Overview of the Inaugural Canadian Design Workshop (CDW1): From Vision to Evaluation*

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The Canadian Design Workshop (CDW) is a new biennial workshop – held in partnership with the Clive L. Dym Mudd Design Workshop – that aims to investigate and share information on design education and research unique to Canadian institutions, focusing on elevating engineering design education and research within the Canadian context. The Canadian engineering education and research landscapes presently share commonalities and important differences from the landscape typically explored during the Clive L. Dym Mudd Design Workshops. This paper discusses the logistics of running the inaugural workshop (CDW1), including challenges and opportunities afforded by the virtual offering. A thematic analysis of the presentations and ensuing discussions during the workshop reveals a number of recurring themes across all sessions, including transdisciplinarity, sustainability, the design studio pedagogy, teaching of design in the "middle years" of engineering programs, and challenges in design education. The paper concludes with a reflection on the first offering of the workshop and implications for the future of CDW.

Keywords: design; design education; design research; network; community; undergraduate

1. Introduction

The Clive L. Dym Mudd Design Workshops (MDW) have become a highly desirable meeting place with important intellectual contributions and exchanges on design pedagogy and research. They regularly attract an international audience, including Canadian researchers and educators. However, while the Canadian engineering and research landscapes share many important commonalities with the broader, international community, there are also distinct differences; these include the general engineering educational landscape comprised of public universities and technical colleges, differences in accreditation processes, as well as differences in the industrial sector and funding sources for design and engineering education research. Therefore, the Canadian engineering design education and research landscape shares both commonalities and important differences with the landscape typically explored during the MDW.

The Canadian Design Workshop (CDW) is a new biennial workshop that aims to investigate and share information on design education and research unique to Canadian institutions, focusing on elevating engineering design education and research within the Canadian context. Its aims are to (1) help sustain a Canadian community of practice of engineering design educators and researchers; (2) build a network of faculty and graduate students passionate about engineering design and design education; (3) share current research, and evidence-based educational practices; and (4) bring attention to Canadian issues in design. The inaugural Canadian Design Workshop (CDW1) was hosted virtually by the University of Waterloo on December 7–9, 2020. Its theme was "Designing Engineering Design Education in Canada".

The aims of this paper are to provide an overview of how CDW1 was delivered, present the prevalent themes that emerged from the presentations and discussions at the event, and reflect on the effectiveness of the event in achieving its goals. The rest of the paper is structured as follows. In Section 2, we outline the logistics of running the workshop, including challenges and opportunities afforded by the virtual offering. Next, in Section 3, we detail the key ideas that emerged from the conference plenary talks, presentations, and discussions, as well as broader recurring themes. Finally, in Section 4 we present a reflection on the workshop, evaluate its effectiveness to meet its goals, and discuss next steps.

2. Conference Logistics

2.1 Overview

CDW1 was organized by the combined efforts of the local organizing committee, comprised of three University of Waterloo faculty and staff members and one graduate student; and the program committee, comprised of seven faculty members from institutions across Canada, one industry representative, and the Director of the Center for Design Education at Harvey Mudd College. The local

organizing committee of CDW1 attended every session and are the authors of this paper.

Organization began in the fall of 2019 with an initial conference date set for July 2020. The Call for Papers was sent out in early 2020 and submitted abstracts underwent a round of double-blind peer reviews to assess relevance of the work to the workshop. The authors and program committee acted as reviewers.

Due to the COVID-19 pandemic, the workshop was re-imagined as a virtual offering and postponed to December 7–9, 2020. As a result of the later workshop date, we were able to extend the full-paper deadline, with all papers undergoing a round of double-blind peer reviews prior to the workshop. Once again, the authors and program committee served as reviewers.

The workshop hosted 68 registrants over three afternoons and included 23 presentations; of those, 12 were 10-minute presentations of full-length papers (which underwent full peer review), while the remaining 11 were 5-minute presentations with an accompanying three-page extended abstract.

After the workshop, the full-paper submissions were invited to submit their work for consideration of inclusion in a special issue of the International Journal of Engineering Education. Ultimately seven papers successfully completed the peer review process for this special issue.

2.2 Workshop Schedule

The general schedule of each day was similar, as presented in Table 1 and available at [1]. Each day of the three-day workshop began with a plenary talk. Following the plenary talks came two blocks of presentation sessions. The sessions were organized by theme, and therefore included presentations of both full paper and extended abstract submissions. The sessions were facilitated by a program committee member and began with pre-recorded presentations. Discussions began simultaneously via the chat feature. Following the presentations, the moderators facilitated a transition

Table 1. Schedule of CDW1

Day 1
Opening Session
Session 1 – Teaching Design at Scale
Session 2 – Hackathons and Design
Day 2
Plenary Speaker 1 – Robin Adams
Session 3 – Sustainability and Design
Session 4 – Preparing Students for Work in Industry
Day 3
Plenary Speaker 2 – Carlos Cardoso
Session 5 – Instructional Design
Session 6 – Capstone Design
Wrap-up Session

to break-out rooms where small groups of 3–6 participants discussed their take-aways from that session for 15 minutes. After the break-out rooms, discussion resumed with all attendees together for another 15 minutes. In its final day, the workshop ended with a retrospective ("wrap-up") and networking session. The objective of that session was to reflect on CDW1, begin discussions on the future of the workshop, and establish connections for future work within the Canadian design education and research network.

2.3 Logistics of a Virtual Conference

The necessity to change CDW1 to a virtual conference posed many challenges and required careful consideration of various aspects of the workshop. The first concern was that the virtual conference would reduce participants' ability and opportunities to interact and network with others. This was an important consideration in the selection of the Microsoft Teams (Teams) platform, which allowed for multiple channels as well as many meetings running simultaneously to serve as breakout rooms. Further, we intentionally instructed participants to connect via Teams in private chats, broadcasted social activities (e.g., "chair yoga") during scheduled breaks, and scheduled time for networking. We also changed the groupings in break-out rooms for each session to encourage participants to meet as many new people as possible. Finally, we hoped that the CDW1 Team could continue to serve as a networking platform post-workshop.

The second concern was the impact of "Zoom fatigue" [2]; as such, we decided that the workshop would only run for half days, opting for afternoons to accommodate time zone differences across Canada. Finally, we were concerned about the technical challenges of a virtual workshop such as internet problems and participants' unfamiliarity with Teams, and so all presentations were pre-recorded and played live during the appropriate session. Further, we offered two optional sessions before the workshop began to assist participants in joining the Teams environment and navigating meetings.

The move to the online format also brought some unexpected advantages. First, there were large cost savings for both the organizers and attendees. The virtual event did not require space rentals, travel vouchers, or meals. The attendees did not incur travel nor accommodation expenses – and notably, the workshop was free to attend. Second, since attendees did not have to travel, we had a greater attendance from a larger geographical distance. Attendees were able to join the workshop from across Canada, the United States, and India. Finally, since the presenting authors did not have

to present live, they were available to engage in chat-based discussions with the other attendees in "real-time", as the pre-recorded presentations were played. This resulted in an overall increased engagement and richer discussion during and after the presentations.

3. Key Ideas from CDW1

The presentations were thematically clustered into six sessions: (1) Teaching Design at Scale, (2) Hackathons and Design, (3) Sustainability and Design, (4) Preparing Students for Work in Industry, (5) Instructional Design, and (6) Capstone Design. These themes were identified and selected by the local committee with an emphasis on describing the breadth of contributions, while keeping the number of presentations in each theme approximately equal. Sessions were moderated by a program committee member and featured presentations on both full-length papers and extended abstracts.

In the following sub-sections, we present key ideas emerging from each session of CDW1, concluding with a discussion of the emerging themes from across the workshop. To aid in this analysis every session was recorded and transcribed.

3.1 Opening Session

The workshop began with opening remarks from the local organizing committee, followed by a welcome address from the University of Waterloo's Dean of Engineering, Mary Wells. The opening session concluded with a plenary talk from Gordon Krauss, Director of the Center for Design Education at Harvey Mudd College and organizer of the MDW. His talk, titled "Communication in Academic Educational Conferences", outlined the structure of the MDW, and thus also the structure of CDW1, and described how the small, single-track nature of these workshops accomplishes the goal of a highly interactive and interconnected workshop experience.

3.2 Presentation Session 1 – Teaching Design at Scale

This session (as detailed in Table 2) was scheduled first as it started the workshop with the sharing of instructional successes, a universally relevant topic to the attendees. In what follows, we present a brief summary of the discussion themes that arose both during and after the presentations.

The first presentation was on the topic of transdisciplinarity, which was a standout theme for the session, and the entire workshop. Jamieson et al. presented their experience of offering a transdisciplinary first-year engineering design course. The

Table 2. Presentations in Session 1 – Teaching Design at Scale

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|---|
| "Design at scale in a first-year transdisciplinary engineering design course" by M. Jamieson, A. S. Ead, A. Rowe, J. Miller-Young, and J. P. Carey |
| "Developing a cornerstone "Human in the System" engineering design course" by F. Salustri and P. Neumann |
| "A mechanical engineering design experience within a cross-cohort course project" by H. Pourmohammadali, K. Ghavam, and L. Botelho |
| "It's a trap!: Navigating project-based teaching of mechanical engineering design" by S. McLachlin, J. Spike, E. Li, J. Tung, and J. Montesano |

questions asked via the chat feature during this presentation inquired about the definitions of multi-, inter-, and transdisciplinarity, the extension of cross- or transdisciplinary work beyond first-year studies, and how to overcome the "siloed" boundaries of disciplines in order to foster transdisciplinary education.

The second presentation introduced the concept of "dysfunction" in design. Salustri and Neumann presented findings from 10 years of offerings of a second-year cornerstone course on the introduction to engineering design with an emphasis on human factors. Attendees discussed situations in which team dysfunction is a hindrance (e.g., when it prevents learning) versus an opportunity (e.g., when students learn how to manage teamwork). One of the factors of dysfunction was identified to be a lack of shared design terminology between different team members. This point was connected to the previous presentation as a shared challenge when working across disciplines.

The third and fourth presentations described project-based learning initiatives in the middle years of mechanical engineering curricula. Discussions during these talks focussed on the fair assessment of students across cohorts, including appropriate marking schemes.

After the presentations and chat-based Q&A, participants continued their discussion in breakout rooms, where they explored topics in more depth with a small number of attendees (typically fewer than 5 in each room). The noteworthy discussions from the first session breakout rooms included further conversations on transdisciplinarity, mainly: its definition, logistics of offering transdisciplinary work, possibilities of involving disciplines outside of engineering, limitations, and expectations on design instructors to model transdisciplinary work. Other conversations included how to navigate dysfunctional teams as course instructors and how to develop course projects that engage students and reflect real-world experiences.

Following the small-group discussions in breakout rooms, participants returned to the large-group discussion, where another topic was the challenges
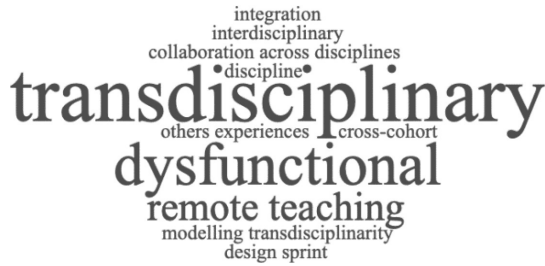
Fig. 1. A word bubble of participants' reflections from Session 1. More frequently submitted words appear larger.

Fig. 2. A Word Bubble of Participants' Reflections from Session 2.

of teaching design during the COVID-19 pandemic. Participants shared how remote design teaching was different from regular on-campus offerings, particularly with respect to reduced hands-on design work for students. Students' ability to chat during class sessions was discussed as both an advantage in terms of engaging more students, and disadvantage when misused by the students. The final theme was how the institutional systems in which design courses are offered both hinder and help design instruction. Attendees discussed how time and monetary constraints limit the possibilities of design instruction, as well as how the Canadian accreditation requirements do not encourage transdisciplinary work.

At the end of the session, attendees were asked to reflect and share their major takeaways, as visualized in Fig. 1.

3.3 Presentation Session 2 – Hackathons and Design

The presentations in this session (Table 3) highlighted unique opportunities for short-duration, high-impact design instruction through hackathons or hackathon-like events.

During the first two presentations, there was some discussion around the logistics of offering hackathon-like events as part of courses, as well as student emotional responses to those events (which were reported as being very positive). After the second presentation, the discussion also started to focus on how to encourage a thorough and complete design process in a design event of short duration. Attendees discussed the trade-offs present

Table 3. Presentations in Session 2 – Hackathons and Design

"Development and implementation of an integrative and experiential design project: Design, build and test a scanning tunneling microscope" by J. Coggan and C. Rennick
"Hackathons as a novel design pedagogy in engineering education" by M. Flus and A. Hurst
"Engineering Students and Entrepreneurship through Experiential Learning with Canada's largest Hackathon for Beginners and Designs for Venture Creation Course & Co-op Internship Program" by W. Chang, M. Kirmani, and W. Nippard

in these activities, such as how the design iteration and research phases would be limited.

The final presentation presented a case study of a hackathon and the learning during the event. During this presentation conversations continued about post-event reflection and how the event garnered a 50–50 gender split among participants (which is a more even gender split than is common in many Canadian engineering programs).

In the breakout rooms, discussions mainly explored the benefits and drawbacks of hackathons as a design teaching tool. The main concern shared was students' inability to thoroughly engage with each phase of the design process, thus limiting the potential learning. Some breakout groups brainstormed how to overcome this challenge, concluding that hackathons hold a large potential to highlight certain aspects of design, so should be utilized as an introduction to the design process, with an emphasis on a singular design phase. One group suggested repurposing the hackathon structure as a final assessment tool in place of the standard final exam. Attendees' final reflections on the session are visualized in Fig. 2.

3.4 Keynote Speaker: Robin Adams

The first keynote presentation, from Professor Robin Adams on the second day of the Workshop, was titled "Tracing Design Knowing". Adams presented the Informed Design Teaching and Learning Matrix [3], which measures nine patterns of design performance as students develop from novice to informed designers. Adams encouraged attendees to reflect on what patterns they were able to identify in their students, and what changes help them become more informed designers. The nine patterns presented were paired statements of a poor design behaviour and more competent design behaviour, corresponding to a beginner and informed designer, respectively. For each pattern, Adams outlined contributing behaviours and how design instructors can aid in the transition from a novice designer to an informed designer. Adams stated that the nature of a design project, that is, how an

instructor designs the project, can help students become better designers.

The question and answer period began with the question, "how do we encourage students to treat iteration time as important instead of a single cycle mindset?" to which Adams offered the advice to frame iteration as "strategic" and facilitate mini design sprints during which students are to practice strategic iteration. Another question pondered how design educators must navigate trade-offs when teaching design; that is, what phases of the design process to emphasize. Adams explained that it is the responsibility of the educator to be aware of students' previous course design experiences in order to build on those. Other discussions explored how to push students past the threshold of ambiguity to nurture their comfort with wicked problems, how to best use design tools such as the decision matrix, how to encourage students to sketch, validate, and test their designs, and finally, how to train teaching assistants to give good design feedback when they themselves are not informed designers.

3.5 Presentation Session 3 – Sustainability and Design

This session started the second day of presentations and introduced the theme of sustainability in design. The presentations are summarized in Table 4, and post-session attendee reflections are visualized in Fig. 3.

The first presentation analyzed the use of design and sustainability in engineering promotional materials targeted at prospective undergraduate students. The paper compared every accredited Canadian engineering program. During this presentation, attendees discussed how the field of

Table 4. Presentations in Session 3 – Sustainability and Design

"What do engineers do? Design and sustainability in recruitment materials of engineering programs in Canada" by A. Hurst, A. Dai, M. Flus, G. Litster, and J. Nickel
"Distilling sustainable design concepts for engineering and design educators" by J. Nickel, P. R. Duimering, and A. Hurst
"Greening engineering pedagogy by design for health and sustainability" by R. Habash, M. M. Hasan, J. Chiasson, and M. Tannous

Fig. 3. A word bubble of participants' reflections on Session 3.

engineering is communicated to and understood by the general public, and ultimately, if the promotional materials accurately reflect curriculum and resulting graduates' attributes.

The second presentation communicated sustainable design concepts. Authors Nickel et al. summarized a brief history of the pillars of sustainability and emphasized concepts that are important to design educators. Attendees' discussions explored the meaning of "development" in the context of sustainable development. A question was asked about the perspectives considered when using "development" due to the association of the word with colonialism, patriarchy, and modern capitalism. The participatory approach to sustainability was presented as an approach that allows the communities impacted to define their own needs to the designers. Chat conversations continued about emphasizing the social sustainability pillar among future sustainable designers and the concept of a "sustainable engineering mindset". Sustainability was discussed as a way of framing problems, thus a constraint to design solutions. The conversation was then connected to the earlier keynote; problem framing is an opportunity for innovation, so the constraint of sustainability becomes an objective.

The final presentation facilitated a continuation of these discussions. Habash et al. outlined a transdisciplinary learning model that was implemented in engineering courses with the objective of meeting the requirements for health and sustainability. There was consensus among attendees that a hands-on opportunity to complete a sustainability project such as the one presented would have been very appreciated by them when they were themselves students.

Topics explored in the breakout room discussions included how to define sustainability, the perception of engineering and what engineers should be responsible for, the future of engineering, and how to integrate sustainability in engineering education. The conclusion of this session was that sustainability should play a larger role in engineering curricula than it currently does. The large group discussion explored reasons why this is the case, with suggestions such as feelings of inadequacy from instructors to teach the topic and the lack of time when curricula are already filled by traditional technical content.

3.6 Presentation Session 4 – Preparing Students for Work in Industry

All presentations in this session were case studies of initiatives connecting course work with industry. Table 5 summarizes the presentations in this session, but unfortunately a word cloud of attendee

Table 5. Presentations in Session 4 – Preparing Students for Work in Industry

"Engineering design for the E-Waste recycling industry – Connecting industry and students through curriculum projects and applied research" by I. Kolenko
"Engineering students and entrepreneurship through experiential learning – a novel design across different courses and entrepreneurship internship co- operative education" by W. Chang, M. Hurwitz, and J. Boekhorst
"Playing with a design course: Redesign of first year mechanical engineering design course to include a toy design project" by A. Milne, R. A Fraser, M. R Collins, and J. Baleshta
"Model for effective engineering design learning" by L. Simon and R. Slute
"Enhancing process design in chemical engineering via integration of project-based laboratory and process simulation" by J. Zhang, C. Newton, J. Moll, and W. Anderson

reflections is not available as no responses were received in the online form.

The first presentation was an excellent transition between the previous session on sustainability and the fourth session on working with industry. It outlined a work-integrated learning opportunity in which students worked with an industry partner over two courses to design and implement a pilot-scale e-waste recycling line. The real-world expectations provided students with an authentic design experience.

The remaining presentations in the session showed the diversity of approaches to integrating industry into the classroom. This included interacting with local start-ups (Chang et al.), the use of real companies as clients for design projects (Milne et al.), including mentors from industry in the capstone process (Simon and Slute), and incorporating tools and techniques prevalent in industry in undergraduate design labs (Zhang et al).

The chat-based discussions revolved around the logistics of offering an industry partnership in various design projects. Questions about necessary resources, how project ideas were selected, and future plans for growth were all asked. There was also a lengthy discussion on navigating a relationship with industry with respect to establishing expectations and negotiating intellectual property. Finally, the theme of sustainability returned in the context of how industry-connected projects could incorporate sustainability concepts.

The breakout room discussions were reflective of the topics that emerged in the chat discussion. Additionally, breakout groups discussed how to encourage students to place value in industry collaborations, why toy design is a clever design project, how to leverage co-operative work experiences to build relationships with industry, how to leverage industry to validate student design pro-

jects, challenges to industry collaborations, how to appropriately scope industry projects within a course structure, and how teaching staff can mediate student-industry collaborations. It was clear from these discussions that there was a lot of interest in establishing industry collaborations and exploring how these can best serve students.

3.7 Keynote Speaker: Carlos Cardoso

The second keynote revisited many themes explored during CDW1, mainly transdisciplinary work, sustainability, and introducing design throughout a degree. At the beginning of day 3 of the workshop, Professor Carlos Cardoso presented a keynote titled, "Undefining design futures: broadening knowledge and competencies". The focus of the talk was on the attempts to reimagine an industrial design program. He highlighted four points to address in design education and research: (1) the conflict between systematic and agile design methodologies and how methodology is chosen, (2) the siloed nature of design methodologies, (3) the disregard for designers' role in the greater design picture, and (4) the conflict between designing artifacts versus complex sociotechnical systems. Considering these points when reimagining the design program, he asked, what will industrial design look like in the future, where is the discipline going, where *should* the discipline be going, what new methods and methodologies will be needed to tackle current and emergent global issues, what will it mean to be human in the age of Artificial Intelligence, and how will design disciplines answer to emerging technologies?

Cardoso emphasized the importance of viewing design as part of a larger system. He claimed that successful design is the creative problem solving of wicked problems. This design requires the inclusion of knowledge outside of the domain, with a consideration of a holistic worldview with respect to sustainability, and the design of the socio-technical system rather than the singular artefact in the system. He also emphasized the shift from designing *for* users to designing *with* users, when co-design is possible, and the growing use of systems thinking language in design.

The question and answer period began with the question, "does systems thinking fall into the same traps as design thinking?", to which Cardoso answered that systems thinking is more encompassing than the minimalistic approach of design thinking. Another question asked how to shape students into design thinkers when coming from different backgrounds. Cardoso once again emphasized the importance of interdisciplinary perspectives, explaining how the program can be leveraged to allow students to pursue the path they desire, for

example designing artefacts versus researching design. Other discussions revolved around when design should be integrated in education, the pedagogical approach to capstone projects (e.g., how much instructional support should students receive), and opportunities for undergraduates to engage in design work.

3.8 Presentation Session 5 – Instructional Design

All works presented in this section, listed in Table 6, highlighted research on design instruction. When asked for one-to-two word reflections on the section, the standout topics were "design studio" and "cloud CAD", which accurately describe the main focus of the presentations and discussions during this session. These reflections are visualized in Fig. 4.

The first presentation proposed a reflective tool to compare the design of hackathon-like activities for engineering students across disciplines. The discussions during this presentation centred on how the measurements in the tool were rated and the presence of uncertainty in the ratings.

The second presentation introduced the concept of cloud-based Computer-Aided Design (CAD) tools in engineering education. Attendees asked about how cloud-CAD resembles other software collaboration tools such as GitHub [4], and pondered the fears of professionals switching to cloud-CAD due to frustrating glitches and how fostering psychological safety supports the uptake of cloud-CAD. Others offered their thoughts, reactions, and experiences with using cloud-based CAD pro-

grams, suggesting that they offer a major benefit to collaborative projects.

The third presentation was on the design studio in an architectural engineering program as a way to facilitate project-based learning [5]. The questions during the presentation were about the logistics of the design studio, and how the design of the space fosters collaboration.

The final presentation proposed a new model to enhance the CDIO initiative [6] by facilitating knowledge creation transfer among learners. This presentation encouraged some networking among attendees, with evidence of post-workshop connections to further the discussion on tacit knowledge and engineering entrepreneurship, which connected back to previous sessions.

The breakout room and large-group discussions bridged the four presentations in this session by focussing on how to implement more creative teaching methods such as those presented within curriculum constraints, how to encourage students to engage in material that is highly ambiguous, and the necessity of fostering a growth mindset in engineering students. One group noted that there is a lot of learning available between disciplines, thus revisiting the topic of transdisciplinary learning in the context of knowledge transfer.

3.9 Presentation Session 6 – Capstone Design

The final session was on the topic of capstone design, as detailed in Table 7. The short reflections on the session highlighted three concepts which were identified as important during capstone design (Fig. 5).

The first presentation outlined design critiques as

Table 6. Presentations in Session 5 – Instructional Design

"Characterizing and comparing design activities for undergraduate students: A reflective tool for design instructors" by C. Rennick, G. Litster, A. Hurst, C. Hulls, S. Bedi
"A Qualitative analysis of collaborative Computer-Aided Design experiences to inform teaching and curriculum" by K. Leonardo and A. Olechowski
"Design from day one: Design studio in UW's new Architectural Engineering program" by A. Atkins, F. Lim Tung, and C. Zurell
"Transfer of knowledge creation in engineering design" by R. Habash

Fig. 4. A word bubble of participants' reflections on Session 5.

Fig. 5. A word bubble of participants' reflections on Session 6.

Table 7. Presentations in Session 6 – Capstone Design

"Introducing Critique to Enhance Traditional Evaluation in Design Courses" by K. Mercer and M. Borland
"The invisible curriculum in engineering design" by M.V. Jamieson, M. Naef, and J.M. Shaw
"A Reflection on the First Six Years of a Multidisciplinary Entrepreneurial Capstone Design Course" by S. Maw and T. Cao
"Design logs for instructional support: Early observations from implementation in 3rd year project course" by J. Tung, P. Kumar, and E. Mohammadbagher

a valuable method to advance design. Mercer and Borland cautioned that critiques should not be negative feedback sessions but should instead foster a constructive conversation about the design. The perspective was appreciated by the attendees who either followed a similar teaching pedagogy in their design courses or asked questions about implementation, particularly in courses with a large class size. The design studio pedagogy was revisited as a means of offering critiques at a large scale. It was agreed that resources (both instructional team size and time) are the major barriers to facilitating valuable critique sessions, but worth investing in. An interesting conversation emerged about peer critiques and how the instructor can discourage shallow feedback. One attendee shared their experience of including learning how to critique as a course objective.

In the second presentation Jamieson et al. presented their course as an example of teaching the invisible curriculum – the tacit knowledge brought in by experienced practitioners – through storytelling and case analysis in a flipped classroom. The discussion centered around integrating co-operative work experiences into the curriculum to facilitate connections.

The third presentation revisited the inter- and transdisciplinary approaches to design pedagogy with a reflection on a multidisciplinary capstone course. The course is officially 8 months long, but Maw and Cao reported some students began their problem finding in the previous term. It was found that the multidisciplinarity in the teams encouraged more ownership of team roles and the development of a shared language. The attendees were interested in the pre-capstone course problem finding process.

The final presentation of the session and workshop suggested design logs as an instructional support tool. Tung et al. outlined a design course during which students had to submit 6 design logs answering prompts. This presentation prompted discussion on how to implement the logs in conjunction with verbal critiques and how reflective the logs were of design processes. This discussion ended with a note on the importance of reflection during design, not just after, and how design logs could aid in this.

In the breakout rooms, attendees discussed common challenges in capstone projects, implementing critique into courses, how to build the psychological safety needed for effective critiques, the purpose of design logs, and how to reflect the inherently multidisciplinary nature of design work in capstone projects.

3.10 Recurring Themes

It is evident that the workshop covered a wide breadth of topics throughout the six presentation sessions and three plenary talks; however, the thematic analysis reveals two additional themes that were underlying the discussions over multiple sessions.

The first was the instruction of design in the middle years of engineering programs. Many presentations discussed courses that were offered in second or third year, which differs from the typical design course offerings at Canadian institutions: an introductory course in first year, and the capstone design course in final year. The takeaway from this recurring theme and the related discussions was the need for design education to be included in more engineering courses throughout the duration of the degree, rather than as mere bookends.

The second recurring theme was the need to overcome challenges to implementing more design instruction and creative approaches. Each session shared tools, techniques, reflections, and experiences related to engineering design education. From introducing perspectives from multiple disciplines into curriculum to encouraging the use of logbooks, attendees were eager to share their knowledge on how to advance engineering design pedagogy. A comment made in nearly every session, however, was how difficult it is to change curricula and implement new tools that require significant resources. The institutional expectations and requirements of accreditation limit the ability to implement all the useful learnings from CDW1 into courses.

4. Reflection on CDW1

In this section we summarize the key post-event reflections that emerged from the wrap-up session at the end of CDW1 attended by 34 participants, and an optional follow-up survey with 10 participant responses. Both practices were reviewed by and received ethics clearance from a University of Waterloo Research Ethics Committee.

4.1 Retrospective Session at the Workshop

The final session of CDW1 was a retrospective wrap-up session. First, the local organizing committee summarized the main themes of CDW1 as teaching at scale, hackathons, sustainability, preparing students for industry, instructional design, and capstone design. Then, attendees were asked: "what is still unresolved in your mind?" and "what should this community focus on?" in consideration for the next offering of CDW. Attendees responded that they wished to engage in more conversations about diversity and inclusion, how to embed the idea of designing within a larger socio-technical society in engineering education, introducing trans-

disciplinary topics, how to give assessment and feedback, and the development of a Canadian Design Institute nationally. Other points raised during this session explored what is uniquely Canadian about CDW, what engineering education would look like in a post-COVID world, and what design competencies are important to emphasize in engineering education. The desire to identify avenues for continued connection among the gathered design educators and researchers was echoed many times, suggesting a demand for future CDW offerings.

A comment was made that the topics explored during CDW1, mainly assessment and how to best teach design, have been topics explored for many years in many avenues. This observation is synergistic to how design is taught; that is, solutions are never perfect. Teaching design is a design problem, so engaging with the community to share best practices offers insights to alternative solutions and pedagogical opportunities.

Attendees were then presented with the goals of CDW1 and asked to evaluate the workshop on its effectiveness of reaching them. The event goal of building and strengthening a network to forge new collaboration was emphasized. Attendees expressed they were pleased with how CDW1 was able to accomplish this, and there was a clear request to continue the momentum moving forward.

4.2 Follow-up Survey Findings

A follow-up survey was sent to all workshop attendees one month after the workshop. Its primary purpose was to evaluate the effectiveness of CDW1 after some time had elapsed from the event, however some additional insights on CDW1 were also gained. The survey asked participants to evaluate CDW1 on meeting its goals, identify elements of the workshop that should continue or stop in future offerings, what they would like to see in future offerings, and their major learning takeaways from CDW1.

The question, "What did you learn at CDW1" received the greatest variety of responses, summarized below:

- How Canadian universities differ in their approaches to engineering education.
- How to implement hackathons into design education.
- How design exposure is currently scaffolded during undergraduate programs and how there should be more interventions throughout the degree.
- Facilitating creativity is often overlooked in favour of teaching core engineering concepts.

Perhaps the most interesting learnings were not about content, but a greater understanding of the discipline and community of practice. One attendee wrote, "I learned that I'm not alone in my desire to teach and advance design", a sentiment also echoed by two other attendees: "I learned that there are a number of people outside of my own institution that are passionate about design education and design education research. I look forward to building on those relationships in future years" and "This is a field/discipline with deep roots and a small, but tight-knit community". These sentiments suggest CDW1 was successful in gathering a community of practice and strengthening the network of design educators and researchers.

The final question the survey asked was, "Were there any takeaways from CDW1 that you have implemented (or plan to implement) in your design instruction and/or research? If so, what were they? How has your instruction and/or research changed?". This question, too, received a great variety of responses, including:

- An inter-university design course.
- More emphasis on group dynamics and social impact in design courses.
- Curricular hackathons.
- Ideas on curriculum and course design.
- New design research directions and possible collaborations.
- How to generate interactivity in remote, synchronous sessions.
- Research on design from a systems thinking perspective.

4.3 Conclusion and Next Steps

The discussion during the retrospective session and responses to the question on learnings from CDW1 suggest that CDW1 was able to foster supportive discussions that connected design educators and researchers, both faculty and students. Overall, the workshop succeeded in connecting design educators from across Canada. Attendees reported an overall enjoyment of the workshop, complimenting the presenters, the organization of the event, and ability to have many discussions throughout the workshop. They also reported that they enjoyed hearing about practices at other Canadian institutions and learned ideas they wish to implement in their own research and practices. Many valuable contributions and enriching discussions were shared. This feedback suggests that CDW1 achieved its first three goals.

The fourth and final goal – bringing attention to Canadian issues in design – is CDW's largest area for improvement. At CDW1, the workshop theme was intentionally chosen to be broad in order to draw submissions from a variety of topics. The

Canadian perspective was naturally embedded in all presentations and discussions as all presented work was from Canadian institutions. In future offerings of CDW, the pursuit of uniquely Canadian issues in design education will be prioritized. From CDW1 we learned that Canadian educators and researchers are not alone in the challenges they currently face and can confidently conclude that the inaugural offering of the Canadian Design Workshop was a success.

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