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Design for Climate - A Case Study from Architectural Education

Cover Page Footnote

This paper was created to capture the ongoing development of architectural education to address the climate crisis and acknowledge the engagement of the Bachelor of Architecture programme lecturers, students, the Architectural Students Association, and the external professional industry partners who have supported and championed the work accomplished to date. The author would like to sincerely thank the three hundred students on the Bachelor of Architecture programme at Technological University Dublin for their engagement and commitment to becoming responsible architects. The author would like to thank colleagues within the Dublin School of Architecture, Lecturers Mr Mike Haslam, Mr Brian O'Brien, Ms Emma Geoghegan (Programme Chair), Mr. Cormac Allen (Assistant Head of School), Mr. Joseph Little (Assistant Head of School), and Ms Orna Hanly (Head of School) for supporting the initiative. Their contributions and open constructive feedback throughout the project was essential. In addition, thank you to colleagues across Technological University Dublin who have supported the initiative and championed its strategic intent for our University's sustainability agenda. In particular, thank you to Mr. Andy Maguire (TU Dublin Sustainability Coordinator 2016-2021). The author would also like to acknowledge external support and engagement from Ms. Sandra Campbell, Education Director of the Royal Institute of Architects of Ireland. Finally, the contribution of colleagues from the wider community in the Dublin School of Architecture, Technological University Dublin are gratefully acknowledged.

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Design for Climate – A Case Study in Architectural Education

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Design for Climate – A Case Study in Architectural Education

Keywords: Sustainability, Innovation, Curriculum Development, Responsible Design

ABSTRACT

This case study examines the impacts of a project that utilised a form of collaborative innovation, called co-creation, to embed sustainability into the five-year Bachelor of Architecture programme curriculum at the Technological University Dublin. This project's co-creation process deployed design thinking, a term used to describe a human-centred creative problem solving process, to develop understanding, create shared purpose, and generate accountability across a wide range of the academic programme stakeholders to enact change. The project's approach sponsored an opportunity for exchange and dialogue which enabled cultural change, using the unique and established pedagogy found within the programme's core learning subject, Architectural Design Studio. The project prompted a philosophical movement away from traditional linear programme development and provided an interconnected, transparent, circular pattern of interactions (referred to as feedback loops) enabling students and educators to engage directly with the complex challenge of addressing Climate Change[1] in architectural education. This paper explores the innovation opportunities possible when addressing sustainability challenges through the integration of co-creation, curriculum development, and design thinking.

[1] Climate Change as defined by the Intergovernmental Panel on Climate Change. (2018) *Special Report: Global Warming of 1.5° C:* (Summary for Policymakers) https://www.ipcc.ch/sr15/chapter/spm/

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INTRODUCTION

The *Architectural Design for Climate Change* pilot project was designed to embed the concerns of global sustainability, as defined by the United Nations World Commission on Environment and Development[2], to become central in undergraduate architectural education. The pilot engaged three hundred Bachelor of Architecture students, thirty-six educator practitioners, academic programme managers, industry professions, external partners and the professional body (Royal Institute of the Architects of Ireland) over a twelve-month period (May 2019-June 2020) to embed the *United Nation's Sustainable Development Goals for 2030 (UN SDGs 2030)* into the curriculum by using its framework of interdependent goals, targets, and indicators, as a lens through which to review, revise, and assess the academic programme. The project's open co-creation process empowered students and educators to re-assert the professional value of architects through a new model of education that elevates responsible citizenship and engenders a renewed sense of ethical purpose in architectural practice. Through the disciplinary lens of architecture, the project demonstrates how problem-based learning in higher education can adopt a new model for embedding education for sustainable development[3].

The use of dynamic feedback loops deployed in open innovation models generated through co-creation and design thinking have been proved effective by Yun & Lui (2019) when they simultaneously engage wider stakeholder groups such as industry, government, community organisations, and society. When maintained throughout this pilot, using transparent inclusive principles, feedback loops promoted virtuous cycles of engagement from students, educators, and

[2] *Report of the World Commission on Environment and Development: Our Common Future*, Unite Nations World Commission on Environment and Development. Also known as 'the Brundtland Report', 1987

[3] Education for Sustainable Development (UN SDG 4.7.1) is defined as the: *Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment.*

the discipline's professional body to fuel the further development and embedding of sustainability related curriculum revisions within the Architectural Design Studio modules. Over a short time period, the project delivered substantial programme level curriculum revisions to a well-established professional academic programme, re-directed focus and priorities in plans for future programme development, and resulted in student projects gaining national and international recognition. The project successfully drew from it's organisational environment, connecting high level emergent organisational strategy for global sustainability imperatives through a ground-up student led process, drawing upon what Linton & Klinton (2019) describe as the native entrepreneurial mindsets of the architectural participants.

1 PROJECT CONTEXT

Professional Context

The profession of Architecture resides, along with other built environment professions, within the construction industry. The construction industry is responsible for consuming half of all resources humans take from nature. It accounts for 42% of global energy consumption and it produces 38% of the world's waste, as cited in 2011 by United Nations Environment Programme in its publication for policymakers *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. The industry requires a rapid and radical response across its supply chain and workforce to address sustainability challenges and operate within our planetary boundaries. Educational institutions, including higher education, have a duty of care to prepare graduates for an anticipated reformed industry which values enterprising responsible global citizens. The necessary seismic changes to academic programmes, the upskilling of academic staff teaching on these programmes, and the upskilling of active industry professionals is a substantial undertaking

and requires a new approach to change in order to respond in to critical sustainability threats. Architecture is one of several professions within the construction industry which is equipped to adapt in response to systemic sustainability challenges. To address sustainability challenges and increase the level of understanding of global responsibility within the profession of architecture, we must consider the complex sociological understanding of responsibility as related to architect's professional legitimacy(Blau,1984). Any substantial revision of this professional programme to address the increased levels of knowledge and responsibility for sustainability will necessitate revision of national level professional codes of conduct, review of professional accreditation criteria, and in this context, review of the *European Professional Qualifications Directive (2005/36/EC)* competencies legislation.

University Context

In tandem with the external forces of an emergent construction industry revolution (Alaloul, et al., 2020) which is grappling with technological innovation disruptions, the project's internal academic institution, the Technological University Dublin (TU Dublin), has also undergone significant organizational change. TU Dublin formed through the merger of three Institutions of Technology (IoT) Dublin Institute of Technology (DIT), Institute of Technology Blanchardstown (ITB), and Institute of Technology Tallaght (ITT) to create Ireland's first Technological University in January 2019.

In recognition of the need for higher education to respond to major societal challenges, the development of the new TU Dublin Strategic Plan consultation process signaled the UN SDGs as priority objectives for demonstrating priority actions within the new University through specific reference to Sustainable Development Goal 4 – Quality Education. This Goal, measured through Target 4.7, aims to create globally responsible citizens as defined by UNESCO's report in 2018 on *Education for Sustainable Development and Global Citizenship*.

School Context

The Dublin School of Architecture, found within the College of Engineering & Built Environment at TU Dublin, has a strong national reputation in practical and applied education delivery dating back to 1942. The School's legacy within the Bolton Street campus area of Dublin's inner city extends across all levels of academic award (Apprenticeship to PhD). Previous School and College level initiatives to sponsor and inform curriculum development for built environment professionals and address industry changes have focused on digital technologies and building performance analysis practices to meet new European Directives (2010/31/EU (EPBD), 2012/27/EU, 2018/844/EU) and forthcoming national Irish building regulations to increase the energy efficiency in buildings.

While adoption of Building Information Modelling (BIM) and Energy Performance Analysis modules were incorporated into the School's Programmes in Architectural Technology, Construction Site Management, and Building Performance, initiatives to incorporate this knowledge and skills, did not affect meaningful change in the School's largest programme, the Bachelor of Architecture. Possible reasons for this are noted by Rogers (2003) where Architects and architectural education have historically oriented towards maintaining traditional practices, due in part to alignment with more traditional values found within the social systems of architectural practice culture. Relative to other built environment professionals, Architects have historically been slow to adopt emergent innovations (digitisation, off-site construction, and multi-disciplinary collaboration). This classifies architect's as industry laggards, a characteristic particularly evident during periods of substantial industry diffusion or technological change.

Global Context

In 2016, the United Nations provided an accessible international framework designed to communicate seventeen urgent challenges facing the world. Through the creation of interdependent targets and indicators, the UN SDGs dissolved industry boundaries and promoted joined up thinking and collaboration to meet the goals and achieve global sustainability by 2030. With an accessible message, and aesthetically pleasing colourful graphic image, the UN SDGs became increasingly normalised throughout mainstream western society during the years of 2017-2019. One goal in particular became publicized extensively due the increased number and catastrophic impacts of world-wide ecological disasters. By 2019, Sustainable Development Goal 13, *Climate Action*, had gained significant and regular attention by the media, which triggered a wave of organised youth activists.

2 RELEVANT ESTABLISHED PRACTICES

This project drew from three distinct areas of education practice; signature pedagogies in architecture, design-thinking, and embedding sustainability within higher education curriculum. The literature in these three areas contribute to and offer historic context for the contribution this case study offers to education practice.

Signature Pedagogies in Architecture

Architectural pedagogy has long embraced the German Bauhaus education model from 1914, which fosters an approach to design that unifies principles of technology, craft, fine art, and function. The Bauhaus movement cultivated debate in architectural design around fundamental relationships between craftmanship, mass production, usefulness, and beauty. The Bauhaus did this through the delivery of workshops where participants developed designs using a problem-based learning approach (Nicol & Pilling, 2000) in a shared open studio environment as a means of

progressing a culture of architectural production. This experiential model of learning (Kolb, 1984) and primary location for architectural enquiry has evolved into what is now adopted internationally across architectural education known as the Architectural Design Studio (ADS).

As typical within architectural education, the cumulation of ADS learning hours constitutes more than 65% of the current five-year full time Bachelor of Architecture professional programme requirements. Secondary modules including subjects in Environment, Visual Communication, Building Technology, Structures, History, Critical Theory and Professional Practice are delivered using models that respond to organizational learning and teaching culture (Altomonte, 2014). At TU Dublin a plurality of approaches are deployed across the five-year programme relative to the ADS modules, including parallel (independent) delivery of ADS and secondary modules and through partial integration of project assignments. Through the weighted importance of the large portion of learning credits ascribed to ADS within the five-year curriculum, students prioritize their time on ADS modules over supporting subject based modules. Therefore, the attributes of the ADS module are not only well suited to the introduction of new knowledge, and to the investigation of complex emerging issues, they are also capture the highest level of attention within the curriculum for students. ADS pedagogies promotes an open and innovative culture that can generate new creative solutions for our built environment.

Design-Thinking Culture

Architectural education places emphasis on teaching design skills using cognitive ‘thinking’ processes (Oxman, 2004) in learning and teaching methodologies which are deployed through ADS. ADS project design briefs (assignments) engage students in problem formulation and solution generation using ideation design strategies to structure the process. Students work through a structured design process to inform decisions to satisfy the project brief following rigorous research, testing and analysis where iterative design revisions are expected. This

approach is applied across all project scales and project brief complexity in ADS within the five year professional programme. In this learning environment, students develop projects where thought and action are not separated (Noel and Liub, 2017). Such learning and teaching techniques, mirror those found within formal design thinking practices (Shute, 2012). The repeated exposure of working through design thinking stages for each project, strengthens students critical thinking skills and fosters an entrepreneurial mindset within the culture of architectural education. Interestingly, action-oriented academic delivery and student-centered outcomes are recognized in the literature on architectural educational, however this culture of open innovation design thinking practice is not widely reflected in architectural education's development process for itself (Teo, 2019).

Embedding Sustainability into the Curriculum

The *United Nations Sustainable Development Goals 2030 (UN SDG 2030)* framework is designed to foster a systems-based response to addressing critical global challenges to ensure global needs can be met now and in future generations. Through a process of distillation seventeen global goals are identified, with each measured and monitored across over 162 countries and territories through clearly defined targets and indicators[4]. Inherent within each goal are purposely designed interdependencies to other goals, reinforcing the need for shared global and ethical (Jordan and Kristjansson, 2016) responses. The UN SDG 2030 framework communicates each goal in accessible language, enabling action to be taken at all scales – from the individual citizen, an organisation, an industry, or a nation.

Primarily, the approach within the literature to embed sustainability into academic curriculum to date has looked at creating sustainability literate graduates (Décamps et al., 2017) and to develop

[4] https://unsdg.un.org/resources/un-sustainable-development-cooperation-framework-implementation

and review existing modules that incorporate key words identified as aligning to the UN SDGs. This alignment can be assessed through quantitative and qualitative academic content analysis of curriculum descriptors (Budihardjo et al., 2021). However, it does not include for other aspects of curricular and extracurricular factors that contribute to creating a culture of sustainability in higher education. While both approaches contribute to an increase level of sustainability awareness in students and educators, they fail to address the potential of other systems level factors such as the inclusion of student voice, prioritising industry challenges, and active contribution to communities to create meaningful long-lasting culture change to wholly embed sustainability and create globally responsible citizens through quality education[5].

While useful to examine, the existing literature does not offer actioned examples of how a combination of architectural education's unique pedagogies, its use of design thinking in learning and teaching, and methods for embedding sustainability into curriculum can be effectively deployed to address the wicked problems (Rittel & Webber, 1973) of climate change in higher education curriculum. Consciously, these three areas of practice were utilised in combination within this project's piloting to provide a unique environment which purposely departing from traditional curriculum change processes.

3 Project Design

Emergency Meets Serendipity

The *Architectural Design for Climate Change* project was timed to respond to a confluence of internal and external factors and leverage the potential for collaborative and large-scale engagement to generate curriculum change. Internal factors including a new School mission and

[5] https://unstats.un.org/sdgs/metadata/?Text=&Goal=4&Target=4.7

the TU Dublin Strategic Milestones 2023 alongside external factors such as global warming (IPCC Report, 2016), increased public awareness of climate change risks6, and decreasing professional legitimacy of architects in the construction industry value chain (Samuel, 2018) created a unique opportunity for taking a new approach.

Against the backdrop of global, professional, and organisational change, the Dublin School of Architecture Executive team agreed a Mission that captured the values shared across the discipline leads in Architecture, Architectural Technology, Construction, and Apprenticeship. In March 2019, the Head of School communicated the Dublin School of Architecture Mission to the School community (lecturers, staff, and students) at a meeting of the School Forum. The mission as described was '*To deliver sustainable building. To do this, buildings must be economic, efficient, ethical, and beautiful*.'[7] The mission was accepted and established an understanding for the need to change areas within the School's curriculum.

At that time, the connection between sustainable building, to meet School, University, and Global goals was not consistently evidenced across all programmes. A new approach was needed to make this connection explicit, where previous initiatives and regular programme development processes had been unsuccessful.

Agility to Respond

A strategy was devised to use a human-centred design process, described by Giacomin (2014) as connecting responsibility and accountability to generate a new set of agreed values. The sponsoring of an event to promote vocal public engagement and engage students' concerns about the future of the planet was offered as a means creating a new value system for the programme community. Once attested, these values could update professional competency requirements and re-establish

[6] https://www.weforum.org/agenda/2022/01/global-risks-report-climate-change-covid19/
[7] Dublin School of Architecture Mission led by Head of School, Ms Orna Hanly

the relevance of the professional architect in the construction industry by focusing on solving real world problems such as Climate Change.

As identified by Empson (2019), in order to affect change to address Climate a systems level change is necessary. Similarly, a new process for tackling the traditional value system of architectural education required a new approach that challenges established structures and processes in order to meet multiple interrelated objectives.

Finally, the academic manager, responsible for the caliber and quality of academic delivery and the provision of operational resourcing, played a critical role in the curation and sponsorship of this project. Professor Leith Sharpe (2009) identifies in her research from over a decade of university campus sustainability movements a uniquely critical role for the 'middle manager', to make connections up and down within the hierarchy of an academic institution to realise theory into action. Typically, middle managers have the knowledge and perspective of key stakeholders in order to generate meaningful dialogue for change. An example of this is in their role and authority to connect the student voice with broader strategic goals, such as those relating to University or United Nations level objectives. In their position within the academic institution, the middle manager can create and oversee a new local mode of distributed programme governance and decision-making processes through an 'emergent operating model'.

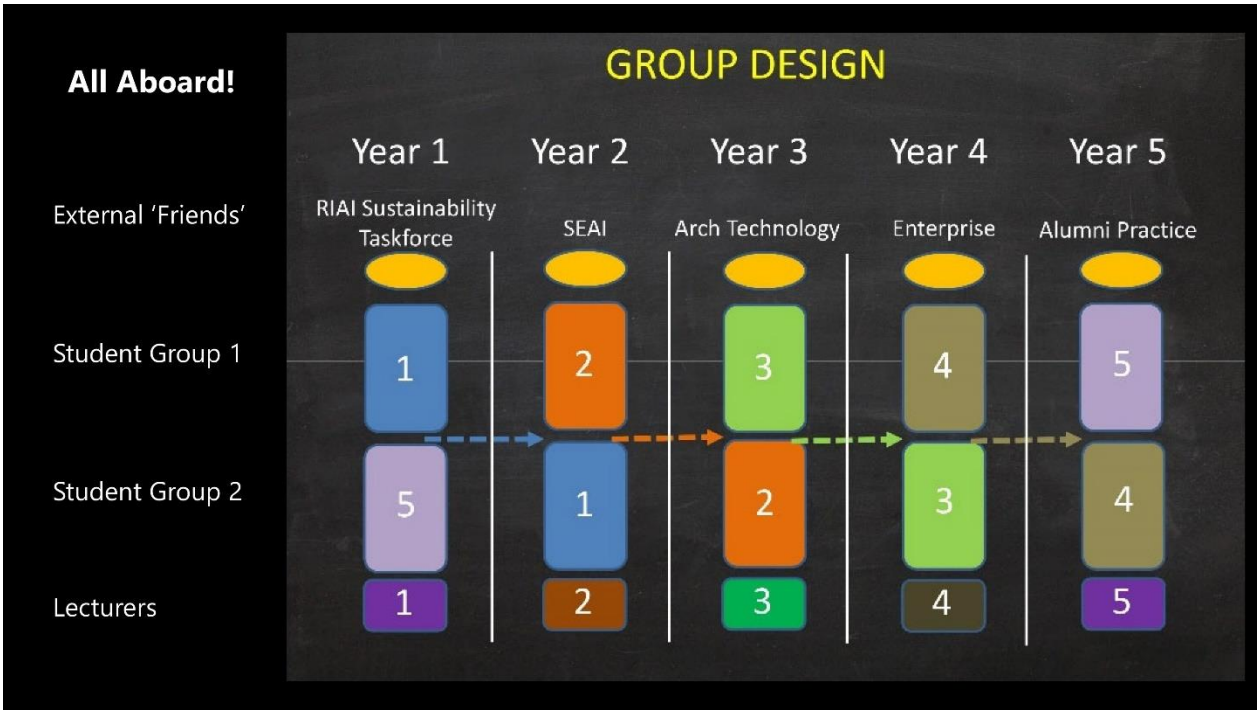
Creating Conditions for Dialogue

Higher education is recognized as a 'safe space' for creating new knowledge, exchanging, and debating ideas. In support of this, the Architectural Design for Climate Change pilot was designed to include key internal and external stakeholders, to provide external insights for stimulating dialogue and new outcomes (Melles, 2019). 'Critical friends' of industry, alumni in professional practice, the professional accrediting body, and academic colleagues from other disciplines areas

were invited to perform in active facilitation roles throughout the workshop. These 'actors' were charged with helping to raise questions, offer clarifications, and moderating discussion between students and lecturers. Feedback from external stakeholders on the design and objectives of the workshop were sought and included.

Participants in the workshop were asked to prepare responses to questions in advance and given an outline of what to expect at the workshop event. This was done to reduce participant anxiety, create a level of psychological safety, noted by Wannags (2020) as critical to diffusing tensions and allowing participants control over their contributions.

Other preparations included buy-in for the event from key stakeholders, such as class representatives from each year, Year Heads and lecturers in ADS modules, and other internal and external stakeholders. Feedback from internal stakeholders on the details, design, and objectives of the workshop were sought and incorporated into the design of the event.



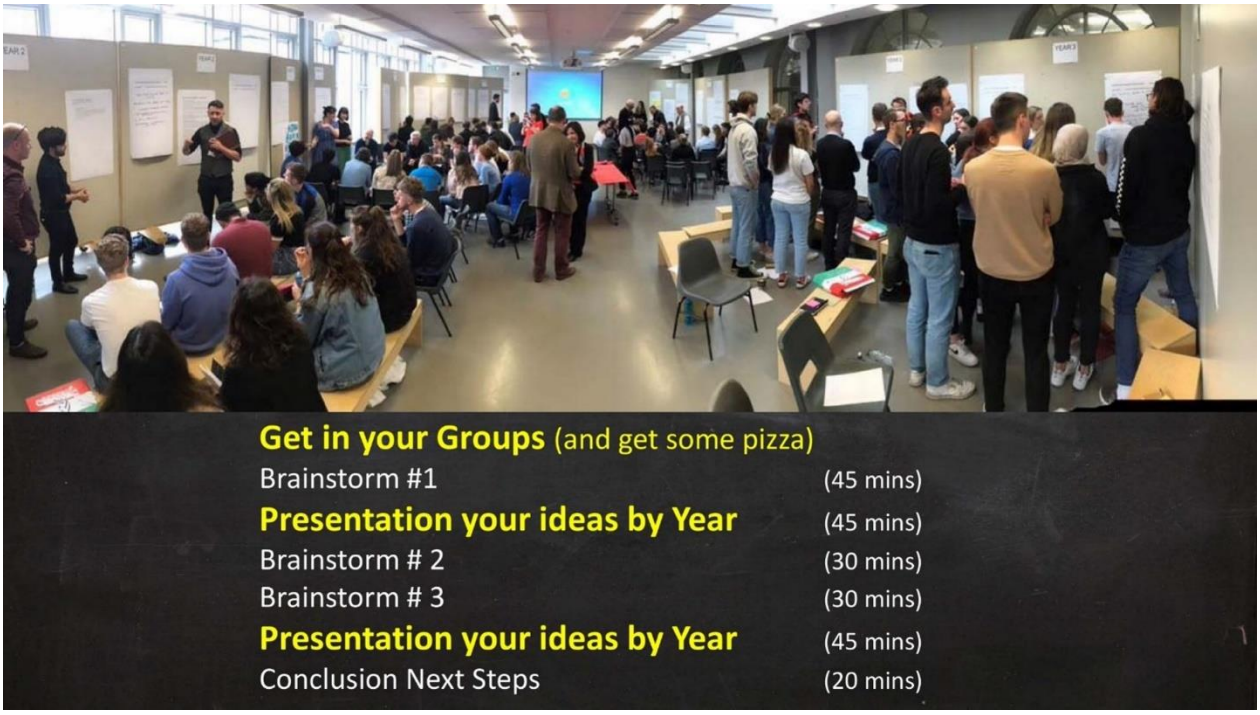
Architectural Design for Climate Change Workshop Group Design years 1-5 B Arch Programme, May 2019

Within the workshop, groups were organised to include a diverse constituency of students, lecturers, and industry professionals. Students were allocated to specific years within the programme and charged with co-creating the ADS curriculum for that year. Students were split across year groups to distribute the student's experiential knowledge, as essential wisdom, to creating a future curriculum. This gave students agency in contributing to the workshop and creating their ADS curriculum for the next academic year. By linking the passion of students to act to prevent climate change and determine their future academic curriculum, the workshop, provided an intergenerational response that connected internal and external environments and generated a level of transformational change to the B Arch programme's knowledge and value system (Fazey et al., 2020).

Co-creation through Ideation

The co-creation process included key principles of *Geodesign* (Steinitz, 2012) which acknowledged the value and roles of the 'people of the place' to contribute to and take ownership of making change. Through a '*transparent communication'* defined by Carl Steinitz's Geodesign framework, the process of ideation was undertaken by each group, where they were asked to openly ideate on five questions.

- *What priorities and themes can the Architectural Design Studio undertake to address/solve for Climate Change?*
- *What are project types (building typologies, site locations, end users, materials) that can answer the needs of the identified priorities above? Describe each individually.*
- *How do we measure success in Architectural Design Studio projects with these priorities?*
- *What new or additional information, knowledge, or resources are needed for us to deliver on the Architectural Design Studio objectives above?*
- *What supports do we need to stay focused on Climate Change?*



Architectural Design for Climate Change Workshop Brainstorm Sessions, May 2019

For each question, the groups had 30 minutes to generate ideas, evaluate their ideas, and select ideas through silent dot voting. Throughout the process active facilitation by external 'critical friends' promoted creativity, deferred judgement, ensured turn taking and parity of voice between students and lecturers, encouraged quantity and diversity, and kept the group on topic. At the end of each brainstorm, selected rapporteurs communicated conclusions to the wider group. Findings were recorded in real time on a large format screen within the workshop space. The process created a public contract in the form of public commitments to action and outputs created by participation. Through a constructive and focused dialogue working together, a more sustainable curriculum in architecture emerged. Brainstorm posters generated by groups were collected, collated, fed back to participants to verify accuracy, and formalised as communication posters within the shared spaces of the School.

4 Project Implementation

Agree to Action

The Architectural Design for Climate Change event generated action and engagement from the Bachelor of Architecture community on May 3rd, 2019. Over 300 participants attended the workshop over a four-hour period. By opening up ideas and inviting participation from the extended community, students, lecturers, and other stakeholders enthusiastically accepted responsibility to deliver on curriculum change to address climate change. During the process of ideation, additional sustainability challenges (housing, universal design, economic inequality, biodiversity) were incorporated by participants to expand the scope of the project and established a greater number of architectural responses to climate related consequences.

Debrief & Discussion

In late May 2019, summary posters capturing each groups contributions and selections, were circulated to students and lecturers for final comment. Once confirmed, year summary posters were hung on walls in common areas throughout the campus. The posters provided each year with the priorities, project types, and assessment techniques developed from the workshop which were to be implemented in the new academic year (September 2020).

In June 2019, the programme lecturing team discussed the challenges of re-writing module level learning outcomes to embed sustainability before having trialed the new project briefs in the studios. Discussion and debate on this extended beyond the School and programme team to colleagues across the University active in research in the area of sustainability education. Fundamental questions arose. *What is the lexicon of sustainability in curriculum? How is this measured and weighted through words*[8]*?* A practical view was taken by the team during the pilot

[8] Conversation Dr Philippe Lemarchand, Research Fellow, Dublin Energy Lab, TU Dublin June 2019

year to focus on project-based outcomes in the first instance, as a means of assessing the revised curriculum's focus on sustainability. This approach enabled a more reflective and robust module(course) descriptor to be written in light of questions raised about assessing sustainability outcomes post-pilot delivery.

As a means of capturing changes and emerging agendas in a programme overview across all five years, Year Heads were asked to summarise their year's Climate Agenda into a shared ADS framework for review by the programme team. This framework provided an overview that concisely communicated each year's theme, agenda, site location, project typology, and scale of intervention. It provided as an assessment tool for the team to review the new ADS curriculum in its totality, and identify gaps, mission drift, or overlaps between and across years. It also served to identify good practices across the programme team, and as a shared file allowed all members of the team to view and edit, further reinforcing the collective learning journey. In addition, this framework provided a means of reflecting on academic programme progression to ensure that the level and complexity of Climate Agendas were commensurate with the programme learning levels and competencies.

Review of Mission Alignment & Feedback

To ensure mission alignment during project implementation, transparent feedback loops were critical to co-implementation and collective responsibility of students and lecturers.

Returning from the summer break, Year Heads uploaded newly drafted ADS project briefs to a shared team folder. An online peer review process consisting of programme team lecturers, student class representatives, and external industry participants providing written feedback and constructive evaluation notes on the proposed ADS briefs and curriculum in line with the agreed Climate Agendas captured in May. Year Heads, student class representatives, and external

workshop participants then re-submitted draft briefs which we discussed and reviewed in person before the start of classes.

As final design briefs were prepared, further refinement and development of the ADS framework was undertaken to include additional evaluation criteria such as Values, UN SDGs, Partnerships, and Class Trips/Field Study. In previous academic years, class trips and class field study had formed an essential portion of learning where students would undertake building surveys, visit exemplary buildings, and experience different scales and styles of architecture as integral to ADS delivery. Typically, this had involved class groups travelling by air to European cities to undertake these activities. Such trips also provided for great group cohesion, proximate learning, and elements of group work. Having reflected upon the carbon footprint of long-distance travel, Year Heads consulted with their teams and deemed previous air travel practices incongruent with the programme's new focus and emerging value system. Ultimately, the majority of class trips were planned locally within Ireland. Upon final review of the revised ADS framework, it was evident that the framework had multiple uses including its use as a guide for aligned decision making by the team.

Delivery of Pilots, Semester 1 Programme Years 1-5

In September 2019, the B Arch programme team, all three hundred students, and external stakeholders gathered to launch the start of the new academic year designed to address the challenges of climate. A short video which captured the *Architectural Design for Climate Change* workshop in May was played as a reminder of our public contract and for the benefit of introducing new incoming first year students to the programme agenda. Each Year team introduced the ambition and purpose of the projects planned by year to the audience. The Environment Services and Materials strand of the programme launched the *Climate Reader*. Recognizing that the team was embarking on a new journey of delivery in ADS, the community paused to reflect on the year

ahead and privately record any hopes or fears they had anonymously on small pieces of recycled paper. Later that day, the hopes and fears of the group were shared publicly in a collage in a common area in the School.

As the first weeks of the semester progressed, there was positive purposeful energy and engagement across the programme team and students. Students and Lecturers attended the Climate Action March in coordinated efforts. Unprompted, individual lecturers and students began posting motivational quotes and inspiring posters within the corridors of the School.

In late October 2019, the School hosted *Climate Camp* as a weeklong vertical co-creation competition for all years in the B Arch programme. The week included a Climate Project Challenge focused on designing climate solutions for Dublin's city centre. A series of lunchtime workshops were offered on themes such as *Carbon Calculator, Gender in Construction, Sustainable Building Services, Agile Teams, Public Good, Architectural Intelligence, Green Campus,* and *Sustainable Business*. At the end of the week, students, lecturers, and an invited panel of guests selected three winning projects.

Semester 1 Pilot Feedback, Dissemination, & Delivery (Again in Semester 2)

At the start of semester 2 in January 2020, the full programme team, students, and external stakeholders gathered to review and offer feedback from the experience of the project during semester one. Results from a live feedback survey using an online polling application showed student responses to the following prompts:

1. *Describe something you learned about in semester one.*

   Responses with largest word cloud scale rating – Flooding, Timber, Ecology, Groupwork, Carbon, Sustainable Design, Density, Landscape, Conservation, Infrastructure, SDGs, Presentation, Awareness, Healthcare, Trees

2. *Rate your semester one learning experience.*

   Responses – 16% Excellent, 50% Good, 20% Fair, 6% Poor, 8% Very Poor

This gathering event also provided an opportunity to showcase student work. A selection of students from each year to present their final semester one projects to the full programme community. Communication about the student projects from *Climate Camp* selected for involvement in *I-cubed* TU Dublin Hot House incubator funding. Two climate events were planned for March and April. The first event showcased exemplary student projects on Climate to visiting class groups from Cardiff University. The second event invited guest speakers to debate the topic of *Responsible Citizenship* in Architecture. The second event was not held due to disruptions from *Covid19* following national lockdown measures initiated in mid-March 2020.

Although the disruption of Covid impacted on ADS teaching on campus in studio, the significant project milestone of capturing and drafting new module(course) documentation following the piloted delivery was completed by the programme team across modules in all five years. In June 2020, the module revisions of all Architectural Design Studio modules, constituting 160 of the 300 credits of the programme, were brought forward by the School and formally approved by the College Academic Quality Enhancement Committee.

5 Project Evaluation & Reflections

The project revised a substantial portion of a large undergraduate professionally accredited programme. The remaining modules remain under review by the programme team. Further embedding of sustainability ethics as linked to the professional responsibility of an architect are being considered. This work anticipated and aligned to a changing external environment around the programme, where other Higher Education Institutes and B Arch competitors, professional

bodies within the built environment as well as organised action networks are actively working to address cross industry upskilling and education in response to the twin crises of climate and ecological breakdown.

Human-Centred Design

Deep change requires the education of multiple learner cohorts simultaneously, including the upskilling of so-called discipline experts and educators. The use of a public contract records an open commitment and shared testament for co-creators to take ownership of and deliver on change outcomes proposed and agreed. Refinement and development of agreed changes is facilitated through iterative and transparent peer reviews processes, creating a safe space for learning for all participants simultaneously. This pilot's findings suggest that human-centred co-creation design processes reflecting intergenerational stakeholder concerns and motivations are superior to traditional cascaded approaches to upskilling if motivated by a larger shared purpose.

Project Sustainability

To maintain the level of continuous evaluation and open feedback is essential throughout a large-scale change project. This endeavour requires substantial resources and dedicated project management to communicate and incorporate changes dynamically throughout the project phases iteratively over time. Adjacent practices to co-creation such as participatory design have struggled to articulate the value of such practices to cover the additional resources required to deliver them (van der Velden & Mortberg, 2014). Lecturers are also learners within this project. They require support, resources, and a safe space to upskill in areas of design for climate and sustainability. A comparison undertaken by Professor Leith Sharp (2009) of actual costs and long-term value across change models would provide further insight as to the investment requirements for projects like this might develop to enable full impact.

6 Conclusions

The project's success can be attributed to several factors; architect's intuitive propensity to engage with creative challenges, the scale and extent to which the project included key stakeholders, the processes deployed have replication value, and recognition of the level of change was evidenced (through formal and informal channels) throughout the project stages by internal and external stakeholders.

Emergent Practice

Architects demonstrate unique characteristics, knowledge and skills that allow them to readily engage with design thinking and idea generation processes through the signature pedagogy of Architectural Design Studio. Because of architectural education's transformative learning culture in Architectural Design Studio, architect's engage positively in projects that pose creative open-ended challenges. The United Nations Sustainable Development Goals framework acts as a catalyst to transform industry and society to protect future generations. Architects are forward looking, optimistic, and entrepreneurial, offering Universities a new approach to learning according to Linton and Kilton (2019). Architects are also capable of complex problem solving, traits shared by many futurists (Watson & Freeman, 2013) necessary to properly engage with wicked problems. Therefore, by extension, architectural students and lecturers have a proclivity to engage positively with change when undertaken through an open-ended yet structured design process. When this process is aligned to tackling global challenges, architects respond by reasserting their profession's relevance through the creation of inspiring solutions, offering a new methodology to develop responsible learning.

Scale for Impact

A number of factors play a role in affecting culture change, however evidence presented by Smollan & Sayers (2009) suggest that to create lasting impactful organisational change, the number of people engaged in making change is most critical. The large scale of this project is an important criterion in measuring a change to creating a more responsible culture in architects.

The scale of the project also produced significant external support, through funding, time, and the creation of new projects and partnerships. The knock-on-effect of these cumulatively have led to new research, new funding streams, and new roles for key stakeholders to further support the work and embed sustainability more widely in across the construction industry and international academic communities.

The project developed and delivered a process that enabled deep change at scale and pace in a discipline area where the relevance of the profession has been in question for some time. Through the pilot, which married global objectives, personal values, and professional purpose, a groundswell of enthusiasm and engagement was sponsored, triggering a number of key positive knock-on effects to engender responsible cultural change within a community of 350+ people ages 17-65. The School mission of the Dublin School of Architecture is now understood at an individual level within the community, where a holistic understanding of Sustainability is prioritised in the education of architects.

Transferability

Design thinking is the overarching methodology. This interactive, open, iterative ideation process when combined with a co-creation process to include the diversity of key stakeholders, can provide a critical voice to identifying areas of the architectural curriculum which are no longer relevant. The process of reflecting on critical knowledge and skills areas essential to delivering responsible

design invites in other disciplinary knowledge and skills as essential to addressing current gaps. And with this, a collaborative design process which includes multiple discipline perspectives can not only develop stronger capabilities to addressing Climate Change through shared learning experiences, but also provides other disciplines with project-based learning templates to stimulate and transfer the innovation practice piloted in this project beyond the Architectural Design Studio. Because of this pilot's unique characteristics, which utilise design thinking, project-based design studio pedagogies, and prioritise global challenges over professional traditions, its agile process can readily adjust for scale, adapt to local conditions (cultural, regional, technical capacity, professional, etc.), and transfer to other disciplines by leveraging each group's unique expertise.

While cross-disciplinary and interdisciplinary knowledge was identified by the programme team and students in the early project stages as necessary to deliver holistic design solutions for climate, we found that an initial intradisciplinary cultural change process was needed as the first stage to give agency to architectural knowledge. Similar findings from pilot projects outside of the architecture show how local cultural change is an important stage preceding cross-discipline collaboration.

Project Recognition

There are both qualitative and quantitative evidence delivered from the project which recognise the project's success in embedding climate and sustainability into the B Arch curriculum at TU Dublin.

The Academic team delivery on the ADS framework, module descriptor revisions, and design for climate project briefs continue to be delivered within the programme community. Consequently, student projects produced throughout the academic year since 2019 remain focused on addressing climate and sustainability challenges.

An increased level of student engagement was evident by lecturers and academic managers within the School. This was measured through a variety of means including attendance, academic results, the number of (and focus of) new extracurricular activities and events.

The project undertaking and success by the students, programme team, and academic management has been recognised internally – featured in the first TU Dublin internal newsletter 'Strategic Spotlight' where the project was commended for its proactive delivery on University level strategic objectives.

In July 2019, the School responded to a call by the Earth Institute, Center for Sustainable Urban Development at Columbia University to bring forward the Architectural Design for Climate Change project as part of the *Local Projects Challenge*[9]. By contributing to this process, the project joined a number of global exemplar sustainability projects, gained external international recognition and feedback winning Best Education Project Honors Award at the *World Urban Forum* in 2020, thus increasing the School's international sustainability network.

In early October 2019, the School presented the project at the Royal Institute of Architect's Annual Conference in the Climate Change and Built Environment session. This was the only third level education pedagogy presentation at the conference.

Further to this, in November 2020, the national professional body (RIAI) annual student awards declared TU Dublin students as winning both the 1st place and runner up in the Sustainable Design Excellence Awards.

[9] http://localprojectchallenge.org

Summary & Acknowledgements

This paper was created to capture the ongoing development of architectural education to address the climate crisis and acknowledge the engagement of the Bachelor of Architecture programme lecturers, students, the Architectural Students Association, and the external professional industry partners who have supported and championed the work accomplished to date. The author would like to sincerely thank the three hundred students on the Bachelor of Architecture programme at Technological University Dublin for their engagement and commitment to becoming responsible architects. The author would like to thank colleagues within the Dublin School of Architecture, Lecturers Mr Mike Haslam, Mr Brian O'Brien, Ms Emma Geoghegan (Programme Chair), Mr. Cormac Allen (Assistant Head of School), Mr. Joseph Little (Assistant Head of School), and Ms Orna Hanly (Head of School) for supporting the initiative. Their contributions and open constructive feedback throughout the project was essential. In addition, thank you to colleagues across Technological University Dublin who have supported the initiative and championed its strategic intent for our University's sustainability agenda. In particular, thank you to Mr. Andy Maguire (TU Dublin Sustainability Coordinator 2016-2021). The author would also like to acknowledge external support and engagement from Ms. Sandra Campbell, Education Director of the Royal Institute of Architects of Ireland. Finally, the contribution of colleagues from the wider community in the Dublin School of Architecture, Technological University Dublin are gratefully acknowledged.

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