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Building creative confidence during COVID-19: adapting design thinking for online learning

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Abstract: In this paper, we describe our experience in designing and delivering a course on Creativity and Innovation Management with a heavy emphasis on Design Thinking using Kolb's Learning Cycle theory as a framework. The main challenge involved being able to preserve targeted outcomes based on Creative Confidence despite the constraints imposed by lockdowns due to the COVID-19 pandemic. The metadisciplinary approach to re-implementing the course with technology through principles involving Puentedura's SAMR model has yielded positive results based on creative confidence as the primary desired outcome.

Keywords: design thinking, experiential learning cycle, creative confidence, SAMR model, COVID-19, online learning

1. Introduction

Creative confidence is an important competence cultivated in students by design thinking education (Rauth et al., 2010; Jobst et al., 2012, p. 45) as well as in design thinking practice (Kelley & Kelley, 2013, pp. 69-70). By building foundational knowledge on empathizing, ideating, prototyping, and testing, design thinking methodologies contextualized as an educational model establish methods, mindsets, and processes that are crucial in reinforcing creative behavior. Glen et. al (2014) argue that design thinking education is relevant not only to design-related fields but to businesses as well. Innovations driven by design thinking may be key to creating value for the customer, competitive advantage for the business, and solutions for the organization.

In this paper, we evaluate the course DECSC25 Creative Thinking and Innovation Management, a required core subject taught to all undergraduate students of the John Gokongwei School of Management at the Ateneo de Manila University in the Philippines. The course specifically aims to introduce design thinking and other creative problem-solving methods in the field of business, culminating in a capstone project where real-world problem solving for businesses is simulated. The subjects involved in this study are a total of 133 third-year students, and the course was adapted into an online learning environment using a learning management system (LMS) to address the prohibitions of face-to-face teaching during the COVID-19 pandemic.

In the study, we leverage on design thinking as a metadisciplinary framework in (1) teaching it as a core educational concept that can be translated in an online learning environment, (2) its adaptation into the course design and teaching methodology, and (3) its application as a practical tool required for the students' output in the course. We also focus on design thinking's ability to maintain, and arguably, augment its capacity to deliver core creative competencies through technology-aided pedagogical execution in the context of challenges brought about by the pandemic.

2. Methods

2.1 Challenges brought about by the COVID-19 pandemic

In the previous semester, the university attempted to pilot online learning for a month to bridge topics that were interrupted due to the lockdown and quarantine imposed by the Philippine government. This experience revealed several issues that became the basis of formally transitioning to online learning for

the following intersession. In no particular order, these were the anticipated considerations made while designing DECSC25's online course:

Table 1. *Anticipated challenges to online learning*

<i>A. Technology / Infrastructure</i>	
#A1	Some students have an unstable internet connection.
#A2	Group activities are more difficult to conduct due to varying internet connection levels, personal schedules, living conditions, etc.
<i>B. Classroom Dynamics</i>	
#B1	The traditional “teaching by telling” will not be as effective since students are likely to be disengaged or distracted at a certain point due to the physical absence of a teacher.
#B2	The course should be able to cater to different learning styles to be effective and engaging.
#B3	The ideal learning experience is composed of relevant content and learning from teachers and peers. This is no longer as convenient and immediate in an online setting.
<i>C. Assessment Formats</i>	
#C1	Summative assessments, previously the norm, do not provide enough feedback about what the students have learned. Formative assessments will serve this purpose better.
<i>D. Workload</i>	
#D1	Formative assessments take more time for students to accomplish and for teachers to check.
<i>E. Mode of Learning</i>	
#E1	Bias for asynchronous learning experiences to account for students’ varying accessibility to the internet results in students being in control of their pace. They can easily spend too little or too much time on the course without proper guidance.
<i>F. Student-Teacher Communications</i>	
#F1	Feedback is not as immediate as in the traditional classroom set-up, where students can consult more easily or receive answers to their questions more quickly.
#F2	There is a lack of verbal and non-verbal cues.

However, once the course had begun, teaching faculty were also confronted by unforeseen challenges reported through direct student feedback and discussions in the wider university community:

Table 2. *Unforeseen challenges during online learning*

<i>A. Technology / Infrastructure</i>	
#A3	The start of the intersession semester was impacted by technical problems during enrollment and enlistment which delayed access to the LMS for some students.
#A4	Computer screen fatigue was reported by several students as well as faculty members.
#A5	The pacing of intersession combined with the adjustment to a new LMS and teaching methods had implications on the mental health of both students and teachers.
<i>B. Classroom Dynamics</i>	
#B4	Learning time to understand lessons and topics were underestimated by teachers.
#B5	The students’ capacity to independently understand topics varied in a self-paced environment.
#B6	Unfamiliarity with classmates made group dynamics harder.
#B7	Students were found to have prioritized Math-based subjects more due to the difficulty of understanding mathematical concepts independently.
<i>C. Assessment Formats</i>	
#C2	The format and structure of the course’s capstone project needed to be adjusted due to the inhibiting nature of the original face-to-face course being judged by a live panel.
<i>D. Workload</i>	
#D2	Students taking 1-2 other online courses simultaneously during intersession reported an increase in workload for assessments relative to their experience in face-to-face classes.
#D3	There was a reported tendency for teachers to increase the number of assessments to compensate for the reduced number of synchronous sessions and direct interaction.
<i>E. Mode of Learning</i>	

#E2	Once a week limit for synchronous sessions as imposed by the university across all courses led to an inconsistent view of the scope and content of the sessions for the students.
<i>F. Student-Teacher Communications</i>	
#F3	The idea that students could do the course at their own pace led them to message teachers outside of socially acceptable hours and on unofficial platforms.
<i>G. External Factors</i>	
#G1	Socio-economic issues, especially those on a national level, negatively impacted students' emotional well-being, which also affected their adjustment to the online classroom setting.
#G2	Staying home due to the community quarantine blurred boundaries between the students' personal and academic lives.
#G3	Lack of access to their usual coping mechanisms and knowledge of other stress-relieving activities led to students feeling overwhelmed.

These factors were substantiated through qualitative feedback that was formally submitted by DECSC25 students, faculty, and findings of the university community during intersession.

2.2 Course Design

The course was collaboratively designed by six teaching faculty members of the Ateneo who were conscious of translating aspects of its form, structure, and content online. Design decisions were deliberately made to preserve the core learning outcomes of the original face-to-face setting while allowing for significant flexibility for students to experience design thinking education as immersively as possible. The final course learning outcomes were translated as competencies, and aligned with the overarching goal of building creative confidence, as follows:

1. Substantiate and justify the importance of creativity and innovation with a solid understanding of why they are necessary to survive in today's highly disruptive environment
2. Appropriate the use of creativity and innovation tools, frameworks, models, and processes to various contexts including barriers, opportunities, and challenges
3. Design and champion ethical solutions that address real-world needs by mastering creativity and innovation principles
4. Develop viable solutions by integrating creativity and innovation in a holistic way to achieve strategic organizational success or competitive advantage

2.2.1 Kolb's Experiential Learning Cycle

The course is typically aligned with Kolb's experiential learning cycle as it is parallel to the principles of design thinking (Beckman & Barry, 2007), simulates real-world scenarios, and is appreciated more by the so-called generation Y (Deutschmann & Botts, 2015). Design thinking in itself is an example of experiential learning (Deutschmann & Botts, 2015). Kolb & Kolb (2005) describe the experiential learning cycle as composed of four stages:

1. Concrete experience, where learners immerse themselves in new experiences without bias
2. Reflective observation, where they reflect on their experience from different perspectives
3. Abstract conceptualization, where they analyze their experience and reflections to form logically sound theories
4. Active experimentation, where the theories are used as a foundation for problem-solving and decision-making

Through this cycle, learners recursively grasp and transform experiences to constantly learn and relearn (Kolb & Kolb, 2005). In the traditional classroom set-up, students could go through the cycle recursively and without delay. However, the challenges brought about by the pandemic, both anticipated and unforeseen, were disruptive to the experiential learning cycle. To illustrate, here are just a few examples of how it was impacted by the transition

- Students could no longer conduct fieldwork and observe people and events in their natural environment, which hindered them from maximizing concrete experiences.
- Typically, students rely on teachers as a sounding board for their reflections, ideas, and theories. As anticipated, there became delays in giving feedback to students.

- Students also rely on feedback from peers, which they used to easily ask and receive through everyday interactions both inside and outside of the classroom. Without these, feedback from peers was no longer as convenient or immediate.

2.2.2 Methods in Design & Execution for Online Learning

The course design can be divided into three phases that reflect metadisciplinary approach of design thinking both as the theoretical grounding of the course and the faculty's practical application in creating, teaching, evaluating, and adjusting the course components. These phases also reflect the make-observe-reflect model of the creative process (Dubberly Design Office, 2009), but adapted as create-teach-adjust in the context of making the course, teaching the course, and adjusting the course design and requirements iteratively and recursively.

These correspond to validating the anticipated and unforeseen challenges previously indicated in Tables 1 and 2, represented by numbers within the parenthesis format (e.g. #A1), although not all stages of the course design have a direct and corresponding issue or challenge that it tries to solve.

(1) Course Development Phase

This covers course preparation from the design team and the process by which each building block of the course was created, configured, and adjusted to become ready for publishing in the LMS.

1. **Timeframe.** Plotting the new 7-week timeline for intersession as directed by the university administration was essential in imagining the course structure. Course development started one month before the first day of the semester.
2. **Learning Outcomes.** The core lessons retained were aligned with learning outcomes set together with the department. This dictated which of the foundational topics across the four modules of (1) Creativity, (2) Design Thinking, (3) Strategic Innovation, and (4) Commercialization were crucial in delivering the outcomes that were ultimately framed as competencies instead.
3. **Assessments.** Assessments were formulated before creating course content to be consistent with university guidelines on adaptive design for learning, which implemented Backward Design (Wiggins et al., 1998). This also involved rethinking how formative and summative assessments were conducted in the environment created through the LMS, i.e. objective quizzes and long tests were transformed in favor of qualitative graded discussion prompts and reflective course syntheses. The summative capstone project was retained as a major requirement that applied course lessons in conjunction with the learning outcomes and competencies. (#B2, #B3, #C1)
4. **Structure.** Similar to the findings of Rauth et al. (2010), the modules and course building blocks were presented linearly to introduce the concepts of design creativity to first-time students and factor in the limitations of the LMS. However, the capstone project and the majority of the requirements were realized and experienced in an inherently cyclical manner reflecting the iterative nature of design thinking. Students constantly sought and applied feedback from their projects' target users, improved and adjusted solutions that were ideated, and built and refined more features in streamlining their prototypes.
5. **Learning Management System.** Understanding the structure and technical limitations imposed by the LMS was also a crucial factor that influenced the course design. *Canvas* (<http://www.instructure.com>) was the university-mandated LMS that offered an interface that can be populated by original content written by the team, sourced academic references for topics, as well as rich media and collaborative third-party digital tools that can be embedded for the students to access. However, the LMS was limited in terms of its inability to document the design thinking process that each student group went through for their projects, as publishing content in Canvas only captured its end and final state without a viewable history of its changes and evolution. Faculty extended the flexibility for students to choose any platform that suited their creative process best.
6. **Content writing and adaptation.** The design team collaboratively generated a unified outline that included required topics that must be present for all sections of the course. Populating this on the LMS with lesson content was achieved by dividing the team into three groups where teachers built on existing course material (presentations, cases, capstone project guidelines) to write the modules. Teams proofread each other's topics and a fourth group was created to conduct quality assurance of both originally created and externally sourced curated content. The difference in writing styles and language was later adjusted by review and edit sessions with the team. (#B4)

7. **Estimating learning time.** Learning time of around 8 to 10 hours per student per week was advised by the university, which included reading assigned reference material, watching or listening to a live or prerecorded lecture, participating in discussions (whether synchronously or asynchronously), working on an individual task or group project, and taking assessments. Initial feedback from students indicated that total actual learning time, especially due to the group-oriented nature of the activities, was more than what was estimated. (#B4, #B5)
8. **Content customization.** Teachers were allowed to individualize content according to their expertise. Two lenses were applied: (1) a “corporate” model where course content revolved around companies that already have established footing in specific industries. This was developed for students who planned to join corporations after graduation and highlighted problem-solving within specified boundaries and contexts of a given organization. The second was a (2) “startup” mentality where students generated unique and novel ideas that did not have any precedents or precursors that are already commercially available. These two lenses are most evident in the execution of the capstone project, but it must be noted that both approaches are not necessarily mutually exclusive from one another in terms of foundational knowledge of the course’s core content. (#B2)
9. **Digital tools.** Multiple third-party tools such as Padlet, Google Suite, Jamboard, and others were integrated into the LMS to help visualize and aid students in their design thinking tasks. Video editing software, prototyping apps, and mind mapping tools were also used. (#A2, #B1, #B2, #B3)
10. **Visuals.** Visual branding for the LMS was created to aid students in their learning experience: (1) a visually striking *frontpage* was created to emulate popular contemporary interface design aesthetics to ease the students’ transition into online learning, and also brand the school of management’s courses with a consistent style. (2) *Module headers* were used as visual signals to indicate if a particular section within a page was an assignment, graded discussion, required reading, or video, etc. We wanted to clearly signal to the student if there was a deliverable, or information that needed to be highlighted. (3) A unified *visual information hierarchy* created consistent fonts and text stylization across the modules authored by different teachers.
11. **Rebranding and hype-building.** Cognizant of the course’s rather fast timeline and pacing, and an inevitable learning curve presented by a new LMS online, the course was framed as a specially designed “Innovation Bootcamp” version for the intersession. This rebranding aimed to manage the expectations of the students in the course design given the challenges imposed by the pandemic. “Marketing” materials were developed to influence student engagement by creating weekly newsletters that included the scope of topics in the upcoming week, reminders for deadlines, and course events. This is a commonly used technique in MOOCs that was adapted by and sent through the Announcement section of the LMS, and the students’ university email addresses to urge course completion and timely submission of assessments by the students. (#E1)

(2) Teaching Phase

This phase refers to the teachers’ actual teaching period with the students during intersession. Course preparation was also conducted concurrently due to the iterative nature of designing and adjusting course components. Observations by the teaching faculty were carried out in this phase as well that factored into the third phase of the course.

12. **Teaching timelines.** Half of the total course content was initially published at the beginning of the semester with assessments and corresponding deadlines. This created a flexible and asynchronous self-study pace for the students while maintaining a common structured timeline that preempted the possibility of cramming the course. Students indicated that a long-term view of deliverables helped manage their schedules effectively, with the visibility of course content as a function of how they can independently manage their time given the workload. (#A3, #B4, #E1)
13. **Synchronous sessions.** A prescribed once-a-week schedule for synchronous sessions via video calls were conducted following the course timeline. These were announced with considerable lead time, did not require student attendance, and were recorded and released for students’ reference. Content varied for each teacher, which may be a synthesis of each module or an overview of certain topics. These synchronous sessions also became an opportunity to supplement learning by allowing students to raise clarifications about lessons or requirements. (#A1, #B4, #E2)
14. **Departmental webinar.** Previously, supplemental topics were discussed by inviting guest lecturersj to the campus or arranging a field trip to a company. This was adapted into an online departmental webinar, where given scheduling conflicts, teaching faculty agreed to independently schedule guest

speakers to suit their respective sections' availability and progress in the course. Invitations to the speaking events were extended to all DECSC25 sections for students to freely select topics and speakers they found interesting and relevant. (#B1, #B2, #B3)

15. **Communication channels.** Teachers' availability for consultation and coaching was a priority given the assumption that online learning will pose challenges to communicating concerns about course activities. Group chats with students were created using social media platforms like Facebook Messenger and Viber. Although consultation schedules were formally announced on the course syllabus, these chat groups allowed students to reach out in real-time and created an impetus for teachers to respond within reasonable hours. (#A4, #A5, #F1, #F2, #F3)
16. **Student touchpoints.** Surveys and polls that served as temperature checks for the students were also conducted through the chat groups. This involved qualifying their emotional state into emojis or using a scale to rate the quality of their overall experiences regarding the course or intersession as a whole. Student groups also had weekly calls with teachers for progress updates and feedback for their capstone project. (#A2, #A4, #A5, #B6, #F1, #F2, #G1, #G2, #G3)
17. **Faculty touchpoints.** Weekly touchpoints among faculty members via chat or video meetings were created for knowledge sharing and overseeing the degree of consistency that was applied when proposed changes or adjustments were implemented in their respective sections. (#A4)

(3) *Adjustment Phase*

Due to the feedback and observations from student touchpoints and the university's findings during the teaching phase, both major and minor modifications were applied to the course in order to respond to unanticipated challenges posed by online learning during the pandemic.

18. **Readjustments on assessments.** Course requirements were streamlined to help students balance workload together with other courses taken concurrently for the semester. The faculty had the discretion to adjust the quantity and structure in concurrence with the department and students. This resulted in a prioritization exercise to determine which assessments were crucial to building the competency-based learning outcomes, and a collaborative effort within the department to restructure the course from a content perspective. Implications on grading components for any changes were also aligned departmentally to maintain consistency across all sections. Among those changes included tagging certain topics as additional source material that students can have the option to study, eliminating one of two case studies, and reducing the number of graded discussions in favor of free-form "think and share" prompts that allowed students to submit interpretations of formative questions in a non-restrictive format and structure. (#A5, #B6, #B7, #C2, #D1, #D2, #D3, #G1, #G2, #G3)
19. **Readjustments to the capstone project.** The usual format for grading the project involved assembling a panel of judges for a live presentation and Q&A session immediately afterward. Scheduling conflicts resulted in having the panel judge and grade projects asynchronously through tools like Google Sheets. A degree of variance was allowed for the format of the final project deliverable with respect to the individualization applied. For example, teachers who chose to have a "corporate" lens structured projects to resemble proposals to implement creative solutions for an existing company, represented by a judge in the panel. Students who chose a "startup" setting had the opportunity to create public announcements of their projects, which were innovative solutions applied as startup business ideas and delivered through website mockups, social media campaigns, petitions, and working prototypes. Judges were invited to "invest" seed money (that were simulated amounts rather than actual funds) to projects given a set of evaluation criteria that was similar to the corporate rubric as well. A virtual gallery of the final projects was published by the department. (#A5, #B6, #C2, #D3)
20. **Course synthesis.** In place of a final exam, the students were asked to synthesize their individual takeaways from the course and conduct an analysis of the knowledge they acquired, as well as skills and competencies they developed. They contextualized their learnings with a comparison of their understanding of creativity and innovation prior to taking the course, their experience taking it, the mindsets, methods, and behaviors they acquired, and their outlook on creative thinking moving forward. (#B4, #G1, #G2, #G3)
21. **End of course survey.** Students were also asked to provide feedback regarding the course in terms of how they perceived the content, assessments, and their experience with the teacher.

2.2.3 Redesigning the Course for Online Learning using SAMR

Following the Substitution Augmentation Modification Redefinition (SAMR) Model discussed by Puentedura (2014), activities and requirements were translated from the traditional classroom set-up to online learning. To address some of the experiential learning cycle delays caused by the transition to online learning, tasks were transformed and enhanced. Table 3 shows concrete examples of this.

Table 3. *Enhancement and transformation of traditional classroom activities for online learning using Puentedura's SAMR model*

Traditional Classroom Set-Up	Online Learning
Redefinition: Tech allows for the recreation of new tasks, previously inconceivable	
For their capstone project, students submit a paper and present it to a panel of experienced professionals.	The online course simulated a more realistic experience of starting a new business or implementing a solution for an existing corporation. Students were required to create a prototype of their conceived product or service, gain feedback from target users, and publicly launch their business to gauge market interest.
Students have the option to pass drafts of the paper required for their capstone project.	Teachers conduct weekly cadences to check-in with the groups via video call, discussing updates on their progress and immediate feedback on the building blocks of their projects.
Students are required to submit papers as their requirements.	Students have creative freedom over submissions, i.e., they may submit podcasts, drawings, infographics, etc. to articulate their learnings and accommodate multi-modal answers.
Students watch a video then the teacher asks them for insights and synthesizes their learnings.	Students watch and reflect on a discussion prompt or question, then answer via discussion boards. They can comment and discuss their classmates' input without a time limit.
In class, students discuss one wicked problem and trace it to different causes.	Each student identifies a wicked problem they're interested in, traces it to different causes, and maps it to the rest of the class's wicked problems and causes via a visualization tool like Padlet.
Modification: Tech allows for significant task redesign	
In class, students bring foods with contrasting flavors and try them together to practice the da Vincian principles of <i>sfumato</i> and <i>sensazione</i> (Gelb, 2009).	Students reflect on which da Vincian principle they have developed the least and perform activities relating to the principle. Assessment for this topic required students to document findings over three weeks, which enabled them to build habituation for their selected da Vincian principle.
Augmentation: Tech acts as a direct tool substitute, with functional improvement	
Students conduct fieldwork to empathize with their target community.	Students leverage on social media to identify the target community's sentiments in addition to reaching out via phone and/or internet.
Students keep up with the pace of the class, consulting with peers and/or teachers if they have clarifications.	Students may reread or rewatch resources at their own pace until they sufficiently grasp the concept, with the option to consult their peers or teacher, as well as share new insight and ideas they discover to enrich the class' discussions.
In class, students discuss a concept while the teacher mind maps their points on a whiteboard.	In a video call, students discuss a concept while the teacher mind maps their points using an online tool (e.g. MindMeister). Students are free to use the online tool directly too or choose other tools that they find appropriate for the exercise.
Students were either invited to a talk by a professional or a field trip to a business's office.	Webinars on different topics were done by professionals. The new set-up allowed bigger audiences and better access to the

	speakers since travel time and room capacities were eliminated.
Practical application of creative thinking tools involved creating physical materials like post-its, paper, cards, etc.	Creative challenges in the course allowed students to survey digital tools that could mediate their collaborations online. These tools are more robust in terms of being able to document the changes and evolution of students' output and be adaptable in generating multiple formats.

3. Results

The metadisciplinary approach taken in designing the course delivered results better than expected. In terms of content, the online course was able to aggregate a rich set of creativity and design thinking resources stemming from the joint effort in course development by the design team and teaching faculty, and the ability of the learning management system's interface to integrate related tools and host course materials. Multi-modal discussion boards afforded all students the opportunity and time to voice out opinions and insights in formats that may not have been possible in a classroom setting. The collaborative nature of the coursework reinforced habituation in the application of creative methods, where students iteratively exercised key concepts in the design thinking process to deliver requirements, and autonomously seek design-oriented approaches to problem-solving.

Ultimately, even though this was a pilot with fair opportunities for further refinement in succeeding semesters, it can be argued that the very circumstances that created an impetus for developing the course online subjected both students and teachers to a much deeper and profoundly intense immersion in a design thinking mindset amidst a pandemic. This is concretely manifested in the capstone projects submitted, where the majority of the assumptions and contexts factor in the complexities surrounding the biggest simultaneously global and local issue of our time. Teachers applied design thinking itself into an extensive understanding of the pandemic's issues in how guidance and academic advice was provided to enrich the students' outputs. Notable capstone projects include:

- A mobile application to make travels safer and more personalized by connecting travelers to locals, visualizing itineraries, and making all relevant travel information accessible
- A do-it-yourself soap kit with customizable scents and fun designs to combat negative perceptions of handwashing among children
- An affordable radio-powered tablet designed specifically for high school students foraging into online learning in remote rural areas in the Philippines
- An application that recommended computer models and shops best suited for online learning given a particular budget

It is also important to note that while the experience itself presented many challenges for the students, the quality of output and academic performance demonstrated in the online course did not indicate a difference in quality versus the output in previous semesters. Teaching faculty were able to successfully facilitate the pilot without compromising the quality of assessment submissions, as evidenced by the meticulousness and level of analysis performed by the students. We can definitely say that cognitive knowledge transfer was achieved through the design decisions made for the online course, in addition to accounting for the students' emotional and motivational abilities in its delivery.

Firsthand accounts from students through their summative course syntheses also strengthen and affirm the fulfillment of the desired competencies. Students were able to concretely identify changes in their behavior with respect to their self-perception of creativity, noting that the skills they developed and mindsets they cultivated during the semester contributed to a greater trust in their own creative skills that they did not acknowledge prior to taking the course.

4. Discussion

The challenges posed to delivering the course online during the pandemic were overcome by taking a metadisciplinary approach to (1) identify blockers to the experiential learning cycle; (2) redesign activities and requirements following the SAMR model and learner-centric principles, and (3) simultaneously teach and redesign the course depending on the students' needs and overall context of

the semester. Through these measures, the team was able to effectively deliver the course lessons online, and by extension, successfully build creative confidence as a core competence for the students.

The success in delivering the course online is validated by the three important factors Lloyd has identified as contributors to successful online learning for design (as cited in Taheri & Meinel, 2015, pp. 471-472). In Table 4, the factors are shown alongside the measures taken to adapt to the online environment. Although other efforts to deliver the course effectively are not specifically aligned with these factors, they were still relevant as they helped overcome the challenges presented.

Table 4. *Lloyd's factors for successful online learning for design*

Factor	Efforts taken for DECSC25
Introducing creative social networks that serve as a broader audience and provide feedback	<ul style="list-style-type: none"> ● Requiring feedback from users at different stages of the process ● Hosting webinars with professionals in the field ● Inviting professionals as panelists for the capstone project ● Requiring feedback from their peers
Defining design not just as creating aesthetics artifacts, but also encompassing different areas like communication	<ul style="list-style-type: none"> ● Allowing students to submit requirements in any format ● Introducing design as the intentional facilitation of group sessions ● Introducing user experience to emphasize function as design
Communicating feedback effectively online	<ul style="list-style-type: none"> ● Conducting informal check-ins with students via social media ● Conducting weekly check-ins for their capstone projects ● Holding frequent consultation hours (i.e. 2-3 times a week) ● Providing detailed and actionable feedback on submissions

These are the key insights that led to students becoming more confident in their understanding of the course and consequently, their creativity:

- Students could go through the experiential learning cycle at their own pace because of the asynchronous set-up combined with synchronous sessions, weekly check-ins, official consultation periods, and informal consultations over chat.
- Strong and persistent efforts to communicate topics and deadlines periodically with stimulating visuals helped students develop an inclination to go through the LMS, set their own pace, and manage their time and workload despite the challenges external to the course.
- Weekly check-ins allowed for feedback to be given more immediately as the students progressed through their capstone project. Teaching faculty had the opportunity to ground the foundations of the project in the context of the pandemic and reinforce problem-solving mindsets.
- Simulating real-world market acceptance of products and services established creative design thinking into creative design doing.
- Formative assessments, such as reflection papers, cases, and discussions prompted by open-ended questions emphasize the creation, framing, and validation of students' unique insights rather than a prescribed analysis or synthesis of ideas. This is consistent with viewing the application of design thinking as a learning model that supports creativity (Rauth et al., 2010).
- Giving students the freedom to decide the format of their submission (e.g. text, drawings, presentations, collages, music playlists) helped unleash their creativity. It was also considered stress-relieving for some who chose to align their format with their hobbies and interests.
- Consistently gauging the feelings of the students throughout the semester via surveys, polls, or informal conversations enabled the teachers to adjust and redesign the course as necessary.

Overall, we strongly affirm the hypothesis that the deliberate design choices made throughout the development of the course were able to successfully deliver the learning outcomes not only consistent with previous semesters, but also with a greater opportunity to immersively experience design thinking education. We can also assert that the adaptation of design thinking principles in an online learning environment was successful in its purpose of cultivating creative confidence among students. We recommend for succeeding semesters to further streamline the process of restructuring assessments to have a tighter holistic approach in conjunction with the capstone project, but still value the diversity of possible output from students. Future research can focus on the impact of applying specific course design methodologies to other subjects being adapted online.

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