussion (based on Hampton, 2007*)

Description:
What is the most important / interesting / useful / relevant about the lecture or idea?

Interpretation:
1. How can it be explained (either your view or the literature, and/or what you have learned in other modules)?
2. Do you think there are different perspectives on the issue discussed? In other words, would all disciplines, clients, public, etc agree with these views? Would they be different from those in the past or future? In Ireland versus elsewhere?

Outcome:
4. What have you (each student) learned from this?
5. What might this mean for your future professional practice?

*Hampton M (2007). Written assignments: Reflective writing - a basic introduction. (Handout No. WA13a). Academic Skills Unit, University of Portsmouth, UK.

Figure 3. The student handout on the structure of the discussion

At the end of the discussion slot, students drafted their individual Learning Journal and submitted it before the following week's session.

The weekly learning journal

Learning Journal: 8 journals
Length: 1 page approx. (done in class, then typed and to be submitted).

Please answer the following questions in your learning journal:

— What have I learned from the both the lecture and the group discussion that has influenced (changed or re-enforced) my views on this topic(s) (topics such as professionalism, other disciplines, reflection*, and or other aspects of Architecture)?
— What are the learning outcomes in this topic (what questions still remain unanswered)?

*Schön Donald A (1983) The reflective practitioner: How professionals think in action - The reflective practitioner: How professionals think in action (available online)

Figure 4. Learning Journal - the student handout

At the end of the semester, the students gave group poster presentations on a chosen topic. Initially, each group was expected to give constructive feedback to two other groups but due to COVID19 restrictions, the constructive feedback requirement was cancelled to reduce workload. However, I am hoping to implement constructive feedback as part of the assessment in 2021/2022.

Final Presentation: Group Poster Presentation and Group Feedback

Based on one of the module's key issues or themes, your group will be graded (30%) on both a) your group's poster and b) how well you can give constructive feedback on another group(s)' poster. This is a group mark.

a) This grade is marked by a staff member in the presentation session and it will be based on the same criteria as used in the 'STUDENT GROUP FEEDBACK FORM' attached.

b) In the same session your group will need to observe and ask questions of (an)other group(s) and following this as a group fill in, all sign, and hand-in the 'STUDENT GROUP FEEDBACK FORM' . Your comments on this will be graded on your ability to give constructive feedback (see example below) .
Some Principles of Constructive Feedback based on source given below*:
— Focus on the positive,
— Be sensitive to your message,
— Give ideas for alternatives where there is an aspect to be improved,
— Focus on behaviours that can be changed,
— Focus feedback to the criteria given.

(*for more details see www.faculty.londondeanery.ac.uk/e-learning/feedback/giving-feedback)

Figure 5. Group poster presentation and group feedback - the student handout

The following examples illustrate not only the teaching materials in the module, but also the work completed by some of the participants:

— Lectures;
— Peer review instructions;
— A few examples of student peer review comments and feedback; and
— Examples of group presentations.

13. Lectures:

The lectures were very diverse in their structure and approach. It is important to note that the topics discussed in the lectures were also very diverse, but included Architecture as the common thread and how it is connected to business, civil engineering or to law.

Below are a few summaries of lecture content:

Orla Hegarty (Architecture) spoke about the Architecture as a profession. The students were asked to fill a time capsule form to be preserved by students and to be opened in ten years' time. The lecture explained how diverse architecture is from a number of perspectives (cultural, political, social,urban etc.). The lecturer said that each student could find their own niche within the field.

Paul Arnold (Architecture) spoke about ethics and conservation. We were looking at the origins of ethics from anarchist ethics, through deontology to utilitarianism. The military ethics was discussed by many students in their weekly journal. With regard to conservation, it was discussed when to intervene to protect and when to protect without intervening in the original structure.

Michael MacDonnell (Business) discussed many topics from Apple's tax policy, Brexit to uncertainty of the business in today's world and the risks we take.

Emer Hunt (Law) made the students aware of issues connecting architecture and law using local (for example, pyrite cases in Dublin) and global issues (for example, migrant construction worker deaths in Qatar).

Orla Hegarty -
Architectural Profession

Paul Arnold - Architecture
and Ethics

Karen Foley - Landscape
Architecture

Alan Mee
 - Urban Design

Jennifer Keenahan
 - Civil Engineering

Hugh Campbell
 - Architecture

Michael Pike
 - Architectural Practice

Mark Scott
 - Urban Planning

Michael MacDonnell
 - Business
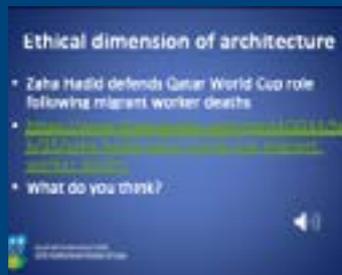
Emer Hunt
 - Law

Figure 6. Examples of lecture slides

14. Peer review instructions:

You must click the link below peerScholar (External Learning Tool) to take part in this exercise. This exercise is divided into three parts.

1. You must RESUBMIT your already submitted Reflective Journal Week 2 to 5 (copy and paste) to peerScholar. The submission should not include your name or your UCD Student Number.

2. The peerScholar will allocate your submission to three of your peers for review. You will also receive three submissions from your peers to review. You should analyse the work carefully and write a reflective critical review. The review you give should be useful to your peers and it should help them to improve their writing. You must also remember that your review should be written respectfully. The video from Dr Lisa Padden (See week 1 folder) on Inclusive Learning and Peer Feedback contains extremely useful information on that.

3. This is the reflective phase of your own work: after analysing your peers' work and after reading the comments you received on your own work (3 in total), you should reflect on how you could incorporate the feedback into your next submission and your work in other modules.

I would like to let you know that I am planning to use the data for research purposes (e.g. publications). The UCD's research and ethics guidelines will be followed. All data will be anonymised. If you would like me not to use your work for research, please send me a short email stating that by 30 November.

Figure 7. Peer review instructions
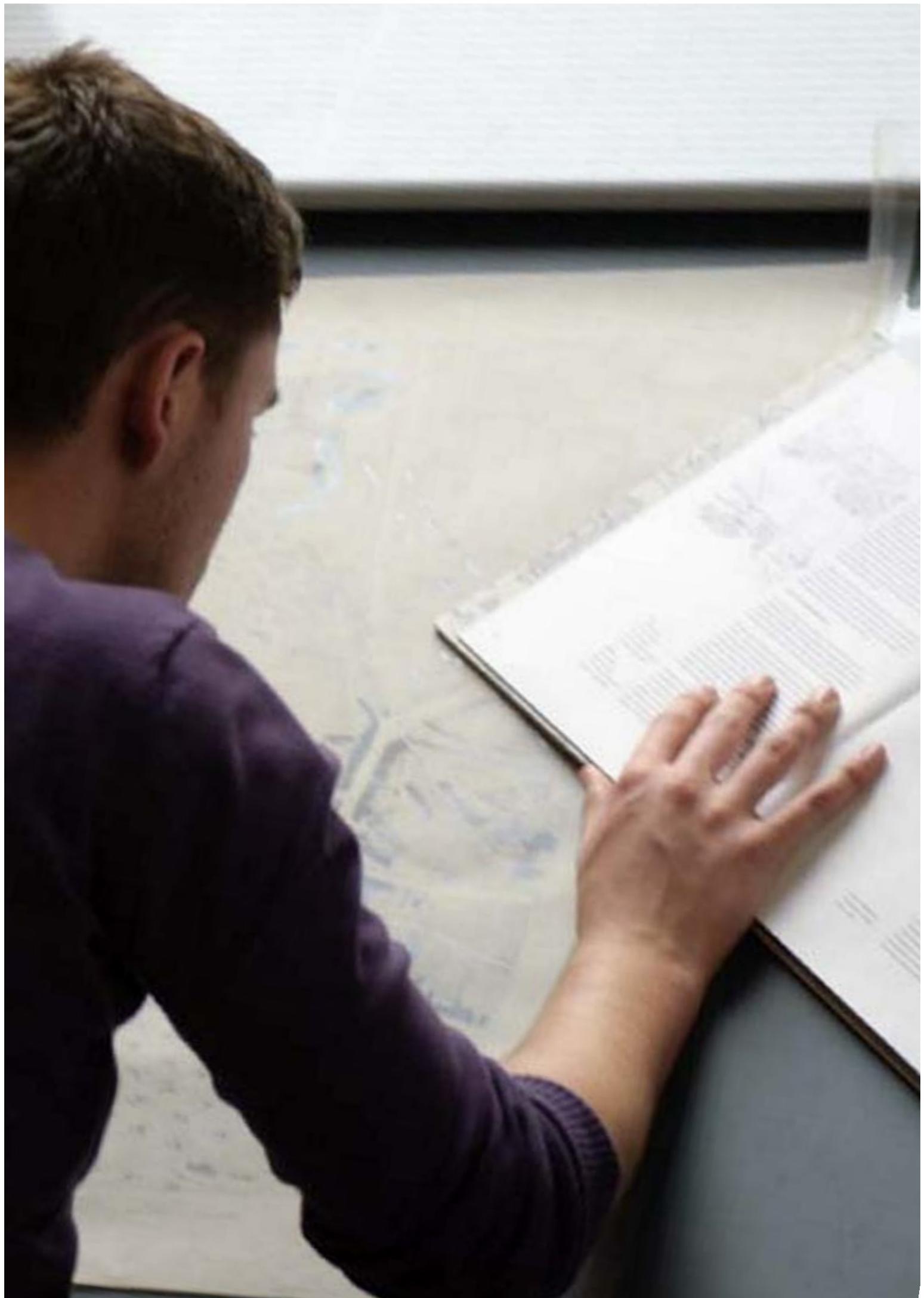
15. A few examples of student peer review comments and feedback:

The peer review was introduced in 2020/21 for the first time, therefore there is no comparison. However, each student received three feedbacks from peers and that helped to improve the standard of the learning journal.

1.
Comments from the peer reviewer: The vocabulary was great. What brought you down from 6 to 5 was that you haven't checked your spelling mistakes. Furthermore, conclusions weren't very clear. Transition phrases would also be helpful in the structure of your reflective writings. Overall, they are great pieces of writing with valuable information. Well done!!! / 50 Words

Comments from the receiver: This feedback was great, it pointed out what was positive as well as pointing out where I could have doe better. For example, they pointed out that most of my journals lacked conclusions. This is something I will improve on. / 40 Words

2.
Comments from the peer reviewer 1:

is. The aim of an urban designer is to design "smart cities". This has to be in line with both ethical values and to also find solutions after ethical issues and concerns are addressed. Thus, I really admired the scale at which they so many different factors, which temporal, functional, perceptual principles of : promoting to prote generations), strive to protect th

The second thing that reall Although I thought they were the same thing, I learnt that they were in fact different. The insight I

The to-infinitive "to find" has been split by the modifier "also". Consider changing this to "also to find solutions". Avoiding split infinitives can help your writing sound more formal.

Comments from the peer reviewer 2:
You have structured your reflective essays very well, which made it easy for me to read and understand. For the most part, your work is clear and concise; however, I noticed that some your sentences can be wordy so if you consider that an issue, try rewriting some sentences to avoid some of these non-content words: if, the, was, with, its, to, of, a, in, be, as. Some non-content words are necessary, but readers get stuck in sentences that use too many of them. By avoiding unnecessary non-content words, you'll help your readers focus on the most significant parts of your sentence, and it'll make your work more comfortable to read. You made some grammatical errors, so try to remember to proofread your essays so that you can catch any small grammatical errors you might make. I thought you developed your points very well, and I enjoyed reading your interesting take on the lectures. I even learned some new information from your essays that I missed during the lecture. Overall I thought your essays were very well written. / 178 Words

Comments from the receiver:
After reading through the comments, I was amazed by how easy it was for me to make so many grammatical errors. I found the feedback very concise, short, and easy to understand. The reader gave me examples of how to improve by providing replacements of words to better my work. They have taught me new grammatical terms that I was never aware of. I am satisfied by the level of detail, precision, and usefulness of this feedback. I have a more clearer understanding of how to phrase my sentences, which was the main downfall of my essays. All in all, I am very happy with the reader's comments and I intend to incorporate this feedback into my future reflective journals and similar assignments in my other modules. / 127 Words

3.

Comments from the peer reviewer :
Good consistent reflective tone used through. Interest in the subject shown by additional research done outside of the lecture. Clear and concise language used, minimal rampling etc. Great use of quotes to further put across a particular point. Shows that attention was paid to the lecture throughout. Strong and interesting perspectives and opinions translated in a concise and to the point manner. Strong use of vocabulary which indicates a wide knowledge of the English language. Each submission was very well structured. My only criticism would be the openings, which didn't properly introduce each reflective journal or contextualize the lecture. In the future you could begin the journal outlining who the lecturer and providing a short introduction to the subject. I am also unsure if using the lecturers first name when referring to them is appropriate for this type of journal. The endings were very strong and providing an honest and confidently articulated assessment of the learning done in each lecture. All in all each journal was very complete and to the point, showing great reflective and interpretation skills throughout.
/ 179 Words

Comments from the receiver:
This peer was probably the most critical, but also the most helpful. They executed the task of peer reviewing very well, and the advice they provided was very understandable and manageable. I will be sure to improve my introductions in the future. / 42 Words

Figure 8. A few examples of student peer review comments and feedback

16. Examples of group presentations:

The groups were given the option to choose a topic that interests them to discuss and analyse critically.

That allowed the students choose diverse themes from Architecture in films, the problems female architect encounter to the ethical dilemma the tobacco industry is facing.

Figure 9. A few examples of group presentation slides

Results and Impact

According to the student feedback received in the previous years and in particular in November 2019, there was a need for more clarity about the assessment, including the learning journal. Consequently, in September 2020, in the very first lecture the assessment strategy was explained in detail and examples of prior work were shown and made available through Brightspace.

The students were encouraged to ask questions and to explore different approaches that they were comfortable with when completing assessment.

The impact of the changes introduced is evident from the following:

— student feedback
— standard of work
— variety of submissions
— student engagement / participation during the lecture sessions.

As far as the impact of COVID-19 and pandemic restrictions are concerned, this concerns:

— More engagement from the class due to online teaching (students taking part in sessions using chat etc).
— Students spent more time working on their projects / assessment than usual due to COVID19 restrictions and that helped to improve the submission standards.

The Outcome:

1. As all the lectures and the tutorials were conducted using Zoom, it was interesting to note that the first-year students felt more free to take part in the discussion using the CHAT option after the lectures to ask questions. Normally students ask questions when you move from group to group in the lecture hall at the allocated discussion time. But this year they were free to talk in front of the whole class. However, it is also important to note that one student wished for more break-up rooms.

2. Students greatly appreciated the use of peerScholar. The peer review worked well and most of the students took this task very seriously and gave very balanced, respectful comments (please see examples provided).

3. The standard of learning journals improved in comparison to 2019/20 due to peer reviews they received. Each student received three reviews on how to improve their work on their first draft. That helped to improve the overall standard of work.

4. The group presentations touched on many diverse topics. However, it is also important to note that in 2019/20 the topics were more diverse. This may be due to a misunderstanding / miscommunication concerning the choice of the topic (i.e. the assumption it had to relate to Architecture).

5. The module achieved the goals it set itself at the beginning of the semester in relation to inclusive teaching and learning as evident from the student survey conducted by Dr Lisa Padden.

Below is a sample of the responses submitted in a survey conducted at the end of the trimester 1 of the academic year 2020/21:

Q1: Clear communication: Were the learning outcomes and rationale for the learning modes (projects, presentations, discussions, labs, etc) and assessments made clear?

A1: Yes I had a clear understanding of what we had to do for our assignments. We were also given a schedule of the upcoming lectures, so I knew what to expect and could prepare accordingly.

A2: Yes, they were made clear from the beginning.

A3: Yes everything was laid out on Brightspace in the overview. It was detailed, concise and straight forward.

Comment: very clear communication from week 1 explaining how the module was structured and regular emails with additional information and reminders helped to achieve the goal.

Q2: Engaging students: Did you feel able to participate in class and other learning activities, or were there barriers to engagement?

A1: I felt as if this lecture was very open for engagement

A2: I felt free to participate if I wanted to, I did not feel any barriers.

A3: yes I felt encouraged to participate

Comment: Encouraging students to ask questions, to participate in the discussions helped to achieve this goal. In zoom sessions students were encouraged to use the chat option as well.

Q3: Flexibility: Was the teaching material and its delivery (lectures, online material, in-class discussions, etc.) sufficiently diverse to support your learning?

A1: Yes, I really liked the fact that Daniel brought in lecturers from a diverse variety of backgrounds.

A2: We had a diversity of teaching material such as lectures and presentations, pre-recordings, powerpoints, in order to support my learning. This way of teaching has helped me become fully engaged with the module as we had to write reflective journals for every lecture. This helped me to write down everything that I have learned and also go back and re-watch the lectures in order to learn everything that was said.

—

A3: The teaching material was very diverse and I learned many aspects to different fields of work - like law, engineering and landscape architecture.

Comment: It was very clearly communicated on week 1 about the different topics we are going to cover and the different tools we were planning to use during the lectures.

Q4: Flexibility: Was learning supported by a variety of learning modes (projects, presentations, discussions, labs, etc), or do you feel there were other ways to enable your learning that could be offered as alternatives?

A1: I think it was supported by a variety of learning modes, maybe a lab would've been nice as well.

A2: Yes we had many aspects to our learning.

A3: I believe all the learning modes possible for this course were used. We've had projects, presentations, discussions and guest speaker so I was happy with it.

Comment: All the available options were used using Zoom. However, the on campus teaching may allow experimentation with more learning modes in the future.

Q5: Flexibility: Did the assessment strategy build in flexibility and variety to address different learning styles?

A1: Yes I felt I learned and experienced many different learning styles within this module.

A2: I think it did. For this course we had to write reflective journals as our assignment. This was very flexible as we were allowed to discuss what we found interesting about each guest lecturer rather then being told what to write on. We have a group project due which is also very flexible, as we get to pick any topic that relates to architecture and have to make a presentation on it.

A3: Yes, there was a written assignment for those good with words, a peer review for those that are more analytical and a group project for those who like to work with people

Comment: assessments strategy set for this module allows the students to try different options to achieve their goals.

🔍 Recommendations and Advice for Implementation

Based on this case study, the following recommendations could be considered for academics wishing to adopt similar inclusive teaching and learning methods:

— peer review (using peerScholar tool) can help students to see and comment critically on each other's work, which is extremely helpful especially in online teaching / blended learning contexts e.g. due to pandemic restrictions, while also ensuring anonymity.

— students should be given more flexibility and freedom with regard to the choice of topics, e.g. for presentations and weekly learning journal, to foster motivation.

— using a combination of different assessment strategies to take into account e.g. different personal learning styles and preferences.

— make all the learning materials available using Brightspace or similar Learning Management Systems to accommodate students who - for various reasons - cannot attend classes / may wish to review content in their own time.

— be very clear about the organisational issues such as delivery of lectures, schedule of topics, submission dates etc.

— repeat important information in weeks 1 and 2 to ensure all students have understood the requirements and have had enough opportunities to ask questions.

References and Further Reading

Choulier, D. et. al. (2007). **Reflective practice in a pluri-disciplinary innovative design course**. European Journal of Engineering Education, 32(2), 115–124

Donohoe, A., McMahon, T. & O'Neill , G. (2008) **Online Communities of Inquiry in Higher Education**, In, R. Donnelly & F. McSweeney (Eds) Applied e-learning and e-teaching in higher education, pp262-288. London: Information Science Reference (an imprint of IGI Global).

Gransden, B. (2004). **Reflections on teaching observations and the use of a personal development journal in medical teacher education**. Educational action research, 03/2004, 12(1).

Hanson, J. (2001). **Morphology and design: reconciling intellect, intuition, and ethics in the reflective practice of architecture**. In: (Proceedings) 3rd International Space Syntax Symposium.

Hatton, N. & Smith, D. (1995). **Reflection in Teacher Education-towards definition and Implementation**. Teaching and Teacher Education, 11, (1) 33-49.

Kolb, D. (1984). **Experiential learning**. New Jersey: Prentice Hall

London Deanery Faculty Development, **Giving Effective feedback**

Schön, D. A. (1983) **The reflective practitioner: How professionals think in action**

University College Dublin, **Peer Review/Peer Assessment**

University of Portsmouth, **Reflective writing - Help and advice**

3

Diversity of teaching and assessment modes in Environmental Engineering

Case Study 3

Dr Sarah Cotterill **Diversity of teaching and assessment modes in Environmental Engineering**

Dr Sarah Cotterill

Dr Sarah Cotterill is an Assistant Professor in Civil Engineering and Stage 3 Year Head. Prior to joining UCD, she completed an Engineering Doctorate at Newcastle University, a Fulbright fellowship at The Pennsylvania State University and postdoctoral research at Durham University. She coordinates four modules at UCD including 'Creativity in Design' and 'Introduction to Water Resources Engineering'. In 2019, she received funding for a Learning Enhancement Project to create digital resources to improve student access to practical applications of environmental engineering. Her research interests include water conservation, nature-based solutions for stormwater management and resource recovery from wastewater.

Outline

Title	**Diversity of teaching and assessment modes in Environmental Engineering**

Abstract

This case study sought to expand the opportunities for student learning in a stage two engineering module through the inclusion of collaborative group work and practical-based applications of calculations. The cohort is a diverse mix of students from civil, structural and mechanical engineering. As such, the intention was to create a wider variety of learning modes, beyond lectures, to maximise engagement and opportunities for transdisciplinary knowledge exchange.

Module Name

CVEN20030 Environmental Engineering Fundamentals

Discipline

Civil Engineering

Level

Stage 2, 5 credits

Student numbers

56-62

Introduction and Context

Environmental Engineering Fundamentals is a core stage 2 module in Civil Engineering, and an elective module for Structural Engineering with Architecture, the Global Engagement Masters Pathway and the ME in Energy Systems Engineering. The module aims to lay a foundation for more intensive modules in later stages by introducing concepts about environmental ethics, engineering calculations, and the fundamental biological, chemical and physical processes used in environmental engineering.

There is a diverse cohort spanning two different stages and four degree programmes. In 2019/2020, 68% of the students were male; 42% of the students were international (either on a study abroad programme, such as Erasmus or a non-EU exchange, or on the Global Engagement pathway); and 3% of students were registered with UCD Access & Lifelong Learning as having a disability.

A change in coordination for this module in 2019/2020 coincided with the outset of this Inclusive Teaching Pilot Study. The intention was to increase opportunities for student engagement, to move away from 'chalk and talk' style lectures and expand the variety of assessment types and diversity of learning modes. This was thought to be needed from the student perspective based on initial feedback, from the 2019/2020 post-it note survey, which suggested there was a desire to see more group and practical work included and a greater diversity of learning modes such as laboratory experiments and worked tutorials to provide "more practice" and "more time to understand the examples".

Design and Implementation Description

In 2019/20 the course was taught as 30 hours of face-to-face lectures. In addition to this, there were two in-class tests in week 4 and week 8, and a revision/recap session in week 12 ahead of the exam. In 2020/21, the course was delivered entirely online due to COVID-19 restrictions. Initial plans for the Autumn 2020 trimester involved a blended delivery in which small group teaching could take place on campus, provided there were fewer than 50 people at a distance of 2m, present in a room at any given time. For all other situations, students were advised not to attend campus, and to work from home. The number of students registered on this module exceeded the maximum room capacity, and therefore no face-to-face activity was planned. Over the course of one online trimester, the intention was to create opportunities for variation in learning mode – i.e. learning from the lecturer, learning independently, learning from one another – and flexibility in communication style. The three, one-hour timetabled lectures per week were delivered in one of three delivery modes: (1) live Zoom lectures, (2) shorter pre-recorded videos and (3) 'offline' workbooks.

(1) Zoom lectures

Lectures were delivered live over Zoom once or twice a week. The lectures were recorded for those unable to attend or those who wished to re-watch later. Lectures involved a mixture of theory and discussion: the former was delivered, as it would be on campus, through the use of 'chalk and talk' PowerPoint slides, and the latter was facilitated through Zoom features including polls, whiteboard and breakout rooms. Polls (Figure 1) were used to gauge understanding, begin discussion and/or obtain feedback on an activity. The feature allows you to create single or multiple choice questions ahead of a Zoom meeting to gather responses from the students attending.
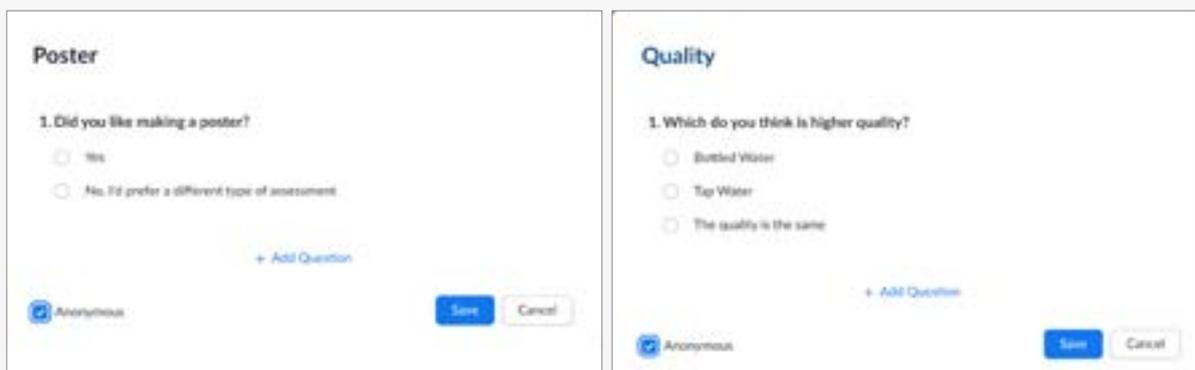
Figure 1. Two examples of a Zoom poll: to open discussion (left) and to obtain feedback (right).

The whiteboard feature enabled the lecturer and students to annotate a shared whiteboard screen by typing text, drawing lines and arrows or inserting pre-defined icons (such as a tick or a star). This was used as an ice-breaker or gateway to smaller group discussions in breakout rooms. Breakout rooms enabled groups of 4-5 students to discuss a topic in more depth before reporting back to the class in the main room.

(2) Pre-recorded videos

The nature of the blended cohort – comprised of several degree programmes – meant that some of the students (e.g. Stage 2 civil engineers, approx. 30 students) may have had small group campus activities prior to, or immediately after, this module's lecture(s). Therefore, there was an added challenge when scheduling live Zoom lectures that students may be travelling between campus and home, and might be unable to log in during the timetabled slot. To counter this, a proportion of the classes were uploaded as pre-recorded videos to Brightspace to allow greater flexibility for the students to access the content. A selection of shorter videos (e.g. 10-15 minute videos) were uploaded instead of one hour-long lecture.

(3) Workbooks

Finally, a number of workbooks were created which included a variety of guided tasks, reading, virtual labs, questions and calculations to support topics covered in lectures (Figure 2). This was intended to provide a break from the large volumes of videos and PowerPoint presentations the students were expected to be consuming (due to the online format of learning), and to encourage them to read more widely around the lecture content. Some of the workbooks were created around a particular theme, such as the sustainable development goals and resource use. Others functioned as remote laboratory classes, with links to animations or filmed footage of practical experiments, and simulated data sets aligning with the footage to use in calculations and data interpretation.

Figure 2. Excerpt from one of the virtual lab books. It referred to videos and animations of laboratory procedures (which were filmed and posted to Brightspace) with calculations and other questions.

Module content was assessed through a series of timed multiple choice question (MCQ) tests, a group poster and a take-home exam-style assignment. MCQs were delivered using Brightspace Quiz to evaluate numerical skills and the students' grasp of fundamental principles. Brightspace Quiz enables the creation of a question library from which a random selection of questions, generated to be of a comparable level of difficulty, can be selected for each student. The questions were designed to: (i) align with key learning outcomes relating to the fundamental ethical considerations environmental engineers face, and (ii) test their ability to perform basic environmental engineering calculations.

An academic poster was the required output for the group task. Students were assigned to groups by the module coordinator to ensure a mix of degree programmes, stages (years) and experience to promote and encourage cross-disciplinary knowledge exchange. They were each asked to pick a topic from one of the UCD Green Campus priorities, such as waste reduction or water conservation (Figure 3). They were asked to provide an introduction and context to the problem, to critically evaluate the progress UCD has made in addressing this topic, and to outline one or more suggestions for how UCD could improve further in this area. Suggestion(s) could include the implementation of new technologies, behavioural change and/or changes to policy or legislation.
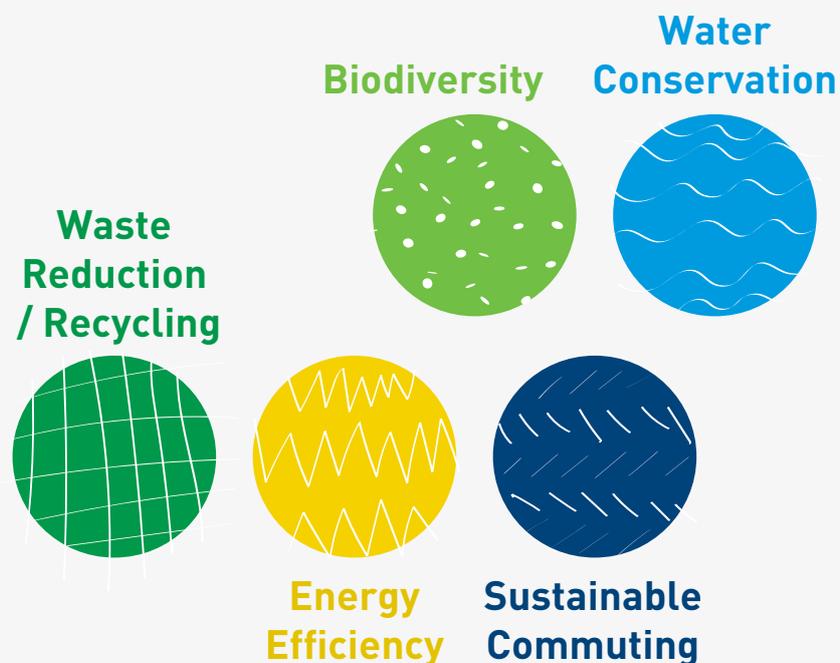
Figure 3. Five priority areas for sustainability for UCD Green Campus.

The poster was graded using a rubric, which was developed in partnership with the students. This was achieved in a single Zoom session, through the use of Zoom breakout rooms and MIRO – an online collaborative whiteboard platform – to identify what the poster should include and the relative importance of the component parts of the task. Students were allocated into breakout rooms and asked to discuss what they thought was essential for the poster. Ideas were relayed back to the entire class and mapped out collectively using MIRO (Figure 4).
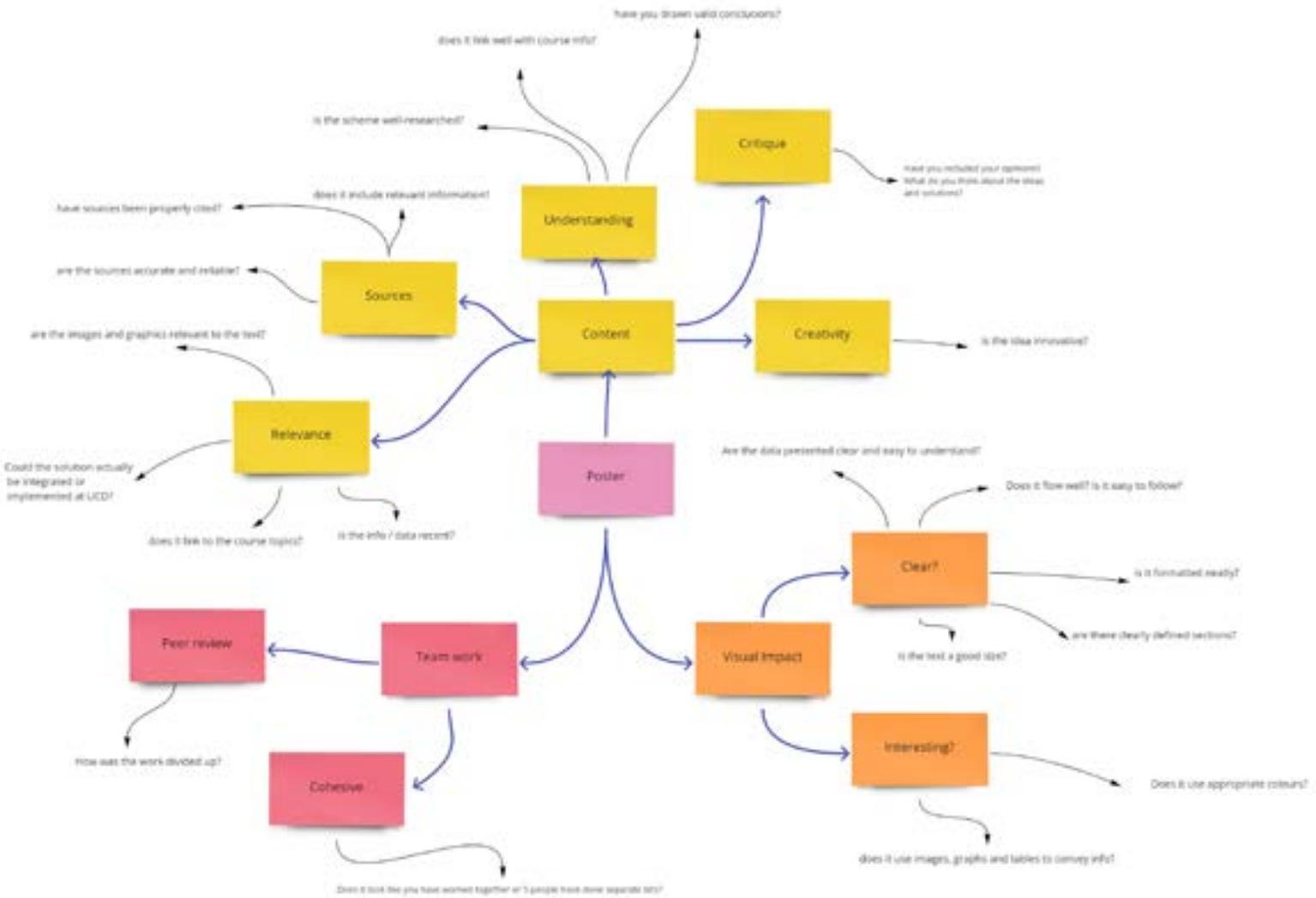
Figure 4: MIRO output summarising student comments on what the poster should include.

After this, students returned to their breakout rooms to discuss how they would allocate or weight the graded parts. At the end of the one hour Zoom call, students uploaded their suggestions (from each breakout room) to Brightspace. This was converted into a grading matrix (Figure 5) aligning the feedback and input from the students with the standard grading scales used at UCD.

	A+	A	B	C	D	E	F
	90-100%	70 – 89.9%	60 – 69.9%	50 – 59.9%	40 – 49.9%	30 – 39.9%	20 – 29.9%
Understanding: - **Context** - **Links with course material** - **Use and interpretation of references**	Exceptional understanding. Supported by wide ranging and credible references. Demonstrates clear understanding of the wider relevance. Seamlessly linked with the course material.	Excellent grasp of underlying issues. Clear evidence of thorough research, drawing on a wide variety of sources. Strong ability to connect concepts to context. Appropriately linked with the course material.	Sound grasp of issues. Some ability to connect concepts to context but little analysis of wider relevance. Limited references to support context. Attempted to link to course material.	General grasp of main issues, but some evidence of gaps in understanding. Limited attempts at linking with topics covered in the module.	General awareness of the context underlying the challenge selected. Some shortfalls are apparent (i.e. lack of understanding). Poor links with module content.	Superficial grasp of broad ideas and concepts. Major shortfalls are apparent in some key areas. No attempts to link with topics covered in the module.	Little or no grasp of broad ideas and concepts. Major shortfalls in most key areas or section missing entirely.
Analysis of Progress Made at UCD: - **Use and interpretation of references** - **Critique** - **Evaluation** - **Inclusion of appropriate data**	Summary of progress is concise, well presented and shows a high level of understanding. Exceptional interpretation of data collected from relevant and appropriate sources. Demonstrates ability to review, reflect and critique information. Substantial evidence of original thought including creation of own figures and/or tables.	Very good range of supporting evidence. Good evidence of critical analysis around the success of interventions. Some evidence of analysing multiple sources of data through creation of original figures/tables.	Good use of a limited range of sources to present a clear summary of progress. Data included is appropriate and relevant. Some evidence of critical evaluation.	Summary of progress is hindered by a limited selection of sources and data. The summary is adequate, but provides limited critique. The images selected are primarily photos, rather than graphs or tables, and are not as impactful as they could be.	Limited references collected, and poor links provided between interventions, progress and context. Understanding is basic, but sound. Little evidence of critique or original thought. Lack of data included as figures or tables.	Very basic analysis and a poor summary of progress made at UCD with some substantial shortfalls in understanding and/or inaccuracies in places. No evidence of critique or original thought. Visual representation of data (figures and tables) missing.	No discussion of progress made at UCD – section missing entirely.
Discussion of Ideas for Future Solution: - **Innovation** - **Creativity** - **Relevance**	Exceptional suggestions highlighting original thought, creativity, and/or an outstanding review of the literature. Ideas are highly relevant to the topic and suitable for implementation on a university campus, such as UCD.	Very good discussion of ideas, with some original thought and creativity, or inventive suggestions taken from a thorough review of the literature. Ideas are relevant and realistic for an application on a university campus.	Good discussion of ideas, but limited evidence of original thought, with most ideas taken solely from the literature or other campuses. Suggestions are relevant for a university campus.	Some suggestion of ideas that are somewhat relevant and realistic. Suggestions lack original thought, creativity and innovation.	Limited discussion of ideas, OR suggestions which are somewhat irrelevant and unrealistic for application on a university campus	Ideas presented are irrelevant and unrealistic for implementation on a university campus. There is little to no discussion of these ideas.	No discussion of ideas or suggestions for future work to address this challenge.
Poster layout: - **Visuals** - **Structure** - **Cohesive** - **Referencing**	A visually outstanding poster, with a very clear structure, combining each of the team's contributions cohesively. Figures and images are excellent and referencing is of publication standard.	A very well-structured poster with good use of images and/or tables. Some of the figures are original (created by the group). The content is well written and flows logically between the different sections. There are no formatting issues (e.g. typos) and good referencing.	A well-structured poster, with some thought to the visual aspects, but without the creation of original figures. Concisely written with good grammar, but some (limited) formatting issues. Appropriate use of references.	A satisfactorily presented poster. Some issues with formatting (e.g. typos, large blocks of text, or lack of cohesion between different sections etc). Some references, but not entirely appropriate format. Visual design OK, including some figures, but could be improved.	Poor style of writing, with some parts difficult to follow. Visual design either lacks figures or tables or includes irrelevant ones. Layout is difficult to follow and is not cohesive. References provided in an inappropriate format.	Difficult to read and lacks a logical train of argument. Individual sections do not combine into a single piece of cohesive work. Very poor organisation and presentation with no, or poor quality, images included. References either not included, or not cited appropriately.	Little more than a set of notes. Poster lacks any real structure with no care given to the visual design. Arguments completely unclear. No references included.

Figure 5: Rubric created after student discussion identifying the key elements of the poster and the weighting they should have in the grading process.

A peer review template (Figure 6) was submitted by each student individually upon completion of the group poster (Figure 7) to assess how they worked within a team. The group assignment intended to stretch their ability to conduct independent research, synthesise information, collaborate with their peers and present information in a concise and engaging way.

Complete the Team Member Participation Evaluation Table below in respect of your evaluation of the quality of each team member's participation in the group task (including your own). The Partitcipation Evaluation Scale Table below should be used to assign a score for each criteria.

Where appropiate provide commentary in the box titled 'Steps Taken to Address Unequal Participation'.

Participation Evaluation Scale Table

Very good	Good	Satisfactory	Marginal	Unsatisfactory
5	4	3	2	1

Team Member Participation Evaluation Table

Group number: _____

*please also include yourself in the table

Criteria	Names				
	1.	2.	3.	4.	5.
Contribution to workload					
Engagement with group					
Meeting attendance					
Total					

Steps Taken to Address Unequal Participation:

_____

Figure 6: Example of peer review template used to assess group contribution.

Finally, a take-home exam was chosen as an alternative to an end-of-trimester exam, due to the online circumstances and challenges with conducting timed closed-book exams. This assignment involved five open book style questions, testing their ability to connect fundamental concepts and integrate further reading. Students were informed that higher grades would be awarded for those using a wide range of sources (i.e., more than one text book, article or research paper) and the original presentation of the answers (e.g. using tables, diagrams, figures they had created themselves) – to discourage students drawing solely from their lecture notes.

Water Efficiency: Do UCD Care?

Introduction

UCD: A Review

Management

Efficiency Measures

Lacking Information

Behavioural Change

14%

Suggestions for Improved Efficiency

Smart Water Network

What is it?

What are the Benefits?

Smart water network packages best suited to UCD:

Smart Network Leakage

Smart Network Optimisation

Low Flow Networks

2 years

Why Retrofit?

30%

Case Study: Aerators

How Do Aerators Work?

Why Invest?

193'500 l

Figure 7: Two examples of group posters

Results and Impact

Meeting the Objective

The objective of the project – to increase the diversity of teaching and assessment modes – was achieved. The changes made involved the inclusion of group work, problem-based learning and (virtual) laboratory experiments. All students who responded to the online survey in 2020/21 thought there was clear communication, flexibility in assessment, and flexibility in learning styles (given the constraints of online learning). The majority of respondents felt able to participate in class, with several noting breakout rooms supported this. However, there are still barriers to address here, with one student commenting that speaking out online can be "daunting".

Students commented that, "the group poster assignment and the breakout rooms were a great way to get to know the class" and "working with students from [other] courses made the groups more interesting and good for getting different points of views rather than us all having the same pool of knowledge". This was raised in the initial post-it note survey, where several students suggested the poster project could have been a group task. In a Zoom poll at the end of the module, 84% stated they enjoyed researching the topic in their poster, 68% reported they liked working in groups, and 100% suggested they liked making a poster.
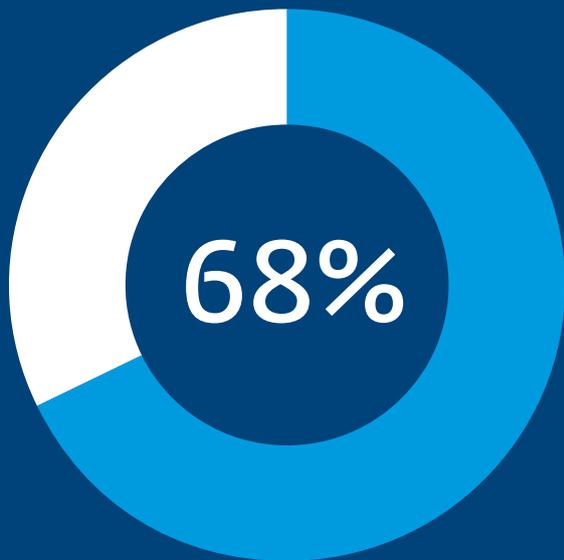
68% liked working in groups
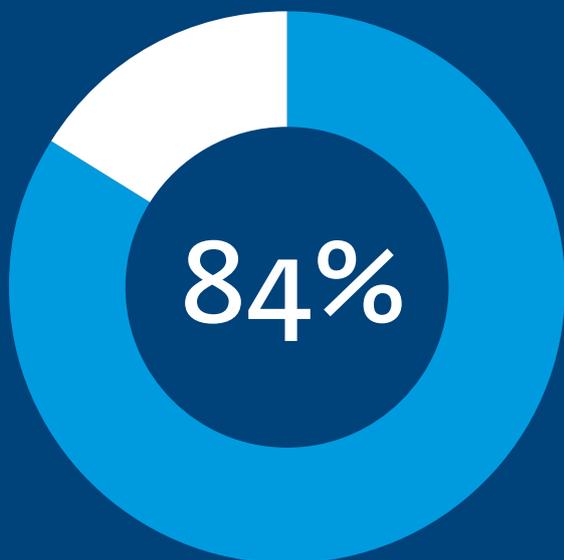
84% enjoyed researching the topic

100% liked making a poster

Several students referred to the worked exercises in tutorials, commenting these were, "helpful for practicing the numeric material". This addressed concerns from the previous post-it note survey, where students asked for more opportunities to practice the examples provided during class.

Evidence of Impact

There was a lower response rate to the online inclusive teaching pilot post-it survey in 2020/21 (<10% students registered) than the number who completed in-person the previous year. As such, feedback was collated from a wider variety of sources including the online survey, the general module feedback collected on UCD InfoHub, and via informal emails from students.

Student feedback on InfoHub is collected as Likert responses to five statements:

Q1. I have a better understanding of the subject after completing this module

Q2. The assessment was relevant to the work of the module.

Q3. I achieved the learning outcomes for this module

Q4. The teaching on this module supported my learning

Q5. Overall I am satisfied with this module

There was an increase in overall student satisfaction (Q5) with the module from 4.25 in 2019/2020 to 4.5 (out of 5) in 2020/2021. Feedback suggested students liked the "very detailed and well-structured content" which was "well delivered with a mix of live classes and mini assignments". There was acknowledgement that, "very varied assessment types" were used, and that these assessments required a "mix of technical understanding and applied knowledge". The Likert responses suggested the assessments were relevant to the work of the module (4.83 / 5, Q2) and the teaching on this module supported student learning (4.5 / 5, Q4). The overall module grade distribution was consistent with previous years, despite disruption caused by the pandemic. One student commented that the lecturer had been "so responsive over the semester" helping to "calm students" and create a "really enjoyable module".

Lessons Learned

There were a range of suggestions for how this module could be further improved. The initial design of the module – which intended to accommodate the aforementioned challenges related to online and blended delivery – was intended to be diverse (i.e. 1 live lecture, 1 recorded lecture and 1 guided workbook) and inclusive, particularly for students who may be traveling between campus and home, or for those experiencing Zoom-fatigue. However, some feedback suggests this was, with hindsight, not enough "screen/face time". This will be addressed in the 2021/22 term, when there will hopefully be a more substantial return to campus activities, and less need for pre-recorded video which offers little direct engagement.

Furthermore, feedback suggested students would still like more lab work – but acknowledged this was difficult due to COVID-19 restrictions. A challenge moving forward will be implementing this with this module's relatively large group size and timetabling constraints. Laboratory classes for water quality are difficult to implement in a one or two hour time slot – and would be more feasible if a morning or afternoon session was dedicated to this instead. Additionally, even if social distancing requirements are removed entirely, the laboratory space in the School of Civil Engineering is able to accommodate less than half of the class at any one time. Whilst efforts were made to include virtual labs and tutorials, students expressed a preference for more hands-on experience, but acknowledged that this "wouldn't work this year". Realistically, this is likely to be a longer term strategy to evaluate how to incorporate real, hands-on practical activities feasibly into this module.

👍 Recommendations and Advice for Implementation

Some of the tools and resources used in this case study arose as a direct consequence of online learning and a heavy reliance on Zoom. These tools may, or may not, be relevant when returning to on-campus activities, but can potentially be slightly adapted to fit an in-person format. For example, by enabling students to take more control over their learning, through the use of 'offline workbooks', some students engaged in deeper research, following up with emails and questions based on their self-directed interest in the subject. This was not uniform within the class; the remote format may have widened gaps between those comfortable conducting self-guided work and those who, perhaps, need a little more direction. In future years, these workbooks could be adapted to a flipped classroom format, which would make use of the time invested in the planning and design of these activities, whilst delivering benefits for a wider variety of students.

The use and co-development of the rubric with the students, was a success, and will be taken forward. However, this was a small first step and can be further built upon in subsequent years. The students showed a much better understanding of the poster task than the previous year, which may be a result of it becoming a group activity or due to the co-creation of the rubric. Future implementation of this could involve an iterative process, which may not all be achieved in the first academic year. The creation of the rubric provided a method of facilitating a conversation around grading; increasing the clarity and transparency of the task with expectations set early in the process. This process could be improved through student validation of the rubric, achieved by asking the students to grade a selection of sample posters from previous years, using their agreed-upon rubric, to see if it is fit-for-purpose.

Simulations and videos of laboratory protocols were developed from scratch for inclusion in the virtual laboratory workbooks. These were designed for use during the Covid-19 pandemic when module delivery was entirely online, but it was hoped that they would have longevity beyond that. Whilst these resources took a substantial amount of time to create, they enable information to be conveyed in a time-efficient manner, enable a greater number of labs to be delivered than if physical labs alone were relied on, and can be rewatched and revisited to reinforce learning. Previous studies have shown that students are generally positive about the use of virtual technologies, so long as they are not used to replace in-person learning entirely, and instead are used as an additional tool. Further work will be done to evaluate how a hands-on laboratory session can be incorporated into the module, perhaps blending hands-on activities with some virtual components. These resources were time-consuming to produce, but there is now a vast amount of guidance and information available online to support the planning and creation of this material (see below).

Resources

Instructional Resources

University College Dublin, Showcase (Ms Mairead O'Reilly). **Video Production Fundamentals for Practical's & Instructional Videos**

UCD Teaching & Learning, Showcase (Dr Sarah Cotterill). **Improving Access to Practical Elements of Environmental Engineering**

UCD Teaching & Learning, Showcase (Dr Kevin Nolan). **Digital Animation for Educators**

University of Sheffield, T**he Remote Practicals Playbook** from University of Sheffield

Readymade Resources (freely available)

New Mexico State University, **Learning Games Lab** (includes labs on water quality sampling and testing (CONSERVE) and infiltration and runoff (Western Soils) etc.)

4

Street Life, how to study it and improve it

Case Study 4

Dr Miriam Fitzpatrick

Street Life, how to study it and improve it

Dr. Miriam Fitzpatrick

B.Arch. (Dublin) Hons., M.Sc. City Design (Dist.), LEED AP., Ph.D.

Miriam Fitzpatrick is an urbanist with a specialism in the micro-analysis of urban open space. With twenty years in international architectural practice, a masters degree from the LSE in City Design, and a Ph.D. from UCD, she has developed the discipline of Urban Design at UCD since 2006 motivating students from across the school to nurture their curiosity about urban design, connecting their skills from visual thinking to academic writing, and encouraging a sense of social responsibility. She was shortlisted for Teaching Excellence award in 2020.

Outline

Title

Street Life, how to study it and improve it

Abstract

This module is an introduction to the principles of urban design with a focus on improving street life. The challenge in the second year of this pilot (2020 to 2021) was to imagine more liveable urban places post-pandemic. Based on lectures on urban design and research methods in observation, students documented life on a street within easy reach of their home during lockdown and gained agency by their detailed observations and suggestions for design interventions from their close-in view. The module performed a dual role: to gain understanding of how to make public space more accessible while also making the module more inclusive.

Module Name   ARCT40160 Introduction to Urban Design

Discipline   Architecture, Urban Design, Landscape Architecture

Level   Level 4, 5 credits

Student numbers   30-40

Introduction and Context

'If your heart doesn't break at the state of urban society in the world today, then stop reading now. This is for those who want to make a big difference but don't know where to start. Because even though the difference-makers didn't get us into this mess, we are the ones with the drive and belief to get us out of it.' (Campbell, 2018, p.5)

This quote is by urban designer Kelvin Campbell and sets a challenge that my module on street life seeks to address; curiosity and agency. Understanding the delicate balance of engaging across scales is a core challenge for designers, so the module aims to familiarise students with ways of looking closely at the city, while also taking account of a range of placemaking tactics and theoretical perspectives in order to help them gain insights and find agency in improving urban open space.

I have been curious about how public space can enhance inclusivity and how small-signals of exclusion can impact a sense of conviviality in urban places. So when the Inclusive Teaching Pilot was offered at UCD I was intrigued as I foresaw an opportunity to learn new pedagogical tactics and the potential to embed my research into my teaching.

Figure 1. 'Chairs enlarge choice.' (Hyatt, 1980) To the credit of urbanist William Holly Whyte (the subject of my current research) Bryant Park in New York is home to over 4,000 movable chairs (and 1,000 tables): a testimony to the value he placed upon small choices - like where to sit - to the overall sociability of urban open spaces. Source: Photo of Movable chairs for children in Bryant Park by author.

I was researching the extent to which choice in the design of public space could enhance inclusivity so the objectives of the Pilot to widen participation and increase engagement were wonderfully in sync (Fitzpatrick, 2019). I had been inspired by UCL's Prof. Dilly Fung's research on the subject of 'Embedding Research In Teaching,' and presented on this subject to the Professional Certificate and Diploma Programmes in University Teaching and Learning students so participating in the Pilot Project seemed like a chance to go a step further and improve my knowledge of teaching strategies for inclusivity. My interest was piqued by our first workshop as a Pilot Group held in January 2020. It prompted me to reflect on the possibility that if the design of space can have unintended consequences for end users, might the design of my module have unintended consequences for learners?.

My pedagogical approach is to regard teaching as a social act. I therefore designed our classes to include opportunities for exchange, engagement with diverse thinkers in urban design and for reflection. This interest in shared learning comes from a professional experience in international architectural and urban design practices, where differences in perspectives are valued. But the pilot gave me tactics to make this object more embedded pedagogically.

The OED describes perspectivism as 'the practice of regarding and analysing a situation, work of art, etc., from different points of view and on different levels'.

'....by perspective I do not only mean its literal meaning - that is how we see - but also how we understand' (Westin, 2014).

In this quest, I have been influenced by the sociologist C Wright Mill's suggestion for a Sociological Imagination of 'thinking in a variety of viewpoints because the mind becomes a moving prism catching light from as many angles as possible' (Mills, 1959). My research interest in feminist pedagogy added other dimensions. From feminist geographers in particular, I was interested in what gets missed. Geographer and feminist Gillian Rose influential 1997 essay surveyed the landscape of reflexivity in Situating Knowledges: Positionality, Reflexivities and Other Tactics. According to Rose, research is a two-way flow between the researched and the researcher. The researcher's positionality (in terms of race, nationality, age, gender, social and economic status, sexuality) may influence the data collected and thus the information that becomes coded as knowledge. Rose (1997) explains how 'this transparent self then looks outward, to understand its place in the world, to chart its position in the areas of knowledge production, to see its own place in the relations of power' (p. 306).

A counter tactic is 'To be Able to Image Otherwise'. This is the title of a paper by community archivists Michelle Caswell, Alda Allina Migoni, Noah Geraci and Marika Cifor, whose work speaks to a growing interest in emancipatory action research (Caswell et. al., 2017). I revised my module to draw on some of their ideas of producing knowledge that can empower the researcher and disadvantage people by co-participation (Chuh, 2003).

As a result, I aimed to make more explicit the emancipatory aspect of ethnographic fieldwork for students, for how fieldwork holds the possibility of increasing self-esteem and courage to identify or confront structural sources of marginalization, oppression and exclusion in the design of public space. The aim was that students might come to recognise their own positionality (i.e. how the researcher can impact the research) by asking what they have missed by their initial assumptions.
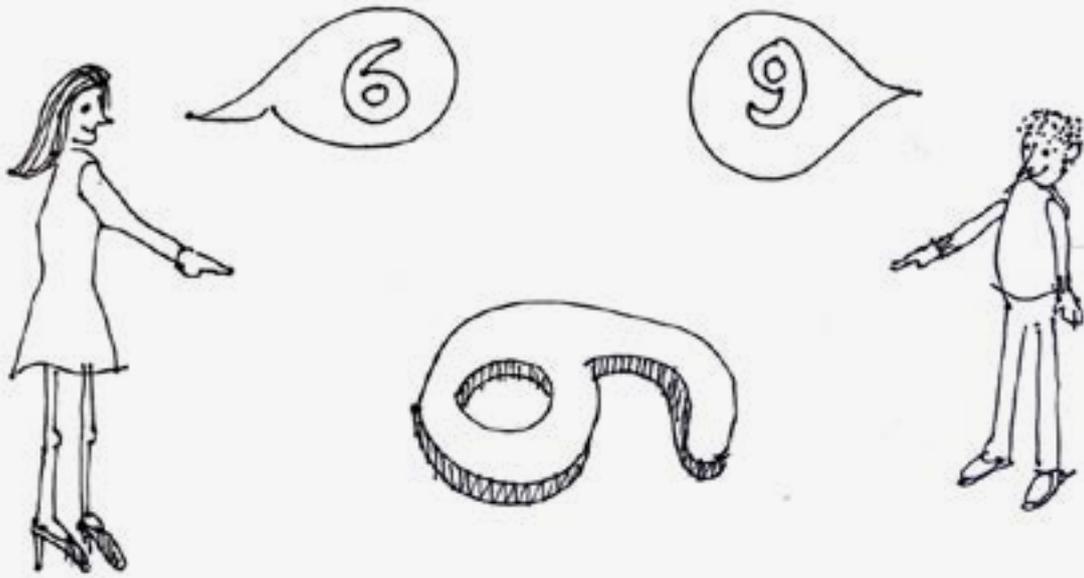
Figure 2. Sketch by author of validity of different vantage points.

Figure 2 sketch aims to capture the validity of different researcher's vantage points. This became a driver for weekly windows into the world, as students presented their street to each other. Using ethnographic methods, they found validity for their view while also discovering new ways to look at streets. By peer-to-peer feedback, they became more aware of what they had missed and in turn their own positionality. Accordingly, by establishing a weekly forum for students to present their street, they were encouraged to find their own voice.

Design and Implementation Description

I developed this module in 2016 for students in the Masters in Urban Design. From 2019, the module was offered as an 'Option/Elective' and so was open to many more courses and as a result, it attracts students from very diverse disciplinary backgrounds. In 2020 to 2021, the class was made up of a third each from a background in Architecture, a new MSc in Architecture, Urbanism and Climate Action, and a third from a mix of Masters or Bachelor in Landscape Architecture. The class included students from North America, EU, UK, South Africa, India and China in a split of just over half females.

I developed a structure of three building blocks, which I related to Roald Dahl's story of 'the Giraffe, and the Pelly and Me'. (It was a nice coincidence that I shared a birthday with Roald Dahl on the first day of the academic year!). Roald Dahl's story is of three intrepid creatures who through shared adventures learn from each other. Representing blocks of different duration, it allowed a way to give a structure to a module that had a changing cohort and focus every year. It also reflected a way to embed a cascade of formative assessments so student input and feedback could be cumulative.

The Giraffe, who is vertically advantaged, offers the distant vantage point of the view from above (overview): Pelly, the pelican, with voluminous beak, walks the field (fieldwork) and captures the idea of city as a repository of urban open space: the third phase focuses on 'Me' and allows time to capture subjective experience and to enhance a personal academic learning journey.
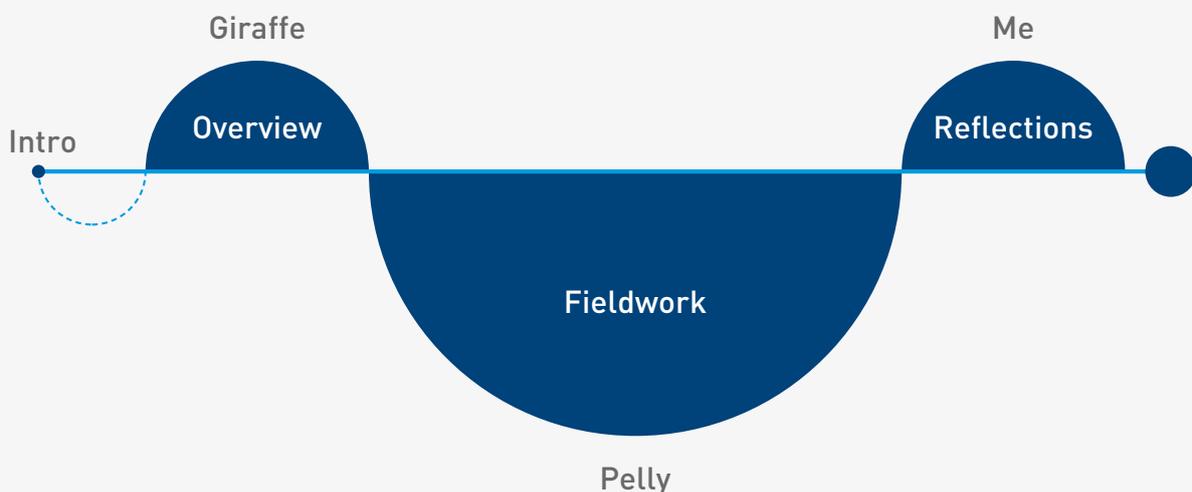
Figure 3. A visual of the module structure over 15 weeks.

The tripartite structure translated into a detailed substructure of content, deadlines for assignments and feedback throughout the module. It also highlighted external activities - made easily accessible via Zoom - to widen our horizons.

Figure 4. My hand-out in week one for feedback on deadlines.

By January 2020, because of participating in this pilot, I had multiple pages of rich student feedback highlighted with a shortlist of identifiable actions and options. Because I ran another module in the second trimester, I was able to test some of the suggestions, an option that turned out to have enormous knock-on benefits given the lockdown mid-way and the switch to emergency remote teaching in March 2020. (More later)

Phase 1, the Giraffe - an Overview

Given the switch to full on-line delivery for 2020 - 2021, for the second year of the pilot, I was ready with new tactics. I posted my introduction lecture on Brightspace to free our first class for more time to 'meet and greet'. The Flipped Classroom eased students into the module as I asked them to be prepared to introduce themselves by a city/town that they loved or to describe where they were spending locked-down. We had 30 cities/town enthusiasts from day one, with students from North America to China, UK to South Africa. It was a great way to begin our venture. They were each the authority on their own place.

The tripartite structure helped students engage early. The introductory weeks established urban design principles and set out the pedagogical approach for lectures and assignments. I had learnt from student feedback how much they appreciated seeing the best for past work so, with the student's prior agreement, I posted the best assignment from previous years on Brightspace and invited questions in early weeks. The work varied and students appreciate seeing the range as all examples of Grade A work. It assured students that there is no right answer. This year, I also invited a past student to present and answer questions. Both opportunities eliminated some of the challenges of self-sabotage by developing a secure foundation of knowledge and expectations and helped build confidence as it allowed each to feel free to experiment while also developing a deeper understanding.

Because of the earlier experience of lock-down, I had come to recognise that we all needed to feel more in control, given the vagaries of our personal situations. So to start off I expanded on some of the insights I had gained from my evidenced-based teaching approach. I developed a special talk on Self-Paced Learning for the motivational and mental demands of remote working. It focused on time management, placing emphasis on starting on a hill with a tiny task, on visual thinking, and various supports for time-blocking. (I am indebted to UCD for a number of workshops on literacy especially those run by Hugh Kerns on Imposter Syndrome. (His company is www.ithinkwell.com.au)

Figure 5 and 6. My Pep-Talk for autonomous learners on time management during Covid19 Lockdown.

I recorded the talk and at various stages of the year, students emailed me as to how valuable the talk was to their studies.

Phase 2 Pelly - Fieldwork

One output was to document streets by comparative analysis and another was to follow up with an in-depth evaluation through fieldwork. I developed a template for students to use.
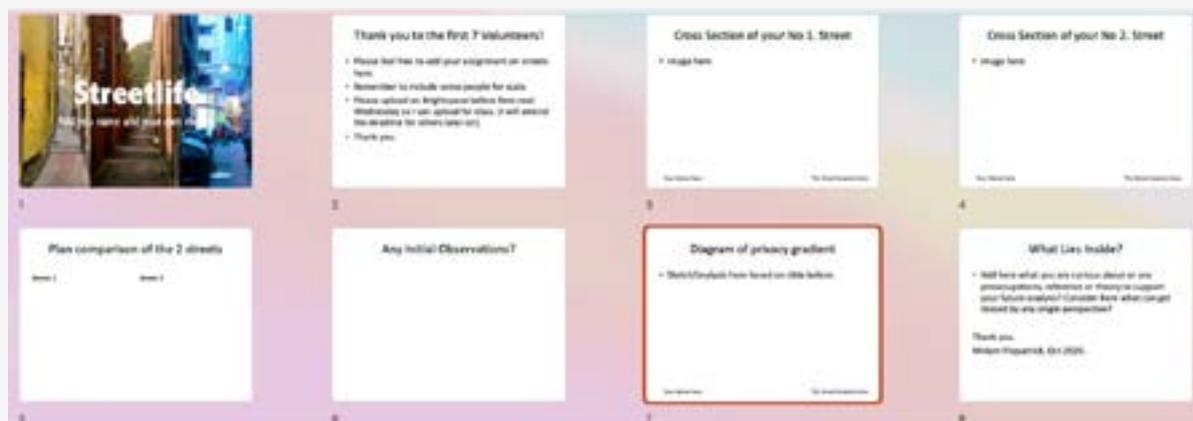
Figure 7. Screenshot of template for street comparison by students.

Typically the fieldwork phase would include lectures on various methods, comparative analysis and trips together to specific places. This had to be altered for Covid19 lock-down. My alternative strategy was that from week 4 to 10, students would provide a window into specifics of their local street. The next images became my index for weekly lectures as every week, it highlighted where we were in the structure. After three opening lectures, in place of fieldwork in the middle section, students were invited to present their street observations for 3 to 5 minutes each. (Week 7 is a review week in studio modules so I scheduled as a 'Golden Week' - to cover of topic of choice so attendance is maintained; this year was on 'Reclaiming the Street for Pedestrians').
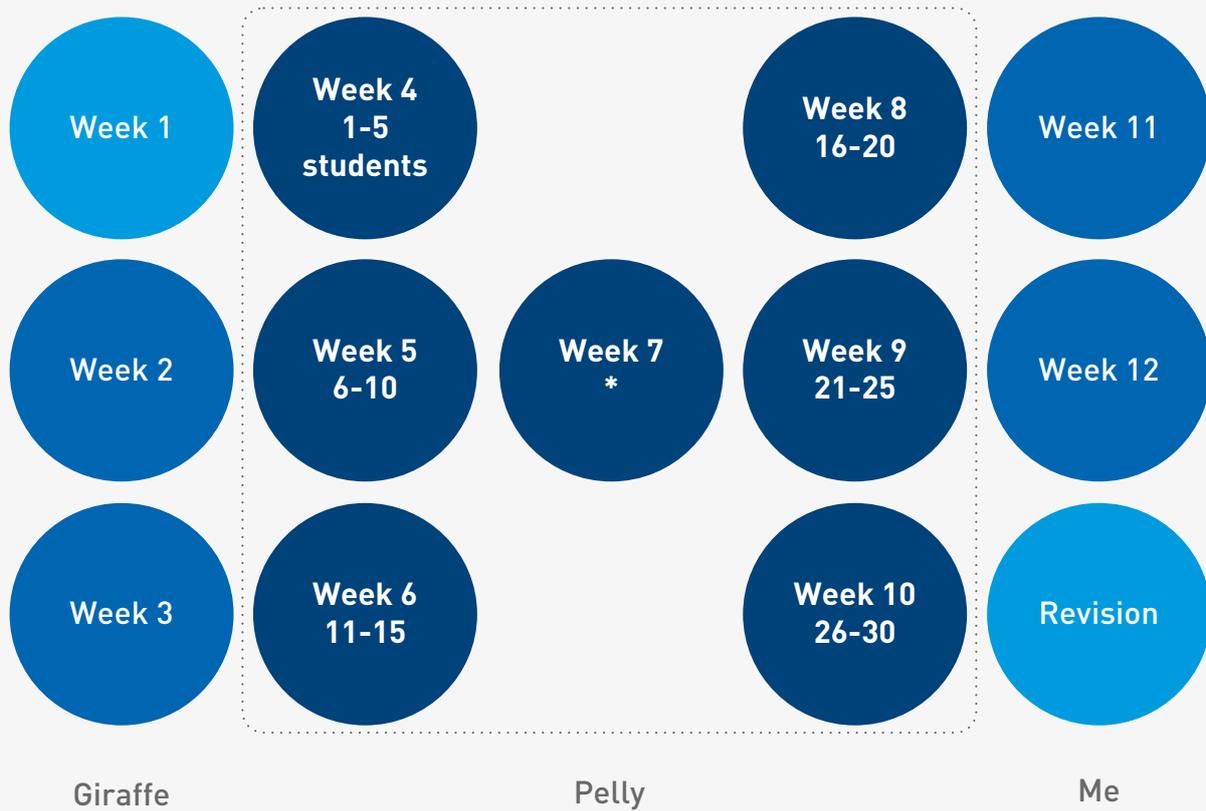
Figure 8. My index/aide memoire of the module structure.

Each week, while we were in lock-down, we managed to travel by these windows into streets worldwide. Designed as a strategy to manage the absence of shared fieldwork, the results were remarkable for their diversity and for class engagement. Here are a few examples:

Figure 9. Street section by student Emer Martin
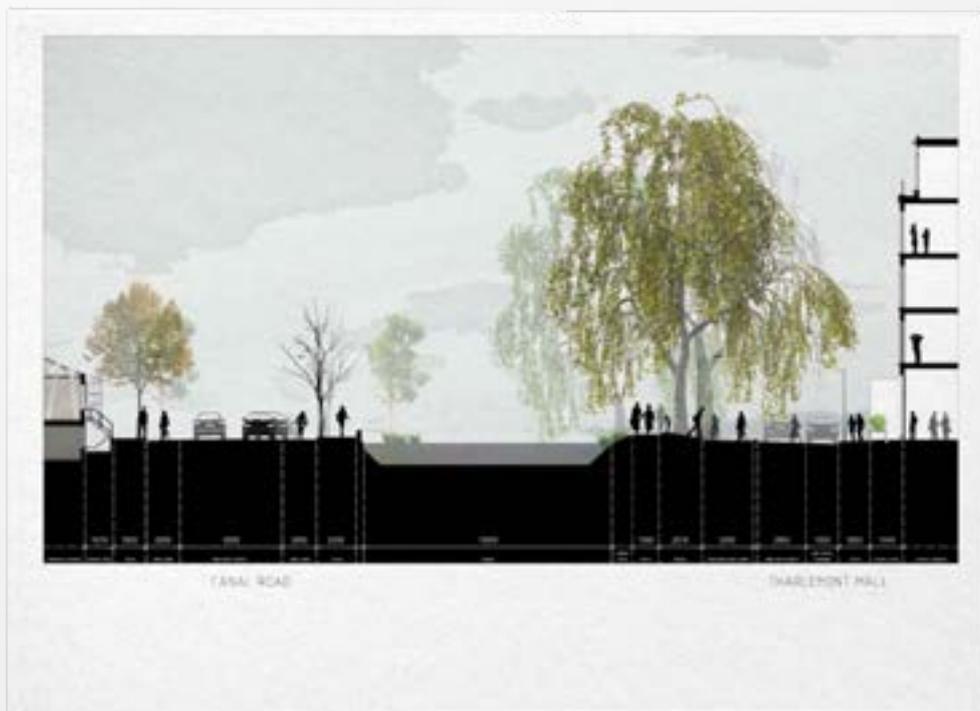
Figure 10. Street section by student Alice Bowler

Figure 11. Street section by student Jennifer Breslin
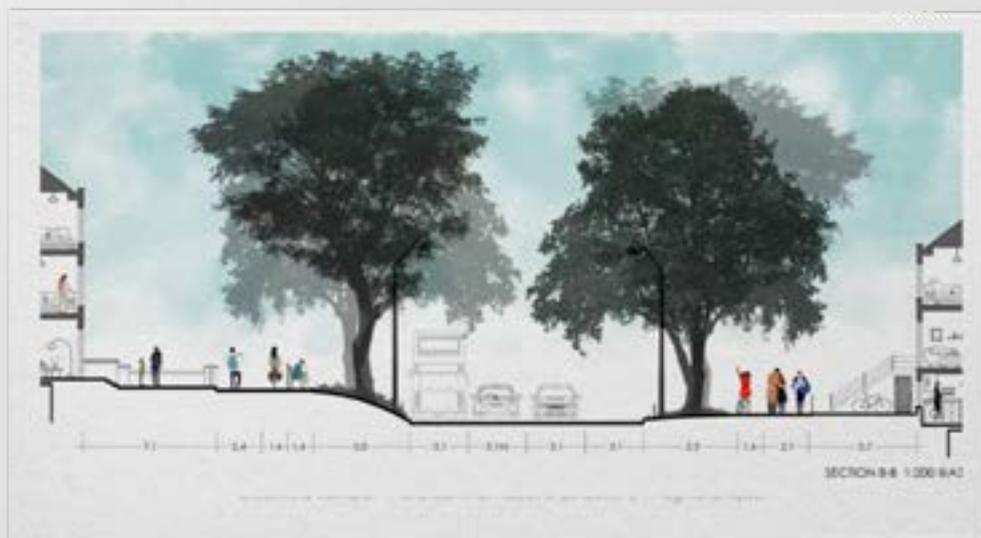
Figure 12. Street section by student Polina Suliana

We travelled from streets in America to China, from Ireland via Europe to South Africa. The work was exemplary and discussions inquisitive and lively. In the spirit of inclusivity, all the results from this assignment have been captured by a student-assembled website on Street Life www.ucdarch.com/street-life One student submitted a video of her street, which captured its life better than the cross sections so I will develop this method in future years.

After repeat visits to their streets, students gained agency as they came to identify what did not work and small changes which could make their street more convivial, more accessible, more enjoyable as a place to walk, to live, or a place to sit and wait.

Phase 3 Me, Academic writing skills

My pedagogical aim is to motivate students to nurture their curiosity about urban design, encourage a sense of social responsibility, and connect their skills from visual thinking to academic writing . Accordingly, I allowed time in the schedule to focus on the student's learning mode, academic writing skills, and reflections. One assignment I have developed for literacy skills is the book review when students read from a range of preselected texts on streets. As some students in Architecture favour visualization and sketching, I emphasised transferring this organizational skill for their essay structures. Some students continue to complete their capstone dissertation with me and I found over the years that for students with dyslexia, this method can be liberating. Why so? Bong Joon Ho, the Director of 'Parasite' storyboards his entire film before he rolls the camera. He does not shoot master shots: he shoots his storyboards. The first step of the review was to capture its structure visually. Here is an example:
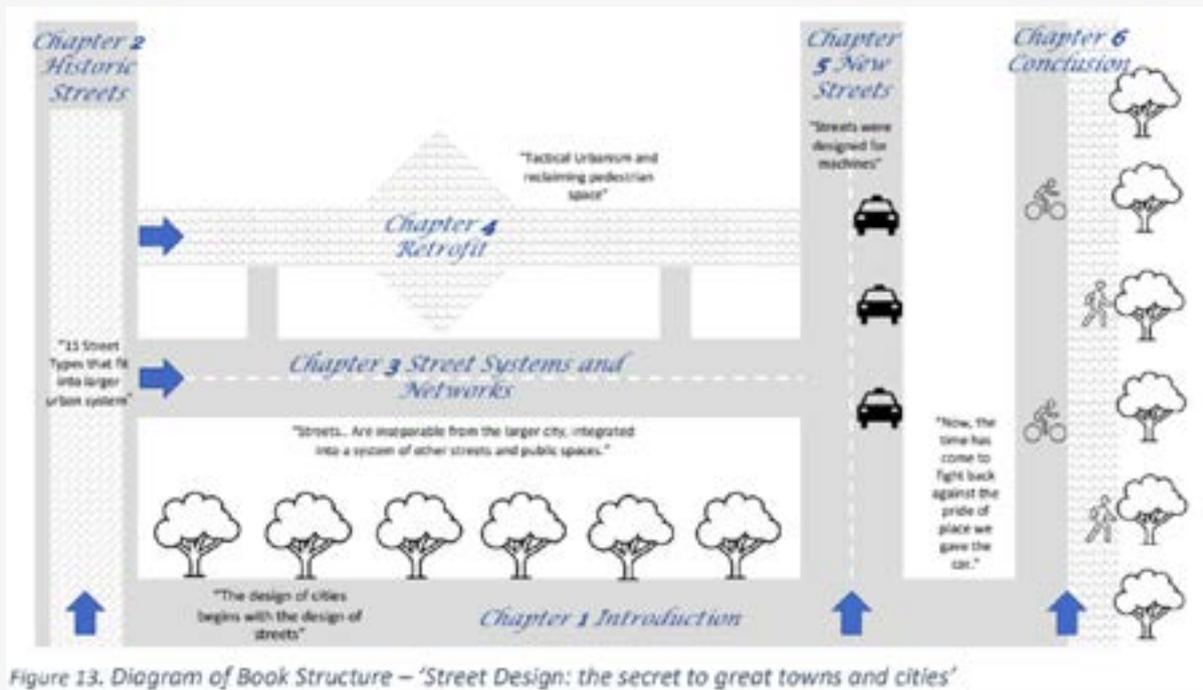
Figure 13. Diagram of Book Structure – 'Street Design: the secret to great towns and cities'

Figure 13. Visual of Book Review by student Hannah Jordan

With a graphic of an essay's structure, design students can be freer to 'shoot' and write: they can also use this prop or infographic, to share their enthusiasm for a chosen book with their peers. But the method was not only applicable to a book review: it can scale up to plan an essay and later a dissertation. A few students availed of the Optional Assignments for the final essay and submitted very creative responses. This is an example of one who submitted a visual in place of a written book review:

Figure 14. Visual as an alternative to a book review by student Stephen Wall.

The embedding of visual representation had other benefits. Most included their findings and analysis as infographics in their final assignment. Here is an example of one student's observations over time. The final essays included lovely visually engaging submissions and received high grades as I included this skill of representation in the grading rubric.

d. Stationary Activity Mapping

		WALKING	RUNNING	ROLLING/ BICYCLING	CONSUMING FOOD/DRINKS	SITTING	TALKING	CARRIED BIKE/ DOG/ STROLLER	ANY ACTIVITIES IN FRONT YARD	
MONDAY	9 AM	46 %	4 %	17 %	10 %	7 %	8 %	4 %	4 %	72
	2 PM	52 %	4 %	11 %	8 %	1 %	18 %	6 %	0 %	95
	6 PM	45 %	8 %	29 %	0 %	1 %	14 %	3 %	0 %	107
SATURDAY	9 AM	43 %	4 %	10 %	10 %	8 %	15 %	8 %	2 %	51
	2 PM	49 %	2 %	8 %	11 %	6 %	19 %	5 %	0 %	132
	6 PM	63 %	5 %	15 %	0 %	1 %	12 %	4 %	0 %	83
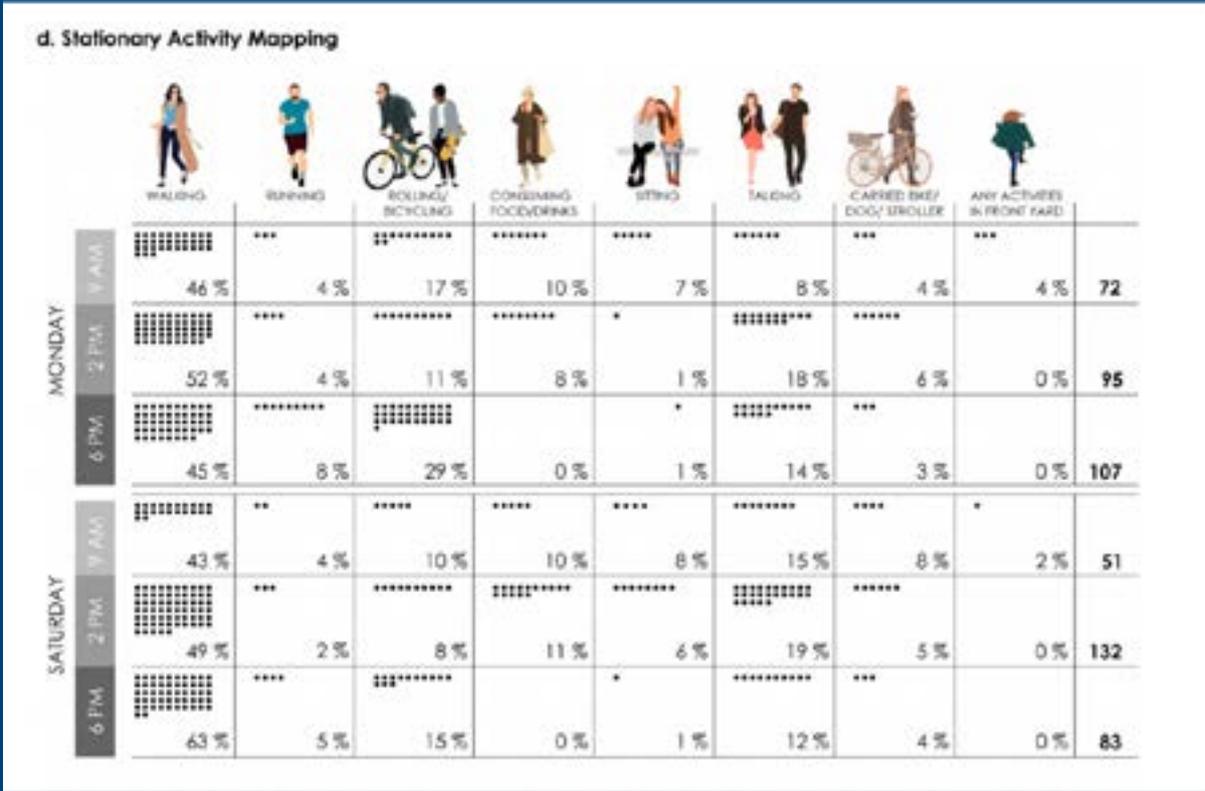
Figure 15. Infographic of street observations by student Polina Suliana

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BELOW ARE SOME NOTES ON THE USE OF THE AREA OF STUDY:

Urban Street	WHO	WHEN	HOW LONG	WHERE	WHAT
Evenaar Straat Skatepark	Toddlers	W th parents	Pushed/Dragged through	On the pathways	Walking, r ding n pram
	Teenagers	After School	1 to 2 Ho rs - meeting and skating	In and aro nd the skatepark, b ke path	Meeting, skating, taking, playing
	Yo ng dults	Passing thro gh to tra n and b ses	Momentary - always rush ng	Street island path, cross ng path, b ke path	Standing, r nning, walking
	dults	Morn ng & N ght	Slow passing through	Island walk ng path, cross ng path, b ke path	Excers se, dog walking, crossing, meeting
	Senior dults	Morn ng & N ght	Slow pass ng through and apprehensive	Island walk ng path or cross ng path	Greet ng, relax and dog walk
	Sen or ti ens	Rarely	Q ck pass from one s de to the other - fear skater act v ty	ross ng paths	Fast walk

Figure 10: Street study notes, Evanaar Street, in table form by Author

Figure 16. Infographic of street observations by student Chris Gey von Pittius

Results and Impact

Feedback from 2019-2020 suggested that I should issue all information on the module upfront. I had held back on this because the cohort, and their studio location, changed every year. A good compromise suggested by Dr. Lisa Padden was that I recalibrate the assignments in opening weeks and lock-down deadlines at week 3, once all students have confirmed their Options. This allowed me to issue all the assignments early rather than piecemeal and also allowed opportunity for some feedback on assessment methods. The strategy of 'tweek-and-release' therefore worked well to reduce uncertainty for students and it worked for me as I drove my own content and relied less on the vagaries of multiple studio modules.

Despite being on Zoom, the students were incredibly engaged this year with a min 90% attendance every week. I credit this to the weekly presentations of streets by their peers when we could all wonder at the opportunity this Window on the World provided to escape from our otherwise restricted views.

Student Feedback.

39% (11 of the active 28) submitted feedback in the second year of the Pilot between December 2020 to January 2021. Against the specific five questions posed for Student Feedback, this is my interpretation of answers submitted.

Q1. Clear communications: 91% (10) found clear and 9% (1) that assignments got clearer once time was given ahead of each assignment submission. One noted that "there was a very clear module structure for the assignments and good communication throughout of what was expected."

Q2. Engaging students. 91% (10) confirmed they felt engaged and could contribute but 9% (1) found it somewhat 'awkward to bring things up'.

Q3. Flexibility on delivery. 100% (11) There was "no added stress" and "everything was perfect, and it's great that we could learn from the teacher but also from our peers (through the street sections or participation)!"

Q4. Flexibility on learning modes. 91% (10) confirmed it was suitable with one misunderstood answer. A suggestion was to have videos/TED lectures in place of some readings.

Q5. Flexibility on assignments. 100% agreed assessments were inclusive "with diverse learning methods and project delivery options".

"Overall this was a really good module and the teacher was really great at listening to our concerns and making sure that everyone could get involved in their own way!" and one stated "we were given alternative assessment options at various stages of the course which allowed us to learn and present findings in ways that suited us personally."

"I felt this was an excellent aspect of the course which I'd like to see replicated in other courses. Over the course of the trimester I felt the modules that allowed choice - in study topics/ presentation techniques - were the ones in which I learned the most relevant information."

9 students also gave feedback to the standard UCD feedback form. This was an increase on 2 students in 2019 as the duplication of feedback forms (for the Pilot and for UCD) confused some.

Across the five metrics used by UCD student feedback, the average score improved. The five questions are:

Q1. I have a better understanding of the subject after completing this module.
Q2. The assessment was relevant to the work of the module.
Q3. I achieved the learning outcomes for this module.
Q4. The teaching on this module supported my learning.
Q5. Overall I am satisfied with this module.

In 2019-2020, before the Pilot, the mean score was above 3.5 and generally on-par with ARCH module and APEP averages.

Mean (Likert) for Core Questions 1 to 5 (*)					Standard Deviation (Likert)				
Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
4.50	4.50	4.50	3.50	3.50	.71	.71	.71	2.12	2.12
3.94	3.96	3.78	3.76	3.58	1.03	1.04	.96	1.19	1.31
4.01	4.05	3.83	3.81	3.68	1.01	.98	.96	1.20	1.25

Figure 17. Stats prepared by UCD, 2019

In 2020-2021, after the Pilot, the mean score was above 4.5 and generally above ARCH module and above APEP averages. This represents a full point improvement from 3.5 to 4.5 average (Thank you to the team!)

Mean (Likert) for Core Questions 1 to 5 (*)					Standard Deviation (Likert)				
Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
4.56	4.78	4.44	4.78	4.56	.53	.44	.73	.44	.53
4.04	4.09	3.80	3.82	3.72	.93	.95	.92	1.20	1.17
4.08	4.13	3.85	3.91	3.80	.94	.95	.92	1.18	1.16

Figure 18. Stats prepared by UCD, 2020

Unintended Consequences

The first year of the Pilot Project continued during the first lockdown and acted as a lifesaver for me. I am a part-time member of staff at UCD and the Pilot meant I was able to reach out to teaching colleagues to share solutions to the challenges we faced so abruptly. Despite all the personal demands presented by the initial lockdown, I felt so lucky to witness conviviality and collegiality among this special group. In fact it made me aware that such moments of academic collegiality are all too rare.

In turn, this buoyed me up so I had the resilience to support students. The spill-over of this Pilot was to my other modules and it did not end there. One student confirmed in feedback that the micro-mapping of their academic trajectory "was a way to prepare us to excel beyond just this module". Moreover, a few students have gone on to excel in their final research dissertations.

The Pilot had the delightful consequence of acting in turn as a lift during lockdown. As I had a sense of success in my module delivery and had my material newly organized on Brightspace, I was in a position to throw a metaphorical line out to Erasmus students, many of whom had to suddenly return home from their time abroad in March 2020. Bureaucracy was luckily jettisoned in our school in favour of continuity of educational experience for this special cohort.

With some quick adjustments, I was able to re-run my module six weeks out of sync, which meant none of these adventurous travelers lost out on their education. Erasmus would have been proud of this special cohort and our school's creative adjustments. I could not have done this without the peer-review 'Pilot in Inclusive Teaching' and various collaborative experiences I witnessed, and a culture of support that reached across the college during lockdown.

Based on discussions with our Pilot Group, I developed a Rubric for grading on-line, which captured four learning outcomes against grading criteria. I attended a UCD course on this but it took longer than expected to tweak but had the advantage of grading being objective and transparent. Because all submissions and feedback was digital, feedback as a result was made a little less cumbersome, timely and actionable.

Below is the detail of the grading Rubric and weighting. Alas, it is extremely difficult to capture, print or extract a Grading Rubric from one module to act as a template for another on Brightspace - it requires importing all the content as well!)

Marking Criteria for Academic Writing A

Criteria	Exceptional 5 points	High Honours Level 3.5 points	Honours level 2.5 points	Pass to Hons level 2 points	Incomplete 1 point
Criterion 1 Understanding (Relevance, breath and extent of engagement with theory and cultural context).	The essay/review exceeds expectations, is highly engaged theoretically and demonstrates an exceptional level of understanding.	The essay/review is highly engaged with theory and demonstrates a good level of understanding.	The essay/review demonstrates a good level of engagement and depth of understanding.	The essay/review demonstrates engagement with most texts and an adequate level of understanding.	The essay/review is incomplete.
Criterion 2 Structure (Narrative and structure of formulating/developing/concluding a research question).	The essay/review is well structured, is driven by a clear research question, and the material is organised to support this.	The essay/review is well structured, is driven by a clear research question, and the material is organised to support this.	The essay/review is well structured and has identified a research interest/question.	There is some evidence at structuring the essay/review, an interest/quest is outlined but parts remain incomplete.	The narrative lacks a clear organising structure.
Criterion 3 Methodology (Critical thinking and engagement with research methodology and theory).	The essay/review has demonstrated exceptional critical thinking, is visually engaging, and has followed through a research methodology.	The essay/review has demonstrated a high level of critical thinking, is visually engaging, and articulate an intended research methodology.	The essay/review has demonstrated some critical thinking, is visually interesting and/or give evidence of an intended research methodology.	The essay/review has demonstrated some analysis but the graphics are less clear and/or methodology is understated.	The methodology is unclear and lacks engagement with all the material covered and/or is graphically light.
Criterion 4 Language (acknowledges sources, clarity of communication and includes a bibliography plus coversheet on plagiarism).	The essay/review is exceptionally clear, literate and complete. It is well illustrated and references/images are all cited consistently.	The essay/review is very clear, literate and complete. It is well illustrated and references/images are all cited consistently.	The essay/review is clear, literate and/or well illustrated and references/images are all cited consistently.	The essay/review is difficult to understand, reference/images sources and/or illustrations are unclear.	The essay/review requires further editing or work on syntax and/or lacks consistent acknowledging of sources.

| Total | | | | | / 20 |

Figure 19. Rubric from Brightspace

As a result of the iterative process inherent in assessments building up as a cascade, students could use the feedback for their next submission, and could seek clarity ahead of the final assessment.

Apart from two students who were ill (6%), it meant that in the end, 94% of students got honours with 30% getting an A - to A+ grade.

As I run a couple of modules at UCD, I had two bites at the cherry of improvement: I could test suggestions in different environments. One benefit of this learning cycle was that by engaging in this pilot for ARCT40160 Introduction to Urban Design, I could transfer some of the feedback to another module (ARCT40180 - Urban Design Theory) in the following trimester for which I was nominated for a Teaching Excellence Award by students in May 2020.

⊕ Recommendations and Advice for Implementation

Figure 20. Extract from the University Observer, edited by ex-student Doireann DeCourcy Mac Donnell, September 2020 and including image by Edward Cullinan Architects signing a co-operative manifesto in 1965.

I thought I would draw from the experience of feedback and implementation to summaries 10 points of recommendation as follows:

1. Whenever an opportunity presents itself, avail of a Teaching Pilot to connect to like-minded colleagues and enjoy the collegiality this triggers.

2. Invest time ahead of running a module to structure the learning experience; then populate Brightspace with to reflect the substructure. This preplanning gives students certainty and security knowing they are in safe hands.

3. Map out the semester, lockdown the timing and detail of all assignments by week 3, and invite feedback on alternatives.

4. Include a non-prescribed week circa week 7 as a 'Golden Week' for unanticipated interest that is sure to emerge from circumstances or ask students to identify an interest.

5. Design assessments as a cascade (growing % of value), give timely feedback and offer choice of assessments.

6. Prepare some pre recordings to allow sufficient time for student discussion or presentations.

7. With past student permission, upload the best of the past year on Brightspace and if possible invite a student to return to present their learning experience and answer student questions.

8. Establish a prize for the best work. (I have established an annual prize for a "Young Urbanist" announced at our end of year show).

9. Be sure to publish findings and let the Pilot team know of any subsequent successes. I recorded some of mine for the University Observer (Fitzpatrick, 2020).

10. Be open with students, accept new challenges and be prepared to be pleasantly surprised.

References

Campbell, K. (2018). **Massive Small, Building the Urban Society We Want**. White River Junction: Chelsea Green Publishing.

Caswell, M., Migoni, A. A., Geraci, N. & Cifor, M. (2017). **To Be Able To Imagine Otherwise: Community Archives And The Importance Of Representation**. Archives and Records Association. 38(1).

Chuh, K. (2003). **Imagine Otherwise: On Asian Americanist Critique**. Durham: NC: Duke University Press.

Clanchy, K. (2019). **Some Kids I Taught And What They Taught Me**. London: Picador.

Dahl, R. (2001). **The Giraffe and the Pelly and Me**. London: Puffin Books.

Fitzpatrick, M. (2019). **For A More Liveable City, It All Comes Down to the Micro-Details**, W H Whyte and his Street Life Project (1971 to 1975) Building Materials 22, Public.

Fitzpatrick, M. (2020). **The Design of Buildings is a Social Act...so is teaching**. The University Observer.

Fung, D. (2016). **Strength-Based Scholarship And Good Education**; The Scholarship Circle.

Hyatt, J. C. (1980). **"What Makes a Public Place Pleasant for People"**, The Wall Street Journal, October 3, 1980.

Mills, C. W. (1959). **The Sociological Imagination**. Oxford University Press: Oxford.

Rose, G. (1997). **Situating Knowledges: Positionality, Reflexivities and Other Tactics**. Progress in Human Geography. 21(3).

Westin, S. (2014). **The Paradoxes of Planning, A Psycho-Analytical Perspective**. Farnham: Ashgate.

CASE STUDY

5

Diversifying assessment: project based learning in a module

Case Study 5

Dr John Healy

Diversifying assessment: project based learning in a module

John Healy

Dr John Healy was born in Co. Dublin, Ireland in 1983. He was awarded the B.E. and Ph.D. degrees in Electronic Engineering from University College Dublin in 2005 and 2010. He has worked as a postdoctoral fellow in Physics in UNAM, Mexico, and in Computer Science and Electronic Engineering in Maynooth University. In 2012, he was awarded the NUI Postdoctoral Fellowship in the Sciences. He has been a Lecturer in Electrical, Electronic and Communications Engineering in UCD since 2015. He is a member of the IEEE, the OSA and the SPIE.

Outline

Title

Diversifying assessment: project based learning in a module

Abstract

Modes of delivery were diversified from PowerPoint lectures to include a textbook, MATLAB code demonstrations including video, and video lectures. Accessibility of teaching material was enhanced. Assessment was changed dramatically to centre on a group project with a choice of topics. Other assessments were removed during the pandemic, but these will return in the steady state to provide a diversity of assessment methods.

Module Name   EEEN40620 Biomedical Imaging

Discipline   Electronic Engineering

Level   4, 5 credit module

Student numbers   18

⬛ Introduction and Context

Two mainstays of university teaching, lecturing and final exams, are perhaps overused (Friesen, 2011). Lecturing is a medieval solution to a medieval problem: in a time when a printed book might cost as much as a house, lecturing was the most cost-efficient method of transmitting information from a lecturer to a student. The role of the student in a traditional lecture is passive. The student's prior learning and experience are of little relevance. Teaching practices that focus on the student's construction of knowledge are seen to be more effective in the development of science literacy (National Research Council, 2003). The price of this fixation on lecturing is that the profile of students who achieve academically is narrower than it could be; we see examples of this in students who perform above expectations in the capstone project because the nature of project work is quite unlike the rest of their education. My goal in this pilot study has been primarily to broaden the range of teaching and assessment approaches I have experience using, resulting in a better learning environment for the students. I have read that even when faculty were aware and in favour of inclusive teaching, they often felt constrained from implementing them by factors such as time, and that felt a little too familiar! A more diverse palette of teaching modes should in turn allow a broader range of capable students to demonstrate they can and have learned the module material. I also wanted to improve student engagement. Of my modules, this one is the outlier with lower-than-average student feedback scores; there also existed an opportunity to revitalise the module in that regard.

I will detail the changes made to the module later on, but my motivation for the changes I proposed came from reading relating to a Teaching and Learning module. The very short version goes as follows. People used to think that learning was a passive activity. Strong students could synthesize ideas beyond what they read, and weaker students were limited to rote learning. These ideas are out of fashion among experts, though I have heard echoes of them in many a discussion around teaching. Piaget introduced the idea of learning as an active process, in which teachers don't merely deliver material, but are responsible for how students receive it. Stimulating learning activities then result in students learning better. Mutual support from other students is also relevant. Based on this kind of thinking, I planned to reduce the weighting of the final exam and subsume my existing assignments into a more open-ended project.

EEEN40620 currently explores topics in two broad categories: the physical principles of medical imaging from a signal processing and Fourier analysis perspective, and image processing for image enhancement or interpretation. In the first category, students learn about the compound microscope and optical imaging in general, medical x-ray images, and magnetic resonance imaging (MRI). They study mathematical models of image formation, reconstruction algorithms, and factors that limit resolution of those devices. In the second category, they learn how a digital camera works, how a digital image file represents and stores an image, wavelets for removing noise from images, and the fundamentals of neural networks for problems like segmentation and categorisation. The topics complement each other, forming a complete pipeline from patient to image. The topics and the links between them explicitly drawn in the module are depicted in Figure 1. Some additional links exist, e.g. neural networks are applied in all three imaging modalities, but are not emphasised for time reasons.

	Compressive MRI		Machine learning in medical imaging
Image processing Computer programming	Compressive Sensing	Wavelet Transform	Neural networks
Physical principles Design considerations	Magnetic Resonance Imaging	Microscopy	X-ray imaging

Figure 1. Thematic links within the components of the module

Design and Implementation Description

The module I chose to modify, Biomedical Imaging, is one I have taught for several years. The majority of the class are Biomedical Engineering students from the 4th year of the BE or the 4th or 5th year of the ME programmes. The class size is intermediate, ranging from 15-35 from year to year. The class is typically roughly 50:50 men and women, as is typical in the Biomedical Engineering programmes. I have been asked to comment on disabilities in the class for this case study: there are typically 1-3 students with mild accommodations for, e.g., dyslexia. The students are quite capable, so I wanted to challenge them a little more and cultivate some skills they could carry into capstone projects and beyond. More specifically, this links in with a number of programme outcomes, viz:

— Demonstrate advanced knowledge and understanding of the mathematics, sciences, engineering sciences and technologies underpinning Biomedical Engineering;

— Identify, formulate, analyse and solve complex engineering problems, specifically problems related to physiological and medical/healthcare systems;

— Ability to work effectively as an individual, in teams and in multidisciplinary settings, together with the capacity to undertake lifelong learning; and

— Communicate effectively on complex engineering activities with the clinical and engineering communities and with society at large.

My existing approach to delivering the module was narrow in terms of teaching style. Lectures consisted of PowerPoint presentations supplemented with material delivered on the whiteboards that was usually driven by class questions and/or the kind of intangible class feedback during lectures – that feeling that you are losing them – that many of my colleagues have complained of missing since the pandemic denied us that style of class interaction. There are some UDL principles that can be applied to PowerPoint slides to good effect, and which are now captured well by the Ally tool in Brightspace. These include issues like awareness of the effects of font selection on dyslexic students, and of colour choices on colour-blind students. I was surprised to learn that colour-blindness is as prevalent as 1 in 12 men, meaning that this invisible issue was likely present in every class I have ever taught. Most of those modifications are quite painless once you know to look out for them. Another issue that comes up is making better allowance for screen reading tools. While I have not taught a student with severe visual impairment, there are more moderate visual impairments which may be less obvious, and those students may also be coping in silence. I found it interesting to consider this from a UDL perspective: many students are regular users of podcasts, and there are tools incorporated into Ally in Brightspace now to convert a document to an audio format. Small accommodations are all that are necessary to make documents friendlier to such tools, and so the student who wants to review notes on a treadmill or while jogging are accommodated in the same way as is a student with a visual impairment. There are two important – but again quite painless – changes that I am aware of that help here.

— Providing sections using the structures in PowerPoint and Word instead of simply having section divider slides makes the structure machine-readable.

— Alternative text for images eliminates gaps in the narrative in audio format. I'm still getting to grips with best practice on alternative text, especially with complex images and how they interact with captions, because alt text is one UDL element I put on the long finger when I was pivoting to deal with the pandemic.

The discussion above about screen readers is part of a broader principle in UDL of providing multiple modes of learning. To that end, I have attempted to diversify the module materials as follows:

— I have begun to add a textbook;
— I have added a number of MATLAB demos (video + code); and
— And an almost inevitable consequence of the pandemic is that I have recorded my lectures as videos.

In Figure 2, I show a side-by-side comparison of some material from the textbook and the slides. I teach primarily in our partner programme in Beijing, and a consequence of that has been that I have tended towards lecture slides which are a little verbose for my taste. The reasoning was that students who might struggle to follow every word of my lectures could at least find the slides relatively readable. That comes at a toll on slide design, to which the pandemic offers a bypass. The recording of video lectures, along with the provision of more narratively complete textbooks, allows me to pare back the text on slides and reduce the reading burden on students during lectures. I haven't looked into providing subtitles, which I would like to do at some point.
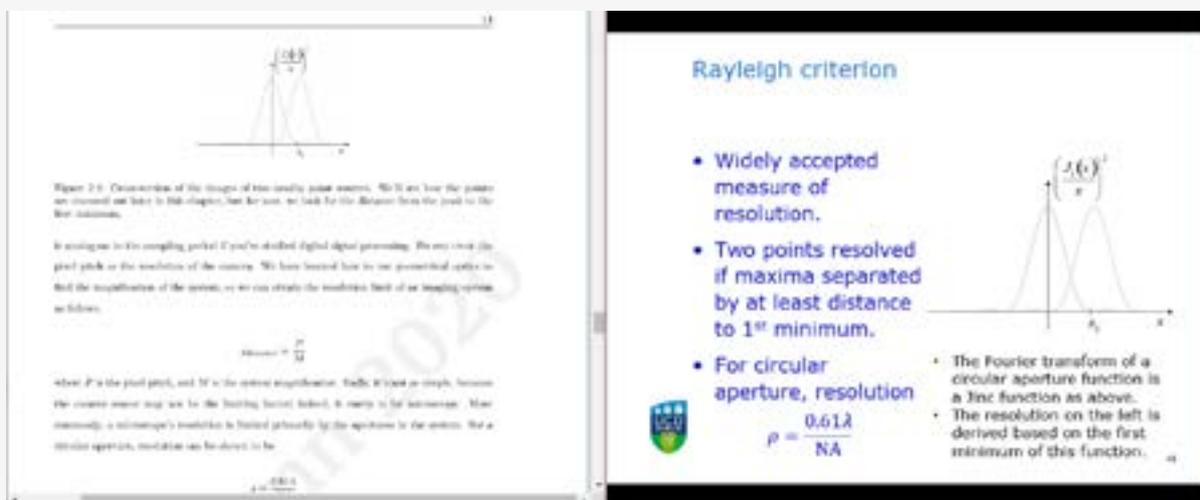

Figure 2. Comparable material is provided in book form (left) and PowerPoint slides (right). The book provides a more coherent narrative to students who prefer to learn in that way.

I was conscious that the changes to the assessment which I will discuss later denied the students certain opportunities to explore basic concepts further through experimentation with code. I introduced a number of MATLAB demos to compensate. I supplied the students with the code and a video in which I executed the code section by section, explaining the meaning of each figure. An alternative I have recently begun to investigate is the MATLAB livescript, which allows me to embed sliders and other interactive elements into the demos. In Figure 3, I show an example from one of the demos.
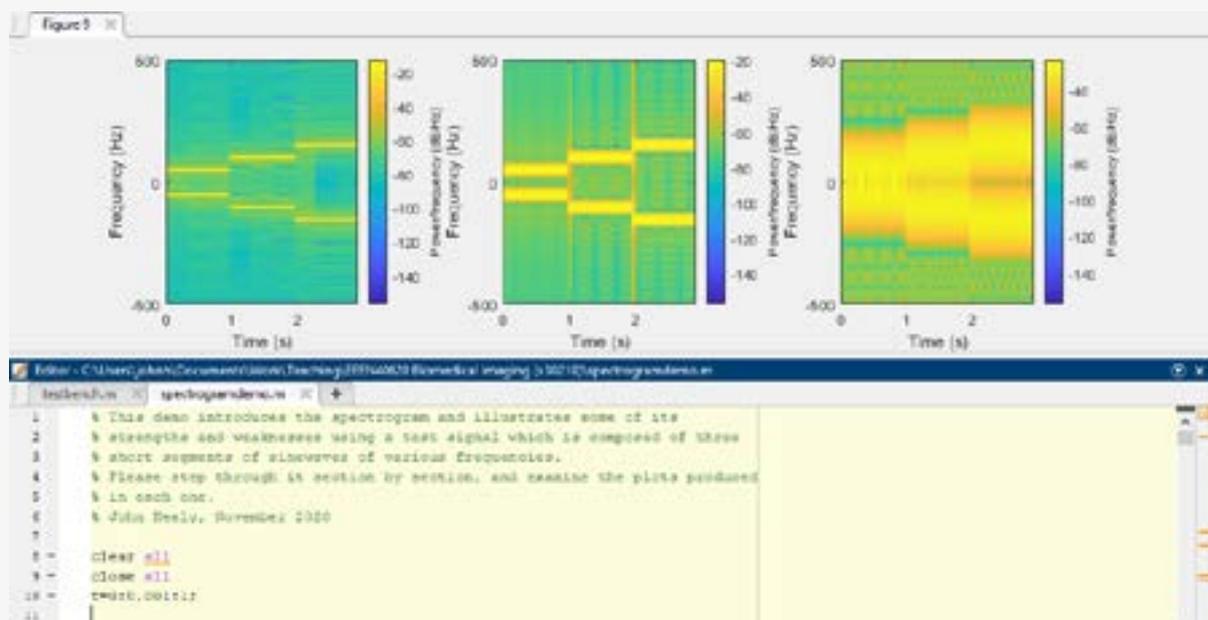

Figure 3. Example of a MATLAB demo. I provided short videos in which I stepped through the code, explaining the function of each section.

A final element of the diversification of modes of learning I introduced this year was the video lecture. I will discuss this in detail as it is something that has been extensively investigated by most teaching staff over the past year. One important lesson I took from my first implementation was to break the lectures into much shorter thematic pieces [14]. This encourages students to watch them and seems to better suit normal attention spans with video. More modular video is also a little easier to maintain.

The discussion above has focussed on the module's teaching materials. The other broad stroke of UDL which I will now discuss is assessment.

In the past, the module assessment consisted of a final exam and three in-class assignments. The assignments were intended to be quite formative, and I typically assigned 15% of the class grade each one to encourage good student engagement.

As I mentioned, my motivation for the changes I proposed came from reading about learning styles. Some authors have talked about learning styles, distinguishing between students who approach problem-solving in a relatively formal planning stage and those who tend towards trial and error from the off. I have also read that learning styles are not universally accepted, but this is a case study and not a formal essay on this material, so let's roll with it for now. My reading terminated in the modern theory of constructivism, the core principles of which are as follows.

— Learning is an active process.
— All new learning builds on earlier knowledge.
— There is no one way to learn. Teaching and assessment should reflect this.
— Learners should be conscious of their learning, and teachers of their teaching.

Based on this kind of thinking, I planned to reduce the weighting of the final exam and subsume my existing assignments into a more open-ended project. I read about problem-based learning and discussed it with my former colleague Bob Lawlor in Maynooth University who is a great champion of that approach. The following are the features of the project as run in late 2020.

- The project has components of a focussed literature review, mathematical modelling, and simulation.

- The students selected preferred topics from a list and noted any preferred partners.

- Multiple groups could work on the same topic if there was demand, though they were expected not to cooperate. Providing an opportunity to select their own topic is aligned with the UDL principle of providing a choice of assessment.

- Students would be free to work in a fairly uniform (i.e. unstructured) team or to play to their strengths in the project by taking charge of some parts of the work.

- Weekly meetings would be conducted with the module coordinator, and each student was to maintain a reflective journal online (shared only with the module coordinator). Engagement is worth 10%, based on the weekly meetings and the journal.

- The final report is in three parts: literature review, modelling and methods, and results and conclusions. Each of those parts is worth 30%.

- Each student is permitted to finally nominate one of the components for a double weighting. E.g. double weighting the lit review would make it worth 60 marks out of a new total of 130. This was optional. The intention was to allow students more flexibility of choice in how they were assessed, which is again aligned with UDL principles.

Results and Impact

Any discussion of results has to begin with an acknowledgement of the effects of covid on the implementation. Time was diverted from writing the textbook and revising the slides to developing more video resources. The assessment was changed radically, removing the final exam and in-class exercises completely. As such, the group project (with expected time commitments suitably beefed up) became the whole of the grade, severely curtailing the intended diversity of assessment. While I received little direct feedback about this, the students on various programmes that semester made representations about the quantity of continuous assessment, which was necessarily crammed into a shorter-than-usual teaching term of just 11 weeks.

The class size was 18, which I broke into 6 project groups. The six weekly meetings certainly added a considerable time cost to me, though I was saved from the need to grade any exams. The time-consuming nature aside, I enjoyed the meetings, and felt I had a much better sense of who the individual students were than I would normally have. Assessment of the individual journals was also time-consuming.

The final reports were written to an acceptable standard. I felt however that the reports didn't completely reflect the work I had seen week-to-week in the meetings, and whether I can blame my rubric or some other factor, the gap between best and weakest projects was a good deal wider than the gap between the best and weakest reports. There's something to figure out here, and I don't yet have answers. Pivoting to changes demanded by covid meant that I was on the back foot in terms of implementation, and rubrics were designed late in the day without any student input. Figure 4 shows an extract from one of the reports.

> ## 3.5 Fourier Analysis
>
> Fourier transform of Siemens Star Bar Test Image. An example of how our sensor pipeline is equivalent to a form of resampling in the spatial domain, which can be mapped directly to zooming in the Fourier domain. Where the image pipeline cannot be mapped directly as a resampling in the spatial domain there
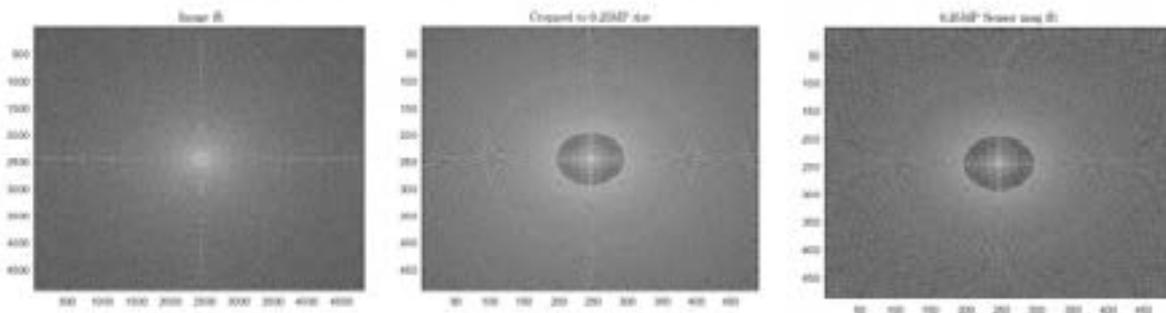>
> FIGURE 10 FOURIER TRANSFORMED IMAGES CROPPED TO COMPARE
>
> are errors in the Fourier domain between the cropped, specifically when we perform the averaging. Using the same 100 sensors as before this can be demonstrated.

Figure 4. Extract from one of the submitted final reports.

There were two formal sources of feedback. Lisa Padden surveyed the students, with three replies that were quite positive. The normal UCD feedback was also responded to by three students, though apparently not the same three, as they were quite negative. One of the more concrete criticisms was that the nature of the assessment meant that there was little incentive to engage with the lectures; a fair criticism, though a transient problem created by the pandemic.

One student took the time to write to me to acknowledge the value of the literature review component of the group project in their final year project.

> **Hi Professor,**
>
> **I thought you might be interested to know that during the gathering of the data for the conference paper I have heavily applied the things I learned from the biomedical imaging project that we did!**

Figure 5. Student feedback email.

I have already mentioned some issues that arose, including some dissatisfaction with the mismatch between the projects I observed week-to-week and the final reporting. Some groups with a very unsatisfactory process were able to gloss over that in the final report, while students who had shown far more independent problem-solving capacity were obtaining similar or not much better grades. I haven't solved this yet. Another issue is the time cost for the students and for the module coordinator. Finally, I felt that some of the groups were excessively passive, turning up to meetings and expecting me to tell them what to do. I have never been taught by means of this kind of group project, and perhaps I didn't structure those meetings and clarify my role sufficiently.

Recommendations and Advice for Implementation

The module as I ran it last year was not what I wanted, not least because of the impact of the covid-19 pandemic. However, I believe it was a valuable step towards integrating a more engaging, flexible, and realistic style of assessment into a module. This kind of approach is suitable for modules later in the degree programme, where students already have a good foundation of knowledge and skill to synthesise in a project. It is relatively intensive, but I found the workload manageable for around half a dozen teams, which could be ~36 students with the larger teams I plan to use in future. Early indications as I write this are that the class is very popular this year, as we have just had to raise the capacity during registration, so I will have practical experience of how it scales shortly!

I have a few concrete recommendations regarding the group projects. Based on conversations with Bob Lawlor, I set the teams too small. In future, I'll be setting teams of 5-6 students, which provides some futureproofing as last year's class was smaller than usual. Another lesson from Bob was to make these team projects instead of merely groups, creating defined roles within the teams. The students may still self-organise but based on a predefined structure. To deal with the passivity I observed in the students, I was recommended to have the students set the agenda of meetings in advance. This forces them to think about what they want from the meeting. One means of reducing assessment workload is to require a summary of the learning journal, and to spend most of my attention for the journals on the summaries. Finally, I intend to revisit my rubrics and carefully re-design them to better tease out the strengths and weaknesses of the projects.

For anyone considering adopting the kind of approach I have discussed in this case study, I have a few recommendations:

— Start by considering the resourcing implications: how much time do you have to devote to the module? How much time per week can you allocate to each team? If you have access to capable Teaching Assistants, this may alter the equation;
— Design the assessment well in advance. I was devising grading rubrics late in the trimester, which compromised both the effectiveness of my grading and the clarity of the goals communicated to the students;

— Larger teams (5-6 students) with specified roles for the students were recommended to me; and

— Ask the students to bring an agenda to meetings. This avoids meetings where they arrive in a passive mindset, expecting the facilitator to tell them what to do.

References

Barman, L., Naimi-Akbar, I., McGrath, C. & Weurlander, M. (2018).**Engineering teachers' approaches to design and deliver inclusive teaching in flexible learning spaces**, 2018 IEEE Frontiers in Education Conference (FIE), San Jose, CA, USA, 2018, pp. 1-5, DOI: 10.1109/FIE.2018.8658810.

Cryer, H. (2013). **Teaching STEM subjects to blind and partially sighted students: Literature review and resources**, RNIB Centre for Accessible Information, Birmingham: Literature review #6.

Dunn, R., Griggs, S. A., Olson, J., Beasley, M. & Gorman, B. S. (1995), **A meta-analytic validation of the Dunn and Dunn model of learning-style preferences**. The Journal of Educational Research, 88(6), 353-362.

Friesen, N. (2011). **The lecture as a transmedial pedagogical form: A historical analysis, Educational researcher**. 40(3), 95-102.

De Graaf, E. & Kolmos, A. (2003). **Characteristics of problem-based learning**. International Journal of Engineering Education, 19(5), 657-662.

Harrison, T. (2020). **How distance education students perceive the impact of teaching videos on their learning**. Open Learning: The Journal of Open, Distance and e-Learning, 35(3), 260-276.

Kelly, A. M., & Padden, L. (2018). Toolkit for Inclusive Higher Education Institutions. From Vision to Practice. Dublin: UCD Access & Lifelong Learning.

Perrenet, J. C., Bouhuijs, P. A. J. & Smits, J. G. M. M. (2000). **The suitability of problem-based learning for engineering education: theory and practice**. Teaching in higher education, 5(3), 345-358.

Piaget, J. (1995). **Genetic logic and sociology**. Sociological studies, 184-214.

National Research Council. (2003) **Evaluating and improving undergraduate teaching in science, technology, engineering, and mathematics**, National Academies Press.

Turkle, S. & Papert, S. (1990).**Epistemological pluralism: Styles and voices within the computer culture**. Signs: Journal of women in culture and society, 16(1), 128-157.

Vygotsky, L. S. (1978). **Mind in society** in M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.

Waters, R. & McCracken, M. (1997). A**ssessment and evaluation in problem-based learning**. Proceedings Frontiers in Education 1997 27th Annual Conference. Teaching and Learning in an Era of Change. Vol. 2. IEEE.

6

Seeking to engage students in their work, beyond the reward value of a marking system

Case Study 6

Tiago Faria

Seeking to engage students in their work, beyond the reward value of a marking system

Tiago Faria

Tiago Faria is a practicing architect and part-time tutor at the School of Architecture UCD.

Outline

Title
Seeking to engage students in their work, beyond the reward value of a marking system

Abstract
This case study sought to explore opportunities to diversify student engagement within a given collaborative mode of work. As such, the intention was to provide a variety of settings for contributions to the collective work effort, in such a way as to make opportunities accessible to all the cohort and allow for an organic development of individual participation within the greater scale of the collective.

Module Name
ARCT40870 Design / Build / Agency

Discipline
Structural Engineering and Architecture

Level
Stage 4, 5 credit optional Module

Student numbers
30

Introduction and Context

This module (ARCT40870) brings together a group of 4th year Civil/Structural Engineering and Architecture students. As an optional module, it was offered initially to Architecture students, but over the years the number of Engineering students in the Module has been building up to reach a near equal ratio, at present. The Module has been running in its current format for 8 years. From the outset, to integrate the diverse cohort of students from different courses has been a guiding element in its design and implementation. For the first year of this study, in 2019/20, the Class comprised 15 students from Engineering, 15 students from Architecture, of which 12 were female and 18 were male. Between UCD's own students, along with Transfer students, International students and Erasmus Exchange students, the cohort had members from India, Saudi Arabia, Italy, China, Spain, Poland, Germany, Mexico and Ireland.

The vehicle for this module is a singular "design & build project", which entails an association between the Class and a Client with a specific requirement (brief) and budget. Other than learning through a "real life" project that gets built, the principal aim of the Module is to implement a collaborative mode of work, where all students are expected to contribute significantly to the work required for the project to happen. This happens, with the pre-established acknowledgement that such contributions may come in different modes from each individual participant.

Every year, the course of the project evolves organically, as a result of the interaction between all parties involved and the specific requirements at any time. For this reason, opportunities naturally present themselves for different modes of contribution. "Agency" in the title of the module and as a grading component, refers to the ability of the Class, as a collective, to take ownership of the questions at hand, in each project worked on. The entire Class receives the same grade.

The Inclusive Teaching Pilot provided an opportunity to assess and adapt teaching and learning practices that had evolved over the years of the module's history.

Context

ARCT40870 is a 5 Credit Module, timetabled once weekly for an afternoon session of 4 hours, over the 12 weeks of the taught Spring Trimester. According to UCD's published academic regulations, a 5 Credit Module requires a total student effort of between 100 and 125 hours. As there is no exam for this Module, the expectation of working hours is set at 105 hours of work over the 16 weeks of the entire Term (12 weeks taught, 2 weeks study, 2 weeks exams). The basis for work requirement is:

Weekly Tutorial (2 to 6 pm)	28 hours
Autonomous work (done in between Tutorials)	28 hours
Building Period	35 hours
Assembly/Report	14 hours

Work is assessed over the following headings:

Inception/Brief Development (Weeks 1 and 2)	10%
Developed Design (Weeks 3 and 4)	10%
Production Information (Weeks 5, 6 and 7)	15%
Building (weeks 8 and 9)	50%
Report	10%
Agency	5%

Design and implementation of the initiative

In order to integrate every student's engagement in the work dynamic of the group and also to try and ensure participation at all times, two strategic operational principles are in place:

— Clear tasks are set specifically, to be worked on during the week and then discussed at the weekly Class meeting.
— Groups of students working together to complete each task set, are mixed and re-mixed along the course of the project.

The intent of these strategies is to create opportunities for every student to participate in the group's endeavour through all the various stages and different modes of work required throughout. These include individual design work, group design work, research on materials, market research on suppliers and costs, presentation and discussion with peers and with clients, and practical (building) work.

To implement the initiative of inclusive teaching, these strategies were assessed and revised over the course of the pilot study. In practice, there are three distinct phases to this project:

— A design phase, which lasts for weeks 1 to 7 of Term.
— A Building phase, which happens immediately after the design phase, over the course of the two-week academic break, in the School of Architecture's Building Laboratory.
— Assembly on site, which usually occurs in the closing weeks of Term.

Below, is a typical sequence of work progress throughout the Term:

Week 1	Site visit and briefing with the Client. Task for the week set as an individual strategic proposal, responding to the Brief.
Week 2	Class discussion of all preliminary ideas prepared during the week. 3 options are chosen by Class vote, to be presented to the Client.
Week 3	Meeting with Client to present and discuss all 3 options prepared during the week. Presentations are made by each group in turn, to the Client and the entire Class.
Week 4	The entire Class meets to discuss Client feedback. The Class is subdivided into new groups, to independently progress different aspects of the chosen single proposal.
Week 5	Client meeting to finalise outline design. Presentations are made by each sub-group and discussed in the presence of the entire Class.
Week 6	Detailed design / specification presented to the Building Laboratory Staff, for a check on technical feasibility. Logistical elements of the project are progressed in parallel.
Week 7	Assembly of working drawings and specification for one last discussion with the Client, to obtain "sign-off" and order materials.
Weeks 8, 9	Building phase of work is condensed into the two weeks of the academic spring break.
Completion	Assembly on site will vary according to each project's circumstances. Student's involvement can be limited by virtue of insurance not covering work outside of UCD.

Module Changes

In 2019/20, the numbers of students in ARCT40870 nearly doubled unexpectedly at the time of registration, from 15 the previous year, to 30 students. This shifted the dynamics of student participation in the learning process, as it brought a new balance of students into the class which had previously been primarily made up from Architecture students and then became nearly equal with Engineering students.

Student feedback at the end of the module listed concerns regarding unequal contribution to group work and confusion in the spread of the overall grade. To address these comments, whilst trying to maintain the principle of collaboration as core to the module, changes to the module for 2020/21, were put in place:

— Be more rigorous in the formation of groups along the design phase of the project and find a greater variety of modes of work, when members in each group are shuffled.

— Revise and publish grade breakdown, to make more evident the components attributed to project stages.

Ultimately, the goal is to encourage the emergence of Agency relative to the project within the Class, by maximising opportunity for diverse contribution. Specific detail for the implementation of these strategies is given below, matching the week-by-week project development pattern, as described above:

Week 1

All weekly Class meetings are minuted, with a clear action list set and allocated to and by the Class itself, such that actions can be followed up on at the following meeting.

The first set of Minutes is done by the module co-ordinator (to create a template). Subsequent minutes are taken by a volunteering student.

Figure 1. Slide from initial on-line Class briefing

Week 2

(in the absence of the module co-ordinator) the Class selects three of the individual proposals to be developed.

Based on commonality of individual strategic approach, 3 Groups of 10 students are assembled by the module co-ordinator to ensure a mix of students from different courses. Each group develops one of the proposals for discussion with the Client.
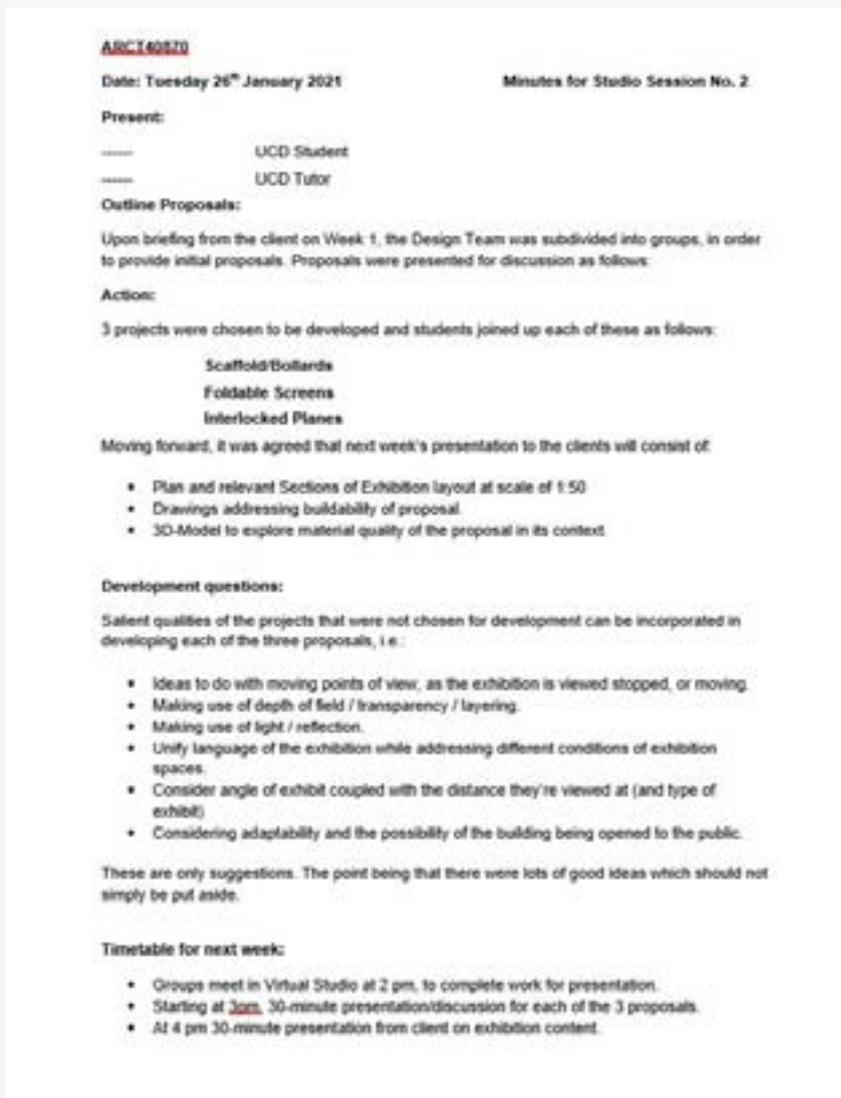
Figure 2. Minutes for Week 2

Week 3

While awaiting Client feedback, the week's task for each group is to critically appraise each other's proposals looking for opportunities to overlap ideas.

Figure 3. Slide from the first of the three Group Presentations

Week 4

With a single option picked, the overall proposal is broken down into distinct components to be developed. 4 new groups of 7/8 students are formed, to each develop one of these components. Each strand of development is done independently, with overlap ensured through Class discussion and minutes.

Students choose their own group, with moderation from the Module co-ordinator, ensuring a mix of students from different cohorts is achieved in each case.

Construction Sheet 1
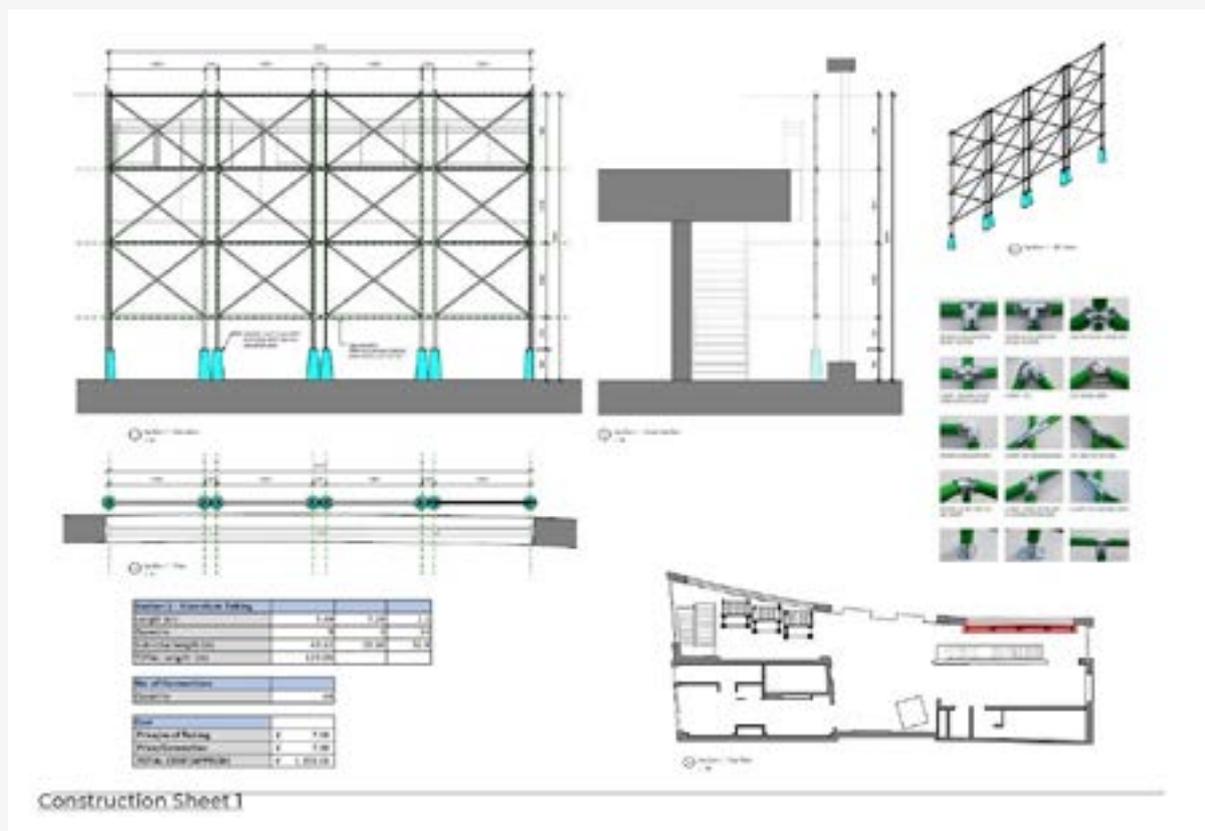
Figure 4. Development of a component of the chosen option

Week 5

New groups are formed, to progress work on a specific task, rather than a component basis, i.e.: Technical detailing, sourcing of materials and budgeting, Health and Safety implementation, project planning and resource coordination. Each student's natural inclination leads them to choose an area of work they prefer This will influence their contribution to the project henceforth.

Figure 5. Proposal for lateral restraint of tall frame

Figure 6. Method Statement for H&S compliance submission

Week 6

Students continue to work in their chosen area of interest. At this point, the project planning and coordination group is retained and becomes responsible for overseeing all different strands of the work.
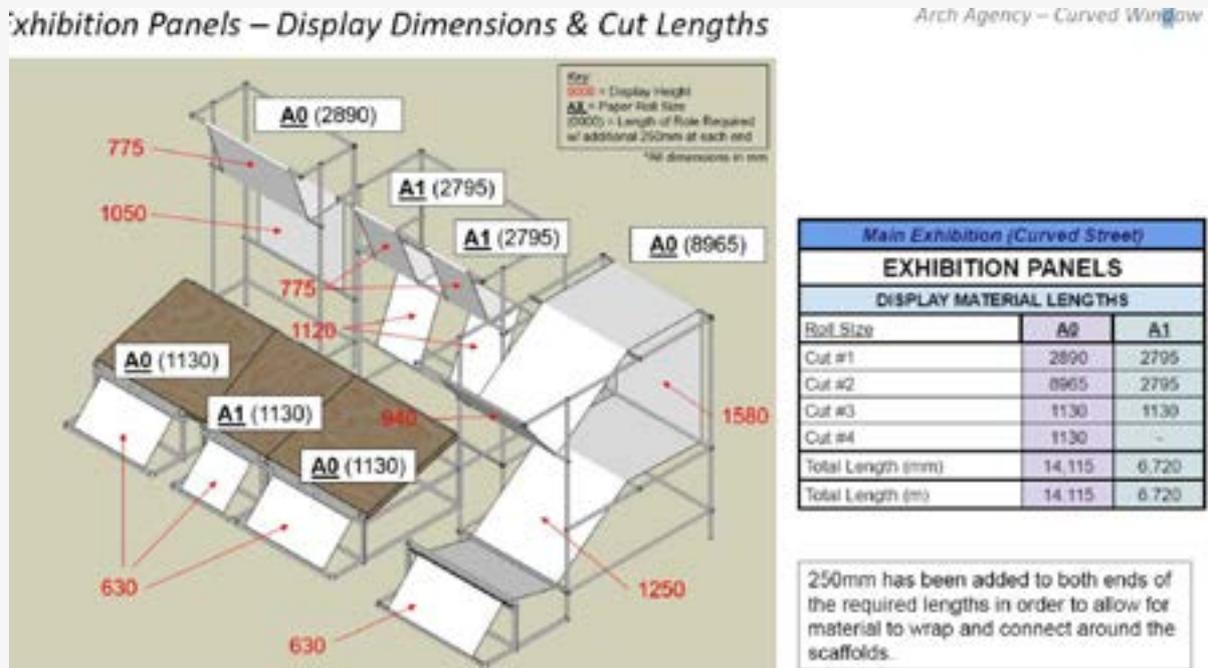
Figure 7. Listing of Materials required

Figure 8. Sourcing of materials and Budgeting Exercise

Week 7

For the completion of the overall proposal, Groups revert back to being component based (week 4). This formation is retained for the building phase.

The coordination group is responsible for the ordering of materials, in time for building work to commence.

Figure 9. Class questionnaire prepared by co-ordination Group

Figure 10. On-line polling for dates of construction

Weeks 8, 9

The entire Class is required to contribute 35 hours of work (the equivalent of one week). A Rota is drawn by the coordination Group to allow for all students a choice of when to work.

Workflow needs to be spread throughout the two weeks of the building period as much as members of each component being present throughout.

In the case of a singular project, where separate components can not readily be established, the sequence of building actions becomes the guiding parameter for student allocation to tasks, according to their time of participation.
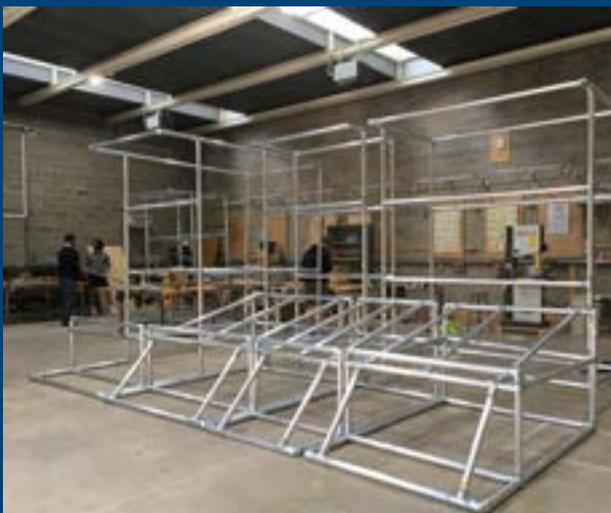

Figure 11. Building Rota

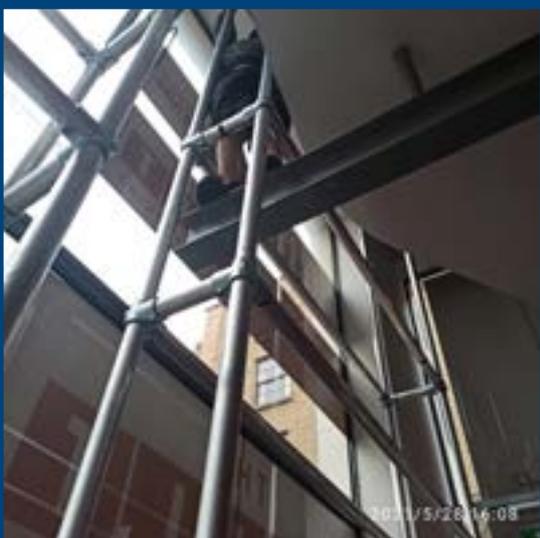**Figure 12.** Construction in the Building Laboratory

Figure 13. Delivery / Assembly on site

Completion

Once the project is installed on site, a report detailing the chronological steps of the process is assembled for submission at the end of Term. This will be graded and form part of the presentation to External Examiners.

Some students are typically not able to participate at some stage or other of the project. These students are allocated the task of editing the contributions to the Report received from all members of the Class.
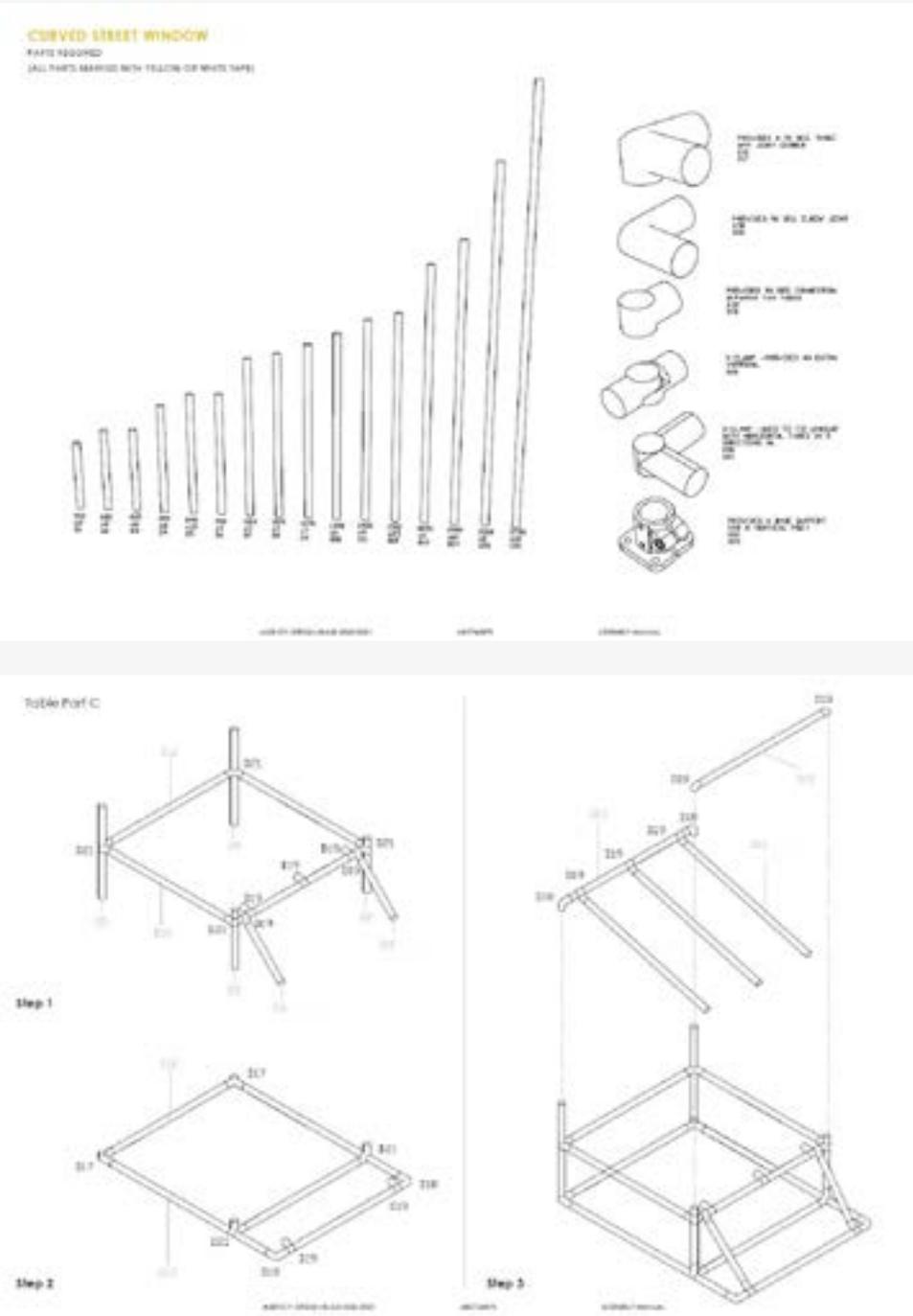

Figure 14. Assembly Manual

Results/Findings/Feedback – Evidence of Impact

Student Feedback was sought at the end of Term, with limited response. Sample set of answers below:

Clear communication:

Were the learning outcomes and rationale for the learning modes (projects, presentations, discussions, labs, etc) and assessments made clear?

Yes, they were made very clear via written communication with the class and uploaded to Brightspace for further viewing, as well as a talk-through of these outcomes with the class at the start of the module. Assessment areas and grading percentages were broken down, as well as the overall structure and organisation of the module.

Engaging students:

Did you feel able to participate in class and other learning activities, or were there barriers to engagement?

Yes, the module was very inclusive and it was easy to participate in class discussions in larger groups as well as smaller groups with students and lecturer. Each student could determine their own level of engagement as there were no strict structures to classes which was very freeing and beneficial for learning practically.

Flexibility:

Was the teaching material and its delivery (lectures, online material, in-class discussions, etc.) sufficiently diverse to support your learning?

Because the module was based around student's discussion and ideas there weren't really any formal lectures which was a nice change. The structure of the discussions varied as much as necessary and there was good communication between module coordinator and students. Maybe some sort of visual prompts for discussion would benefit students who aren't as comfortable coming forward and speaking in a large group on Zoom but not sure what this would entail.

Was learning supported by a variety of learning modes (projects, presentations, discussions, labs, etc) or do you feel there were other ways to enable your learning that could be offered as alternatives?

Yes, there were very varied modes of learning to be taken on throughout the module from group work, individual work, practical work, research, presentation and discussions with the class etc. Students could also work to their strengths in this way and choose which type of work they wanted to pursue in the group which allowed everyone to reach their full potential in the module.

Did the assessment strategy build in flexibility and variety to address different learning styles?

Yes, there were plenty of different modes of work to be carried out depending on people's strengths and where they felt comfortable. Assessment was not based on one mode alone and the strategy was discussed with the class to gauge whether people were able.

This feedback suggests that the intent of the strategic changes made to this module seem to be having effect, particularly in relation to student's perceived opportunities for engagement in different modes of work. Out of this years' experience emerge other ways where the thrust of this intent may be further explored. The relationship of the student cohort with the Client could be further enhanced. At present it is practical and useful for it to primarily go through the single point of contact that the Module Co-ordinator provides, but the role of "go-between" could feasibly be deputised to a student. This could be achieved by an earlier and clearer setting of roles, as the "coordination group" emerges.

Equally, the role of coordination between different strands of the design process can be further developed. This role could possibly become more formal, in order to make more evident to the designers the overlaps with parallel strands that they have to take into account for their own work.

Advice to others for implementation

This year, the mode of running the module was substantially affected by Covid-19 teaching restrictions. The direct mode of communication typically employed was replaced by online remote discussions, where the number of participants became an impediment to participation. Breaking down the conversations into smaller sub-groups was the only way to somewhat circumvent this issue. But in doing so, the overlap which is sought between the various components of a given project was more difficult to achieve.

The Class was not afforded the use of the Building Laboratory when it usually would have (after Week 7 of Term). The feasibility of getting the project built remained in precarious balance throughout the entirety of Term and was eventually only agreed upon at the very end of the teaching period, for the two weeks post-examination period, just before the closing of the grading process. This timing was advantageous, as it provided clearance from all other College work (like the two mid-term weeks usually do).

Not all students in the Class could be in Dublin to participate in the building phase of the project. Administrative components of the work were therefore allocated to those students, in equal measure (estimated time) to the commitment from those who participated in the building process.

Though the actions described above are all specific to the mode of work in this project, general principles that could apply in other settings are:

— Module co-ordination assumes a role of "enabler", allowing for student's initiative to gradually take ownership of the project;

— Provide a variety of work mode settings, freely accessible to the entire cohort of students;

— Keep tasks limited in scope and time, to consolidate involvement;

— Use records to confirm ownership of work;

— Facilitate communication between all parties involved in the project, to create overlap and ensure the dynamic of progress is student driven; and

— Keep learning outcomes open ended, to stimulate a process that evolves organically.

The mode of this year's project was deliberately simplified in its scope and complexity of construction. For this reason, it was possible to extend insurance cover for the students to participate in the assembly of the exhibition in Temple Bar. This was a very positive conclusion to a difficult Term's work.
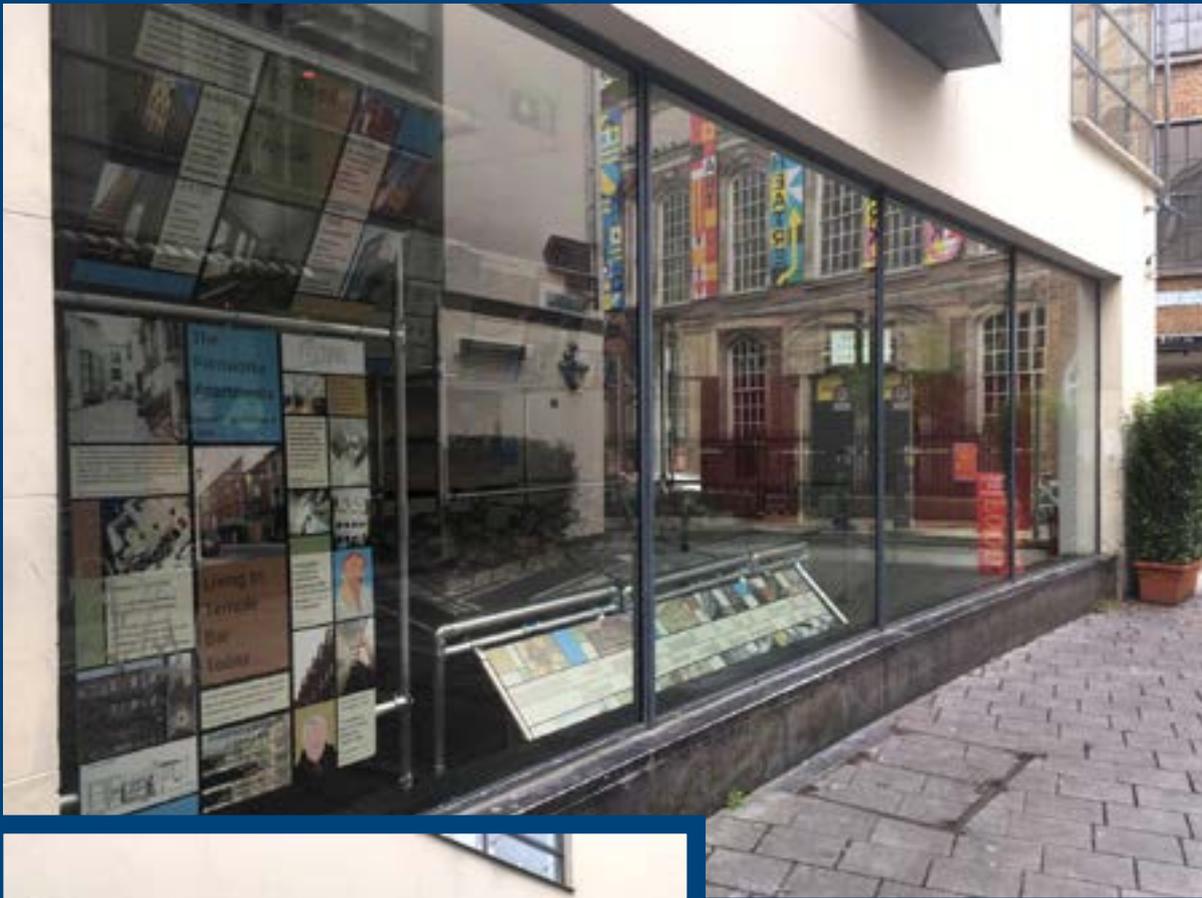
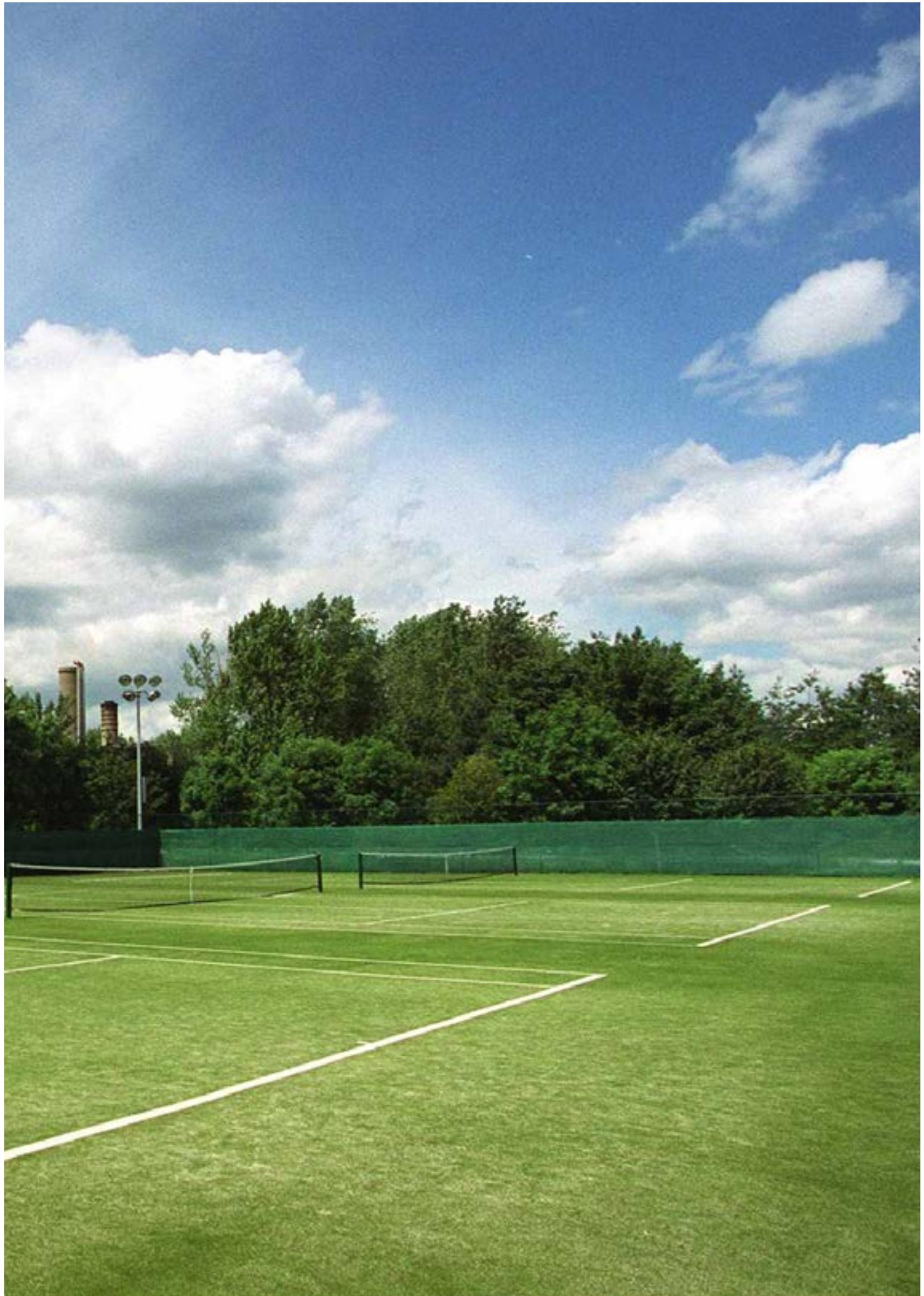**Figure 15.** Exhibition installed on site.

References

Buggy, C. Padden. L Kelly, A. (2019). **Becoming an Inclusive Teacher: the top ten Do's and Don'ts**. Dublin: University College Dublin.

Burke, P. J. & Crozier, G. (2016). **Teaching Inclusivity: Changing Pedagogical Spaces**. 2nd Edition.

Kelly, A. M., & Padden, L. (2018). **Toolkit for Inclusive Higher Education Institutions**. From Vision to Practice. Dublin: UCD Access & Lifelong Learning.

Thank you

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