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INTRODUCTION:

The Role of Technology in Reforming Design Education: Pedagogy – Critique – Transformation

Jae-Eun Oh
Francesco Zurlo

4—15

#education models

#digital pedagogies

#softskills

#pedagogical transformations

#design education mutations

Design education has significantly changed since the 1950s. The era depended widely on normative models such as those proposed by Benjamin Bloom (Bloom et al. 1956) and his collaborators, which resulted in the formulation of Bloom's Taxonomy[1]. Comprising six interchangeable layers (knowledge, comprehension, application, analysis, synthesis, and evaluation) of higher and lower thinking, Bloom's taxonomy sets in place an archetypal model for education that thrives on object-driven goals. Here, pedagogical interchange and the object-driven and organised structure of education can adapt to each layer within the taxonomic structure [2].

Nearly 50 years later, the second international Engineering and Product Design Education Conference (Lloyd, Roozenburg, McMahon, and Brodhurst 2004) chose the theme "The Changing Face of Design Education" to outline a radically different view of design education. The conference triangulates curriculum development using nine categories: philosophies of education, evolving design expertise, teaching tools, problem-based learning, studio-based design projects, design education and the internet, collaboration and the design education industry, collaboration with international connections, and specialisation. In the opening pages, Sietske Klooster, Richard Overbeeke and Kees Appleby (2004) define the intricacies of new curriculum development as specifically focused on a two-level system of core and meta-competencies. These core competencies include ideas and concepts, integrating technology, focus and perspective, social and cultural awareness, market orientation, and visual language. In comparison, meta-competencies include multidisciplinary teams, the design and research process, and self-directed and continuous learning.

A side-by-side comparison of Bloom's taxonomy with the newly proposed curriculum highlights that design education has transformed into a distinct domain and a discipline in its own right. It also shows how external factors impact education in light of new dissemination practices. A wider scan of the research and formation of design education as a field reveals two interesting facts: first, the transformation of education into an enabling praxis shift education away from a craftsmanship emphasis with a 'look over the shoulder' approach, towards an online driven education model that emphasises cross-disciplinary ecosystem and networked collectives; and secondly, education practices are increasingly fusing research with education together with the acquisition of other new tools, such as gaming tools, modelling tools, fabrication tools and representational tools.

In studio-based learning, students undertake a long journey of idea generating, problem-solving, evaluating, and refining their designs throughout the learning process (Oh 2018). Therefore, active communication between faculty members and students is imperative in this specific learning environment to help students remain motivated during the design cycle. Studios are critical in design education as they provide a simulation of industry practice (Brusaco 2000). In this setting, teachers are the area experts who guide and mentor students with their projects. Thus, studio-based learning is an essential teaching approach and a unique pedagogic method (Broadfoot and Bennett 2003) within design education, where face-to-face tutorials and peer learning happen continuously. Interactivity in the studio fosters a proactive learning environment. Students feel more involved in the project and more comfortable approaching educators, who give prompt feedback to their students in a designated physical space (Ma 2016).

In this ever-evolving context, more questions arise. How can technological development today help studio-based learning take place in a virtual space? Can technologies transform and reform design education? Beyond the pandemic, can online learning replace face-to-face tutorials

across different disciplines within design education? And how should design educators adapt to the new direction this era is facing?

1. Setting New Targets Within Education

As designers, we observe users in the context of their lives in order to support critical problem-solving processes and propose new meaningful solutions. Design educators should apply the same approach to education systems to better understand their users, usually young people. This includes the changing nature of design education (DE), not as a mere knowledge transfer model but from a position that views DE as a peculiar kind of service. This highlights the need for educator responses to consider the younger generation's peculiarity with regard to how they build, create, and retain knowledge within the methods of DE and available mechanisms.

There have been two main approaches to the history of education. The first considers the student as an empty container, a head to be well filled. The second, put forth by the French Renaissance philosopher Michel de Montaigne (1533-1592), considers the student as a pupil whom the professor must teach methods in order to handle problems. In a figurative way, this causes a polarity between a well-filled head (full of notions and chunks of knowledge) versus a well-made head (structured to actively manage information and raw knowledge). However, both approaches focus on students as targets of education, occupying the centre of educational endeavour.

Traditionally, the term 'pedagogy' is derived from the classic Greek παιδαγωγία (paidagōgia), referring to the activity of leading a younger individual (Merriam-Webster 2020). Contemporary methodology retains this position as part of its credo. John Dewey (1991) emphasises that education is not about telling or being told, but is an active and constructive process. Students construct their own experience and knowledge and learn by doing; the real process of education is the process of learning to think through the application of a real problem (Dewey 1997). To this effect, education is witnessing 'new generational' pupils as active participants, wherein co-creation, multitasking, non-linearity, working on-screen and sourcing rather than facts remains the premise.

As the millennial generation (Reinhardt et al. 2009) comprises digital natives, these students come to higher education with extensive knowledge of and experience with advanced technologies. Universities now employ various teaching technologies to improve student motivation, engagement, involvement, and learning experiences, while encouraging students to use these technologies in traditional classroom settings. As a result, students have undoubtedly become more inquisitive about new technology and possess high expectations for an effective learning experience. Despite this, while a number of studies recommend applying appropriate technologies to teaching and learning in the traditional classroom environment, little attention has been given to the use of technology in design education. We aim to find intriguing and challenging articles in order to uncover this research gap of technologies in design education.

Humans are formed and shaped by technologies and related devices. The advent of the web, ubiquitous digital networks, and the accessibility of a huge range of devices, such as smartphones, personal computers, and others, have changed human behaviour. These technologies have had different impacts on the various generations, with greater effects on the latest ones: the so-called digital natives.

Stewart Brand is an American writer, best known as editor of the Whole Earth Catalogue (1968-1971), and founder of a number of organizations,

including The WELL, the Global Business Network, and the Long Now Foundation. He writes: "Lots of people try to change human nature but it's a real waste of time. You can't change human nature, but you can change tools, you can change techniques. And that way you can change civilisation."[3] Tools and techniques can change mindsets and behaviours. This is especially true for digital natives: people who have learned from the cradle to interact with the digital world.

This way of accessing knowledge forms a different cognitive model, far from the traditional categories of thought referred to in the Enlightenment rationality (attributing labels, organising categories, and creating rational knowledge maps). Digital natives approaching vast arrays of data will abandon aseptic analysis, open to including greater fields or ranges of information to inform their thinking and conceptual development. Creativity, which focuses on connecting dots, becomes the key activity. For Michel Serres (2014) these young people express a "real intelligence". They like to be active learners and want to engage with what they learn by using their learning environments, such as virtual classrooms or digital learning spaces (Massive Open Online Courses or MOOCs, YouTube, and other social media platforms).

Technology has always been part of their lives, and they don't feel awkward adopting and integrating it into their learning experience. For example, social media plays a critical role in their lives, both for socializing and learning skills (Oh 2018). Lee Andrew Dunn (2013) postulates that social media may offer an enhanced learning experience when given a constructive direction. Douglas Fusch (2011) argues that equipping students with digital life skills is equally important to the learning objectives. These new generations enjoy having class discussions and an interactive classroom environment to immerse themselves in the learning.

There are some consequences that educators must consider, however: the social-digital generation (Hietajärvi et al. 2015) access new information and process a vast number of images relatively fast. As illustrated form table 1, Hietajärvi outlines the differences between the conventional and socio-digital participatory models within education. In this scheme, reading papers and books seems peripheral to the flexibility digital mediums provide, where synthesis is the new keyword, even for educational purposes.

Socio-digital participation	School practices
Flexible use of digital media	Traditional media, e-mail
Multitasking	Linearity and sequence
Intellectual ICT tools	Pure mental performance
Internet searches	Limited textbook content
Socio-digital networking	Off line working, face to face
Working on screen	Paper and pencil
Making and sharing in groups	Individual performance
Extended networks	Closed classroom community
Knowledge creation	Knowledge acquisition

Table 1: Digital Generation's participatory models versus School pedagogies' approach (Hietajärvi et al. 2015)

2. Pedagogical Issues

The greatest concern we face in design education today is how to teach creativity using the 'learning by doing' method. To succeed in design-related subjects and projects, students need to master the theories and practical skill sets required to "make" things. For example, the Design Department of Politecnico di Milano uses a triangle to represent their method of teaching and learning design (Figure 1). Every angle represents the students' actions and relative teaching formulas, which include traditional lessons, workshops, and multi-disciplinary courses.

The premise of the 'learning by doing' approach is three-tier based. The first focuses on "being," or soft skills: learning how to interact with others and how to solve problems. The second addresses "making" as practical activities, such as sketching and prototyping. The third tier relates to "knowing," often seen as the conventional approach to absorbing knowledge by way of lessons or tutorials, supported by reading and studying. The properties of this triangle have in itself mutated, as demonstrated in Figure 1. From the left to the right of the image, the first pedagogical cluster differentiates between knowing, making, and being as three separate parts. Wherein the second version reduces the knowing component and moves it closer to the making and being components. The third and last version repositions knowing between and within both making and being.

Thanks to these cognitive transformations, "being" and "making" appear to become central activities for learning, even as they support the traditional activity of "knowing" that creates the real active learning process. Making as an expression of active learning thus fits the purposes of design education. When students enact "making" in class, they often carry this out under a project-based learning approach. Students work together, meaning they have to manage collaboration issues, leadership, and negotiation processes. Making together is the main route to absorbing knowledge (referred to as the traditional definition). Passion, an expression of soft skills within the groups, is a powerful amplifier of creativity and problem-solving orientation. Finally, making things together (and therefore being: humans exploring themselves in relationships) sets a new tone for the education mantra.

Learning by doing has been an essential teaching approach for design students. For instance, project-based learning focuses on constructivism by encouraging students to handle a project on their own with authentic problems provided. From there, students should focus on a "learning by doing" approach, in which they engage with an autonomous learning mode with the aim of becoming more creative. Autonomy and collaborative problem-solving skills are expressions of the *smartness* approach, transforming soft skills into *smart skills*. Using authentic problems to challenge students can provoke creative thinking skills and increase motivation. Studying becomes more motivating, and students are most creative when they feel motivated primarily by a sense of interest, satisfaction, and challenge from the study itself, not by external pressures (Amabile 1998).

"No Maps for These Territories" (2000), a documentary film by Mark Neale, focuses on science fiction writer and father of cyberpunk, William Gibson. The film describes the inability to create complete maps in the age of complexity, especially within this tech-driven world. The ability of Generations X and Y to access vast repositories of data and information anytime and anywhere further exposes the difficulty of creating representative maps related to many kinds of knowledge. As educators, our responses should identify what possible contributions are viable within the student generations and what exact knowledge should be transferred with each generational shift. Educators should aim to provide a supporting compass as students make personal choices, connecting the dots of the immense repository available on the internet. Knowledge creation requires an understanding of what is "north" or "south" of such knowledge maps, similar to the use of a compass for directions when navigating through and across information online. Acquiring competencies in order to distinguish the value (and authenticity) of Internet resources is a key concern in both the active search for knowledge and the validation of its findings.

Essentially, the design education compass requires four key aspects. The first aspect supports an active process in making and being, and, consequently, knowing. Second, guidance enables

overtime (intrinsic) motivation, which makes students co-responsible for their learning process. The third aspect facilitates collaborative activities, taking the view that together is better than alone as a way to enhance soft skills. A fourth aspect prepares designers to face real-world complex problems to create novel artefacts.

'Learning how to learn' is therefore a key consequence of such educational compasses. For instance, it can induce more of a critical thinking process or independence and autonomy in learning. Independent and autonomous learning have been crucial points in evoking students' intrinsic motivation. Through the right learning approach, students can stay motivated throughout their creative endeavours. When looking at a design setting from an educational perspective, students usually work on projects with authentic problems, build experience, and learn from those very experiences. As Phylis Blumenfeld et al. (1991) state, project-based learning (PBL) highlights knowledge acquisition, level of engagement, and motivation. This knowledge-building process includes experiential learning, which helps students generalize, internalize, and conceptualise their understanding.

The teaching of creativity brings forth new epistemes. In the past, studio-based learning has been the primary method for design education. However, project-based learning has been actively adopted by design educators. Therefore, in combination, project-based learning (PBL) is the epistemology that brings real-world problems to the classroom and lets students construct their own experience and knowledge through learning by doing. Students become more engaged, autonomous, and motivated through PBL, which provides opportunities for building and constructing experiences and abstracting concepts by observing and participating (Kolb 1984).

3. Digital Transformation and Impact in Design Education

Returning to the aforementioned context of the digital paradigm, new modes of education happen everywhere and anywhere thanks to new media and advanced digital devices. Higher education has increasingly employed virtual classrooms and distance learning models as core components of their learning practices. As the millennial generation (Reinhardt et al. 2009) largely comprises digital natives, learners come to higher education with extensive knowledge of and experience with advanced technologies. Philosopher Michel Serres (2014) observes the impact that digital technologies have on new generations: how they love, live, interact, and learn. He gives the image of a modern Thumbelina (1846), the female version of Tom Thumb (the novel of Charles Perrault, 1628-1703), who, upon opening her smartphone, acts and thinks through her fingertips, accessing the infinite amount of information on the web, accessible with a single touch. Serres' choice to use the female version of Tom Thumb (Thumbelina) is related to a progressive feminisation of society, a phenomenon Serres connects to the millennial generation and its context of advanced technologies.

Traditionally, the studio-based learning environment has been the quintessential education model that fosters student-teaching interaction (Oh 2018). The studio, or face-to-face setting, provides immediate access to field experts and their professional conduct (Brocato 2009). One-on-one tutorials actively engage students with their learning process (Ma 2016; Oh 2018), and although labour intensive, remain the preferred setting to boost students' understanding of their purpose and academic goals. Today, many higher education institutions have begun adopting online tutorial sessions for non-design faculties to boost students' independent learning (Shaw 2012).

Furthermore, universities now employ various teaching technologies to improve student motivation, engagement, involvement, and learning experiences, while encouraging students to use these technologies alongside traditional classroom settings. As a result, students have undoubtedly become more inquisitive about new technology. On the flip side, technology-skilled learners raise the expectations of an effective learning experience. Despite this, however, while several studies recommend applying appropriate technologies to teaching and learning in the traditional classroom environment, little attention has been given to the use of technology in design education. This timely topic provides intriguing and challenging possibilities for exploring the area of technologies in design education.

With the global pandemic in full force, educational sectors have been forced to immediately convert full curricula into online teaching modes. New technologies have helped support the possibility of substituting traditional classrooms/tutorials in design education, co-evolving technological advancement, and transforming the technological relationships to studio settings. Even so, many design educators believe it would be too challenging to conduct studio-based learning using online tools and insist on a face-to-face format for their teaching and learning activities. The pandemic, the convergence of digital tools, and the growing ease of technology with every day mark an opportune moment to reconsider the potential opportunities that online learning can provide moving forward. Technologies such as mobile devices and laptops enable both teachers and students to explore online-driven pedagogical tools. These technologies can overcome barriers of difference and distance, thus facilitating discussion and exchange of ideas. Miro and Conceptboard, two online collaboration platforms, are examples that have shot to popularity during COVID-19, meant to facilitate active online communication as effectively as in the studio, even as dematerialization occurs with the shift from the strictly physical studio to the virtual space.

Adding to this, new forms of teaching and learning can happen anywhere, extending the studio outward into a variety of personal settings. According to Joi Ito, a former director of MIT Media Lab, "Education is something that is done to you. Learning is something you do for yourself" (as cited in Evers 2017). Ito posits learning over education, emphasising how to learn and not simply acquiring a body of knowledge (Evers 2017). Learning solicits transformation of the teaching systems into one that is supportive and works well for the learners, rather than one that is simply informative. At one level, this requires technology support, dependent on high-speed internet connections and high-performance computing, both affordable and accessible without delay. On another, especially in this internet era, there is a dependency on third-party resources and self-directed opportunities for students to learn from the Internet. While it is certainly difficult to say whether all the programmes students can find on the internet are certified or guaranteed, there are many basic tools that students can pick up to start their first steps in design education. The practice of including social media and dedicated platforms, for example, YouTube and Archistar, is embraced by both educators and students equally. Students can explore free online tutorials that teach how to use software for drawing skills, digital painting, colour theory, and many other transferable skill sets. These online tutorials can be more effective in transferring knowledge than the traditional learning process, with educators teaching and guiding students step-by-step in online learning environment. In online learning, there are no project-related issues, as the focus is on mastering the software for students to apply the skills to refine their projects. YouTube can effectively perform the function of knowledge transfer, and it has become a popular learning arena for those who have a shared interest.

This trend advocates for transmedia learning, which adopts storytelling techniques to engage learners more efficiently; students can relate to the content first, then understand, and finally share with others (Franceschin 2016). These storytelling elements can greatly attract learners and engage them deeply. Students feel learning is more exciting and efficient when they do not just memorise content, but understand and share it within a community.

Tomás Franceschin writes that transmedia learning can transform the education of Latin American countries. His article for edu4me proposes solutions:

> *"This technique has actually been borrowed from entertainment, where producers usually combine different media to tell and promote a story. This can clearly be observed in Hollywood, where any given movie entails far more than the film projected on the movie theatre, as it is expanded into video games, mobile apps, social media pages which display original exclusive content in multiple form factors, soundtrack albums, and many other formats. In education, Transmedia involves the usage of one or more of these channels to develop a coherent story involving a specific content or topic, allowing students both to research and comprehend it and to conceptualise it in such a way that they can adapt it to the different formats. Additionally, this method allows students to get deeply involved in the process of creating content, teaching them how to write, film, edit video, animate, code, or whatever task is needed to complete each project."* (Franceschin 2016)

With digital transformation and the rise of sustainability concerns, designers are leaving the traditional idea of closely defined artefacts in favour of flexible solutions that are accessible to other stakeholders (mainly customers). A simple example could be a customisable pair of shoes. In this particular instance, digital platforms allow users to combine components and details, focussing more on the values of the customers than mere durability. Platforms such as OpenIDEO[4] are enablers to a global community that aims to provide solutions for social and environmental problems with a 'design thinking' approach. These cases show another rule that guides designers. The "enabling rule" triggers and encourages user participation in the production process. We have seen the importance of co-generating knowledge in the learning process, anytime, anywhere, and across different media platforms. In educational institutions, teachers set the goals and provide compasses wherein students learn to be creative within the parameters. From this point of view, professors become life coaches, enabling and helping students to find their way of learning and growing. When universities design curricula and programs, the "enabling rule" remains a key question. A platform must fit with the students' lives, account for generational differences, and minimize the difference between online and offline life: for example, Generation Y versus the values of Generation Z, and their daily experiences (Floridi 2015).

4. About the Discipline

Today, design deals with aspects such as social innovation, social justice, social movements, politics, participatory action, educational processes, gender differences, and other aspects of individual and social life. It happens amidst a trigger that aims at combining different competencies; therefore, a trans-disciplinary approach is needed. An approach that transcends disciplinary approaches by adopting an inclusive framework, generating mutual learning, joint work, and integration of knowledge with the primary aim of problem solving. This approach remains a project-based learning process that aggregates different competencies and experiences.

Ezio Manzini (2015) claims that everyone is a designer: a person who can imagine their future

and find ways to improve the quality of life. For Manzini, there is a difference between a "design expert" and a person who is the subject of education. The design expert acts within the community to provide their expertise, presents visualisation capabilities, and is orientated toward the future. Expert soft skills, which consist of empathy, collaborative problem solving, negotiation and entrepreneurship, become a fundamental set of competences. For the discipline of design, criticism and meta-competence need to be emphasised.

Criticism is the way learners understand contexts and situations. Criticism is the ability to analyse the consequences of every projectable choice, the capability of engaging people, and the sense of value assessment for every executed action. For design education, constructive criticism is an essential component, feeding into the process of how students execute their projects, which in the long run aids in establishing an autonomous and professional mindset. The critique or 'crit' session is therefore mutual, relating to both teacher-student interactions and a peer-to-peer mechanism.

Meta-competence assumes a humble disposition towards understanding people, being aware of what we do and how educational practices fill the knowledge gap. This is a typical design approach, considering the initial set of information and lack of knowledge when commencing a new project. Professional design methods rely on the experiences that constitute knowledge, which in a student setting of project-based learning is part and parcel of an experiential learning cycle that generalises, internalises and conceptualises students' understanding (Kolb 1984).

Number 4 of Cubic, Design Education - Technology's Role in Reforming Design Education, Pedagogy, Critique, Transformation, contains eight contributions to reflect on the challenges of education in the design context. **Peter Vistisen, Bo Allesøe Christensen,** and **Thessa Jensen** explore the theory of Ulrich Beck on risk-taking, combined with current design thinking ideas in their interdisciplinary workshop. For **Michael Louw**, the possibility of radically dislocating the design studio from its traditionally centralised space to the site of investigation takes precedent, as demonstrated in his photo essay. **Gladys Lam Wai Ling** examines the application of blended learning approaches in advertising design, discussing three blended learning strategies conducive to meaningful learning for students. **Iain Choi** and **Fann Zhi Jie** explore how peer learning can enhance students' understanding of Computer-Aided Design (CAD) and empower them to be more motivated with the AutoCAD program for interior design students. **Scott Chin** shares the obstacles to online teaching, moving from the initial resistance to online education to its immediate fusion within education in the face of the global pandemic. **Markus Wernli** explores co-crafting as coursework, applying the notion of recursive publics to adult learning and eco-friendly activation that aim to engage diverse learner groups to promote wellbeing and a healthy environment. **Anneli Giencke's** photo essay links design education to the vertical studio formula as a method to advance peer-to-peer education practices in the digital era. In comparison, **Michael Chan's** photographic essay reflects on service-learning, and his award winning cross-disciplinary hands-on design build model. Finally, **Aruna Ventaktesh**, a PhD student, discusses tacit knowledge and the blended learning studio environment in the assimilation of creativity.

In conclusion, when taking a broader view, the link between design and design education becomes inseparable. Transformations in design will always change design education's goals. Moreover, design education is not only an enabling compass for project development. In parallel, it reveals viable ways of nurturing individuals into becoming responsible students, effective designers, and furthermore, better citizens.

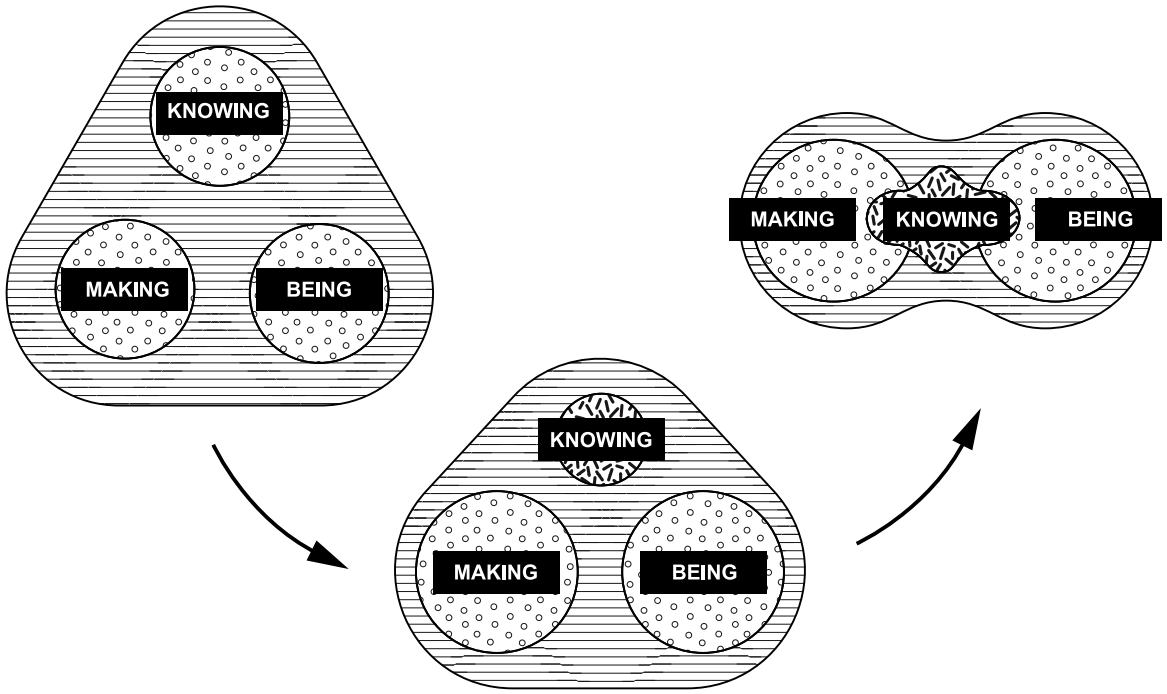

Figure 1: Evolution of Design Teaching: integrating competencies and meta-competences. Department of Design, Politecnico di Milano's educational models on the left hand side, with authors' revision of how knowledge, making and being has transformed within the current educational model. (upper right hand side of the scheme).
Source: authors

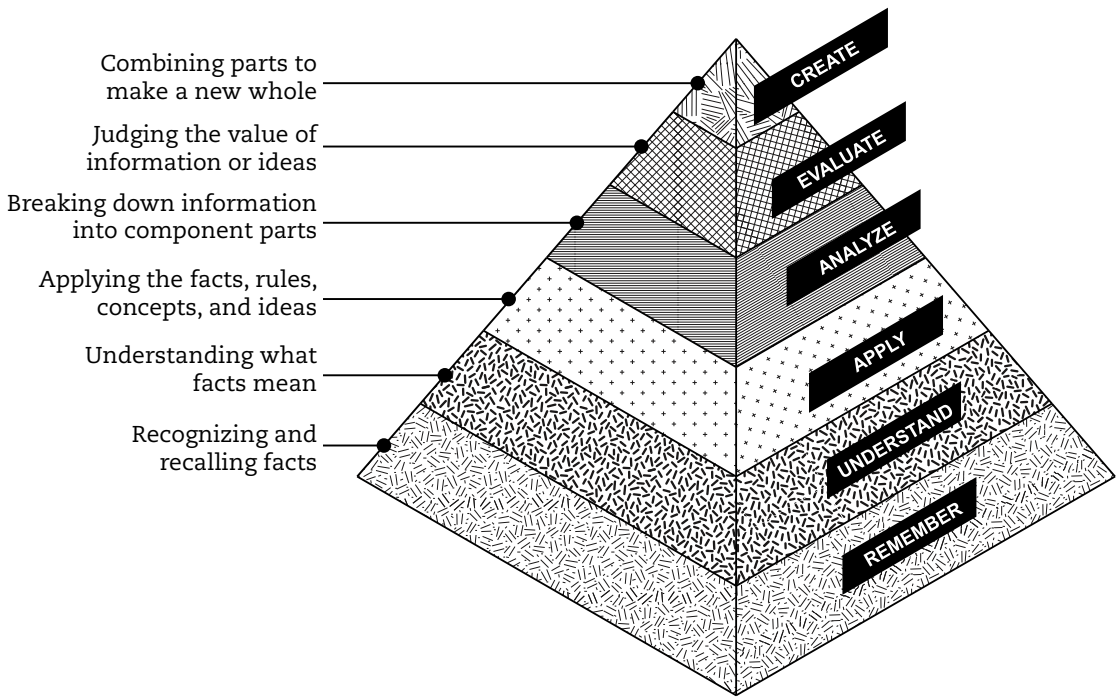

Figure 2: Bloom's taxonomy. Adaptation from Bloom (1956)

Notes

1. In 1956, Benjamin Bloom, along with collaborators Max Englehart, Edward Furst, Walter Hill, and David Krathwohl, published a framework for categorizing educational goals: Taxonomy of Educational Objectives. Generally this is known as Bloom's Taxonomy.

2. See also https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/.

3. See https://scuolaholden.it/en/holden-studios/. Last accessed August 2020.

4. See https://www.openideo.com. Last accessed August 2020.

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Bio

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EDITORIAL:

The Pandemic and This Issue of Design Education

Jae-Eun Oh
Francesco Zurlo

16— 19

When we first initiated a call for this issue on design education, never could we have imagined or foreseen what lay ahead. Since late 2019, Hong Kong has gone through an enormously difficult time. First, spikes of social unrest, rapidly followed by COVID-19. Half of the first semester of the 2019 – 2020 academic year, as skirmishes closed in on The Hong Kong Polytechnic University campus, all courses had to move over to available and often misunderstood online platforms. As the situation finally subsided, the virus emerged, impacting the commencement of the second semester, and the overall delivery modes of a structured curriculum for an entire year.

Both faculty and students of the School of Design lived and worked in high hopes to return to face-to-face teaching sooner, rather than later. In time, hope conceded to a stark reality that online, the virtual and the digital models of education, have moved into focus as the main and primary modes of education. Long gone are the days of the digital as a mere supplemental or peripheral possibility.

The digital reality presented other challenges to design education: ensuring credible and authentic outcomes for each of the design disciplines within a non-studio setting, the expression of ideas, or demonstrating principles across and through digital platforms with the additional burdens of a digital generation that instantaneously become camera shy. Or, in the extreme the mistrust shown by students that reviewers may not understand the design work without a physical presence.

Moving one year forward, the growing pains of digital pedagogies has caused an instantaneous maturing of educators, those being educated, and of what is said, shown and discussed. Somehow, the global body of design environments have collectively responded to these and more local challenges, yet again transforming the specifics of digital pedagogies across unexplored territories.

The following series of images attest to the resilience of digital pedagogies and design institutions. May this stand as a testament to rapid responses, individuals who took the reins, and how educators shape the future of design, design-research and ultimately how design is carried forward across generations.

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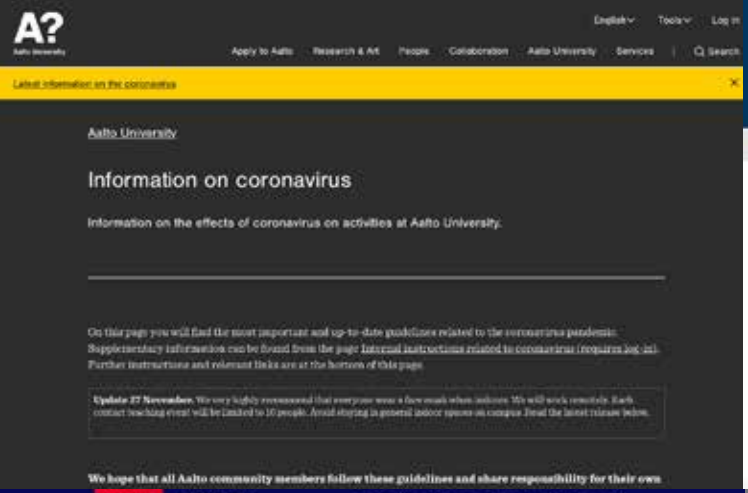

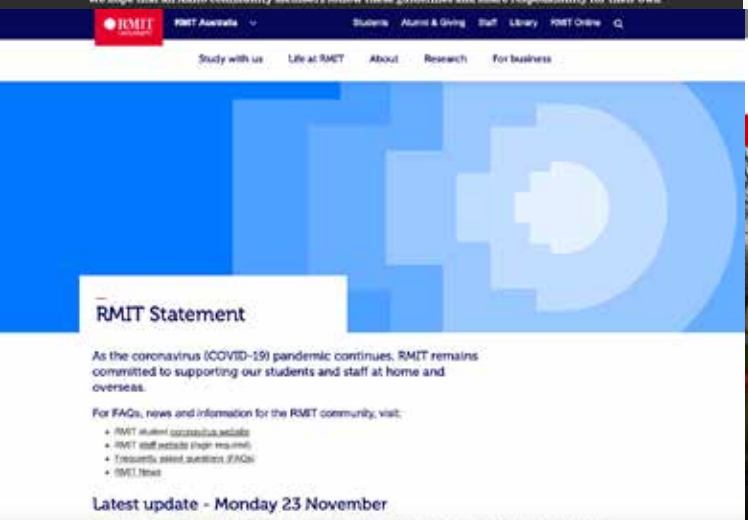

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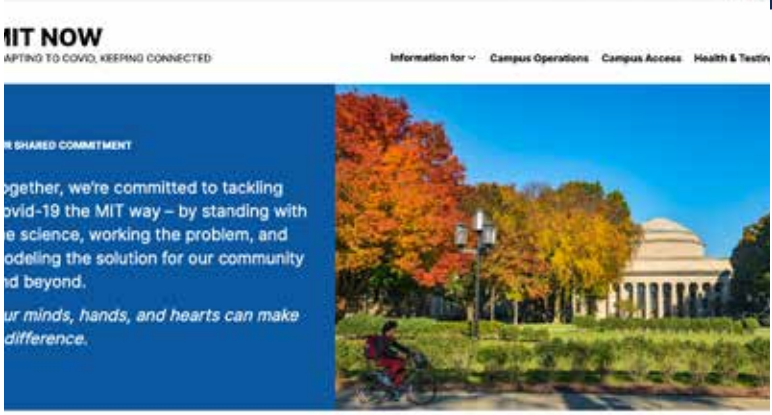

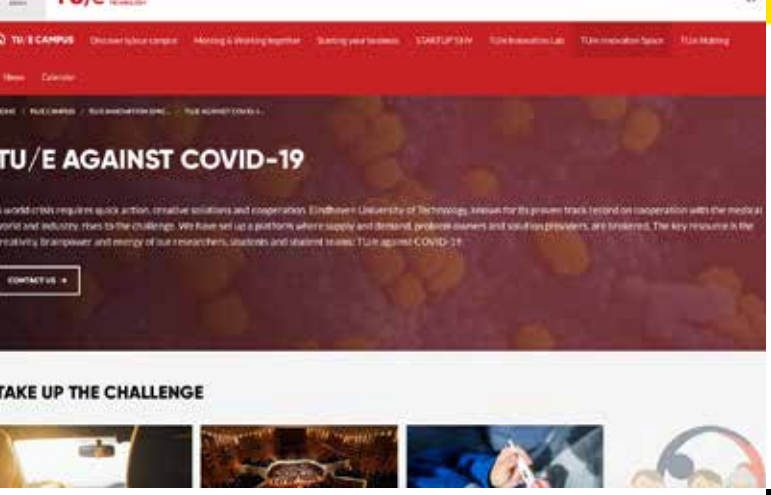
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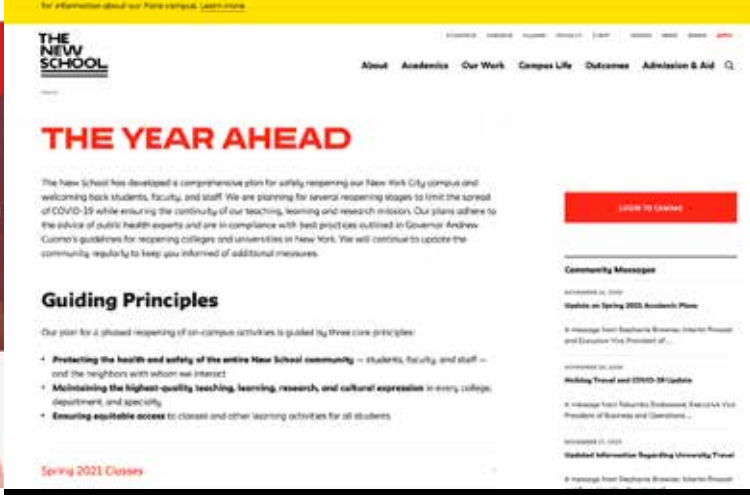
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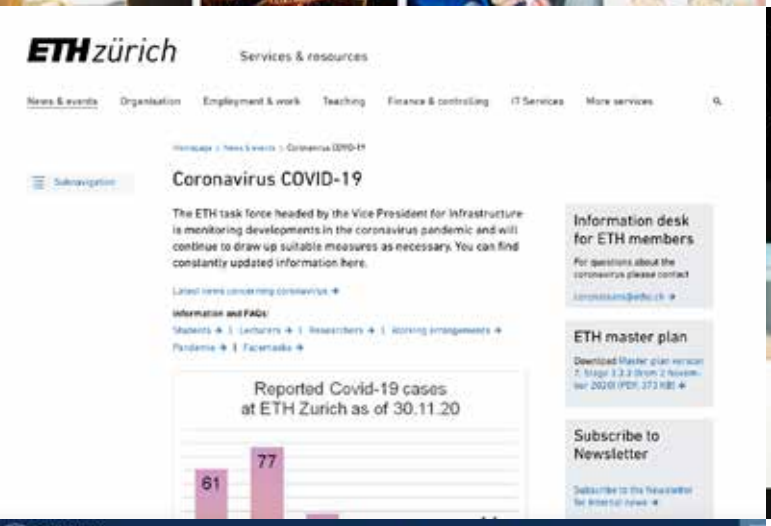
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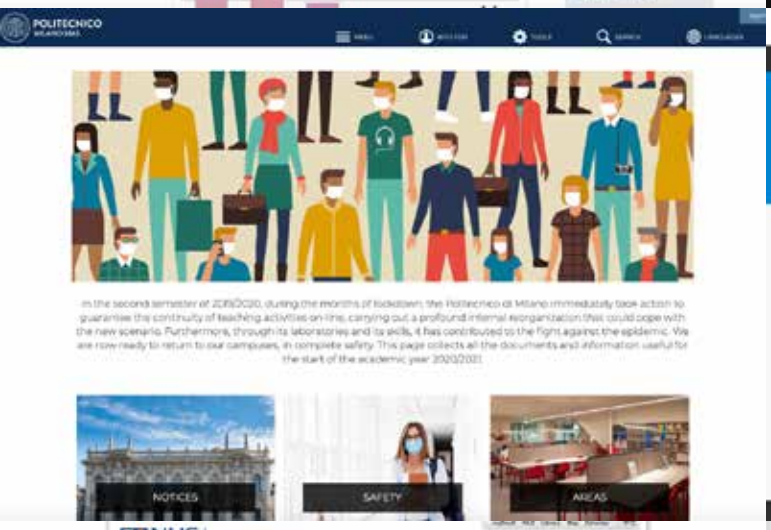
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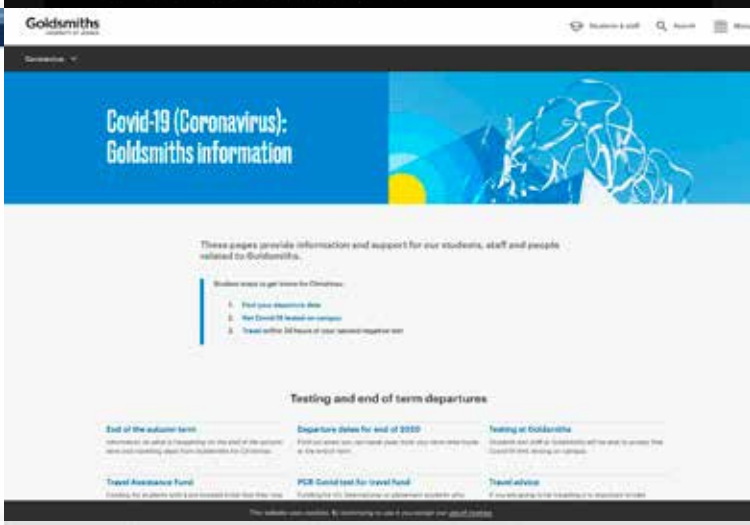
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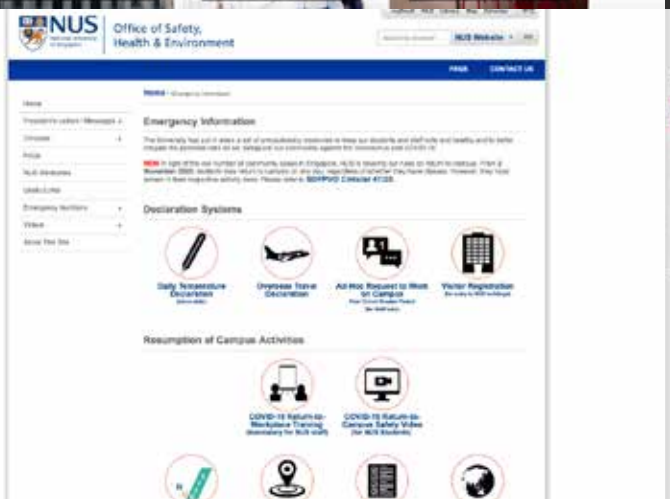
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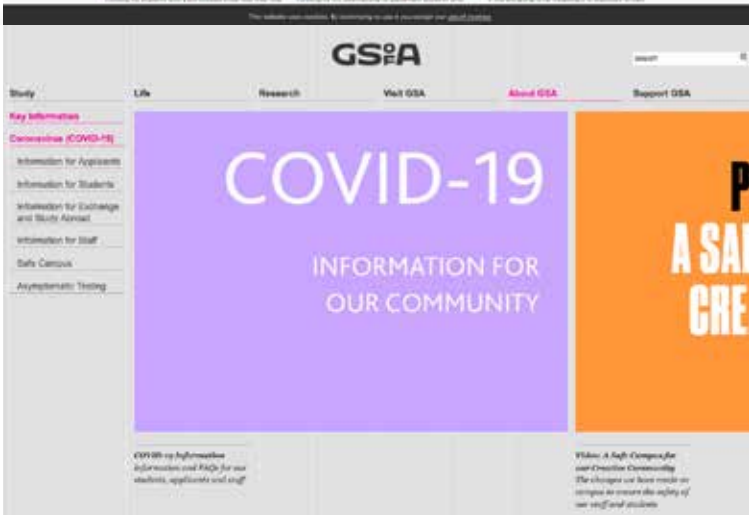
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Almost Risking It All: Non-calculable Risk-taking and Design Education

Bo Allesøe Christensen
Peter Vistisen
Thessa Jensen

20— 31

This paper provides an argument against understanding risk-taking in design education as something ideally in need of only being calculable and formalisable. Using the German sociologist Ulrich Beck's theory on risk-taking combined with the current discourse on design thinking, together with an analysis of a three week-long interdisciplinary design workshop, we analyse and discuss how risk-taking - as a general concept - in design education is an inherent element of the education itself. We argue, however, non-calculable risks, like human-centred design concerns, like desirability of use, ethics of technology, are an equally important part of a modern-day educational skillset as calculable risks. The aim is arguing for the prospect of interdisciplinary design-based education models as one way of embracing the non-calculable elements of a problem space.

#design education

#computational thinking

#non-calculable risk-taking

#risk society

Introduction

In 2017 Christina Redecker and Yves Punie published an EU report on computational thinking: European Framework for the Digital Competence of Educators, in short DigCompEdu (Redecker 2017). Here they presented an elaborate framework for teaching and learning computational thinking using digital tools to do so. The framework exemplified how educators should use digital tools to guide, apply, and assess computational thinking skills in their teaching and in students. The argument was increasing the development of computational thinking skills in learners because these skills were seen as the key twenty-first century skill set.

In this article, we will challenge this framework and the idea of computational thinking as the predominant key skill set for the twenty-first century. We argue for a wider range of skills, including a design-oriented focus on non-calculable risk-taking, to prepare education for the complexity of today's society. Setting out with a definition for risk-taking, we discuss the need for risk-taking in teaching and learning. This includes the embracement of non-calculable outcomes of social and cultural problems, often assigned the label of being 'wicked' (Kolko 2009).

The aim is not to challenge the idea of risk-taking in design education per se. Rather we acknowledge it as an equal component in an academically rigorous contribution. However, we will challenge the idea of seeing computational thinking as *the* method for handling risk (by either avoiding it or making it calculable) through the ideals of formalised knowledge alone. Some phenomena, while dealing with technology, cannot easily be formalised through either inductive pattern recognition or deductive algorithmic thinking, as often heralded in computational thinking discourse (Wing 2008). While frameworks like DigCompEdu are useful, especially in adding informatics to a given academic setting, it is inadequate for the solving of wicked design problems with no single optimal solution. Here, inductive patterns and deductive causality primarily exist to inform the 'qualified guess' of new ideas, framings or re-interpretations of previous dogmas. This is driven by an abductive logic, not easily formalised through computational thinking, but is expressed rather through iterative and creative experimentation with incomplete patterns and human experiences, which to a much higher degree, contain the need for 'risking' to be wrong (Kolko 2009). The need to take risks, the ability to work together in groups, the ability to pitch a project, and present deep reflections, and in the end discard it all as part of a 'designerly' process are skills all needed in the complex society that is developing around us. While these might be included alongside computational skills, we argue these skills need to be acknowledged as possessing their own academic merits to a great extent due to dealing with how they handle risk-taking.

In the next sections we will clarify the problem hinted at in the introduction, focusing on, first, a general challenge connected with the educational ideas behind The European DigCompEdu: that it doesn't embrace a sense of non-calculable risk taking, thus it is not able to incorporate creative skills like design thinking on its own terms. Second, we trace the development of design emphasising its dealing with non-calculable risktaking. Third, we will relate this to Ulrich Beck's (1992) notion of risk society. Fourth, we will use a three-week design workshop, U-CrAc, at Aalborg University, Denmark, as our case study. The workshop has been conducted since 2010 with varying setup and outcomes. We have presented the structure and overall purpose of the three latest workshops, comparing this against the DigCompEdu framework.

Clarification of Problems

Risk-taking and management of risk can be considered part of many, if not all, creative processes,

including both scientific, artistic and design processes, and, in a broader sense, a condition of our current society. The latter points towards dealing with risks, or uncertainties, in different ways and in different contexts, but often, and wrongly so, considering people's behaviour when dealing with risks as uniformly operating with a calculable uncertainty. This, for example, is part of the assumption within social sciences focusing on decision-making without perfect information. Chance becomes part of the conditions for decision-making, but it is minimised by calculating, often statistically, the risks of different scenarios (Hacking 1990; Elster 2007). However, a significant part of risk-taking is non-calculable, i.e. cannot be dealt with using ratiocination and formal methodologies. Instead, it involves the practical use of imagination, is contextual, and often resembles an abductive mode of inferring from incomplete data sets into conclusions outside the premises of the boundaries of said data. However, it is not, as Jaz Choi et al. (2018) claims, a matter of deploying risk-taking within university courses dealing with creativity. Risk-taking needs to be understood as a creative endeavour in itself. It is this latter concept of risk, we will claim, is needed in art and design education, which fails to be captured in the EU report mentioned above, and is the subject of discussion here.

In the European DigCompEdu framework, the main proficiency keywords are directly related to Bloom's taxonomy (Redecker 2017, 29). The six main steps for the educators are awareness, which defines the newcomer and explorer whose mindset should be defined by curiosity and willingness, turning into the second step, exploration, which is defined by meaningful use and variation of the digital technology involved in teaching. The third step denotes integration whereby digital technology is used as a strategy and diversification. The fourth step is expertise, which includes reflection on and the sharing of digital tools, turning into leadership as the fifth step. Here, the educator becomes a creator and a critic, not of the digital technology itself but on how other educators use the tools provided. In the final step of Bloom's developmental ladder, the leader turns into a pioneer becoming an innovator.

While DigCompEdu defines the pioneer educator as critical of digital technologies, this critique is only used to assess digital tools for their proficiency in teaching, assessing, and supporting learners in self-directed learning (Redecker 2017, 19). Like in the fifth step, the pre-given digital technological framework is not questioned. Thus, whatever use is developed – including any risk taken – is defined within this framework. The framework mentions risk several times (Redecker 2017, 23, 25, 84, 85), but always with the aim of managing it. Hence, it is a calculable risk, a risk to be reckoned with.

To achieve the highest levels of proficiency, DigCompEdu identifies 22 elementary competencies, organised into six main areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and finally, facilitating learner's digital competence (Redecker, 2017, 15). All of this should be achieved by using computational thinking methods. Some organisations, such as the British 'Barefoot Computing' (2018), include 'soft skills' like 'collaboration', 'persevering' and 'tinkering' alongside the formal skills, e.g. 'algorithmic thinking' and 'decomposition', in their computational thinking framework. However, the descriptions and use of the soft skills are still often directed towards their support of the formal and rational treatment of a given problem. Only rarely are soft-skills emphasized as something with its own merits, able to spark critical reflections emphasizing non-formal aspects such as ethics, usefulness, and desirability.

This brief discussion of DigCompEdu indicates a number of general points in need of scrutinization when a turn to reliance on digital technologies

understood as formal educational methodologies is taking place. First of all, it presents a one-dimensional picture of the use of digital technology because it fails to consider the value of dispersed and non-formal risk-taking by both learners and educators. So, any notion of risk-taking defined within a specific (formal) digital framework, is thereby delineated by what the formal methodology allows, and unable to 'risk' incorporating anything relevant but outside of what the methodology delineates. Second, and related to the first, critical thinking is not encouraged. One consequence is that technological thinking – here computational thinking as a formal method for dealing with problems, but it could also be a sole focus on statistical inferentiality— is seen as the positive and only solution to a proper education for the 21st century, and not as related, as a supplement or complementarity, to other means of education. Applying design thinking, for example, would entail a critical assessment of design processes and their solution(s). Any design of a product (material or immaterial) carries the risk of non-use with it. The use of a design influences the user, as design itself designs the user, and the user influences the design through its use. Thus, evaluation of such problems, and their possible solutions requires critical thinking skills as a designerly approach, addressing the interaction between design and user.

So, what we will be proposing here, is to "expand" or contextualise the DigCompEdu in the following way. As the DigComEdu paper argues (Redecker 2017, 12), there is a need for competences using digital technologies critically and creatively. We agree, but our argument points to a shortcoming in the understanding of the conceptions of being critical and creative. Assessment of a problem, by a learner, or an educator should be conducted not only by adhering to formative and summative digital tools. Rather, the learners should get feedback – including critique - from relevant contexts including users like companies or end-users besides academics. Empowering learners through digital activities puts the onus on the individual. Our complex society requires learners to be able to work in groups, as well as using technology to solve real-world problems and challenges.

In designing design education, one thing is to argue for design as a valid supplement to computational competencies, but this also needs to be understood through the lens of the challenges of fitting design into academic programs of higher education. This is to be seen in the light of the on-going debate about how to frame design as its own independent research paradigm (Gaver 2012). In the early 1980s Nigel Cross (Cross 1982) argued how design was placed between the fields of natural sciences and the humanities. This distinction was rooted in Wilheim Dilthey and Ramon Betanzos' (Dilthey 1988) division between the natural scientific study of observed (positive) phenomena, explaining these phenomena's causal relation to other phenomena, and the humanities and social sciences interpretative studies of the lived human experiences on both an individual and societal scale. In contrast to these two major scientific fields, Cross argued, design had its own pursuit of knowledge about man-made phenomena. This was further emphasised by Richard Buchanan (Buchanan 2001) defining design as the synthesis of 'products', as well as relating to Herbert Simon's oft-quoted broad view of design as a 'science of the artificial'. In addition, Alessandra Deserti and Francessca Rizzo (Deserti and Rizzo 2014) has detailed this further, separating engineering design from human-centred design and understanding this as a division between studying the man-made in 'a world of limits' (engineering), and a world of 'opportunities' (human-centred design). Recently, 'design thinking' has emerged as a near omnipresent term in the field. It is separated from engineering by emphasising man-made products as concerned with the world as it 'could be' (Kolko 2009), and not to be inferred from its premises to something which 'must happen'. This indirectly

relates engineering to the causal explanations of natural science, and human-centred design as primarily related to the interpretive traditions of the humanities and social sciences. These roots of design thinking are further supported by Buchanan's inclusion of the social planning terminology of 'wicked problems' (Buchanan 1992), where design is framed as "...a new liberal art of technological culture". More recently, (Kolko 2011) has also argued for design as a new liberal art. He argues that in our current technological culture, the focus on user experiences is on par with earlier critical ideological considerations found in arts and craft practices.

When scrutinised, it is clear that due to the continuum between design engineering and human-centred design, attributes from the former are also found in the latter. As Peter Krough, Thomas Markussen et al. (2015) and Ilpo Koskinen et al. (2011) have indicated, substantial parts of design research as well as design thinking are, in one way or another, concerned with the instantiation of 'experiments', i.e. as an active intervention forming a product synthesis to be experienced and interpreted. Design experiments are argued to contain both convergent and divergent logics with construction seen as a knowledge production in its own right, and emphasising the process just as much as the end-product (Krogh et al. 2015). Historically the experiment has played a much less significant role in the humanities than in the natural sciences. Until a few decades ago, the humanities research foci on design was mainly an idea-historical inquiry into and study of the aesthetics of the artifacts produced by the arts and crafts fields (Buchanan 2001). Only in recent decades, with the arrival of design thinking, has the constructive practice of design found its way into the humanities as an area of academic interest.

This has led to an increase in fields seeking to include design thinking into their disciplines and research programmes. Klaus Krippendorff (Krippendorf 2005) pointed to more than 650 different areas relating themselves with or claiming a strong kinship to that of design. But if design can be seen as an addition to a wide range of practices, is design then always to be considered adding the same value? Furthermore, in a cross-disciplinary perspective, how can the knowledge contributions of one academic programme be substantiated, extended, or critically evaluated, through either the scope of design or with design as an addition to a different discipline? Unlike pedagogical challenges within 'traditional' design schools, these intertwined problems emerge and pose a risk-taking for students in academia. This is because design is often seen here as an 'addition' to be adjoined and merged into the traditional academic treatment of their field - much in the same way as the DigCompEdu framework proposes it for computational thinking. Hence, while design has been recognised as a softskill in higher education, this poses the challenge of how students balance the core curriculum with the added design and computational thinking skill sets, often differing from the core curriculum.

This implies several challenges: managing the risk of either focusing on solving the problem presented, perhaps downplaying academic reflection in the process, or meeting the academic requirements, but then often lacking the time dealing with the design problem in depth. Students capable of aligning the academic theoretical, and the practical design or artistic part, often manage risk in an imaginative and contextual manner, but as teachers, we are often incapable of explicating how this alignment can be made or taught. At least we cannot, as the DigCompEdu proposes, present a taxonomy with predefined appertaining methods the following of which will ensure problem-solving.

This is probably one consequence of risks being non-calculable, i.e. we cannot design didactics ensuring the desired effect beforehand. Learners

have to rely on a combination of design and critical thinking, with the application of computational thinking as yet another method. The three methods together, on par with each other, can guide a particular inquiry. This implies also that the logic of neither critical, computational, nor design thinking, are self-sufficient. Rather these are to be seen as complementary skills necessary for risk-taking in modern educational and practice settings. This, however, begs the question of how to establish a suitable didactics and pedagogy teaching risk-taking to students.

To answer this question, we now elaborate on Ulrich Beck's (1992) notion of risk-society, and what this generally means for education.

Risk Society and Its Implications for Education

As Steven Bialostok et al (2012, 8ff) claims, studies of risk usually fall in three categories. One focusing on the understanding of risk in other cultures using ethnographic methods (Douglas 1966; 1992), the second inspired by Foucault's notion of governmentality addressing risk as a (socio-politico-economic) power (Dean 1999). Both are relevant and could potentially be used to expand this study. However, our concern here is neither foreign cultures nor conceptions of power, but risk as a modern societal condition for education, i.e. dispersed between conditions internal and external to education, implicitly uncontrollable. Hence, we will focus on the third, namely Beck's risk society.

The notion of risk society was first promoted by the German sociologist Ulrich Beck (and later in collaboration with the British sociologist Anthony Giddens) who in 1986 presented the notion in a book by the same name *The Risk Society*. The idea revolves around the development of late western modernity, what Giddens terms post-traditional society, with the concept of risk and risk management attaining a different and more prominent role than previously.

Modernity, Beck argues, has undergone a process becoming increasingly reflexive (Beck 1992, 155). While the industrial phase of modern society (from approximately 1860 onwards) showed a rapid change in development of technology and production, thereby creating radical transformations in everyday life of people, it still contained less obviously a dependency on traditional social forms, like gender, work and family roles, within a fairly stable and traditional stratified class society. This changes in the middle of the twentieth century, transforming family structures, employment patterns and welfare provisions, thereby redrawing class boundaries and social identities. To give an example, the increase in women being part of the labour market after World War II, presented a challenge for traditional gender roles as well as family structures, which were transformed in the process. Furthermore, with the increasing dissolution of traditional social structures, a predominant individualisation takes over instead. Without pre-given meaningful structures to rely on, each person is left with the task or burden of creating meaning by and for themselves; of responding to different situations through a reflexive process relating themselves to these situations in a meaningful way. Thus, modernity becoming more reflexive implies that any preconceived notions of how our society is supposed to be understood are questioned. Modernity becomes second modernity, as Beck terms our present time, since it is confronted and forced to deal with itself (Beck 1994). Using the concept reflection in reflexive modernity, is therefore also related to reflection as when one looks into a mirror: we are confronted with the (potentially unknown) results and consequences of our own making (Sørensen 2018, 6).

In terms of risks, we can therefore understand the change in society as follows. Before the onset

of industrial society and its recent development, risks were part of a human condition through the occurrence of natural hazards (like diseases, floods, and famine, etc.) as well as human induced hazards like invasion and wars, oppressive forms of thought and culture, and rigid class structures. With industrial society, risk becomes increasingly human-induced as a consequence of our technological mastery over nature. The risks we now face are predominantly results of our own actions. As in the description of design above, this is related to the world of limits, risks related to the concrete physical design, as well as the world of opportunities, being the possible risks related to what can become.

At first these risks were merely local, like the factory-related or occupational hazards following the beginning of industrialisation in the nineteenth and the beginning of twentieth century. Since then, however, they have become more global in character, cutting across the previous stratified society (Beck 1992, 13). One example here is industrial pollution. It is a result of our own making, and in a globalised society, it affects poor and rich, healthy and sick alike. Beck puts it this way that whereas "poverty is hierarchic, smog is democratic" (ibid., 36). The risks we face today are both like the pre-industrial risks, in that we are exposed to them and cannot avoid or guard us against them. But they are also unlike these pre-industrial risks, since they are either man-made or results of what we have done.

Risks then, pertain to society as a whole, and hence also to education. As Bialostok (2015, 561) claims, "Risk lives in and through educators, students, and the policies that govern them at local and national levels, independent of political ideology or party affiliation."

One example of this is the plentitude of educational reforms after the financial crisis, supposed to ensure the determinedness of education towards the demands of the labour market. And as a management of risk, it is independent of political ideology or party affiliation. The latest example of this is the implementation of educational policies in compliance with the DigComEdu report referred to above, across, for example, the European Union. National governments have put into effect an initiative developing and implementing computational thinking skills in kindergartens as well as in high school and university settings, e.g. Danish government (Danish Ministry of Education 2018). And as the analysis of DigCompEdu above shows, the aim here is to reduce risk in education, learning, and teaching through computational thinking as calculated risk-taking.

Whereas the above indicates the importance of a wider societal context of understanding risk and its relation to educational institutions —we could have delved into the neo-liberal economical side as well (Olsson and Peters 2005; Carter 2010) —we also need to consider how risk-taking and the management of risk are internal parts of educations and educational processes, without being reducible to a sole response to demands from the wider societal and political context. Our example of a design module, presented in the next section, will try to capture the complexity in risk-taking as related to external societal and internal conditions. Furthermore, this risk-taking is framed through three theoretical orientations: computational thinking, design thinking and critical thinking; the three of them understood as complementary.

Case: The User-Driven Creative Academy Workshop

One example of the challenge of merging the students' critical reflection on previous and current theories, artworks and designs, and creating a practical design, is the course module Agile Concept Development in a Design Research Perspective at Aalborg University (2018). The course

module is described, analogously to descriptions of traditional course curricula at Aalborg University, in a standardised regulatory form depicting what knowledge, skills, and competency the students will acquire upon finalising the course. However, a major part of the module is executed as a practice-oriented design workshop called The User-Driven Creative Academy (U-CrAc 2018). This workshop is an annual event, with approximately 150 students from different education backgrounds coming together in a three-week interdisciplinary design sprint working with a series of cases from Danish industry companies (Vistisen et al. 2016, Nielsen and Poulsen 2016). The workshop is built upon Aalborg University's model for problem-based learning (PBL), implying the cases represent authentic real-world problems. These then serve as objects of design challenges, where the theory and methods of the different educations can be put into practice. This is framed through an introduction to general theories and methods of user-centered design, gradually being presented to the students as they progress through the three weeks of the workshops' phases: 1) fieldwork, 2) ideation and 3) concept development. Typically, the industry case partners challenge the students to work on an open-ended challenge and not demand a specific solution. Hence, the students are encouraged to explore the foundation for the problem formulation itself, and devise their own innovative strategy for dealing with the problem.

Prior to the workshop, and before being merged into inter-disciplinary groups, the different students receive discipline-specific courses aimed at their specific educational 'role' in the workshop. As an example, students from the participating entrepreneurial engineering programs receive specific teaching about business modelling, while students from a participating humanities program receive courses in interpreting qualitative data sources. Meeting each other in the interdisciplinary workshop then challenges the students to put their programme specific knowledge into play together with the design-oriented shared theories and methods from the workshop. The idea here is to avoid the calculable risk-taking of focusing solely on either the programme- specific knowledge or the design-oriented practice, but instead seeing it as an interplay between multiple and different strategies, with the process leading to a possible compromise or alignment becoming a natural inbuilt constraint. Hence, instead of managing risk by either focusing on solving the problem presented, or adhering to one's specific academic repertoire, the students are challenged continually to reflect on and articulate why a given knowledge domain's theories and methods are, or are not, appropriate in the given situation. Adding the external 'push' of the industry case partner, and the time limit of three weeks to the process of reaching a compromise, these risks are made very explicit. This is especially interesting since the workshop only involves a limited amount of written reflection. Instead, the experience of risk-taking and the making of compromises within a context comprising the clashing of different kinds of academic knowledge with other knowledge domains and the constraints involved in practice-oriented problem-solving is emphasised. This cannot be understood as a form of calculated risk as described above, i.e. using a ratiocinative procedure or a specific method for dealing with the uncertainties encountered through the process. Rather, this is more akin to the idea of creative risk-taking presented by Choi et al. (2018) developing a contextually related sensitivity through the practical use of imagination. However, against Choi et al. (2018), this is not a matter of conjoining risk-taking with some technique of creativity. Instead, students engaged in the process learn that the risk-taking involved in aligning different kinds of knowledge from different domains is a creative process in itself. The experience teaches them that is it a non-calculable process, since no specific method is capable of paving the way to the solution, the outcome

cannot be predicted (failure is a possibility) and the choices made along the way depend in each case on developing a continual acuity mediating a sensitivity of context and practical use of imagination in how to proceed next.

After the workshop, the students are met with one last intervention, inspired by Donald Schön's (Schön 1983) notion of 'reflection-on-action'. The students are tasked with looking back at the decisive moments of making compromises, risk-taking, and breakdowns challenging them throughout the workshop, and annotate these with the core curriculum from their specific academic programmes. This 'Day of Reflection', in Beck's sense, consists of the students re-reading the academic sources, for example, design-oriented pragmatism (Dalsgaard 2014) and phenomenology (Cross 1999) to critically assess their own workshop process. The goal here is to show that while the risks in the design workshop are non-calculable, the academic analysis of creating these post-reflections is ensuring a level of transparency to the design practice. Classic academic critical virtues are here treated as an equal output alongside the practical work done with the industry case partners in the workshop. This reflection-on-practice, of how the design-oriented didactics met (and clashed) with the programme specific theories and methods of the students are thus one way of acknowledging risk-taking to the students.

Discussion

One important aspect of risk-taking in art and design education is thus dealing with uncertainties. This is probably also a better way of capturing the overall sense of risk that Beck wants to express, because he, in contradistinction to the traditional academic way of interpreting risk as a statistically informed calculable uncertainty, wanted to understand risk as non-calculable uncertainty (Sørensen 2018, 6). In relation to design education and our example above, the important term here is non-calculable, i.e. cannot be dealt with using one method only, including formal methods like computational thinking. Instead, risk-taking involves some sort of practical use of imagination (related to the internal condition of art and design education) and is contextual (it includes reflection on different external conditions).

Choi et al. indicates what conditions must be present in an art and design educational setting for non-calculable risk-taking, or creative risk-taking as they term it, to thrive. First, it depends upon an open and playful learning environment encouraging both sharing and the critiquing of multiple perspectives. Second, students need an adequate period of time developing and revising creative concepts. And third, the students need opportunities to evaluate their own performance in developing creative risk-taking capacities (Choi et al. 2018, 4). The role of the educator here is supporting "flexible ways of learning to achieve a balance between critical thinking and creative innovation."(ibid.) We recognise here an aspect of the dilemma presented above, between focusing too much on the critical academic part, downplayed perhaps because of lack of time, the development of concepts and design, versus focusing on problem-solving without accompanying academic reflection. How do we as educators ensure a proper balance between academic reflection and time for immersion in designing?

Well, in general, not by understanding critical thinking as non-creative, and creative innovation as non-critical. During the U-CrAc workshop, the students are confronted with the consequences of the risks they have taken, making it an example of what Beck termed reflexive modernity. Firstly, it underlines the lack of a pre-given overall structure of meaning for the students to consult when dealing with the design challenge. An alignment of their separate knowledge foundations where effectuated, creating an ongoing

compromise-seeking process, similar to a dialogue. Secondly, without this overall structure of meaning, for example, through the use of one single method (which is more like a monologue), a certain individualisation takes over. This occurs on two levels. First, each member of the project team has to contribute meaningfully to the task at hand, invoking their personal academic experience. "Can this method be used here? How is my use of this theory or method different from how others in my project group use it, and how are we to relate it to the challenge before us?" Reflections like these help the creation of meaning for group members individually but also for the group as a whole. Second, the project group itself becomes individualised as well. The reflection-on-practice creates a space where the group as a whole reflects on what they have done in particular, to problematise and solve this particular design challenge. The reflection then, becomes the mirror which is alluded to in Beck's notion of reflexive modernity: it is the mirror where the students are confronted with the results of their creation, the choices made through the process leading up to it, and the justification of aligning all the different interests and knowledge being part of this process as well. U-CrAc, then, exemplifies how an educational course works with a concept of non-calculable risk-taking, which is reflexive in factum as well as post-factum.

Conclusion

In this paper, we have posed a number of questions concerning risk-taking and design education. Using an example from Danish design education, we have presented a case for considering non-calculable risk-taking as a highly important part of an interdisciplinary perspective including design. We argued against the recent trend of DigComEdu replacing risk-taking with (computational thinking inspired) methods reducing any uncertainties necessary for students to learn. As frames supporting this claim, we presented firstly, an interpretation of the development of design, understanding the risk-taking of students as aligning the academic reflection based on the core curriculum with the thinking of design. Secondly, we related this to Beck's notion of risk society, and the challenges it poses to education. To exemplify this, a design course U-CrAc from Aalborg University, where non-calculable risk-taking is an important part, was presented and discussed. This indicated that future policymaking related to design educations similar to DigComEdu, need to address and include considerations of the inherent non-calculability and abductiveness of design besides the formal and computational skills, to ensure the readiness of modern higher education when dealing with the challenges of the twenty-first century.

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Bio

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Studio In-Situ: From Disjuncture to Dislocation

Michael Louw

32—43

This photo essay explores the possibility of radically shifting the understanding of the design studio as a spatial construct. By considering the seven-year evolution of a (so-called) design-build project known as the *Imizamo Yethu* Water Platforms, it recognises the possibility of dislocating the design studio from its traditionally centralised space in the academy and moving it to the site of its investigation or intervention for the duration of a project.

The *Imizamo Yethu Water Platforms* aimed to improve water and sanitation infrastructure in a severely under-resourced informal settlement in Cape Town, South Africa, through the insertion of small permanent public spaces. Due to a number of reasons, including the physical characteristics of the sites selected for these spaces, the design studio gradually shifted its physical location to such an extent that virtually the entire design, documentation and construction process took place in-situ.

#architectural education

#design-build

#design studio

#infrastructure

#live projects

Flows, Fluidity and Fixity

The *Imizamo Yethu Water Platform* project was a (so-called) design-build project in Cape Town, South Africa, that was run by the University of Cape Town's School of Architecture, Planning and Geomatics from 2010 to 2016 (Louw 2012). The project was initiated as a response to a severe lack of water and sanitation infrastructure in the settlement of *Imizamo Yethu* which was, at the time, one of Cape Town's two most poorly serviced informal settlements. The population of roughly 25,000 people had to share sanitation infrastructure to the extent that, on average, every toilet was shared by more than 60 households and every tap was shared by close to 400 households (Louw 2016, 214).

As with most informal settlements, the static nature or relative lack of infrastructural flows below ground is contrasted by the fluidity of the built fabric above ground. Houses are continuously being built, demolished, rebuilt, expanded or destroyed. Fires are a regular occurrence and the lack of infrastructure as well as constrained accessibility means that lives are lost regularly, and destruction often occurs on a large scale (a devastating fire in 2017 destroyed almost half of the informal settlement). Space is contested and negotiated, private and public space is temporary and some of the only permanent features are tarred roads. The water platforms, besides contributing to the provision of water and sanitation infrastructure, also aimed to provide a handful of permanent public spaces or points of fixity in a settlement that is continually in flux.

Disjuncture

Notwithstanding the challenges that are encountered when building, the challenges encountered when designing in a space like *Imizamo Yethu* are multiplied by a lack of data (there are no detailed contour maps, municipal surveys, servicing layouts, or information on tenancy and ownership). Even when professional surveyors are commissioned, the surveys cannot indicate the unpredictable conditions below ground where poorly constructed retaining walls, illegal service connections, concealed waste dumps or former dwellings amongst others, are encountered when building starts. Open sites for projects that are identified with community members are often built on in a manner of days from when a survey is done to when the site is visited by students for the first time. The unpredictability of what is below ground and the rapidly changing conditions above ground mean that traditional methods of documentation, and withdrawing to a studio that is removed from the site of investigation or intervention, cannot respond quickly enough to rapid change; the linear process of documenting, designing and constructing has to be compressed or disrupted to the extent that these processes happen simultaneously on site in what Jonathan Foote (Foote 2012, 53) refers to as a dialectic process instead of a linear one. John Habraken (Habraken 2007, 13) is of the opinion that despite its many advantages, the design studio is often disconnected from the outside world and he argues that there are three specific factors that do not lend themselves to studio teaching: constantly changing environments, a distribution of design control, and the fact that there is often a lack of shared values between role players.

In many parts of the Global South, and in South Africa in particular, there are ongoing calls for the decolonisation, transformation, and reframing of tertiary curricula with varying levels of actual response. At the same time the academy is beginning to recognise the need for, and value of, engaged scholarship and social responsiveness in terms of teaching and research. Ashraf Salama and Nicholas Wilkinson (Salama and Wilkinson 2007, 5) are of the opinion that "Contemporary societies are in a continuous process of transformations and learning systems should respond

to the changes associated with these transformations." While the design studio as a "social and organisational setting" (Habraken 2007, 11) is well placed to engage with these issues, as a spatial construct it is often hampered by its traditional positionality within the physical confines of the architecture school. Perhaps it should be considered that the space in which learning takes place also needs to change.

One way to do this in architectural teaching is through practice-based or online learning (whether this is through individual consultations, online group seminars, MOOCs or, as has happened since the writing of this article due to the COVID-19 pandemic, the ubiquitous Zoom call) which is becoming increasingly common and it is making the discipline more inclusive and accessible to many disadvantaged students. While peer learning and the capacity to absorb increased student numbers can be accommodated in these modes of teaching to some extent, the simultaneous connection with a community and a physical site as a group is not so easily accommodated. The flow of information and resources through technological means is mainly between the academy and students, and the challenge remains how to channel these flows to and from marginalised non-academic constituencies.

The disjuncture of the studio with communities, whether physical or virtual, becomes more apparent in conditions of increasing uncertainty. The *Imizamo Yethu* project is a case in point where structural inequality that was cemented by former apartheid policies is escalating, while political instability and widespread national student protests that happened during the last two years of the project challenged the very fabric of higher education directly. These, amongst many other factors including the uncertainty of physical space itself (both an inability to access studio space on campus due to protest and the fluid nature of the site) meant that over time, the project saw a gradual diminishing of the use of the traditional studio space.

The project was initially integrated into the design studio for two weeks before progressing into the technology course for two weeks and then moving onto site for two weeks. This changed to a prototyping exercise in the technology course before moving on to site for two weeks, until eventually the entire project took place on-site with only minimal preparatory design work being done beforehand. In terms of documentation, some elemental surveying was initially performed on-site, but this could not surface a range of unknown factors concealed by vegetation and below the ground surface. Smartphones were used to document the site continually through digital measurement, photography, and photogrammetry. This assisted the decision-making processes where designs became assemblages of a collection of standardised precast components and found objects. This process, where the documentation, design, and construction happened simultaneously, enabled a more dynamic responsive approach and allowed students to be less protective over their design ideas. Similar to Foote's experience (Foote 2012, 53), there was often no clear vision of the overall design at the start of the building process. No information was fed to a centralised studio, but the studio took place in-situ.

In terms of pedagogical transformation, the in-situ studio allowed students with skills other than those that are typically valued in the academy to come to the fore. Most of the participating students had never been in an informal settlement prior to the project and they were often initially uncomfortable. The importance of lived experience, the knowledge of social practices and indigenous languages, practical and artisanal skills, and being used to spaces of discomfort or uncertainty amongst others, mean that different students can show leadership and gain confidence which they may not have achieved in the traditional centralised studio space.

Dislocation

According to Ashraf Salama and Nicholas Wilkinson (Salama and Wilkinson 2007, 4), "Research indicates that designers in academia still distance themselves from

the real world, and still barricade themselves from real human problems, while missing the opportunity to learn from the richness and depth of human experience".

The dislocation of the design studio from its traditional centralised space in the academy to an in-situ condition in marginalised spaces challenges the means of documentation and design, and the pedagogical structure and tools used for its delivery. John N. Habraken (2007, 17) notes that "If we carry responsibility for [the] everyday environment, we must study it." The word "studio" has its roots in the Latin word *studium* which means to study, and this implies the application of time and careful attention. The in-situ studio should be embedded in the community over time in order not to be a form of architectural tourism; it should provide what Rudolf Perold and Hermie Delport (2018, 43) refer to as "educational spaces in which critical citizenship can be fostered." It should also be about going to the site and staying there for the duration of a project and beyond without retreating to the comfort of a centralised space in the academy. A design studio in any given context takes time to develop and while methods may be conceptualised and applied in different situations, real engagement cannot. If studio teaching "transmits the values of design professions and society at large" (Salama and Wilkinson 2007, 3) then the values and ethical base of the design professions and society in a vastly unequal society like South Africa should be challenged to reevaluate their modes and spaces of transmission. The displacement of communities should be echoed by a displacement of the focus of design professions and societies, which essentially entails a shifting of the spaces of power.

The in-situ studio, whether it is a design-build studio or not, is a dislocation from the centralised comfort of the academy into a space of discomfort. The situatedness of the studio within a community implies a shifting of the direction of social, economic, and technological resource flows; where these formerly ran from the site via the centralised studio to the student, a situation can be established where these resource flows become reciprocal with the greater balance running towards the community. The dislocation of the studio raises several questions: What happens if students are not able to withdraw to a centralised studio? What is the role of the traditional centralised studio in the future? It might even raise the taboo question of whether the centralised design studio is needed at all.

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Figure 1 (top): Students surveying the burnt-out interior remains of a building in Imizamo Yethu which was severely damaged due to arson; the mural on the external façade was painted after the fire damage which results in a curious inversion of inside and outside. *Source: author*

Figure 2 (bottom): Students from the BAS(Honours) elective, Studio Glocal, on a site visit to *Imizamo Yethu* to prepare for the design of a new Community Hub building which will incorporate the burnt-out remains shown in the image above. The water platform that was completed in O.R. Tambo Road in 2011 is visible below the tree on the left. *Source: author*

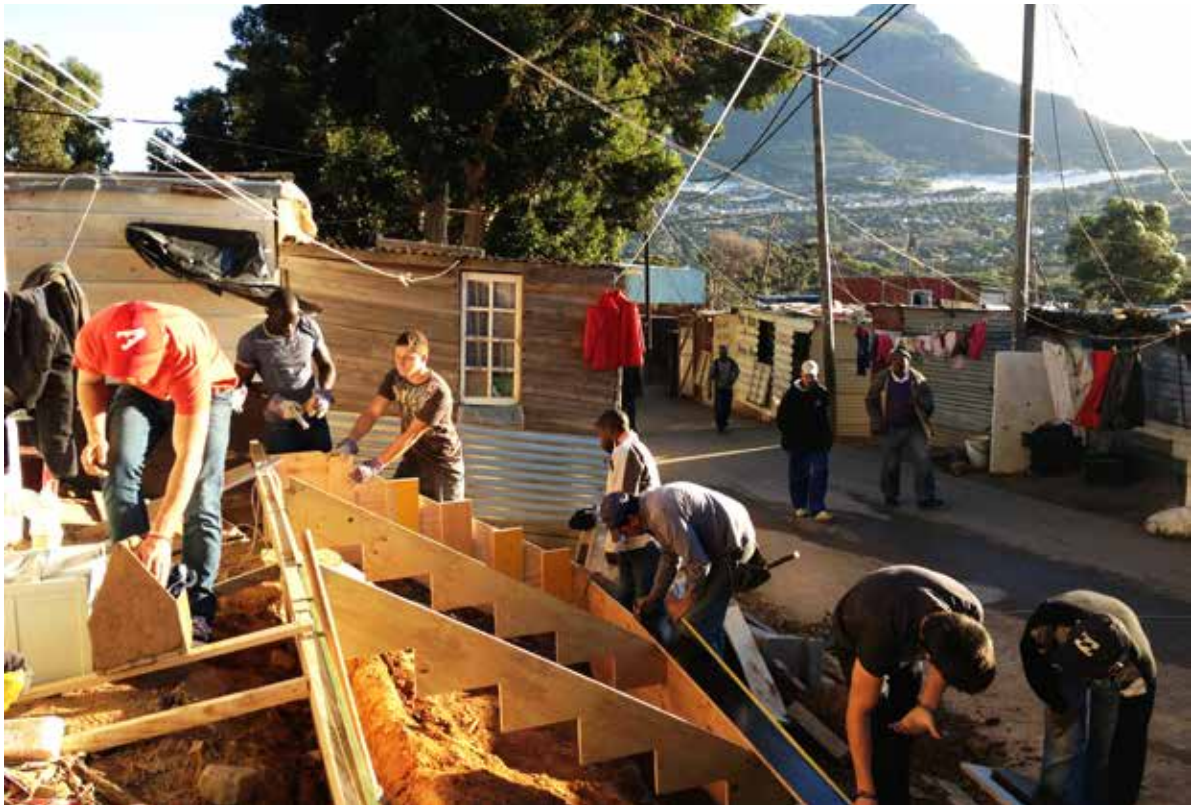


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Figure 3 (page 37, top): Students assembling the formwork for the staircase that leads up to the 2012 water platform from O.R. Tambo Road in Imizamo Yethu. *Source: author*

Figure 4 (page 37, bottom): Students passing bricks to local community members who are building a support column for the 2013 water platform. A mural by an unknown artist is visible on a precast toilet block in the background. *Source: author*

Figure 5 (page 38): Students assembling the shading structure over the 2013 water platform. The structure is made out of stainless steel cables and short repurposed timber sections which were formerly the studio floors in the School of Architecture, Planning and Geomatics's Centlivres building, but they had to be removed due to water damage. *Source: author*

Figure 6 (page 39): Students assembling the shading structure over the 2016 water platform. The structure is made out of stainless steel cables and repurposed milk bottle tops which were purchased in aid of Operation Smile, an organisation that funds operations for children with cleft palates. *Source: author*

Figure 7 (page 40–41): Students engaging with local community members while designing the 2016 water platform in situ. *Photography: Stephani Perold 2016.*

Figure 8 (this page, top): Students passing repurposed concrete test cubes to the site of the 2016 water platform. These were used as pavers and supporting structures for washtops. *Source: Photography: Stephani Perold 2016.*

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037

Blended Learning Strategies for Advertising Design Studies

Gladys Lam Wai Ling

44–53

Technological developments have brought profound challenges to design education. To understand how design educators adapt to new technological directions, this article examines student feedback from advertising design courses that apply blended learning approaches. This study identified three blended learning strategies conducive to meaningful learning: timely and meaningful feedback; engagement with real world tasks; and support from expert tutors. This article also discusses potential resistance and challenges in implementing instruction in blended technological environments.

#blended learning approach

#design studio pedagogy

#student learning experience

#student perception

#meaningful feedback

Introduction

The astronomical development of technology has brought profound challenges to design education. With the market of personal handheld devices becoming more mature and unlimited authentic resources becoming available online, learning can occur anywhere, anytime. Thus, there has been a rapid increase in accredited online courses offered by universities around the world. Technology communication allows students to control the time, place, and pace of their learning. Students are increasingly demanding a quality learning experience with convenience and flexibility. The role of the teacher is to foster a learning environment that is learner-centered and focused on the process of delivering a quality learning experience (Beetham and Sharpe 2013, 31-48).

The learning experience is one of the core components of student satisfaction and academic success. Thomas Fischer (2004) argued that design studio disciplines need to move to the next stage of their existence in terms of what they can deliver. New models are now emerging in response to changing needs. There may be a virtual studio where design students learn by doing things remotely. Technologies have changed not only how students learn, but also ways that students expect to learn and behave. How should design educators adapt to the needs and challenges of this new technological era?

Background

Design education has a long tradition of using studio pedagogy, in which teachers provide feedback and suggestions to students on their designs throughout the creative process. This is done face-to-face. Such communication generates energy and enthusiasm that helps students remain motivated throughout the design process. The teachers are the domain experts who guide and advise students on their projects. Student–instructor interaction is central to studio-based educational practices. In this setting, on-the-spot communication between students and teachers is spontaneous and contagious, but also viewed as "off the lip" (Meyer 2003, 61). Students must remember what has been said and be mentally and verbally quick to respond and clarify their responses.

Blended learning is the integration of synchronous (face-to-face) and asynchronous (text-based Internet) learning experiences (Garrison and Kanuka 2004, 96). What distinguishes blended learning from traditional classroom-based and online courses is the combination of in-class teaching and out-class learning through computer-based technologies. It is characterised by the use of multiple instruction and delivery channels that can retain the best of face-to-face and online learning experiences. Asynchronous Internet communication has the ability to facilitate an important reflective element because it emphasises written communication. Writing encourages reflection and thinking both creatively and critically. Although some competency is required to write skillfully, all students are provided with an opportunity to learn how to clearly express themselves in written form.

Communication can also provide a permanent record and thus expand learning time. Students can revisit instructors' comments as needed. The communication is accurate and no information is lost. Written comments are often less intuitive and better thought through because instructors can think, research, and provide feedback. The most well-known model of blended learning is Anthony Picciano's Blending with Purpose Multimodal Framework (Picciano et al. 2013, 2). Picciano's framework comprises six objectives for educators to take into account for planning their teaching design and delivery, which include con-

tent, social/emotional, dialectic/questioning, collaboration, synthesis/evaluation, and reflection. The essence of this model is the ability to meet the needs of a wide range of students with different backgrounds, learning styles and personality types. There is evidence that blended learning has the potential to be more effective and efficient at constructing meaningful learning experiences than traditional learning methods (Kintu et al. 2017, 11). Therefore, blended learning has become an essential approach to the future of education. However, success depends on a well-designed strategy to effectively integrate Internet technology with the most desirable and valued aspects of face-to-face learning.

An effective blended learning setting requires the design of learning tasks, learning support, and learning resources (Herrington et al. 2005). Learning support refers to the capacity to interact with systems, peers, and tutors in the learning process. Students often turn to their peers for company and seek support and advice from their tutors to guide their projects. Providing this support in a blended learning setting establishes a sense of community and promotes higher-order thinking and conceptual development that is often not achievable in an individual learning setting (Brook and Oliver 2004).

What is needed in a blended learning setting is not only the use of technology but a blended learning strategy. Such a strategy is a deliberate set of learning activities and an environment that engages learners in a process that results in the required learning outcomes. Jane Herrington and Tom Reeves identified ten design principles that characterise authentic learning tasks: real-world relevance; ill-defined tasks; complex tasks; opportunities to examine, collaborate and reflect; going beyond domain specifics; integration with assessment; creating valuable products; and allowing for competing solutions. These ten design principles also apply to effective learning environments in which technology is present. In addition, David Boud and Michael Prosser (2002) argued that high quality learning activities must demonstrate four principles: engagement of learners; acknowledgement of context; challenge for learners; and the involvement of practice. Blended learning offers opportunities to deliver on several of these principles.

Design studio pedagogy has a long tradition of offering project-based learning and mentoring support to students. With the introduction of technology-facilitated classroom management platforms that allow chat rooms, forum discussions, and blogging for community learning, learning support has never been lacking. However, research on applying blended learning strategies to project-based studies has found that faculty members and students do not benefit from using eLearning systems (Ma 2016). In a study of engaging creative media students' motivation, the author suggested that faculty should give students more power over their learning process with their projects because autonomy is a primary motivator (Oh et al. 2018). Learners live in a digital world where they can retrieve information easily and communicate with almost anyone. Flexibility and convenience are increasingly important in the technological age, and it is inevitable that educators will adapt to this new direction. Thus, more research is required to gain a deeper understanding of students' perceptions on effective blended learning approaches to design education.

Research Questions

This study examines blended learning strategies for project-based advertising design courses. It aims to find out the determining factors in student satisfaction and understand the essence of the relationship between students' learning experience and the blended technological world.

The research questions that guide the study are as follows:

1. How do undergraduates perceive and experience their advertising design courses?
2. What blended learning approaches do students find effective?

Research Context and Methodology

The sample was collected from advertising design courses at the School of Communication, Hong Kong Baptist University. Formal written feedback was solicited from students at the end of their courses over eight academic years. These courses were offered by the Communication Studies Department to undergraduate students enrolled in the bachelor's of social science (Hons) program in communications, majoring in either public relations and advertising or digital graphic communication. The design courses under investigation included Advertising Design and visualisation, Advanced Advertising Design and Visualisation, Advertising Copywriting and Guerrilla Advertising. The courses ran for 13-14 weeks, three hours a week, with an average enrollment of 24 students. These students were Year 2 and Year 3 communication students majoring in either advertising (PRA) or digital graphic communication (DGC). The average ratio of female to male in the classes was approximately 7:3. Participation was voluntary with the response rate ranging from 28 percent to 88 percent.

The feedback was collected during the last week of the lessons and released to the course instructor within two months. The feedback was collected via online questionnaires, with eight questions to assess aspects such as course preparation, delivery, and learning environment on a five-point Likert-scale. The questionnaire also included three descriptive questions to invite respondents to describe their experience in their own words: 1) Describe some good points about the course; 2) Describe some areas of the course that could be improved; 3) other comments. The quantitative data indicated students' levels of satisfaction regarding the overall teaching effectiveness of the courses, but the data did not provide much information on the core factors behind this satisfaction rating. Therefore, the main data was derived from the students' individual written narratives. Unlike reflective journal assignments, formative feedback by participants at the end of a course is a way to evaluate the effectiveness of the teaching and improve the course in all dimensions, such as preparation, pedagogy, delivery, and learning environment. All of the responses were anonymous. Because of the nature and timing of the survey, the students had no reason to please the instructor to obtain a good grade. Thus, the narratives were true to the respondents' experience and based on their personal judgment.

The method used was qualitative inquiry with the phenomenological approach. The study of phenomenology pertains to the analytical and descriptive experience of individuals, emphasising their first-hand descriptions of phenomena (Creswell 2013). During the analysis, excerpts and quotes were grouped based on the latent meanings expressed by each participant. Through clustering the invariant constituents, or themes, found in the narrative descriptions are uncovered during the reduction process. Only themes that are representative by each class of participants are checked against the overarching topic, which in this case is blended technology. By outlining the reoccurring and prominent themes across all participants, common themes were identified such that only dominant phenomena with high consistency were considered. Finally, the most essential elements that informed the experiences were conceptualised. In this case, the individual textural-structural descriptions of each participant were not applicable. A composite description of the "meanings and essences of the experience, representing the group as a whole" was presented

instead (Moustakas 1994, 121). The narratives have remained in their original language and a selected few have been presented in the findings.

Results and Discussion

Three themes were identified from the analysis of the data: meaningful and timely feedback, real world activities and supportive expert teachers.

Meaningful in this context refers to giving feedback that students appreciate, feedback that provides value to them, and helps them fulfill their purpose for the course. In examining the technology that facilitated the learning environment, students appreciated "meaningful comments" and "prompt replies." One student cited an incident in which she "was desperate" and wrote an email to her teacher late at night. She was pleased to receive a quick reply. With technology, students can approach their instructors with their own design problems anytime and anywhere through technology-mediated communication. Teachers can provide help when students are most in need. Giving students what they need when they need it does not mean that they are being encouraged to ask frivolous questions. It is meant to show consideration of their needs when they call for support. Technology facilitated communication enables teachers to differentiate the individual needs of students. It facilitates personalised learning and student-centered education. It also avoids an overabundance of opinions because it is the learner who invites the feedback. Some students do not like tutors to intrude on their creative endeavors. Teachers must learn when to give comments and when to stop giving them. Technology-mediated communication helps teachers identify such needs.

Students of PRA and DGC from the Advertising Design and Visualization course wrote the following comments:

> *"I learnt a lot from Gladys' class, no matter advertising knowledge from her real field experience or from her fruitful teaching. I think Gladys is really a good, responsible teacher and she treats us very well. For example, one time I was desperate in creating new ideas for our print ad, I wrote to her through student mail [and] unexpectedly got the answer from her very soon as it is almost very late at night. However, Gladys being a strong passionate and dedicated teacher, she gives me a prompt reply plus offering very meaningful comments on my print ad. I am so glad to have such a great teacher and I hope to continue learning from her :))"*

> *"Nice and responsible tutor. Always have a quick email reply, very appreciate =]"*

The students also enjoyed seeking the teacher's "professional advice" outside class and viewed this as "valuable guidance." The students said that the teacher "judges right and criticises right" and her comments were "constructive," "clear," "useful," and "inspiring."

> *"This class gives us many chances in practicing execution, it is a great chance for us to make an improvement in doing advertising. The lecturer gives a big freedom for us to develop our creativity and also gives us many opinions in our works. That's great!!!"*

> *"She is creative. And she really knows how to art direct. She judges right and criticises right."*

Clear and precise feedback is paramount in design education, whether it is in a traditional face-to face or technologically mediated settings. Written feedback requires special attention and skills. To achieve clear feedback, it is better to write in short paragraphs or in point form. Different stages of the creative process require different formative feedback. During the idea-generating phase, students ask for advice on the potential of their ideas from a pool of rough concepts.

Under normal circumstances, feedback includes:

1. Choosing the best potential idea and backing it up with reasons.
2. If nothing appears to be appropriate, provide direction.
3. Offer suggestions, if it appears to be helpful.
4. Encourage idea development.

During the idea execution phase, students ask for advice on design layouts and production. Comments could be made on refining the art direction and copywriting. The core task is to make sure that the idea can be effectively conveyed through appropriate executions. For clarity and elaboration, both parties could attach layouts, examples and reference links to their communications.

Technologies have caused a revolution in creative production through the Internet and this has materialised in real world activities. Anyone can post his or her creative work on YouTube, social media and many other online platforms. The Internet has become a dynamic medium for interconnecting people and co-creating. These changes in social systems have transformed the ways designs develop, based on knowledge, collaborative processes, and cross-disciplinary practices (Sanders and Stappers 2008, 8-9). Design educators can use social media to design all sorts of simulated tasks based on real world activities. Meetings with "real" people or launching "live" projects enables students to better understand the societal context and their own potential as prospective professionals.

In this study, the students considered their learning effective by launching their projects on the Internet and joining competitions. They said that "having a real campaign" was "really great." It helped them "learn by experiencing the real situation" and created opportunities for them "to think deeply about the practical problems." They also found the project to be "really challenging" and said that "watching our own project be shown to society was exciting." Launching a "real" campaign helped students learn "more practical knowledge" and "made the course more interesting." They remarked that it was "meaningful" and "valuable" to have an opportunity to join a real world competition that was "so interesting," and said it "really inspired us to learn."

Students of PRA and DGC from the course of Guerilla Advertising gave the following comments:

> *"Watching our own project be shown to society is an exciting time for me. The final project is really a challenge to me."*

> *"It's nice to have our work launched, and receiving feedback from the public. Got more practical knowledge of launching a campaign."*

> *"Lots of examples to help us understand this up-to-date hot topic. It is really great to have a chance to visit the advertising firm and get the really updated example to understand this trend of advertising thoroughly. The practical part of having a real campaign can make everyone learn through experiencing the real situation."*

The students also showed interest in participating in relevant creative industries events such as "guest talk" and "agency visit." They said that they like listening to "real design field experience" because they were keen on preparing their "portfolio" for their "future design career."

> *"Miss Gladys' lesson is always eventful, innovative and interesting. Her homework and project made me learn a lot and it was rewarding. The most lovely part of Miss Gladys' lessons were that she always shared a lot of her real design experiences in the field, which prepared me massively to prepare my future design career path."*

Participating in a real competition was very challenging and practical at the same time to the students as they could put their experience into their portfolio.

In the traditional classroom, the teacher often collaborates with industries and invites practitioners to brief the students or provide face-to-face critiques. In the technological age, these activities can be done in a virtual environment. Creative reviews are critical in design education because they simulate professional practice. Instructors need to systematically evaluate the effectiveness of advertising campaigns to promote students' critical thinking. Students need to nurture critical thinking skills to inform the right decisions when choosing the best potential idea. Although the mentor is usually a professional expert, creative work is subjective in nature. By inviting client briefings or professional judgments, students can learn from a diversity of people and benefit from different opinions of those from different backgrounds. Involving industry professionals to provide a few important creative reviews before the final critique would be ideal. Virtual judging can also save commuting time for busy practitioners.

The final theme being supportive expert tutors refer to those who have extensive knowledge, experience and ability in a particular design profession. When the students were asked to describe some good points about their course, they repeatedly mentioned their teacher. The students perceived the teacher as "very warm-hearted" and "passionate," "dedicated" and "always ready to help." She "used her extra time" "to give support" to the students. The students said the teacher was "really kind" and "treated us very well." They admired her because she was "a veteran" with "lots of industry experience" that "gives us a lot of inspiration." The students expressed their admiration and hopes to continue to be taught by her.

> *"As Gladys is a professional creative advertiser, I would love to seek her continued experience sharing in her real-advertising field. Listening to her experience is really fruitful to me :))"*

> *"I think it is so great that the lecturer is an expert in this field. I really admire her and I hope to continue to attend the classes that she teaches."*

> *"She is really kind and always ready to help with her great competency of advertising. I love her!"*

Design educators are usually domain experts. Expertise in the field helps cultivate critical and creative thinking skills in the students. However, not all experts are good teachers. Merely being an expert is not enough. The students looked for a dedicated, passionate, and supportive expert. Joe Ruhl (Ruhl 2015) argued that teachers should possess two loves; love for the subject and love for the kids. It is "genuine, decisional and puts the other person first" (ibid., 47) kind of love that motivates and inspires students in a powerful way.

What is keeping educators from integrating blended learning? Formative feedback is labour intensive, both for the learners and the tutors. Online feedback for teachers is more labour intensive than face-to-face communication due to the amount of time required to respond to questions. To provide feedback, teachers must regularly read and comment on the students' postings. Educators have often said that written communication may not be as effective as speaking face-to-face. However, written communication could become clearer if the core subjects were presented in points supported by references. Even without that, written communication allows students to fill in knowledge gaps through their own inquiries and gives them access to unlimited online information.

Interactions with students after class take up teachers' personal time. It is the teacher's decision whether to embrace the students' participation

outside the classroom or to end the interaction after class. Students learn this on the first teaching day when the teachers establish the classroom rules. Imagine if teachers spoke about the rules on the first day of the class and either required the students to send emails at least one day prior to an appointment or welcomed students to drop by their office for advice. Given that the core learning in design education is to complete a project, for a teacher, making himself or herself accessible is important. Students can find someone to turn to for support and guidance and respond to their questions during the creative process. However, this is not always possible for teachers and professor-track educators who have a heavy workload and a demanding publishing schedule.

Technological glitches have also hindered the willingness of teachers to adopt the blended approach. Although there have been classroom management platforms such as Moodle and Blackboard, students and teachers might not feel comfortable using them as channels for communication. These e-platforms require online logins and take time to load. Even then, notifications are not always available. Blogs for students' reflections, for instance, required a long time to load and could not be downloaded as a file. It was not user friendly and some interfaces could only be displayed properly on a computer, not a handheld device. People are creatures of behaviour and once they become used to a certain platform, they stick to it. For example, most of the students preferred to communicate via email, Facebook Messenger or WhatsApp. These communication technologies are very convenient and reliable in terms of their pop- up notifications. Educators should allow for flexibility and not limit communications to a specific platform. If the platform is too rigid or abrupt, a change may produce resistance and restrict interactivity. Thus, as long as teaching and learning activities take place, we should not limit them to classroom management platforms, although this would mean that universities would not have a history of documented conversations.

To address the concerns above, universities could support teachers by providing release time and recognizing that technological interactions are time-consuming. They could also provide instructor training when technological tools are introduced. In a teaching culture in which adaptability has become the golden currency, it is important to support teachers who are guiding learning in a new environment and are learners themselves. If resources are provided in a personalised way to both teachers and learners, blended learning can evolve dynamically, in a managed way, toward a more interactive and successful pedagogy. What matters is not only how technology can be integrated, but how learning can occur in an enhanced and engaged way.

Conclusion

A qualitative enquiry into advertising design courses revealed three effective blended learning strategies: meaningful timely feedback, real world tasks, and supportive expert tutors. Design education fosters learning by devising projects and helping students learn through feedback provided throughout the creative process. The most important skills teachers should have include knowing how to facilitate learning, design meaningful activities, and create an appropriate environment beneficial to students' learning experience. When using technology, the quality of the experience is more important than the use of the technology itself. Technologies overcome barriers of distance and time to bring everyone together, helping students learn. We need instructors who have instruction skills in both traditional classrooms and virtual environments so that they can handle students' changing expectations, behaviours, and needs. Many educators still insist on face-to-face communication in their teaching and learning activities. They should learn the positive impact of

relinquishing control to the learner. An instructor's decision to implement a blended learning environment and use technology in his or her course depends on the faculty's preparedness to effectively facilitate and manage both online and face-to-face discussion and interaction. Beyond that, it requires teachers to be flexible, committed, and have a positive mindset (Markoff 2014). It also calls for school support and leadership to facilitate change and overcome resistance.

Limitations and Potential Further Investigations

The study was limited to an examination of students' perception of their experience in advertising design courses, primarily with a focus on the development of technology. While individual perception is useful to understand factors behind the phenomena examined, self-reported data includes a degree of subjectivity. To further understand design teaching with technology, future research may consider studying a broader context for the learning experience in design education, for instance: mistakes and learning processes (Wenzel 2002), design making and thinking (Mitcham 2001), critique and learning experience (Hokanson 2012).

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Bio

Gladys Lam worked in advertising for 16 years and served as a creative director of international 4As agencies, winning numerous awards worldwide before joining the Department of Communication Studies, Hong Kong Baptist University in 2006. She taught a variety of advertising design and creativity subjects and supervised honours projects. In addition, Gladys introduced new courses for the school and interdisciplinary general education, presenting the paper in the Global Conference on General Education and University Curriculum Reform at City University of Hong Kong in 2012. She has also published research findings in American Academy of Advertising Global Conference Proceedings. Her current research interests include advertising visual and copy strategies, advertising design and creativity education.

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‘Time to Be an Academic Influencer’: Peer-to-Peer Learning Enhances Students’ Self-Directed Learning with Disparate Knowledge Background in CAD

Iain Choi
Fann Zhi Jie

54—69

This paper explores how Peer-to-Peer learning can level-up students' understanding of computer-aided design (CAD) with Autodesk AutoCAD programme for Interior Design Year 1 students.

As students come from different knowledge backgrounds, they approach the module with different understanding levels, with the weaker students unable to follow the live demonstration tutorials.

A peer tutoring assignment using a student-led peer-to-peer learning pedagogy, was introduced to advance students' understanding and internalise content better by reinforcing their learning. Each group has an equal proportion of students with different levels of knowledge and capabilities, and each group member conducted self-research on a topic segment, shared their knowledge and findings within their group, and thereafter curated a 15-minute lecture and facilitation workshop for peers. Tutors provided consultation and mediation, encouraging students’ participation.

The assignment’s results showed that the peer-to-peer learning approach efficaciously empowered students and motivated learning, enabling them to be self-directed learners.

#self-directed learning

#peer-to-peer learning

#computer-aided design

#peer teaching

#peer tutoring

Current Situation

Interior Design Communication 1 (IDC1) makes up a critical part of the diploma in interior design studies in Singapore Polytechnic. The year 1 Design students have to learn computer-aided design programmes, AutoCAD in particular, and use it to produce professional presentation drawings for concept presentation or construction purposes.

The foundation year curriculum consists of fundamental subjects as shown. (fig.1)

Problems and issues faced in the past existed mainly as tutors traditionally used the instructional-based teaching method for this module, whereby the tutor goes through the basic commands and tools in class, and students will subsequently follow the steps and create the desired outcome given by their tutors. The module has been in this pedagogical format for the past 10 years.

Students frequently grumble about the pace of the instructional tutorials, claiming that it is too fast for them to follow-through and apply them as practice exercises during the tutorial.

> *"IDC is a heavy module that many people have a hard time understanding as the module requires us to rely heavily on computer software, AutoCAD. Many of us have a disadvantage especially for those who are very new to it. I feel that it can be improved by having an online tutorial demonstration by the lecturer to help us understand better."* said Student A, Secondary School Leaver.

Yet, some students find the pacing too slow, or rather, too easy for them.

> *"The lessons greatly helped me improve my drawing skills be it on AutoCAD or hand drawings. We are taught a lot of drawing techniques and hatching techniques that are fun to learn. Engaging and relevant to other modules, the module helps me in my future and I learned a lot of new functions of AutoCAD and learned how to draw environments in different perspectives,"* said Student B, ITE Graduate.

One major issue faced by the teaching team is that students come from different backgrounds, in terms of their technical and design skill sets. They are from either the traditional secondary school system or graduates from The Institute of Technical Education (ITE), who already have three years of basic vocational knowledge experience, which often includes AutoCAD for those who studied an interior design / spatial design course.

Secondly, they belong to a different generation of students, who think, and behave rather differently. Most of our recent students belong to a blend of the 'millennials' and the 'centennials' generation group.

The millennials are known to be autonomous, tech-savvy, very self-confident, sociable and diverse, but also practise extreme individuality, expect quick information, and care about their personal progress (Immerwahr 2009, 233-245). They also value reward for participation, rather than reward for achievements (Mesister and Willyerd 2010, 88).

At the same time, in Polytechnic education, students are now approaching the 'Centennials' generation group, who have their unique thinking and behavioural traits. Born after 2001, they are less self-absorbed but more self-assured, more empathetic, vigilant and more sensitive to the outside world and their peers compared with their Millennial counterparts (Jain 2015, 59).

The current didactic teaching method proves challenging for the two groups of students who belong to a blend of these two generations, to learn the subject effectively.

The teaching team felt that there is a need to test out a new approach in view of the current gap and set out the aims to achieve an active, specially

curated, way of teaching by permitting a more active role for the students themselves, which may allow a paradigm shift of student's mentality towards their learning.

Intervention Research

The teaching team strongly felt that a peer tutoring method has the potential to be introduced into the syllabus based on the students' profile, as collaborative learning can be generated by peer tutoring, which allows students to learn from their peers. In turn, they develop self-directed learning skills among themselves (Choi, Jakob and Anderson 2017).

Peer tutoring is a teaching method, conducted by people who belong to similar social-groupings (e.g. design students), to help each other acquire knowledge among themselves at the same time (Topping 1998).

Similar to peer-to-peer learning, all students have the opportunity to share knowledge. In this setting, each student will have a chance to function as a peer tutor, or tutee at differing times, wearing different hats, both as the knowledge giver and receiver (Hott, Walker and Sahni 2012, 7).

By doing so, students themselves can learn from each other's strengths and alleviate each other's weakness, through constant engagement between peers.

The benefits of peer tutoring have shown in studies that students gain better self-esteem as they feel more empowered by peer tutors to deal with homework and assignments (Eggers 1995, 216-219). Henceforth, they are more willing to query 'at the same level' with their tutors.

Among peers, through helping and learning from each other, students communicate better and special interpersonal synergy was formed (Colvin 2007, 165-181). They also instigate opportunities for peer tutors to be spontaneous, to stay alert and to respond promptly when there is a problem. As such, it helps train the student to be an adequate communicator and listener (Beasley 1997, 21-30).

As a class, the experience helps to make students more self-assured in the way they learn, they start to value what they have learnt and gain a better perspective on how to be a better learner (Colvin 2007, 165-181).

Discipline wise, studies have shown that peer tutoring allows students to be serious about punctuality, deadlines, and submission deliverables, as they are now taking charge of their peers' performance. Peer tutoring also helps to improve devotion towards team discussions and tutor's consultation, which in turn, creates a better set of outcomes as a result. (Kharusi 2016).

Malcolm Knowles (1975) defines the term self-directed learning (SDL) as;

> *"a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes."*

SDL aims to promote self-teaching and self-motivated learning, Julian Sefton-Green and Maurice Gibbons (Sefton-Green 2004 ; Gibbons 2003) further clarify that SDL is a process that does exist to a variable degree in every individual; they take charge of their learning, take control of their thinking and manage their behaviours while dealing with knowledge acquisition. SDL does not limit itself to the individual but it can be involved as a form of collaboration between peers. This-approach further promotes extended learning, which is one of the SDL elements in the Singapore Polytechnic-SDL framework (fig. 1).

There are four key characteristics of SDL (Tan and Koh 2015):

a. **Plan learning:** set goals and outcomes, identify the key task, identify learning gaps, plan learning strategy and ascertain motivation; learning should be systematic with a defined outcome, which allows students to have a framework and direction while seeking knowledge (e.g. research stage);
b. **Manage learning:** proper use of learning strategies and exploring alternatives and making a sound decision;
c. **Review and evaluate learning:** Monitor and review progress, modify/change aspects of learning strategy based on feedback;
d. **Extend learning:** apply learning across different contexts; making connections between formal and informal learning.

Last but not least, students self-monitor their learning process to be consciously aiming towards the identified goals, in which technological learning platforms, such as the internet, email and social media platforms, help improve students' engagement through a round-the-clock knowledgebase (Rasid and Asghar 2016, 604-612).

Individuals extend their learning through activities, projects or deliverables to justify their learning and to show that the students are actively seeking out more knowledge on top of what they have learnt.

In view of the new strategy, the intent was through the introduction of peer tutoring, to allow peers to monitor each other's progress and stock take each other's learning, especially when they are facing difficulty while conducting self-directing learning among themselves.

Based on the research, SDL helps promote personal motivation and deliberate practice of knowledge acquisition (Tan and Koh 2015). Peer-to-peer learning, through peer tutoring method, on the other hand, helps reinforced learning via peer support and a surveillance system, to ensure proper personal accountability of their learning.

This blend of strategies allow students to have a stronger ownership towards their study, instead of relying too much on the module tutor's instructions and following through blindly. An assignment was introduced to facilitate the application of the strategy.

Assignment: Design Peer Learning Through Peer tutoring

The "Peer Tutor Lecture Series" is based on the SDL's influencing behaviour strategy. As a team, they will go through a set of check point reviews, to improve the students' metacognitive awareness of the topic.

In short, self-based learning is applied at the beginning and the end of the series, where peer learning is introduced to facilitate and promote intrinsic motivation and passion for learning.

It is a term-based project, which lasts five weeks in total. The series comprises pre-lecture series activities, a development stage where the team creates the assignment themselves, peer review, and editing of the assignment between peers, and moderation by the module tutors.

The pre-lecture series activities or preparation work of the assignment, starts in term 1 of the foundation year. As the cohort comprises students with different capabilities, only a set of fundamental topics such as the installation of the programme, interface management and basic navigation tools will be covered. It aims to equip everyone with basic skills to ensure an equal footing for everyone to begin with. (fig. 2)

During term 1, the teaching team observed students' behaviours and identified students who performed better, and those who have prior experience from their technical institutional days.

As the above-mentioned students form up to only a quarter of the cohort, some of the group leaders were chosen based on their working attitudes and maturity in handling daily homework instead. (fig. 3)

The development of the assignment included a short lecture assignment, where each peer student team, placed in groups of three to four students, was to curate a ten-minute exercise for the other student teams to execute, plus a five-minute troubleshooting time for the team to rectify the participants' enquiries. (fig. 4)

The team should include the following content during the presentation (fig. 5):

1. The objectives of the tools covered
2. The access to such tools (icon/shortcut)
3. A short demo of its usages
4. The task for students to practice knowledge learnt
5. A set of worksheets for the class to work on during the lecture series.

In stage 1 of the self-directed learning plan, the students were given a week to research by themselves individually, using the list of media channels approved by the tutor, such as LinkedIn, school library e-books and also blog links provided on Blackboard. Nonetheless, they were allowed to access unofficial websites/blogs, CAD-related YouTube channels, and book lists from other platforms.

They were to prepare their first draft of the assignment before meeting their peers for further discussion. At this stage, students managed their self-directed learning, whereby the review of the SDL outcome was in the week after. (fig. 6)

At Stage 2, the peer team met during the next lesson to discuss knowledge gathered and shared within their respective peer team. Each team member showed each other what they have researched so far, and they discussed the structure and content of the lecture details.

Each team filled up an assignment planning worksheet twice in the subsequent weeks for consultation purposes. Team members needed to illustrate details of the tools and commands learnt, and planed out the exercise for the cohort. It is to create an appropriate evaluation system between student team members, to monitor learning and team development (Michaelsen and Richards 2005, 17).

The teams also needed to decide the role of the individual member, both at the development stage, as well as during the presentation. For example, tasking each member to research a topic during the research stage, and to select a presenter or a facilitator during the presentation named 'The Lecture Series'.

The two consultations allowed tutors to mediate possible conflicts between peer team members. It also served a way for tutors to monitor the team's learning and development, which is strongly recommended by Osman Demirbas and Halime Demirkan (2007, 325-359). It also enabled tutors to have an opportunity to conduct a live spot check on the team's understanding of the assigned topics to cover, such as producing circles and arc, and chamfer a sharp corner of a square shape.

The worksheet was then evaluated by the tutor at the end of the discussion; it helped minimise errors to make sure that the exercise was both challenging and professional enough for all students to practise.

Other than the assignment planning worksheet, the teams were required to fill in the content of the presentation, for the peer team to work on. (fig. 7)

For Stage 3, there was a review and evaluation of learning with a series of lectures. During the actual presentation, the student's teams took over the tutors' role as a class tutor, teaching one to two modifier commands per team. Within the 15-minute period, they covered the command in ten minutes, and allocated five minutes for troubleshooting. (fig. 8, 9)

Seated together with the rest of the students, the tutors role-played as students to enact various possible mistakes commonly made by students. The intent was test the ability of the facilitators (the peer team presenting) to resolve common questions on the ground, as this was a hindrance to learning.

At the end of the session, the rest of the students evaluated their peer teaching team in three categories (i.e. clarity of explanation; the level of facilitation and the creativity of activity). Final grades and the consolidated comments from the team evaluation were shared with the respective teams. (fig. 10, 11)

As for their final grade, the module tutors then graded on the peer team's overall execution, the correctness of the command, the quality of facilitation, as well as the preparation of the worksheet and activities.

Peer evaluation was used to review teams' contribution and assess team member's performance, which accounted for 20% of their overall grades, as an individual component. Aside from using it for grading purposes, it also allowed individuals to reflect on their quality of contribution as well as their willingness to work as a team, which is an essential skill as a designer. (fig. 12)

Finally, there was an analysis of implemented strategies upon the conclusion of the assignment, where quantitative data was sought through a short survey administered to the students involved, to rate on their receptiveness and effectiveness of the assignment. A total of 52 responses were returned.

Questions involve the level of skills acquired before and after their assignment, uniqueness of the assignment, whether the assignment is manageable, the team synergy, the comfort level of providing/receiving feedback and comfort level of self-directed learning through online resources. The detailed list of questions is provided. (fig.13-17)

Qualitative data was sought from student feedback conducted at the end of the year, to analyse the module quality, as well as the teaching strategy imposed. Data from both methods were reviewed for the success of the intervention and future pedagogical changes.

More than half of the cohort (65.4%) reported that they learnt more about the subject after the assignment; 88.5% of students had a neutral to positive impression for the exercise. In total, 46.3% of students found that the concept of the assignment was effective enough for them to explore their creativity (Aggregate: 3.56/5). (fig. 13)

Some students suggested that they need more preparation time and added that resources should be in place, during the assignment, to achieve more effective learning and development of the "Peer Lecture Series."

More than 60% of the students felt that they have good team synergy among their peers. (Aggregate: 3.44/5). Around 61.5% of students felt that it was beneficial for them to provide and receive feedback from their peers. (Aggregate: 3.76/5). (fig. 14)

In terms of managing self-directed learning, student teams informed us that they utilised the recommended websites and resources as the main source of reference (60.9%). The number was more significant than those who favoured learn-

ing from a tutor's demonstration in class (30.4%). This is understandable as they are more tech-savvy than their seniors in sourcing both online and offline resources. "This module helps us to learn and improve on our manual drawings and CAD drawings, which are both important in the future when we do interior design," remarked one student.

Upon further analysis – a probing question was asked if they like to do the research – only 3.8% of the students disagreed on the statement.

A majority of their research was done online, with the top three research channels being websites/blogs, online social media/MOOC channels such as YouTube and Lynda.com (76.9%), while 43.2% of them still liked to have one-on-one consultation. (fig. 15)

Students prefered to have a balance between tutors' lessons, self-study and research. A majority (96.2%) of the students would like to have more resources, guides, and materials beforehand, be it online resources or live demonstrations. (Aggregate: 3.68/5) (fig. 16)

We can conclude that students valued the opportunity of conducting research, and they were also motivated to do so, provided there was enough resources available along with sufficient scaffolding on how to access different resources.

In this manner, a student's intrinsic motivation could be elevated before they conduct any self-directed learning.

In terms of review and evaluation of learning, a good majority (80.8%) of the cohort prefered to have more consultation before the presentation. Among those, 52.2% of them prefered an extra physical consultation, followed by 30.4% who favoured online meeting tools such as Skype or WhatsApp, and only 17.4% prefered to be consulted by emailing their work over for comments. (fig. 17)

Students commented that some form of post-presentation recap would help them to have a better grip of the concept of the commands, and allow the tutors to rectify doubts (if any) based on the exercise conducted. "Not much apart from how we need more time to understand better …… as a lot of them still do not understand how their teammates present…. A live recap will help," commented another student.

Students suggested that the lecture series videos be uploaded onto the FLIP-classroom platforms, for easy recap and access by the students. The assignment time spent could be increased so that students would be able to have a better grip on the ideas and enough time for practice and troubleshooting.

> *"IDC is a heavy module that many people have a hard time understanding as the module requires us to rely heavily on computer software, AutoCAD. Many of us have a disadvantage especially for those who are very new to it. I feel that it can be improved by having an online tutorial demonstration by the lecturer to help us understand better."*

For evaluation, analysis, and teaching team feedback, which included all quantitative and qualitative data points, the teaching team re-affirmed that quality of teaching was compromised as it was a strenuous task for the tutor to spoon-feed all instructions within such a short period. As such, the peer lecture series assignment considerably reduced the amount of individual consultation and AutoCAD troubleshooting during the tutorials, and effectively focused on those groups who were in need.

The teaching team also noted that students from the two different knowledge-based groups (ITE and secondary school) had begun to mingle more

amongst themselves. Thus, the assignment also served as a great ice-breaker activity for the cohort.

As for peer evaluation analysis, the teaching team discovered that a great majority of students actively and willingly engaged in the assignment. They proved that they were mature enough to handle the assignment, as they willingly took up tasks based on their skills and knowledge. For example, the students who had better knowledge in AutoCAD were tasked to be in-charge of the overall planning of the exercise, whereas the rest of the team members handled areas such as verbal presentation, the teaching of shortcuts, and helped troubleshoot problems during the exercise.

Peer tutoring, as a whole, allows peer tutors to empathise peer tutees' difficulties and struggles, through conversation and troubleshooting. Secondly, it can be related to the literature review by Eggers (2015) that bite-size tutorials prompted the participants to take notice and evaluate their own set of struggles and thus, an improvement of their problem-solving skills and a realisation of their proficiencies, such as patience, reasonability, and conflict management quality.

When looking at possible gaps and future improvements, it was noted that 22% (4 out of 18) of respondents commented in their feedback that the 'free-rider' issue still existed. There was on average about one student out of a typical team size of four, who does not participate actively, and these students generally have a peer evaluation score of below 50%.

The teaching team also noticed during the consultation that there were free-riders within some teams, especially students with lesser prior knowledge. The free-rider typically looked withdrawn and was not keen on participating in the discussion of the content sharing processes and also the crafting of slides.

Thus areas of improvement will be implemented for future runs of the "Peer Tutor Lecture Series":

1. Each team member is required to prepare and perform a short lecture, within their group. The purpose is to ensure that each member of the team is clear about each other's understanding of the commands so far.
2. It encourages teams to level-up each other's technical knowledge, recognise good practice (such as infographic design) and special skill set (e.g. verbal presentation), amongst the peers. By doing so, the team can task the individual student with a suitable set of tasks, and it ensures that every single team member will be contributing. Hence, this minimises the 'free-rider' effect on those with lower technical knowledge.
3. An extra session of physical consultation and e-consultation will be implemented, to allow teams to level-up team members' understanding of the topic, to reaffirm learning with tutors, and also resolve conflicts between the team members.
4. As a lecture-based presentation may not be the best way to assess the team performance, the teaching team have discussed and will subsequently relook at a better set of deliverables, and possibly integrate it into part of their studio design project deliverables.

The teaching team will observe the result of the implementation during the next run of the series and will monitor the outcome. Other than that, the team also realised the value of such pedagogical arrangement to student learning, and such arrangement has the potential to be transferred to other module assignments.

Conclusion

This assignment proved suitable for freshmen to acquire technical-based knowledge, with the help of their peers, as well as constant review by the module tutors to monitor learning, and students learnt the basic computer aided design tools, and how to prepare their presentation, through self-directed learning, as well as peer-to-peer teaching methodologies. Ultimately, students in this generation belonging to a cross between the millennials and the centennials, were more motivated and encouraged in their technical-based knowledge learning.

Mandatory schedule reviews between tutors and peer teams provided opportunities for them to investigate and seek answers dynamically. Student teams also enabled teammates to share knowledge and hence, supported each other during the execution of the project deliverables. By doing so, there was a reduction of the tutor's hand-holding of students with such a constant feedback loop.

Even though the initial time cost is huge to research and discover suitable learning resources available for self-directed learning, students can recap and learn at their own pace when tutors can use their extra hours for teaching innovations.

Despite the shortcomings, it is noted that the peer-to-peer learning set within a self-directed learning framework provided more benefits by enhancing efficiency and effectiveness in teaching and learning. In addition, this enhanced pedagogical approach of learning can be easily replicated for both technical and non-technical modules as well as varying scales across different cohort sizes. As such, the teaching team envisioned that it will likely be incorporated for other modules within the course in the future.

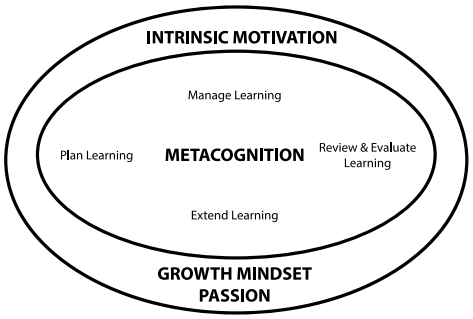


Figure 1: Self-directed learning model (Singapore Polytechnic, 2018)
Source: Department of Educational Development, Singapore Polytechnic

Fundamentals	Beginner tools
•Introduction	•Drawing Objects
•Exploring the Interface	•Modifying Objects
•Managing files and options	•Accuracy tools
•Navigation, Line Tools	•Hatching
•Layers logics	•Text and dimensions

Figure 2: Fundamentals will be covered in semester 1 term 1, "peer tutor lecture series" will be in semester 1, term 2, covering the basic drawings and modifying object tools. *Source: author*

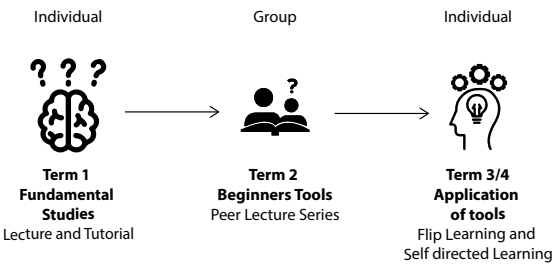


Figure 3: The "Peer Lecture Series" aims to bridge the gap and level-up students' knowledge, to ensure a more equal footing between students at the later part of the academic year.
Source: author

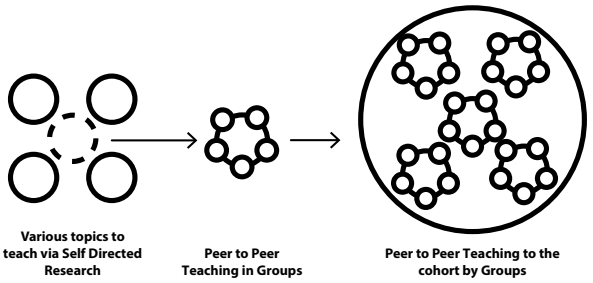


Figure 4: An overview of the "Peer Tutor Lecture Series." It is a combination of self and peer learning, with student groups teaching their peers as part of their assignment. *Source: author*

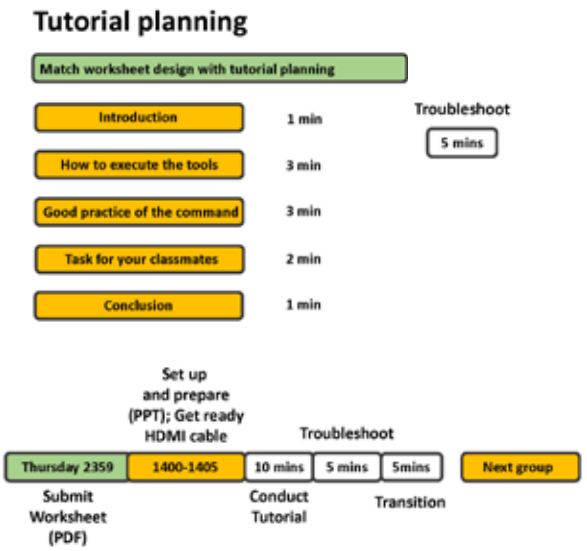


Figure 5: Tutor's touchpoints with students before the final presentation, the lecture delivery; tutorial planning guide for students during the consultation. *Source: author*

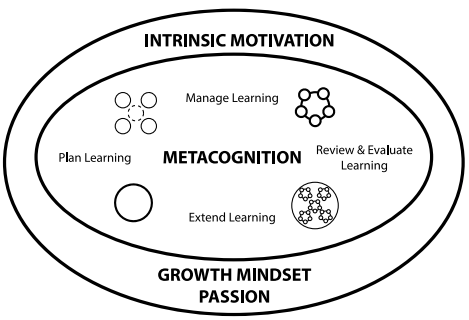
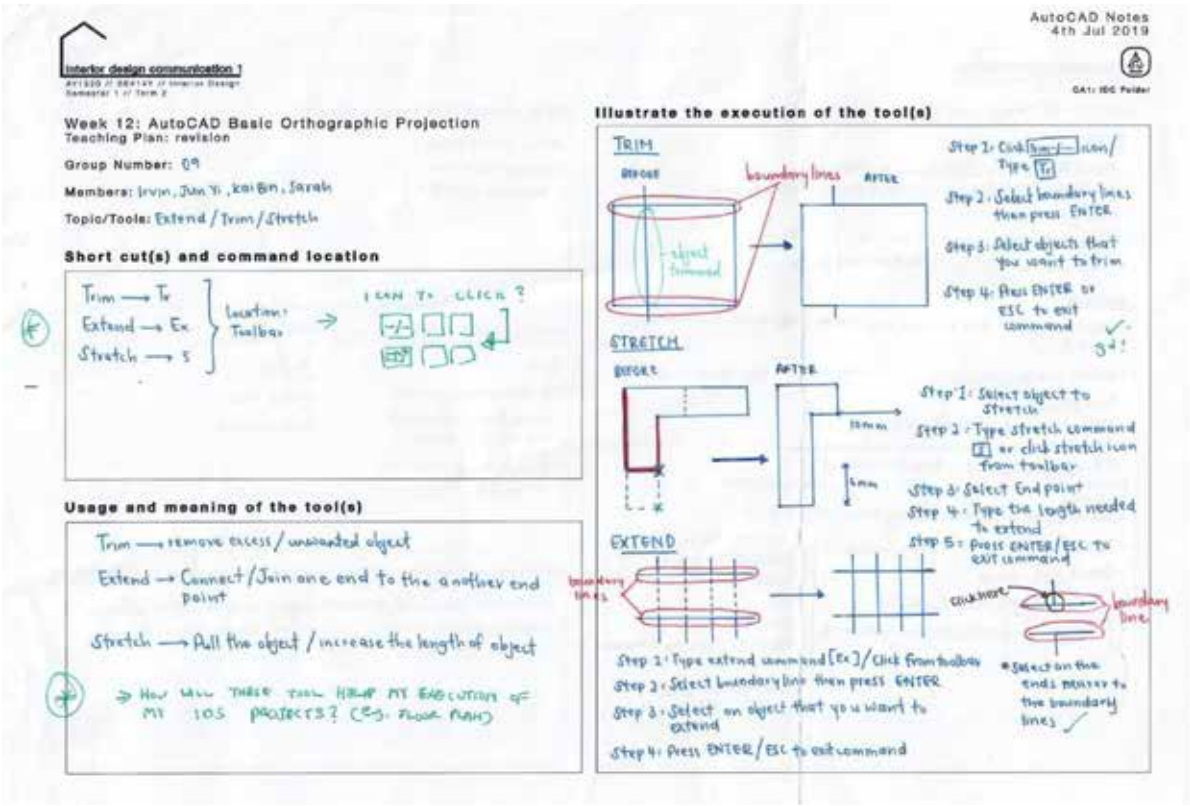


Figure 6: Application of peer to peer learning within the framework of self directed learning. *Source: author*



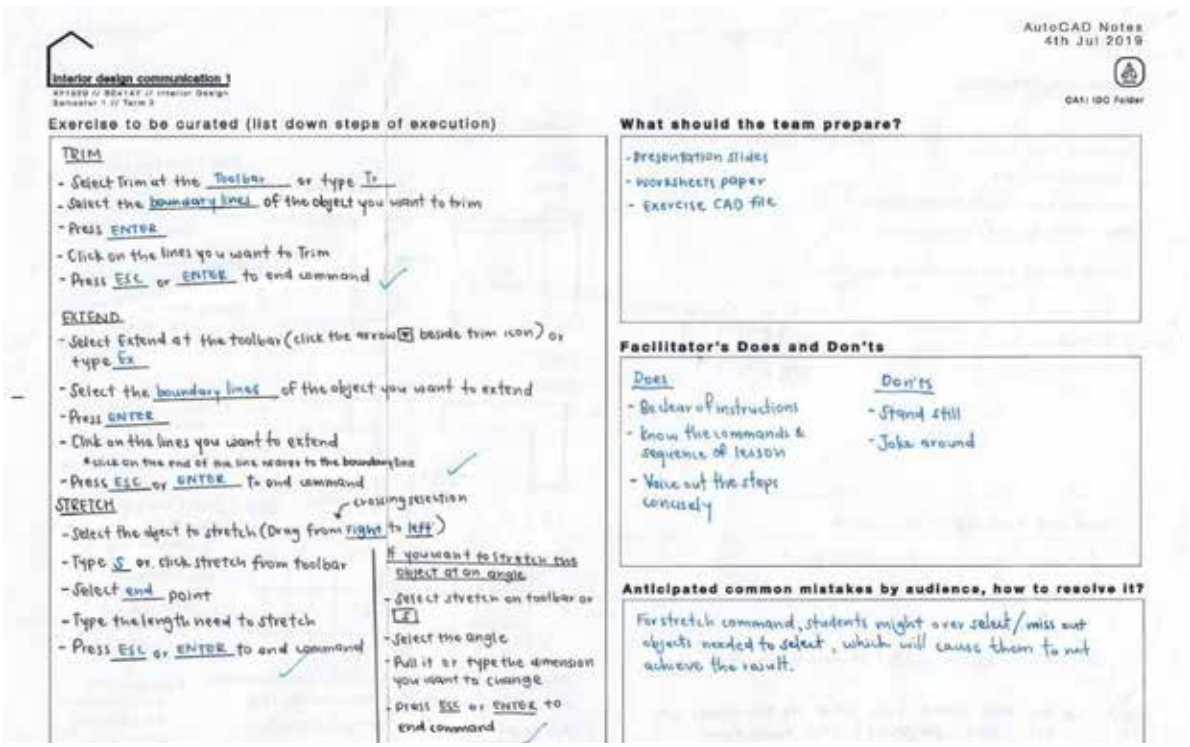


Figure 7: Sample team worksheets. *Source: author*

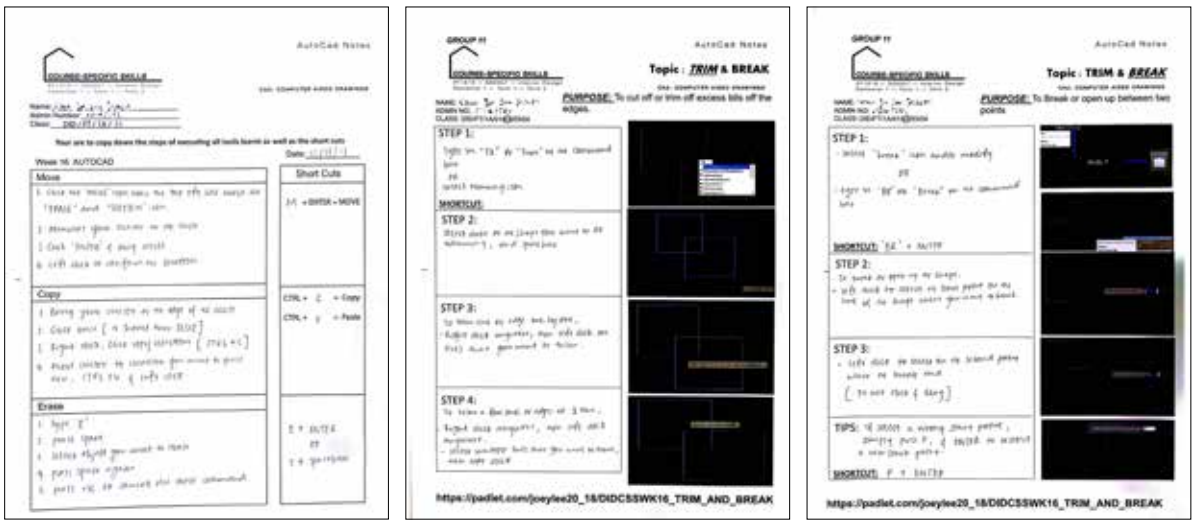


Figure 8: Sample tutorial slides. *Source: author*

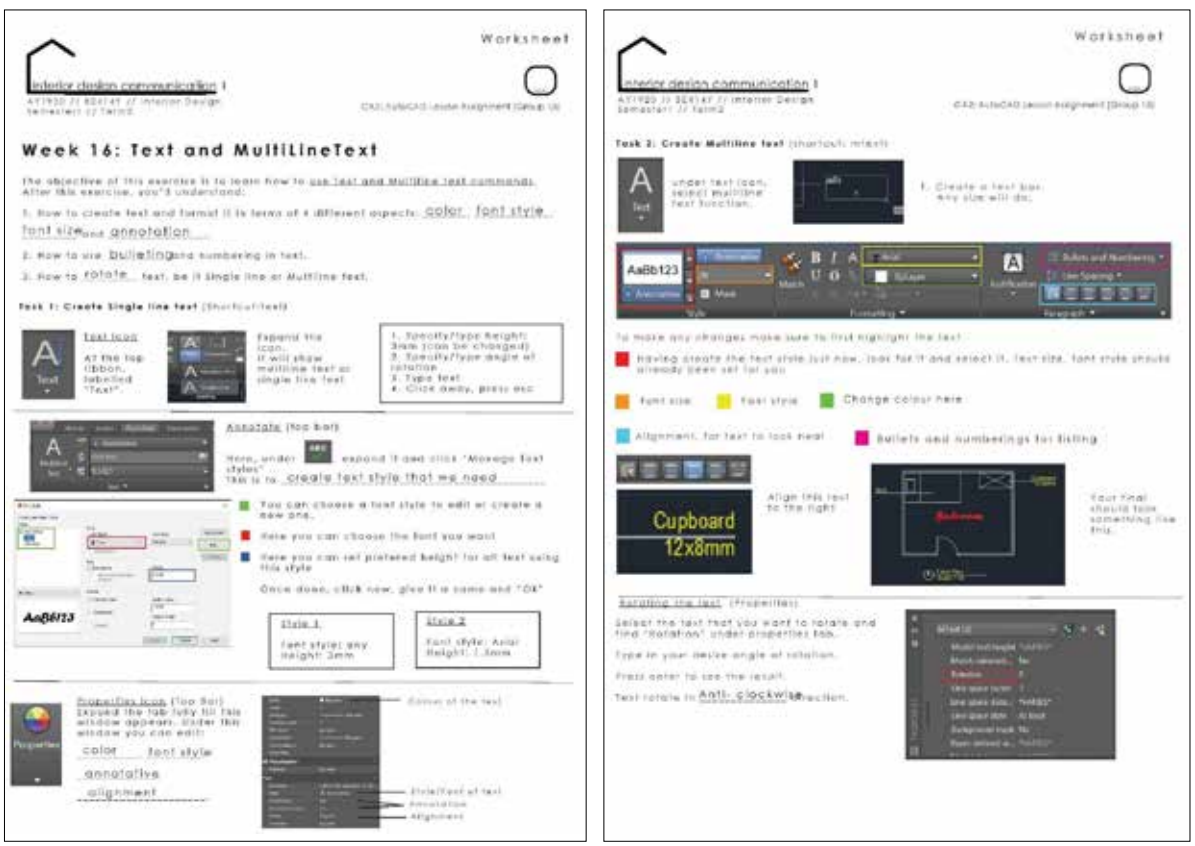
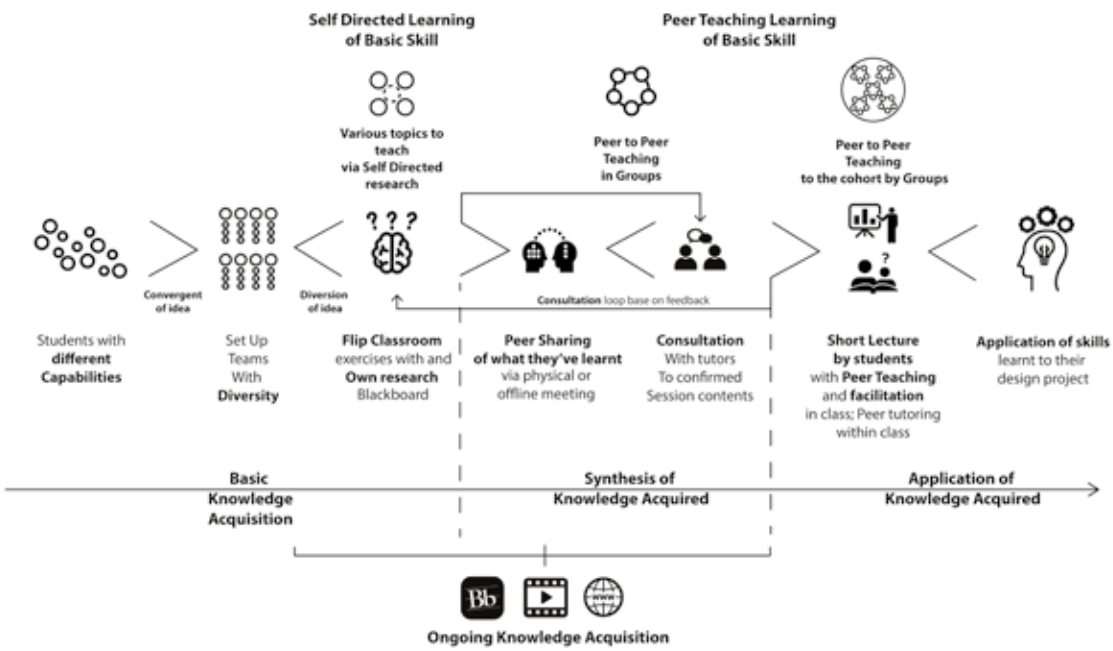


Figure 9: Sample completed participant worksheet. *Source: author*



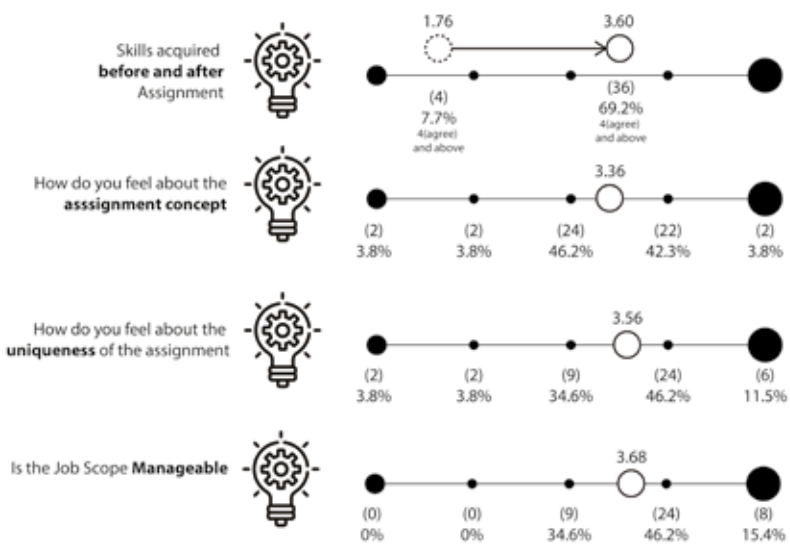


Figure 10 and 11 (top): Individual peer evaluation worksheet for team members (left); and feedback sheets to evaluate peer groups' performance (right). *Source: author*

Figure 12 (middle): A quick summary of the "Peer Lecture Series", in comparison with the framework of the self-directed learning. *Source: author*

Figure 13 (right): More than half of the cohort (65.4%) noticed that they learnt more about the subject after the assignment. *Source: author*

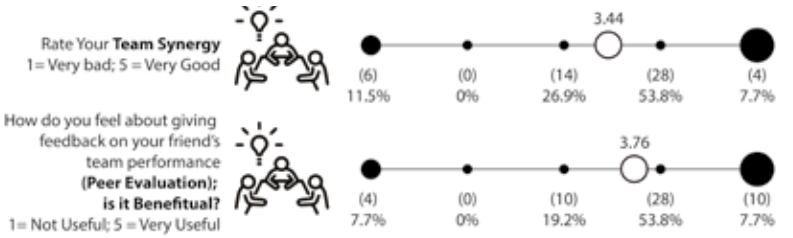


Figure 14: More than 60% of the students felt that they had good team synergy among their peers. *Source: author*

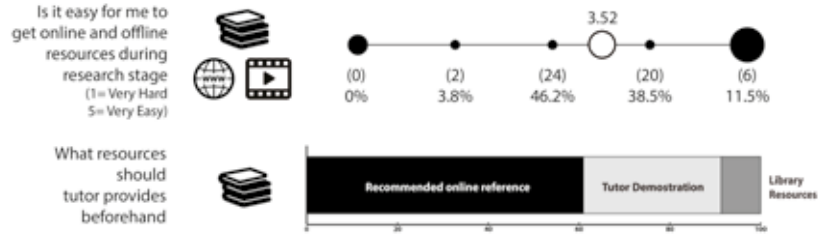


Figure 15: Student teams informed us that they utilised the recommended websites and resources as the main sources of reference. *Source: author*

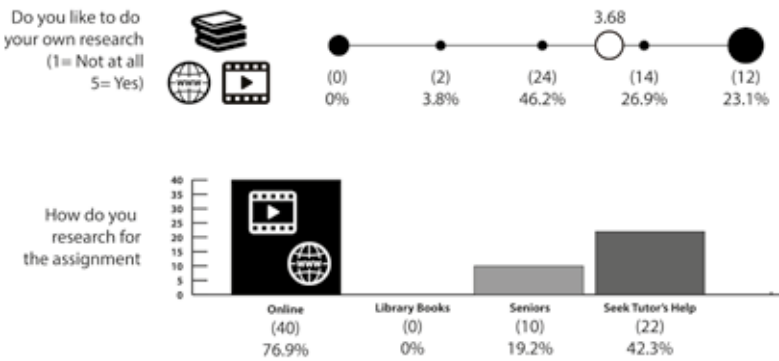


Figure 16: A majority of their research was done online, with the top three research channels being websites/ blogs, online social media and MOOC channels. *Source: author*

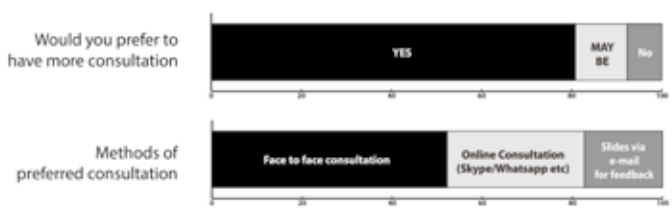


Figure 17: Students prefered to have a balance between tutors' lesson, self-study and research. A majority of the students would like to have more resources, guides and materials beforehand, be it online resources or live demonstrations. *Source: author*

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Bio

Iain Choi coordinates the above-mentioned module in this paper, while looking for better education strategies to benefit students' learning experience. A lecturer specialized in commercial, museum and communication design, he has a strong interest in user experience and empathetic studies. He has participated in design thinking and social innovation projects, both locally and internationally.

Fann Zhi Jie is an experienced lecturer with a demonstrated history of working in design education. He leads a dynamic team to inspire, nurture and grow future spatial designers. He is skilled in urban design, urban planning, architecture, visual merchandising, curriculum development and art. He is a strong education professional trained in Singapore and the U.K.

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039

NON-PEER REVIEWED:

Rising to the Challenge: Education, Pandemic and (Virtual) Skills Transfer

Scott Chin

70—79

With the widening scope of design, the importance of the design studio has concomitantly responded by transforming its own character to become inclusive of the educational domains of history, professional practices, theories, technical, and material studies. The absorption of such domains, part-and-parcel of the studio setting, has irrevocably highlighted the importance of education within the container of the studio or rather 'in-situ' education. However, with the volatility of external factors, the challenges posed to design education are multiple. Especially in light of the rise of a global pandemic, educators globally have had to implement crisis strategies in response. This short visual essay outlines the obstacles of online teaching; moving from resistance to embracing the tools and features that online education provides. Sharing the gained experiences, starting at the rise of the pandemic, the text engages seven key points of interest, while practically demonstrating responses in the product design setting.

#online teaching

#design education

#studio subject

#in-situ training

#pandemic design

The Site of Education in the Context of the Pandemic

It is safe to assume that all designers know, more or less, the meaning and importance of a design studio or studio setting. From early on, design students are made aware of the role of the studio and what it means to creatively produce amongst fellow peers in such a dedicated space. Later on, the same values are transferred to a new generation of students, echoed by tutors, professors, instructors and professionals. The value of a design studio has in the span of 30 years extended its meaning of place, beyond its conventional positions as a space 'only meant for design activities'. With the widening scope of design, the importance of the design studio has concomitantly responded by transforming its own character, to become inclusive of the educational domains of history, professional practices, theories, technical, and material studies. Moreover, the absorption of such domains into the studio irrevocably highlights the importance of in studio or 'in-situ' education. The importance of peer-to-peer learning becomes a natural consequence of a collective and group experience.

However, with the volatility of external factors the challenges posed to design education are multiple. Especially in light of the rise of a global pandemic, educators globally have had to implement crisis strategies in response. What was a fully embodied experience between individuals has had to migrate to a virtual medium. In addition to the digital context, design educators have had to ask complex questions related to their own ways of praxis.

What follows is the reflection in response to the challenges caused by COVID-19. Drawing from experiences in The Hong Kong Polytechnic University's School of Design, the responses cover the first and immediate knee-jerk reaction to a studioless design format, the suitability of virtual platforms, and new reflections after more than ten months of experience with online education.

"Online Does Not Fit Design!"

At the beginning of the pandemic, every faculty member was in a state of literal panic. Given the call in January 2020 by The Hong Kong Polytechnic University, all education and classes had to migrate to online platforms. Many individuals strongly believed that delivering design education through a virtual and online medium was an impossible task. In some instances, the question of semester postponement was raised. The biggest challenge remained: 'how to create and deliver a face-to face-like learning experience?' In addition, what would an online experience mean for those courses that require hands-on training?

Added to this, software knowledge was limited in the beginning. We had no idea what type of platform would be most beneficial to maximise an embodied online learning experience in terms of design and education. The testing and re-testing of different software was the only route to seek a version that best suited our requirements.

Option One or Option Two?

At first, two platforms were suggested: Blackboard Collaborate Ultra and Microsoft Teams. Both ranked high as platforms for organizing and maintaining class structure and content management. However, they also showed limitations. Their varying capacity to upload files and size capabilities caused connectivity issues, especially for students in Mainland China, the use of both Collaborate Ultra and Teams caused more connectivity issues. The various tests realised that MS Teams did not allow for the recording of the tutor's main screen at full size. Over a period of time, students became frustrated, unable to playback the instructors' recorded video when they wanted to review the learning outcomes and other content.

A third platform became the medium of choice. After some consideration and consultations with IT, the Zoom platform was deemed more interactive. With the addition of some hardware, including webcam, lighting, and digital tablet, the design environment was recreated, where visibility on the education actions (hand animation, illustrating, drawing, and rendering) could be simultaneously recorded with the view on the instructor and students.

How Should Design Education Be Adjusted for the Online Format?

Design is a problem-solving profession. For that reason, creating new teaching and learning experiences is equally as important as a design challenge. Moreover, how can we even begin to talk to students about the importance of user experience (UX) or how show empathy for their development, if design education itself cannot fulfil user experience in an educational capacity? Whether this is online or face-to-face, the same question remains valid in terms of user experience and the medium through which these experiences are transferred.

From a design perspective, online education should represent a face-to-face medium in some way or another. Although platforms through which information is disseminated may differ, the 'face value' of education remains. By fusing together virtual with regular education practices, a "virtual-face-to-face" platform may be possible that still fulfills all the educational criteria as well as creating a meaningful experience in the context of what we can define as the 'new normal'. In this fusion, the aim of creating a class experience where students can engage and interact with teachers by utilising given technologies, while still benefiting from in-situ experiences can add new advantages of digital and pedagogical skill sets.

From our gathered experience over nine months of online education, the deciding factor remains the engagement of students' attention and interaction throughout each online session. Conducting in-class exercises, providing direct feedback, and the ongoing real-time critique, define the new practices of online education.

Better than Expected, and Some Benefits!

Still, if given a choice, students remain committed to face-to-face learning. However, their general experience of online education has exceeded their expectations. What is of great benefit is the ability to access recorded material, time after time. Second to that, real-time critiques benefit more than one student per class, highlighting peer-to-peer experiences in the online setting: watching together, practicing together, and listening together. The submission of digital projects has meant saving time on printing and the pin-up process, not to mention the on-time submission of projects, meeting set deadlines, while avoiding rush-hour traffic.

Taking a Step Back, the Evaluation of Teaching Online; How to Evaluate?

Due to the circumstance of online learning, some deliverables, including 3D physical models, quick mock-ups, or prototyping, had to be reduced or omitted from the final assessment. This was further hampered by city-wide travel bans, limited access to buildings and facilities, leaving little contact between students and model suppliers. Although far reaching for some courses, others were less impacted by physical prototyping. In those subjects greatly impacted, these three dimensional or prototype components were simply removed from the assessment criteria. Other courses shifted the weighting of the assessment away from the

three-dimensional criteria, focussing on digital or virtual model components. On the flip-side, with less emphasis on physical model outcomes, certain students were given greater flexibility in how they digitally modelled their outcomes. This allowed for students to become proactive and further explore digital mediums beyond the conventional tools or software options, streamlining the final submission process of all studio and design components.

Online and Virtual Exhibits

Similar to educational formats, many schools or design institutions have had to develop contingency plans to replace the end of year or graduation show. Herein the range of formats, mediums, and access points had to be considered. Should the show be part online and part installation, or should the entire contents of the show migrate to the online format? In both instances, the set-up as well as curatorial work will shift, scrutinising what to show and how to show the contents of each project. And, more importantly, what can be done to differentiate the online format from other shows which lack interaction, engagement, and user experience? From our view, it is not only the linking of students and exhibition curators, but the merging of interaction and information possibilities that make it possible to showcase the work for a global audience. What may at first be perceived as yet another response to the restrictions to the pandemic, could also become a challenge wherein design dissemination should explore new directions and virtual avenues. In our view, this may set new practices, showing design outcomes through dedicated workflow processes, transferring all design work into virtual formats.

Post-COVID-19, it's a Matter of Trust

There are many ways for design to facilitate the process to overcome COVID-19. With the impact on the way of life, we predict the need to focus on product development and serviceability. User experience, has and will, for the foreseeable future, become a daunting challenge for all conditions of design. Implicitly, this lays an additional burden at the feet of design education. First, from a design education perspective, to provide an experience that involves a new generation of designers with new tools and societal requirements. And secondly, to re-establish levels of trust between educators and students, and for students to accept new unconventional mediums that will form part of their educational platforms and information exchange protocols.

The accompanying images were collected at the height of the School of Design's response to the pandemic and its need for online education. Using the course of "2D Communication" we would like to explicate good practices for the use of others, help improve and further extend good practices for design education in the post-pandemic context.

PREPARATIONS FOR THE DESIGN-TUTOR WORK STATION

A. Hardware

1. Webcam. (Facing down to broadcast real-time demonstration).
2. LED down lighting. (Web cast purpose).
3. Headset with microphone. (Because the webcam faces down, it does not detect sounds well. Need a separate microphone).
4. Wacom tablet. (Able to use digital white board and software to enable digital interactive instructions).

B. Software

1. Zoom – real-time online demonstration. (Able to record the full-screen shot video of demo, when MS teams has no function to pin the main screen to record).

2. MS Teams – to manage the class activities. (Create the channel weekly to manage the announcements, attendance and file-sharing).
3. MS OneDrive – for student's submissions. (For both in-class and out of class assignments).

C. Conducted a test-run session one week prior to the start of semester

1. Check the connectivity.
2. Some international students had connectivity issues for Teams and Collaborate Ultra.
3. Decided to use Zoom for better connection.

PRE-CLASS SESSION

1. Create a schedule for class in Zoom and post-invitation links in MS teams under the 'weekly channel', so students can join the class in Zoom.
2. Log in to Zoom five minutes prior to class to check the equipment and wait for students.

DURING ONLINE CLASS

A. Real-time Demonstration

1. This is the most important element of online class in order to create a virtual face-to-face teaching environment.
2. Streaming recorded video lessons is not recommended, as this lowers the expectation and engagement. (Students would not feel it is worth what they have paid for).
3. Using the webcam to stream the lesson in real-time for manual skills and using SketchBook Pro and Photoshop for digital 2D communication skills.
4. In order to maximise students' engagement, in-class assignment is the best way to do so.
5. Stop and re-do the demo on student's request.
6. Benefit of sharing the same viewing angles, compared to face-to-face environment.
7. Each demonstration can be recorded and uploaded to the share folder in cloud storage (MS OneDrive), so students can access upon demand.

B. In-Class Assignment Exercise

1. After the demonstration, students are asked to finish the exercises and upload their work to the share folder in OneDrive. (This helps the tutor to monitor the students performance and their engagements)
2. Use in-class exercises to check attendance and evaluate class performance.
3. If students do not submit the exercise by the end of class, it will be counted as absent.

C. Real-time Critiques

1. Conducting real-time critiques on their work as they are uploaded, one-by-one.
2. Sharing critiques are one of students' favourite aspects of online class, because they can also learn from the comments of each other.
3. Conducting critiques on their submitted assignment at the beginning of each class and going over questions with students. (This is part of the online demonstration I conduct at beginning).

D. Archiving

1. Upload recorded video of whole class to share folder.
2. Student's submission can be easily managed and reviewed using the cloud storage.
3. This can be a good benefit from online teaching.


OCTOBER

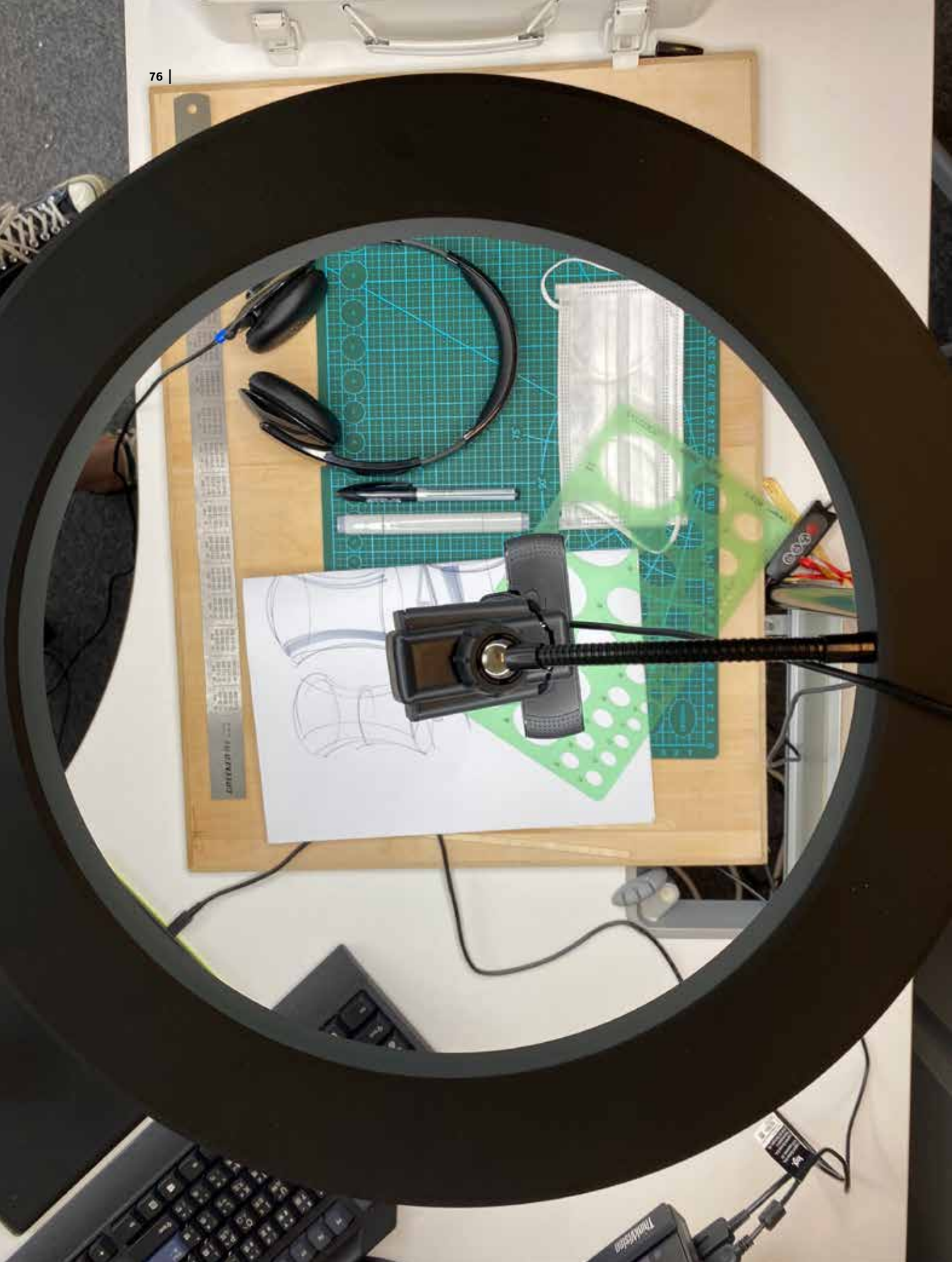


Figure 1 (page 75): Hardware settings on existing workstations. *Source: author.*

Figure 2 (previous page): Material preparation. *Source: author.*

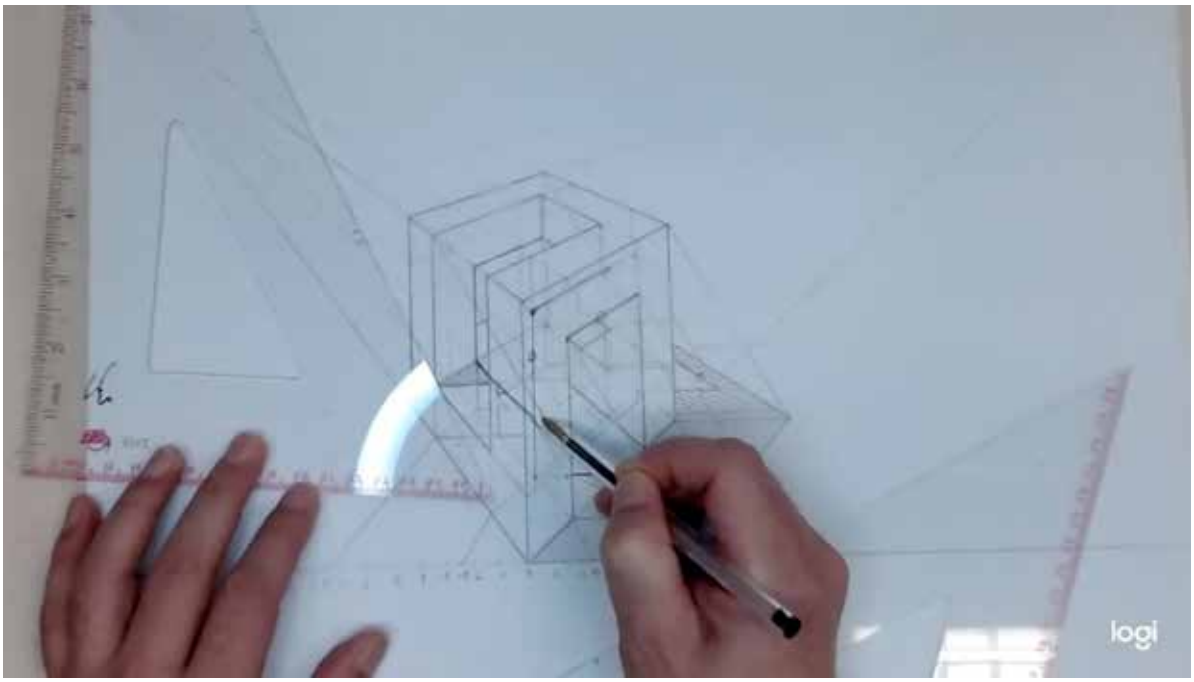
Figure 3 (this page, top): Material preparation for real-time drawing demonstration. *Source: author.*

Figure 4 (this page, middle): Online class in action. *Source: author.*

Figure 5 (this page, bottom) : Digital drawing demonstration using SketchBook Pro. *Source: author.*

Figure 6 (page 78, top): Screenshot of manual drawing demonstration. *Source: author.*

Figure 7 (page 78, bottom): Impact of online education. Demonstration of tutoring set-up. *Source: author.*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Bio

Scott Chin is an industrial designer and educator. He is a teaching fellow in product design of the School of Design, at The Hong Kong Polytechnic University, a position he has held since 2017. He holds an AOCA diploma from Ontario College of Art and Design, majoring in industrial design, with a master degree in design practices from the School of Design, The Hong Kong Polytechnic University. His design education experience, spanning more than 25 years, includes teaching at the Ontario College of Art and Design and Georgian College (Canada), Kyoungil University (Korea) and The Hong Kong Polytechnic University. In practice, he has led and implemented numerous projects, ranging between the design and development of sports equipment to consumer electronics. His mentoring of student projects has led to numerous awards, with the most recent student project receiving the James Dyson National Award 2020.

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Bringing Home Recursions: Co-Crafting Environmental Self-Implication in Adult Design Education

Markus Wernli

80—99

This report is about an explorative co-crafting course applying the notion of recursive publics to adult learning and pro-environmental activation, which aimed to engage a diverse cohort of learners towards patterns of eating, living, and engaging that promoted wellbeing and a healthy environment. This two-month-long, university-endorsed study in Hong Kong saw 22 participants fermenting their urine in which to grow an edible plant (*Lactuca sativa*), thereby creating a material relationship between their bodies and the environment. Technologies were employed to bring people physically together for greater emancipatory engagement inside the shared material condition. When analyzed, these technologies revealed their potential for opening or restricting the synergies from combined purpose, expertise, and immanent life processes in recursively profound and playful ways. This civic-tech study offers a recursive self-implication approach to design education as a collective negotiation process for navigating unknown territory to converge a myriad of expertise and intended beneficiaries.

#co-crafting practice

#civic-tech education

#recursion

#urine fermentation

#pro-environmental activation

Design Education and Societal Change

Design for societal change has a long tradition. It covers a broad range of activities that have in common participatory approaches to researching, generating, and pursuing outputs towards collective and social aims (Armstrong et al. 2014). Among others, Buckminster Fuller, Victor Papanek, Richard Buchanan, John Thackara, and Bruce Mau made a case for socially responsible design (Thorpe and Gamman 2001). However, social responsibility often is subservient to the dominant narrative of human mastery with its unquestioned faith in technological solutions, perpetual growth economy, and narrow assumptions about 'the good life' (Scott 2009).

Tackling environmental issues in socially more deliberate ways makes it imperative for design education to foster capabilities that allow learners to engage with systemic change more confidently, playfully, and to co-evolve with increasing complexity (Dubberly et al. 2010). It means not getting caught up in minute resource circulations, technical solutions, or individual consumer practices since they tend to cement our unsustainable path dependencies; the given economic arrangement and infrastructures that are socially enacting thus pre-programming our elemental functions and responsibilities (Hawkins et al. 2019). If, instead, the material and ethical considerations are to direct systemic change in production and consumption, then shifting tastes and preferences comes to the fore. For example, reconstituting our food culture where our ways of eating are regenerating soils and seas (instead of depleting them) necessitates forms of learning with systemic and social scope (Barber 2014).

Reliance on subject-driven, teacher-centered instruction, and individualised modes of self-formation would be in opposition to the range of competencies needed for contributing to societal adaptation (Swann 2002). In response, there has been a call for education approaches oriented on developmental criticality and collective evidence generation, which help establish design strategies for effective social interventions (Souleles 2017). In this view, practices like participatory action research, applied ethnographies, and real-world experimentation better equip learners to contribute to societal processes in more preventive and preconfigurative ways while increasing the collective potential to thrive on turbulence (Sonne and Tønnesvang 2015).

By reviewing a small case study in communal learning that integrated multiple forms of technical engagement, this article attempts to trace the factors that build capacities both in learners and the cohort. The study stems from a larger research project investigating localised, citizen-led upcycling approaches for the ecological reintegration of organic by-products. The research draws on data obtained from a two-month duration, university-endorsed explorative work alliance with 22 households in Hong Kong named ANTHROPONIX. Between the ensuing five biweekly co-crafting sessions, participants agreed to collect and ferment their urine at home for growing crops, thus moderating the mutual wellbeing of plants and humans for provoking health-promoting responses in the conduct of eating, self-care, and civic engagement. This article draws on data from co-crafting sessions and a broad range of exchanges that recorded the reactions to and perceptions of technically assisted, self-directed learning. The participants' concerns are shared here to explore some of the complexities of socially engaging with technologies in the fluid continuity of everyday life and biological circulations. In concluding, the article considers what this may mean for the curriculum in pro-environmental design education.

Civic Technologies, Craft Activism, and Urine Fermentation

Increasingly, socially engaged design coincides with segments of the current do-it-yourself movement that seeks to identify the elements in life that generate tangible value and nurture healthy relationships with each other and the planet. Responding to the decline in the quality of one's livelihood, communities, and environment, the motivation to reduce the reliance on others faraway for satisfying basic provisional needs brings people together, who strive to produce the substantiating conditions of their own lives (Busch 2014; Hayes 2010; Wagner 2007). For reclaiming their ethical and material responsibilities, activist citizens resort to concrete interventions of technical self-empowerment to imagine and explore new ways of association, production, and collaboration as seen in independent media, radical homemaking, urban farming, maker culture, tech-based activism, public labs, or citizen science (Fan et al. 2019).

These civic technology movements extend beyond the open-source ideology of programmers or hackers and include people from various backgrounds by evolving around a shared concern of advancing social, environmental, and democratic issues (Hagel et al. 2010). Rather than just celebrating technology and gathering around 'tech for tech's sake,' civic-tech movements question the broader society, its values, and politics that technology is thriving on. Spurred by civic responsibility, a can-do spirit, and efforts of pitching in, collectives of practice are forming ad-hoc communities, based on the notion of "adhocracies" (Bennis 1969). Bringing diverse demographics together into a reconciliatory process where differences are acknowledged, previously unknown approaches can emerge, people move past predispositions, and create openings for more horizontal and self-organised arrangements (Rushkoff 2019). Here, people assemble to realise what they want to see happening in the real world by building things that are not incentivised by the market.

In lieu of monetary motivations, these collective tech practices rely on inspiration, commitment, and social bonds. Through extensive collaborations in person or distributed at scale, tech-enabled communities can fulfill their potential and establish complementary infrastructures like citizen-led online polling, environmental science monitoring, or convivial restoration efforts (Tu 2019; Galán 2017; Büscher and Fletcher 2019). Such tech engagement usually takes place in "surplus economies" (Garber 2013) or "gift economies" (Mauss, 1990), where people make time and resource investments without an explicit agreement for immediate or future returns. The ANTHROPONIX course was invested in the meaningful upcycling of human urine and sought to animate these modes of non-transactional exchanges between people and the natural environment within the terms of "biological economies" (Pavone and Goven 2017; Carolan 2016) for engaging in more imaginative ways with nutrient cycles, food systems, and more-than-human health interactions.

Biological economies are about making the immanence of life processes the conversational point of departure in technological and social organisation, to expose more collective and performative learning approaches. Inside biological economies, the human body is in a metabolic relationship with the natural environment, which implicates all life forms through digestion; our organism can absorb nutrients only because gut bacteria are breaking them down for us. All life depends on this eating-through-each-other system. Approached from these intrinsic biological interdependencies, common categories like food producers and food consumers are then replaced with the notion of living inside the "world of eaters'' (DuPuis 2015), thereby decentering what is assumed to be

restricted to the human world. Conversely, digestion as a paradigm is also a viable proposition for social organisation. Keeping close relations with 'untrustworthy' partners (from unsavoury bacteria to ambiguous institutions), paying attention to collaborative processes (from fermentation to tactful persuasion), and living with the consequences (from messy mishaps to wicked path dependencies), can make us safer in the long run (DuPuis 2015). In response, civic-tech movements are facilitating a conversation with technological development. Such conversational capacity-building is not restricted to the digital realm and includes all other forms of skilled, worldly engagement like handmade and craftwork. Here, available resources return into the creation and exchange of ideas, images, and goods as ways of re-making and thus enlivening vital connections to place and people (Garber 2013).

Anthropology indicates how people and environments thrive best together, not in a ready-made, prefabricated world, but in a continuously self-implicating, skilled dialogue with the immanence of life processes. It means that the activities of inhabitants (person or microbe alike) contribute inherently to the participative decay and renewal that all involved depend upon. In this living world-in-formation, inhabitants, and place are intrinsically entangled with each other rather than externally linked (Ingold 2011). What brings people together is an animated way of being alive and open to the world that embraces discovery, astonishment, and the pulse of sensory experience. For motivating changes in people's perception and behavior, regarding their basic bodily functions (like eating and excreting) and their relationship with other living entities, the focus in this co-crafting course has been on building a collective process of enablement for urban dwellers. A purposeful tension was created between upholding values of the handmade – like bodily sensing capabilities or cultural heritage (Ihde 1978) – with the ubiquitous and dematerialising efficiency of digital technology (Pallasmaa 2009; Mccullough 1996) by complementing high-touch techniques of urine fermentation and plant nurture with science-assisted monitoring for biochemical substances. For overcoming the limiting schisms like tradition versus progress, creativity versus conservation, the hand making was given purpose in an unusual context to loosen its operational confines (Ravetz et al., 2013).

In this kind of relational knowledge production, skills and expertise are the gateways for restorative work and the sensory influencers that propel it. Restorative skills like recovering, repairing, fermenting, maintaining, or contemplating allow us to suspend restrictive control regimes of prediction or purity (Caslav Covino 2004), so that previous value-laden decisions that are deemed political are pulled back into the discussion. For disrupting unhelpful assumptions, the educational intervention needed to reach beyond its utility and relate craft expertise and biological resource cultivation directly with the everyday lives of people for imbuing them with personal fulfillment, community participation, and cultural relevance. Drawing literally from the agitating action of fermenting bacteria, the co-crafter can reconceive her life as a transformative process with agency in larger movements of change (Katz 2011).

Recursive Publics and Lab-at-Home Learning Practice

Tech-enabled activism comes with vastly divergent socio-political purposes. The thriving of radical political groups on tech-media platforms or survivalist movements appropriating do-it-yourself culture provides two samples. Thus, design education is challenged to foster a self-awareness that technologies and automation can be used repressively when established ground rules of the social contract are ignored, such as rights, duties, responsibilities, and accountability (Fan et al. 2019;

Rushkoff 2019). For discerning technical engagement both in aspirational and self-critical terms, a guiding concept can be Christopher Kelty's (2008) "recursive publics." The recursive public is a functional unit within society, constituted around the concern for maintaining its own existence and mandate. It means that members of a recursive public are strongly self-invested in the continuous upkeep of their material and ethical arrangement since it ensures the adaptability of public functioning that they rely on. This kind of co-regulated technical engagement assists a public to imagine itself as a public by practising and presenting an actual alternative to existing forms of power. For example, recursive concern groups evolving around online data use or reviving probiotic food tradition become self-aware.

Nurturing civic society means that technological engagement with existential purpose can help the public to become more vigilant to understanding and imagining itself.

Recursive publics do not just collaborate; they also contemplate on the implications of their collaboration. It can be a mutually reinforcing situation, where people keep collaborating because as they collaborate, they think and learn about this very collaboration (Fan et al., 2019). Such an interiorised form of accountability is vital for the creative reinterpretation of priorities and identity in persons and groups underlying decision-making processes and self-organisation (Bendell 2018). Recursion emerges when the group's internal diversity becomes the socially cohesive pivot for engaging with the broader context in adept ways, and thus, adapting its operational logic into areas like open-source modality or inclusive wellbeing.

The reinterpretation of choices inside everyday life is also shaping novel constellations of collaborators who discern experiments for alternative ways of making-things-together, and opening up the potential of "disruptive normalities" (Manzini 2019). Current tech-enabled, making-things-together differs from the 1960s counterculture and its ensuing do-it-yourself movement, which sought to repurpose prevalent consumer culture via the acquisition of goods, books, and tools as a way of expanding shared consciousness. Sold on the premise of idol devotion and consumption, the 1960s counterculture was gradually overtaken by libertarian takes on entrepreneurship that would undermine the very civic regulation and social visions that initially had animated it (Turner 2006; Pinon and Lafarge 2019). In a shift away from consumerism, recursive making-things-together refers to grass-roots efforts of affective collaborations. It positions people and groups as reflective contributors who inhabit a participatory democracy where process and outcomes are considered in terms of whether they connect people and foster social change that accounts for equity and thrivability (Garber 2013). The transformational potential stems from a critical examination of the fundamental principles by which humans live together with each other and with other-than-human agents in the world.

Recursive communities are experimenting with agency and the overarching purpose in social niches where the feedback loops inside the relationships of environment/person, authority/citizens, group/member, or body/mind are encouraged and scrutinized. A feedback loop is a circular activation of affecting-through-being-affected and articulating-through-listening for eventually acting-through-understanding towards a negotiable goal— thus, arriving in an initially unknowable territory (Wiener 1954; Sonne and Tønnesvang 2015).

The critical question then is how differences are negotiated across different publics and activity domains. Here, design education can provide safe, conversational spaces where experiments with people-technology relationships are run and where it is necessary to keep attending to socio-material feedback loops to develop

collaborative systems that continue to adapt future action based on consciousness for past performance. This has implications for sound leadership and for setting out a collaboration dynamic that continues to be modifiable so that the arrangement does not congeal into a static, impenetrable construct.

In response, the ANTHROPONIX case study aimed at an adaptive pedagogical approach for keeping the conversation relevant to what was emerging in person, group, and context. The technical activities were carried by "complementary polarity" (Sonne and Tønnesvang 2015). This meant implicating studio practice with home application; altering individual tasks with group exchanges; contesting bio-data monitoring with intuitive self-awareness; and oscillating general instruction with individual reflection, thereby correlating decision-making with personal accountability. This way, the purpose of technical engagement remained negotiable, and the learners could stay self-contracted in a continuum focused on engendering the thriving of the whole (Wahl 2016). This complementarity emphasised the broadening of the learner's response repertoire, which forms the basis for developmental leaps, rather than correcting isolated aspects and actions.

Tech-enabled activism based on convening-through-collaborating across diverse life domains can be both resilience-building and fragile (Fan et al. 2019). Therefore, the author deemed it worthwhile to understand these recursive dynamics and the efforts involved in more detail by analysing the ANTHROPONIX experimentation. Within this university-endorsed case study, the researchers derived ethnographic data from four types of sources, including course documentation, co-crafting participants, facilitators, and data analysis.

Course Documentation

The ANTHROPONIX learning venture invited the public to become test growers of a renewable, urine-powered, water-based horticulture as illustrated in the workflow diagram and photograph of the planter device (fig. 1 and 2). In spring 2017, the eight-week-long study was structured around five biweekly co-crafting sessions, each with a thematic focus like nutrient fermentation, water-based horticulture, and human/plant anatomy, which is represented in the presentation slides (fig. 3). The sessions consisted of guided peer-to-peer exchange, lectures to introduce technical concepts, and skill acquisition with the simple horticultural contraptions — made up of modular components as depicted in the planter device (fig. 2), which were handed out one session at a time. This modularity required participants to attend every session for securing access to tools, materials, and the exchanges needed for advancement. Participants were asked to bring their material experiments regularly back to the sessions for joint consultation, as documented in the cohort photographs (fig. 4 and 5).

Most of the co-crafting activity took place at the participants' homes, where they were asked to collect, examine, and ferment daily, 20ml samples of their morning urine to be transformed into fertilizer for growing lettuce (*lactuca sativa*). In close collaboration with environmental microbiologists, the author had developed a process for household-level urine fermentation whereby source-separated fresh urine is infused with propagated lactic acid bacteria (generated from sauerkraut). The controlled fermentation in airtight containment stabilizes and acidifies urine over three weeks, thus neutralising its malodours (Andreev et al. 2017). Each fermenting urine specimen became part of an annotated self-examination passage (Meiselman and MacFie 1996) that involved medical dipstick testers (urinalysis), diet monitoring, and plant development tracking. Participants consolidated

this into an intricate food diary, *The Journal of Mutual Flourishing*, as depicted in the graphic (fig. 6). For access to mutual assistance, participants established a text messaging group that ensured connectivity between co-crafting sessions.

Co-Crafting Participants

The cohort of learners consisted of 22 participants, 19 Hong Kong-born and three born overseas, with an equal ratio of 11 men to 11 women, aged between 22 and 58 years from diverse socio-demographic backgrounds. The majority (85%) were dwellers of apartments and shared households. The participants enrolled themselves because the curriculum promised 'a one-of-a-kind skill-up occasion' for the hygienisation of small quantities of urine to be used for indoor planting. The participants answered to a widely distributed public call of the 'urban ecology adventure' to which a total of 40 candidates applied online. Participants were selected based on their tolerance for open-ended experimentation, willingness to commit time, and how their personal backgrounds brought diversity to the cohort. All participants responded to at least two semi-structured interviews, one before and one after the course, totaling 54 interviews with the duration ranging from 45 minutes to three hours (average was about one hour). The self-assessing interviews were primarily focused on learner's motivations, observations, and reactions regarding their learning experience. Researchers established multiple datasets for each participant, from session transcripts, online text logs, home visit exchanges, self-documentation, and field notes to ensure triangulation.

Facilitators

The author was part of the facilitator team that included a product designer, a research assistant, and a communication specialist who played vital roles in developing the study. The facilitators were interested in exploring ways of contemporising ancient resource cultivation models of fermentation for agroecological use (Schmidt, 2014) and considered its implications for relational health orientation in everyday social life and its extension into a co-crafting curriculum.

Data Analysis

Data collected from these sources was interpreted and analysed using the concept of recursion outlined above to discern the influencers of transpersonal motivation and mental flourishing in person and group. Since prolonged, nurturing commitment (Carolan 2016) depends on the adoption of mutually beneficial goals(Hester and Gore 2015; Gore et al. 2018), the craft collaboration needed to account for the fluidity of emotional states in participants (Brooks 2019). To enhance rigor in the analysis, reflections from the facilitator team, field notes from longitudinal observation (Marshall 1981; Lempert 2007), peer scrutiny, and family members' statements were used to deliver multiple datasets for each participant from multiple sources. Despite utmost consideration for data collection and triangulation, self-reported data and tacit knowledge can rarely be independently verified (Schein 1987). In response, the efforts substantiated from the participants' journal-keeping, props appropriation, and their physical presence during the extended contact time were accounted for to establish and understand the emotional fluctuations in the self-regulation dynamics (Sheldon and Hoon 2007; Fitzsimons et al. 2015) of the co-crafting group. The outcome and findings of this curriculum are discussed with the participants' statements from which three main themes emerged – attitude, purpose, and collaborative synergies – and presented in the following sections.

Recursions in Attitude with Initiation of Happy Accidents

With untested planting procedures, unreliable biometric instruments, and uncontrollable variables of dietary intake, ambiguity loomed large in ANTHROPONIX, which assembled people, health concerns, family life, sanitation, and weather conditions. Deliberately, all involved were brought into uncertain positions to unbound status, expectation, and discovery. Ultimately, the course required learners to let go of routine participation and acquire deeper, more dynamic modes of thinking and acting as expressed by Vincent, a plant-loving musician in his thirties, "It was an experiment after all, and things do happen we cannot expect."

Already on day one, when participants returned home, they found urine sample *Number 1* dispersed throughout their bathrooms. The carbon dioxide of hardworking lactic acid bacteria was more potent than the lid of the urine tube. Only hours after the course began, the facilitators had to abandon their designer's pride and launch fearlessly into damage control, admitting lack of preparation while imploring participants to tightly duct-tape the lids. It paid off that participants were explicitly briefed on the implicit uncertainties of the course. Despite the mess in 22 Hong Kong bathrooms, nobody quit. Instead, the collective urine leak was, in the words of several participants, a "happy accident." The exuberant chemical reaction had made the impact of the urine fermentation palpable since it did *not* smell bad—rather acidic. Because everybody encountered the same problem, the incident was a heightened moment of group initiation. It primed the participants' attitudes for bigger challenges yet to come as Vincent pointed out, "In fact, I was a little bumped in the second week when the lactic acid bacteria were not as strong; why not keep it as constant agitation? We can just tape it down; it's no big deal."

An adverse combination of out-of-season seeds, down-scaled planter size, and insufficient aeration of the urine solution made it (almost) impossible to grow the lettuce. Yet precisely these limitations opened opportunities to "play with the imperfect" (Gaver et al. 2003) through intervening or appropriating as described by Cella, a participating bioscience teacher, "You are not establishing how it is supposed to work; you want people to try different things and then share what has worked best." At large, participants embraced the challenges and displayed resourcefulness in their attempts to rescue the floundering plants by experimenting with numerous seed varieties or exploring improvements to the fertiliser solution. Stipulated trial-and-error learning that fosters self-reflection and solution-finding is directed by expertise instead of power (Leithwood et al. 2008). Since advancement depends on the acquisition of necessary skill or knowledge, rather than following centralised prescriptions, like Clemens, a part-time farmer in his twenties noted, "It's certainly good to bring together people with different expertise; and interestingly, peers who didn't stick to the rules actually seemed to yield better results."

Such flattening of status can engender a "feeling of shared ownership" (Muller 2002) where the unfamiliarity of the situation requires flexibility of interpretation, and collaborators are bound to "continuously assess the uncertainty" as long as it persists (Bijker et al. 1987). For people who expect consistency or instant results, this requires interpretative flexibility, which can be overly demanding (Gaver et al. 2003) as indicated by Cella: "It was difficult to get satisfactory results, and the chances are that people will be disappointed." This resolve to adapt to the unsatisfactory situation through broadening its purpose was also the crucial first step to self-initiated, extended learning. Most participants found the resolve in adapting to the technically unsatisfactory situation. The shared experience of obstacles, frailty, and "impotentiality"

(Agamben 2011) engendered not only emotions of frustration but also the full gamut of positivity, genuineness, and courage (Brown 2012) for letting go of external impositions and adapting deliberately from within as outlined in the next section.

Recursions in Purpose with Harm Awareness from Within

The study's original intention was to observe how participants change their eating behaviour when experiencing how the plants' flourishing depended on the the integrity of their urine. This unifying purpose resonated in some participants with long-standing personal quests, as Mike, a middle-aged exhibition designer, noted, "Yeah when you told me about this course, it was already something I was thinking about; the missing part of the loop in hydroponics." The circulatory nutrients proposition also captured surprising aspirations as illustrated by Wilma, a middle-aged veteran gardener: "I was sure that the result is not good, so I joined! I knew this setup is very limited, but I was simply interested in what would happen." Therefore, this wilful engagement against better judgment known as "akrasia" (Adler 2002) was about finding mental closure by witnessing where the journey could lead.

The horti-technical setup for growing urine-powered plants was both desirable and doomed. Cella describes how ANTROPONIX offered both a practical entry point and focus: "It seems easy, like you can grow your plants by collecting urine and water—then off you go! That's simple enough that people will think, I don't need much space, I can hide it under my sink and do it." As it turned out, the real value was not in the procedures' utility, instead, in its contemplative cues. The 'urban ecology adventure' came equipped with dye-tester strips and reference charts for monitoring urine constitution, plant nutrients' deficiency, eating behaviour, and body care. This not only valorised the urine but led to an overarching, health-related interrelatedness as described by Oscar, an arborist professor, "Everything in this set-up connects; your body, your life, your heart, even your sleep. It's in your house, in your washrooms, and in your bedroom."

Health indicators, data, and charts (for humans and non-humans alike) do not matter unless they are connected to the subject's moment-to-moment experience (Rushkoff 2019). Thus, each co-crafting session featured topical presentations that sought to make the science behind the procedures more humanly relatable, to keep actions better attuned to the regenerative properties of lactic acid bacilli and lettuce plants. Facilitators introduced topics like *Participatory Urban Metabolism* or *From Chlorophyll to Haemoglobin*, emphasising interexistent, biological relations. Rendering microscopic imagery next to art-historic anatomical conceptions "enlivened" ecological principles (Holdrege 2010) as noted by Elisa, a nursing student:

> *"You show the plant seed next to the human embryo; this way I can very easily connect myself with nature. People usually think how they are different from plants, but when you look closely and put them side by side, you can clearly see the linkages."*

Embedding scientific education inside the co-crafting sessions was not just an effort to counteract the increasing separation between science research and technological development (Fan et al. 2019). Humanly-relatable science was also meant to inspire a sense of awe, to shift attention away from self-focus toward the "complicity of reality creation" (Rushkoff 2019) as indicated by Vincent, "I pick up little stuff here and there every week I come; like the weird stuff, for example, that plant roots need oxygen. In this moment of my life, such knowledge is something I am interested in, which made me keep coming back."

Beyond the instrumentality of nutrients capture, urine is a highly intricate and personal substance. Active journal keeping around the urine's integrity provided the locus for engaging in a conscious dialogue with oneself, as stated by Elisa, "The cool thing with this journal is that it starts your imagination, and then it really helps me to very lightly reflect on what I did that day." The urine and fertiliser monitoring relied on time-sensitive dye-testers, perceptive cognition, and routine disruptions, which could be delicate to coordinate as Clemens explains, "After I have done the urine testing in the washroom, I want to eat. So, during or after breakfast, I work on the journal. But sometimes, I forget the test strip. Thus it becomes dried up, and the indication colours have changed…"

The tracking regime drew attention to the limitations of such bio-pedagogic methods (Halse 2010) and led to their contestation in participants like Mike who found reassurance in the capabilities of his inherent sensorium:

> *"Because the results of the test strips sometimes seemed random, I felt that I could rely more on my senses than the test strips."*

This reflective practice (bringing attention to an inherent handicap) led to an adaptive reconfiguration in participants where personal conduct became the result of "social enactments of meaning" (Sonne and Tønnesvang 2015) through the oscillating authority between self and otherness as indicated by Helga, a retired, plant-loving accountant, "In the journal, you have a row called 'normal' for the urine test values; initially that was very alerting, but later, I feel like I don't need this strip to tell me if I am okay or not." The emancipatory engagement with technology was about the critical dialectic of internal and external meaning that mobilised, rather than predicted the sensing, thus signifying and acting in the very present moment (Zinker 1977).

During the exit interview, Richard, a participating college student, confessed how he had ingested flu medicine during urine collection and found himself trapped in a potentially eternal feedback effect of pharmaceuticals—if he were to eat his urine-derived lettuce, "In *week two* of pee collection, I took some flu pills because I caught a cold. If I ate the lettuce sprouting in my pee, does it mean that I keep ingesting the medicine and may get addicted to it [laughing]?" The laughter of Richard originated from instructive insight. Once such breaches are exposed, they can direct how to prevent harm and what to do next, like minimise toxins, share unassuming doubts early, and live with the consequences as fully implicated inhabitants of the 'world of eaters.' Harm-aware revelations stemmed from the recursive interplay of people and perspectives. The key to experiencing one's insight was to perceive how it resonated with the context by belonging to something greater than oneself, as the next section indicates.

Recursions in Collaboration with Consensus from the Unexpected

ANTROPONIX participants were wrapped up in recursive dialogues, all at once, with themselves, household members, peers, and facilitators. This kind of co-crafting reveals a material *con*-versation – turning *together* – where the inner determination of the experimenter engages dynamically with the external resistance of what is unfolding (Glanville 1999).

Elisa explains how this circular generativity with her family spurred the insistence for further exploration:

> *"At the beginning, they think, I am crazy. Yet, after I show them the plants that grow successfully in the urine tubes, I find that their attitude has changed. They can see the sprouting leaves and realise it's not just an experiment about the urine alone. I believe working toward such a result is important."*

Most participants soon realised how the currency to learning was in the involvement with others, including close family. Hence many referred to the course as "camp experience" due to its intensity with knowledge-packed sessions, group dynamics, and unforeseen situations. The face-to-face engagement was an active choice, which helped establish good rapport when extraordinary circumstances warranted extraordinary efforts, or as Vincent puts it, "It's a sense of common experience by overcoming common trouble." In ANTHROPONIX, this connectivity of people and place had essentially two ramifications. One was the self-directed demand for expertise, the other, a "generativity" (Avital and Te'Eni 2009) from unforeseeable consensus and synergies. For example, when the set-up's technical inferiority was evident, most participants realized how there was added value in belonging to a surprisingly passionate group of learners. Surprising here is about spreading astonishment and infusing the process with excitement. Such affective dimensions sent essential signals to peers about the mutually held relationship in the group as Cella acknowledged,

> *"Actually, what I liked most was to witness how others were excited; to see that there are actually people in Hong Kong interested in fermenting their urine—that kind of blew my mind because I thought that's impossible."*

Encouraging peer-to-peer feedback during the co-crafting sessions provided pivotal knowledge dividends, the redistribution of personal insights in the group to increase the mutual advancement potential.

Regular group sharing, and progress reports as a way of joint consultation, gave the opportunity to appreciate each other's contributions and contemplate the shared struggle as noted by Felix, an agricultural researcher and educator,

> *"In the end, everybody was giving a little presentation which revealed other people's approaches; how they improvised, modified and made things work. They were happy to share their journey, and it was interesting how they had their own discoveries."*

For somebody like Becky, a college student who resigned midway from active participation vis-à-vis staggering obstacles, such showings could help to self-validate one's personal performance in relation to the group and prompt restorative action, "I suddenly discovered the interesting bits about the course because some peers actually managed to grow real plants! So, I needed to know for myself how the plants can be helped to grow."

In the face of demanding plants and ambiguous technology, it was helpful to let go of external impositions, expectations, and beliefs and instead rely on consolidating ideas, common sense, and intuition for connecting to what was in the here-and-now. Change here emerges from a trust that the present potential in people and places will supply all that is needed for relevant transitions to be made (Beisser 1970).

Recursions at Crisis point With Conversational Forward Search

ANTHROPONIX, as a problem-based learning proposition, pulled participants inadvertently into a collective rescue mission. At crisis point, the confrontation with technical mishap, non-human agency, unfulfilled expectation, and the limits of mastermind thinking raised the profound question of *how to proceed* as co-crafters. In a society, culture, and politics where design practices have been widely co-opted, asking *how to proceed* becomes a global activity without precedent. It identifies the punctuation point we are at in the evolution of design practices. It also boldly admits to the precarious nature of the way forward and what might

be required and adopted by designers and activist citizens to address the new conditions in which we find ourselves; the perplexing space between fraught technological feasibility and natural forces of living systems. Most participants' adept convergence with cycles of mutual influences (Glanville 2014) – including the integration of failure and immanence of life forces – into their learning journey can be considered the essence of design praxis that is increasingly necessary going forward.

In this light, the success of this learning experiment is measured by the degree of self-regulation in co-crafting for undermining human centrism, where the individual becomes derivative and not foundational in the making of reality. Relational systems such as biological economies do not have self-defined spatial or temporal boundaries, human or otherwise (Debaise 2012). It is the recursive relationality of our 'world of eaters' that provides catalysis for the continuing individuation of the terms (including humans).

The challenge of overturning human centrism, rationalism, and legacies of mastery are here understood as definition and reaffirmation of persistence as a design task: for learning what to do when no one knows what to do in profound as well as playful ways. This pursuit of design as collective discovery into an unknown territory requires the expertise of myriad disciplines and intended beneficiaries for minimising unintended consequences. In response, ANTHROPONIX socially enacted small-step conversations that converged into previously unthinkable and courageous ways of adapting by shifting perspectives, exerting diligence, and aspiring for improvement. At the core of this heartening adaptation that resonated with most participants was the rhythmic and complementary continuum between self/others, action/reflection, private/public, waste/resource, and despair/diligence that opened the middle-ground for unleashing unexpected insight, interiorised reorientation, overarching purpose, and disruptive leaps.

Conclusion

Social adaptation processes and environmental restoration require modes of design education beyond the linearity of inputs and outputs. It requires to see the context, people, and their technical activities as contributors to benefits and consequences in complex circularities.

Whatever the technology is, it never will replace the requirement for human dedication. It means that technology is employed in education in ways that do not repress the passion required for social transformation but rather to help those kinds of passions to flourish. The task of design education then is to engage with technologies in emancipatory ways where technologies are not approached for their own sake but how they transcend the possibilities in people themselves, as citizens, as community members, and as metabolising body/minds. Gilbert Simondon (1980) refers to this technological emancipation as "reintegration of technicity" where the transformative forces intrinsic to tools, machines, and technologies are confronted by a resilient social psyche that is aware of its own material contingency, rather than being left to passive-reactionary adjustments of mass consumption, technocratic management, and populist resistance (Bardin and Menagalle, 2015). This humanising imperative in technological engagement can help develop more collectively shaped technologies based on the living continuity of moment-to-moment experience and non-human agency.

In this effort, the ANTHROPONIX curriculum tried to approach the values attached to technologies, including the power differentials and individualism underlying them, not in opposition, but as the context for bringing forth their complements. In such complementarity, the individual's needs are balanced with those of the collective. Here jointly engaged uncertainties can prime critical intuition, where ideas are consolidated into common sense,

and essential human capabilities like tolerance to ambiguity, curiosity, and courage are reaffirmed. Real advancements typically are not attained in the absence of obstacles and hard work. They are attained because of them. In overcoming rather than avoiding distress also lies joy, belonging, and meaning. Engaging with these existential resources, both in person and group, is the beginning of accessing human development and can give relevant direction. Central to this dynamic is how ambiguity inherent to pursuing a unifying goal can bring about essentially enjoyable adaptation through recursive processes in attitude, purpose, and collaboration.

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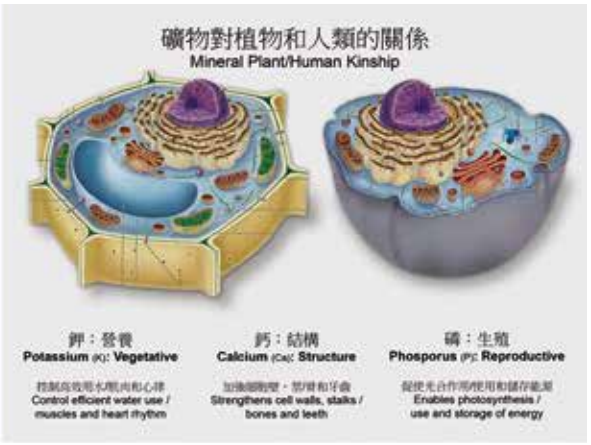
Figures 1 (top): Educational eco-health experiment around the integrity of the urine. The ANTHROPONIX curriculum repurposes urine into something that becomes desirable for reconnecting with our biological foundation. This co-crafting curriculum engaged 22 people who wanted to learn how their urine and personal eating choices can influence the prospering plants growing out of it. *Photograph: Sarah Daher*

Figure 2 (bottom): The ANTHROPONIX planter device was a means to co-craft unprecedented and self-regulatory purposes into the urine. Each urine specimen became a time capsule in an annotated passage that integrated personal eating behaviour, shared anticipation, and experimenting with pragmatic ways of ecological engagement. *Photograph: Sarah Daher*



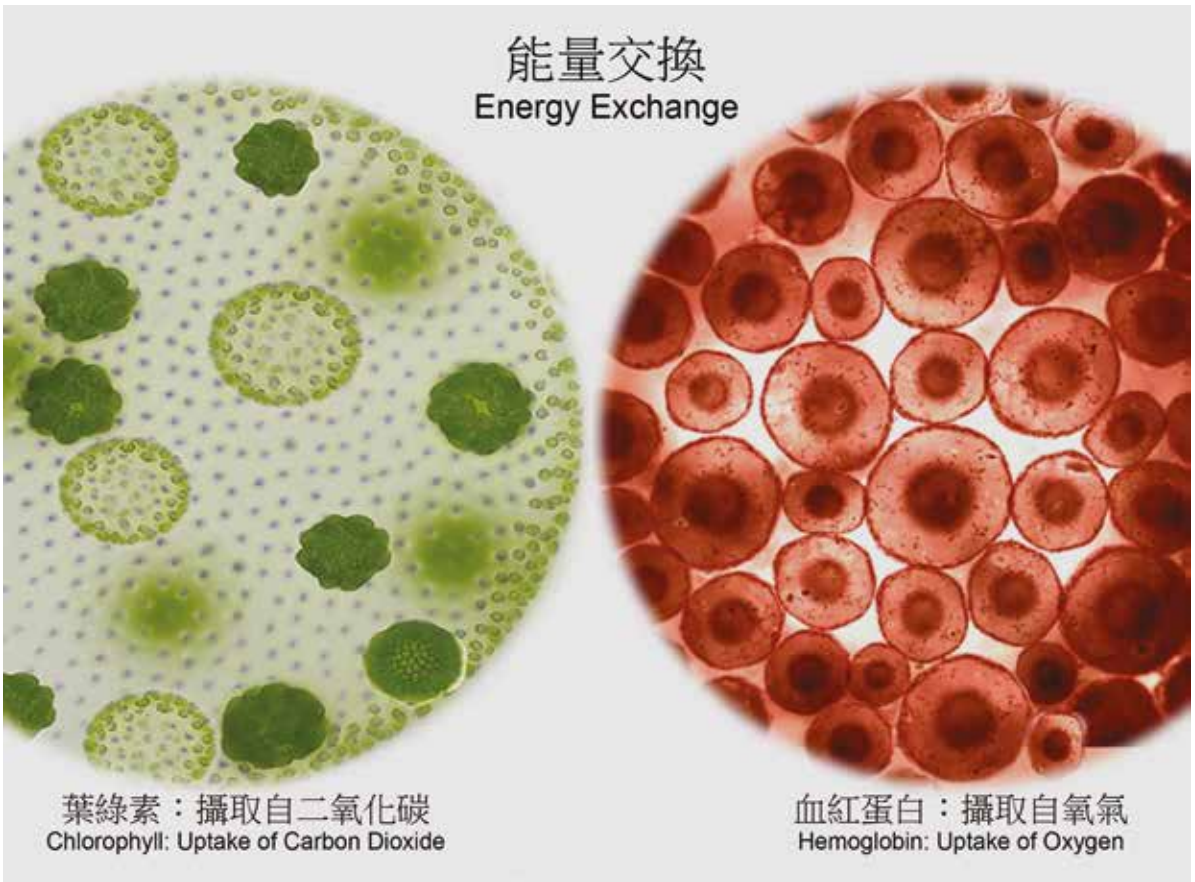


Figure 3: Humanly-relatable science with a focus on interexistent relations. Illustrations by the author.

Each horti-technical topic in the co-crafting sessions was represented by slide presentations that utilized microscopic imagery or art-historical references to put ecological principles and the interrelation of life forms in direct relation with human conceptions and experience. The side-by-side human-nonhuman comparisons made visual connections regarding energy cycle, anatomy, and perceptual systems and considered the possibility of isomorphism without resemblance.

Figures 4 (top) and 5 (bottom): Co-crafting sessions for emergent, self-directed learning. *Photographs by Sarah Daher.*

The five biweekly co-crafting sessions consisted of guided peer-to-peer exchange, lectures to introduce technical concepts, and skill acquisition with simple horticultural contraptions—made up of modular components that were handed out one session at a time. This modularity required participants to attend every session to secure access to tools, materials, and the exchanges needed for advancement. Figure 4 shows how participants were asked to bring their material experiments of the previous week back for joint consultation. Figure 5 shows how more experienced participants explain the concept of anaerobic fermentation of sauerkraut to lesser acquainted peers.

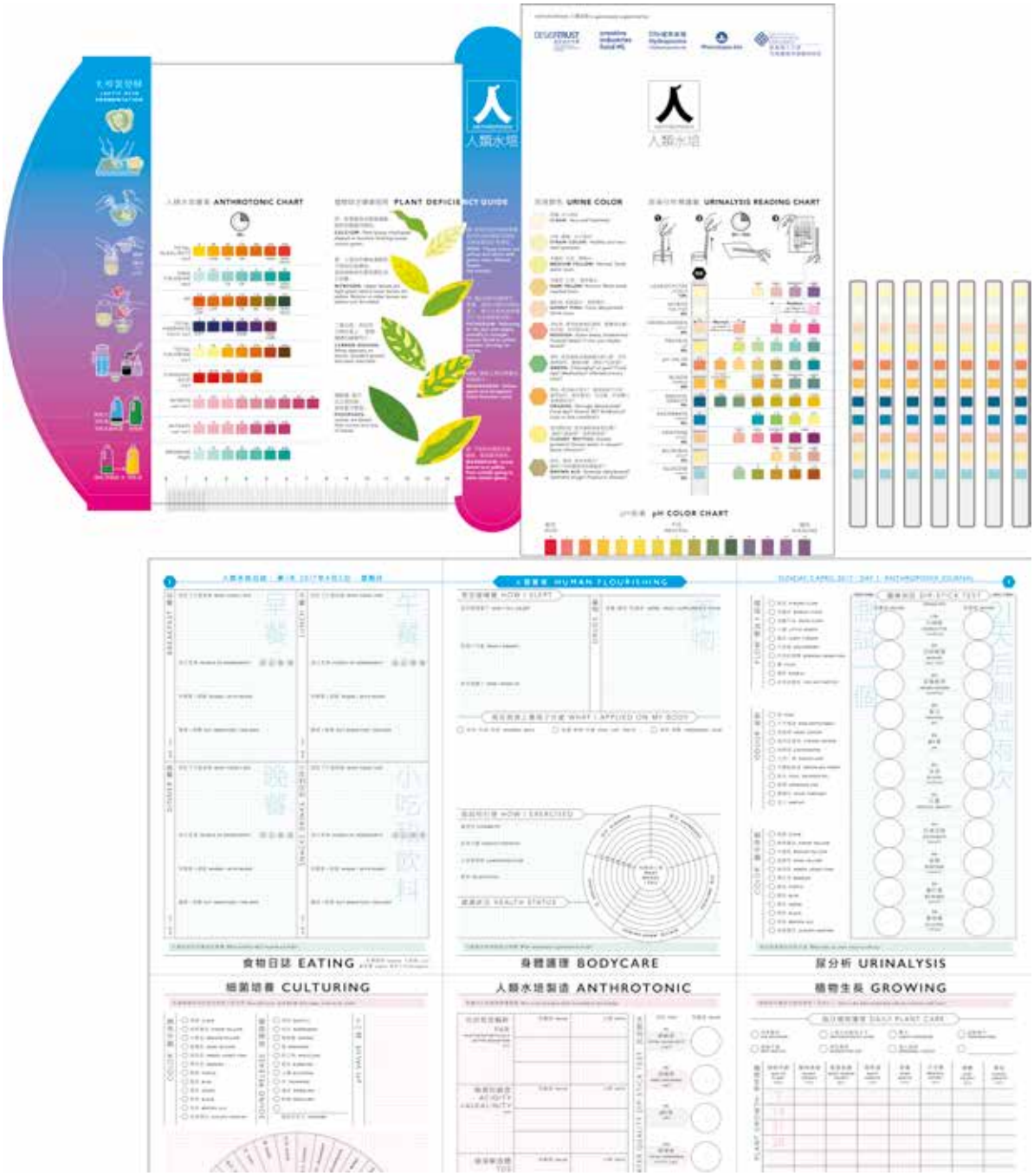


Figure 6: Journal of Mutual Flourishing as a practice of harm-awareness. Illustrations by the author.

The graphic on the top shows the sleeve of the journal (folded to DIN A5) that served as a reference guide and instructions for the bio pedagogic monitoring of human, plant, and bacteria thriving. The graphic on the bottom shows an entry sheet of the journal. With the references on the sleeve, study participants tracked their eating habits, Urinalysis values, odour of urine ferment, growing solution, and markers of plant development. Each diary entry sheet featured two parts, one for Human Flourishing (in blue), the other for 'environmental flourishing' (in red). On the day of urine collection, participants completed the 'human flourishing' part, and three weeks later, when the urine specimen was fermented and ready to use, participants would start monitoring 'environmental flourishing' in planting solution and vegetal offspring.

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Bio

Markus Wernli's praxis, research, and teaching focus on human-nature relatedness by exploring the development of more regenerative, ecologically entangled ways of living and designing. His ongoing research draws connections between our food systems and practices and social, cultural, and local ecosystems. It considers how to forge better relationships between what we breathe, eat, expel, wear, and grow. Much of Markus' research might be considered participatory citizen science or social citizen-design experiments that can be gathered under the umbrella of participatory research through design. He specializes in contextually applied and critical research-through-design, bringing focus to the social and ecological impact of body-technology pairings and human-biosphere interactions. Markus currently works as research assistant professor with the School of Design at The Hong Kong Polytechnic University. Before that, he held appointments at the College of Asia and the Pacific at Australian National University in Canberra, Zokei University of Art and Design in Kyoto, and the Multimedia Studies Program at San Francisco State University. URL: http://markuswernli.org

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041

NON-PEER REVIEWED:

Vertical Studio: Undergraduate Collaborative Advanced Learning and Teaching Methodology

Anneli Giencke

100—107

Since 2016 the Environmental and Interior Design Programme (E&I), School of Design, The Hong Kong Polytechnic University, has implemented an educational model called the vertical studio. Until now, the vertical studio model has become an instrumental peer-to-peer learning scheme while enhancing students' competency in digital literacy. A first of its kind within the design education context of Asia, the vertical studio model has contributed to advance design education practices, embracing collaborative learning opportunities, and facilitate knowledge and skills transfer of drawing techniques, technology, and digital proficiency.

#peer-to-peer education

#digital proficiency

#collaborative learning and teaching methodology

#design educational model

A number of design schools globally have begun to implement the concept of a vertical studio model in their curricula. This is evident from current design courses taught in British, German, American, and South African institutions. The key feature of a vertical studio model is the collaboration of students across all years to address specific themes. In this context, the vertical studio model is not meant to override the traditional curriculum, but to both add, as well as, amplify design skills. Thus, its aim is to create peer-to-peer learning opportunities linked with assignments to translate visual observations and the perception of our built environment into two- and three-dimensional representations using manual and digital drawing techniques.

Having recognised the need to build up and strengthen industry related skill sets in the current E&I curriculum. However facing the limits of each semester's timeframe and allocated teaching resources - consisting of eight design studios, four core subjects and six peripheral courses annually - the concept of the vertical studio model was developed in response to accommodate for such additional demands.

Hence, the vertical studio is a two to four-week design analysis exercise, including students from all four years of the BA Honours program to work together within their designated studio setting at the beginning of the year. Students are organised into groups, consisting of one student from each of the four years (year 1, 2, 3 and 4). Individual students are assigned with different tasks, according to their skill levels, encouraging senior and junior students to collaborate using peer-to-peer learning methodology. During the vertical studio course, students congregate, engage, share, explore, and interact collectively.

The critical contribution of the vertical studio to the general E&I curriculum is the focus on the development and enhancement of specific skill sets and dedicated learning outcomes, which are delivered within a short time frame. First, the vertical studio acts as an introduction module to the academic year, the programme, and the people involved. Second, it establishes support groups amongst peers, allowing for student and staff familiarisation between each year. Third, it facilitates working relationships between junior and senior students, easing the process of juniors' commitment to help seniors during their final year project and in return, seniors assisting juniors with design and programme related questions. Fourth, the vertical studio manages expectations from either positions of the students and the programme, disseminating design and research practices, quality of work as well as what constitutes as a successful final year project.

Since its establishment in 2016, the vertical studio has been constantly evolving through the assessments of the teaching and learning outcomes each year. Tutors valuation and students' feedback are considered to adjust and improve both theme and assignments for future vertical studios.

A detailed insight of how such a vertical studio is excogitated can be described by the example of the studio's 2018 theme of *Verisimilitude* (high resolution detail). The brief was to illustrate one construction detail in two- and three-dimension by first, hand drafting the construction detail into an isometric drawing and second, to use Rhinoceros 3D computer software for its digital translation. Year 4 students mainly provided mentorship for the younger students. Year 2 and year 3 students were asked to digitally draw details, as well as assist year 1 students in hand drafting. In turn, year 1 students were responsible for accurate and specific site measurements and spatial documentation, hand drafting the same details through skills acquired from their peers. Tutors provided overall support for Rhinoceros 3D software introduction (year 2 and 3), introduction to site analysis (year 1), technical concepts and meth-

ods of isometric drawing techniques (year 1) as well as regular development feedback. Overall, the three-week exercise gave students time to encounter and surmount drafting challenges such as: drawing scope definition, site and measurement protocols, descriptive geometry and computer modelling methods, resolution/data management, drawing coordination and construction detailing.

Previous vertical studio themes included, the *Qamarah Eye*, the first of the vertical studio series held in 2016, which examined the status of Hong Kong's interior context. With roughly 4,000 photographic surveys, the main work focussed on the photographic representation of the city's interiority - exploring, understanding and handling of technical components, the notion of light and its three-dimensional rendering effect on space, image formation and aesthetics, while conceptually linking a variety of interior conditions to cultural, social, and economic aspects. The outcomes were presented in the form of two publications, an exhibition, as well as a series of awards for the best images produced sponsored by a design industry partnership with the E&I programme.

The second vertical studio, titled *IN_version*, held in 2017, explored the figure-ground condition within the city interior and the mapping of these complex relationships and boundary conditions. It combined urban spatial analysis with the interior-exterior dynamics of a city and its contiguous matrix of spaces. A total of eight axonometric drawings were produced, each three meters wide and one meter in height, illustrating three-dimensional rendering skills, hatching techniques, explorations of line styles, and spatial compositions.

In conclusion, the vertical studio advances the idea of collaborative design pedagogies. Not only does it promote and encourages a close working relationship between students of all years and their teaching staff but demonstrates an overall improvement of student's general design development, illustrating valuable understandings of knowledge and skills transfer by means of collegial teaching and learning methodologies. Thus, the vertical studio extends beyond the practical needs of digital competency alone but puts emphasis on peer-to-peer learning pedagogies to further theoretical discussions within design education, and to develop applicable models which allow for alternative solutions towards a collective teaching and learning strategy.

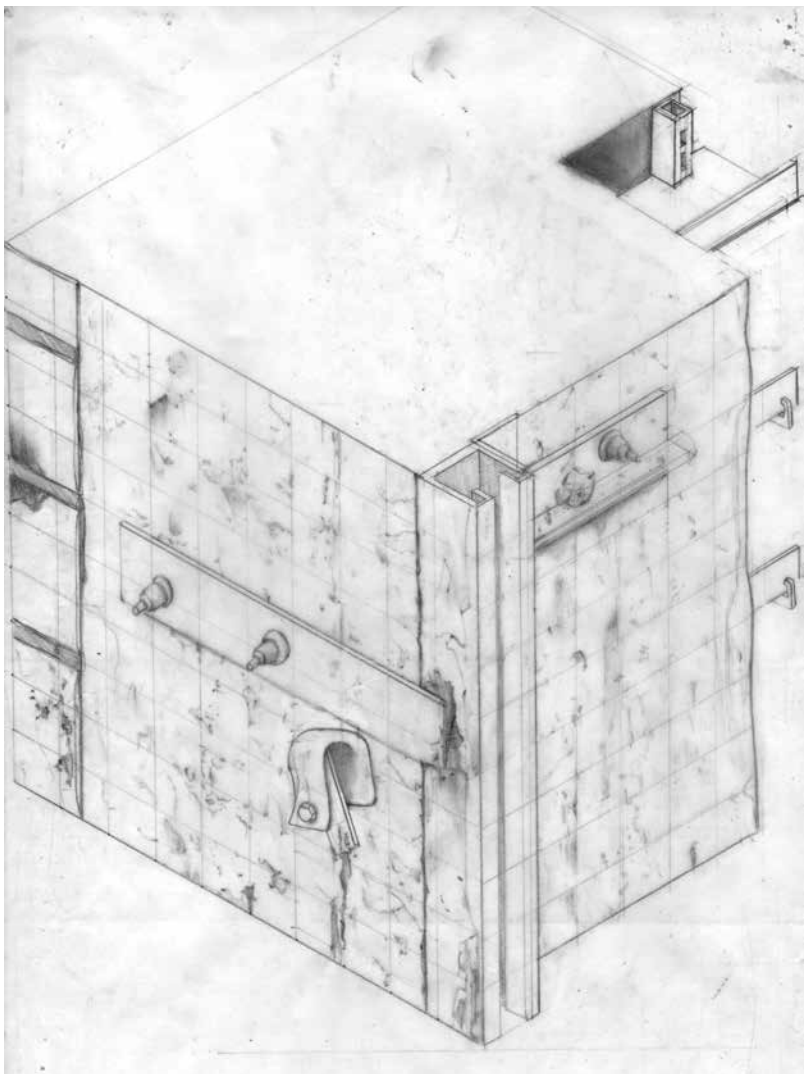

Figure 1 (Previous page): Vertical Studio *Qamarah' Eye* - 'City & the Interior', 2016. Photographic collection. *Source: Cheng Wai Yin, Lee Hiu Hei and Lai Hok Ming.*

Figure 2 (Current page): Vertical Studio *Verisimilitude*, 2018. Hand-drawn isometric. *Source: Cheung Tsz Ching, Lam Yeut Lai and Vong Ka Hei, 2018.*

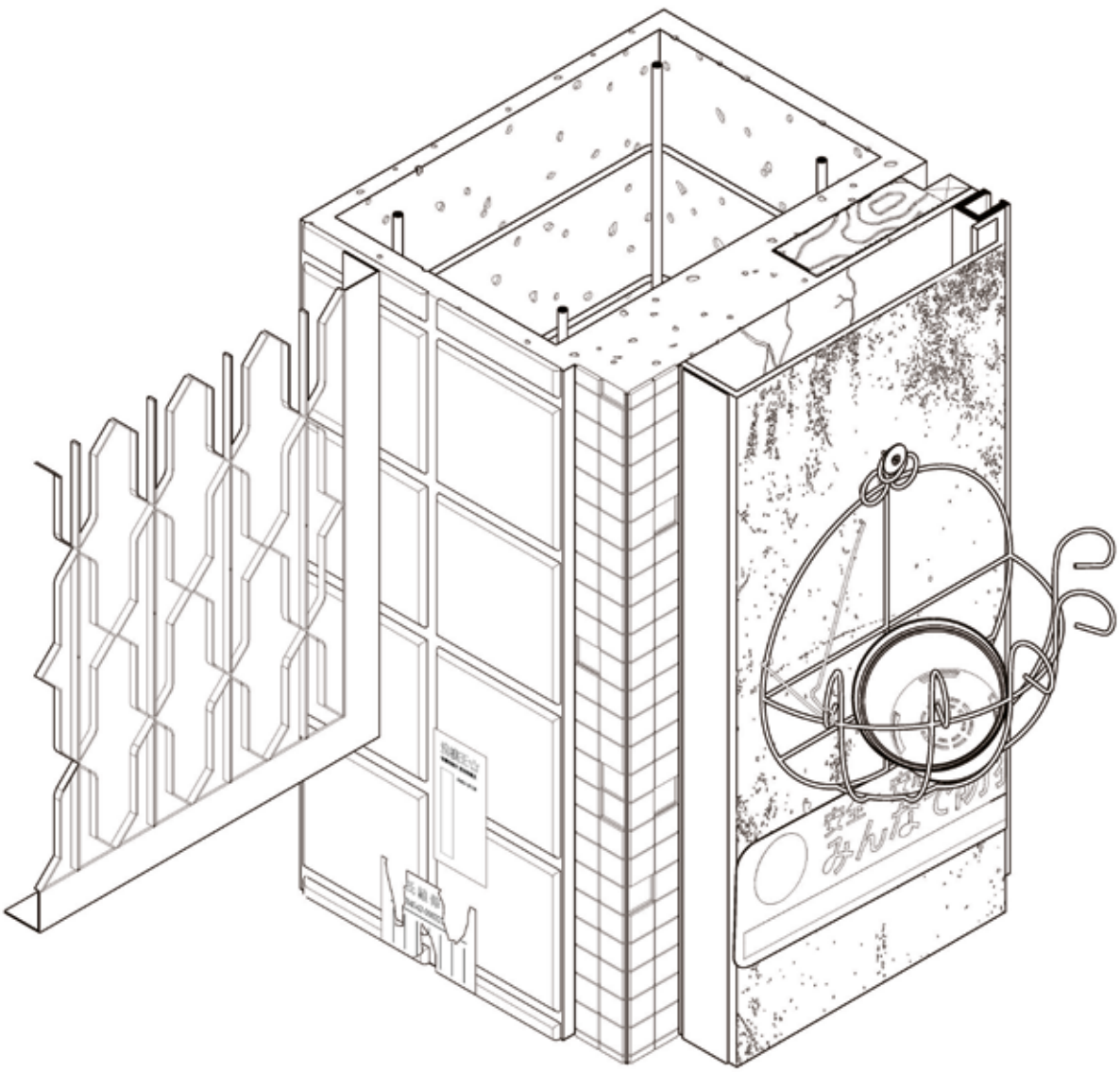

Figure 3: Vertical Studio *Verisimilitude*, 2018. Digital isometric drawing. *Source: Chou Yu Hsuan, Kam Kwan Yin and Wan Tsz Yu, 2018.*

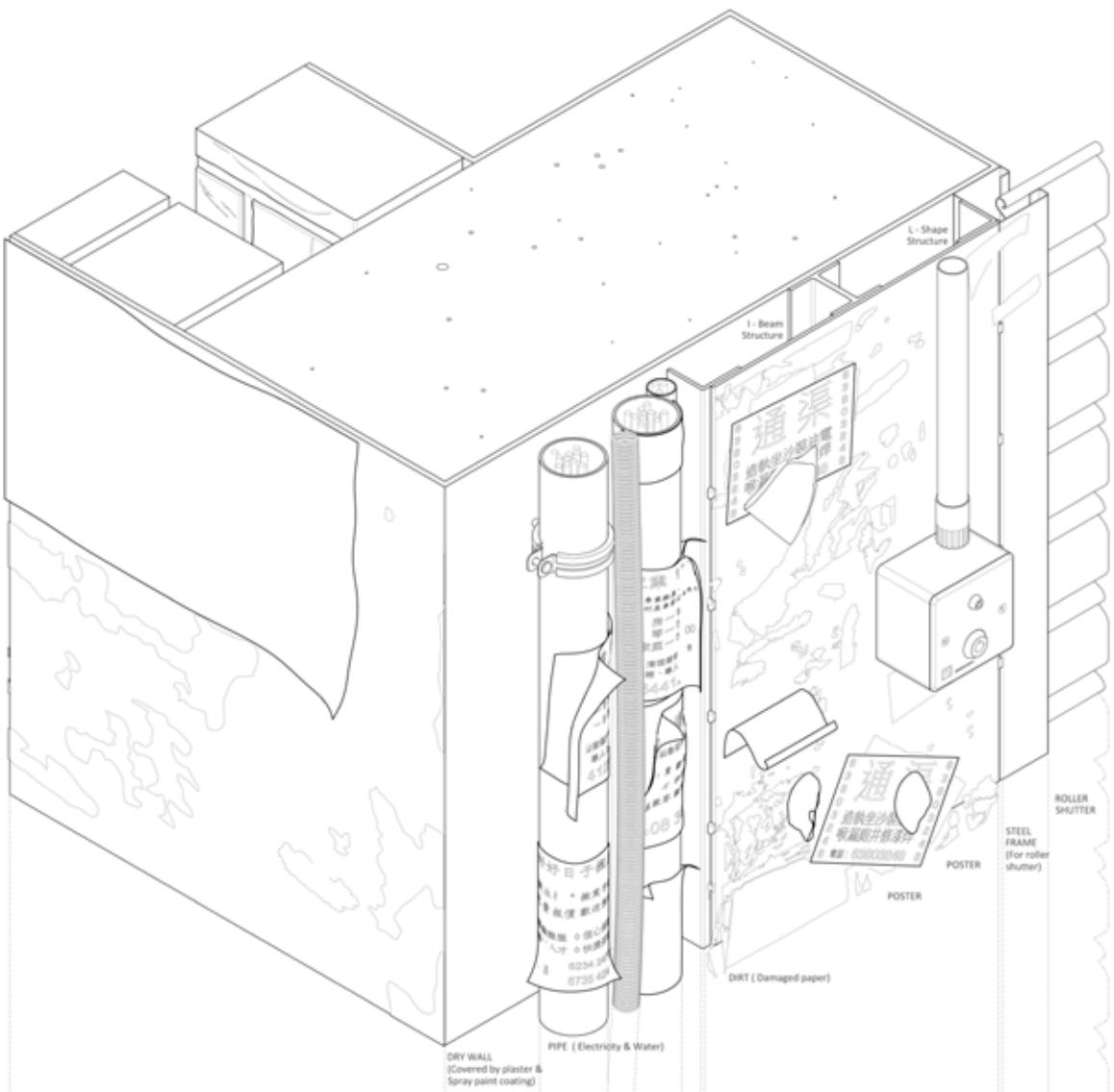

Figure 3: Vertical Studio *Verisimilitude*, 2018. Digital isometric drawing.
Illustration by: Tam Ka Man, Wong Yuling and Leung Cheuk Sum, 2018.

Bio

Anneli Giencke, is an architect Dip Arch (MArch), PGDip, ARB (UK). She studied architecture and interior design in Austria, Germany and London and received her master from the Bartlett School of Architecture, UCL. She has two decades of practical experience working in renowned international companies as a designer and architect including Plasma Studio and Wilkinson Eyre Architects (London/ UK). She is also a visiting critic to numerous international universities including the Architectural Association London (AA), Bartlett School of Architecture, University College London (UCL), Royal College of Art in London/ UK, The Technical University Berlin/ Germany, The University of Hong Kong and The Chinese University Hong Kong. Anneli taught at the Institute for Experimental Architecture / Studio 3 at the Technical University of Innsbruck/ Austria, and more recently at City University of Hong Kong, The Chinese University of Hong Kong as adjunct assistant professor and joint The Hong Kong Polytechnic University, School of Design in 2018. She also works as a freelance architect in Hong Kong.

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042

NON-PEER REVIEWED:

Service-Learning Education Integrated Design Education Through a Design-Build Focus

Michael Chan

108—121

Different from the conventional design-built projects, the service-learning educational model represents a student led community driven education process. This photos essay delivers evidence, spanning 15 years and various contexts, demonstrating the impact of service learning and its dependency on cross-disciplinary skills. Beyond the social value, service learning fosters a series of interpersonal and professional relationships, amplifying skills and education value outside of the classroom.

#design-build

#service-learning-education

#transferable skills

#peer-to-peer development

Service Learning

The Service-Learning educational model represents an alternative to design education in the context of the digital paradigm. Mechanising design-build projects, the emphasis of the service-learning model shifts attention away from the tutor driven model to a student led process. In addition, the model represents an open and cross-discipline model, open to all students of all academic backgrounds and skills to co-design and co-develop build work. This has facilitated a range of tangential projects that formalise cooperative projects between industry, communities and students.

With the ultimate emphasis to enhance the living conditions of under-developed areas and marginalised communities, service learning aims at community enrichment, with a specific focus on the development of village centres and eco-facilities. Six goals outline the service-learning project. First, to provide university students a real-life experience of executing a service project which has a direct impact on social life. Secondly, to respect, appreciate, and preserve the local culture and environment, and to promulgate the concept of sustainability. Third, to encourage students to work with professionals for improving the lives of underprivileged communities by initiating and implementing design and building projects. Fourth, to foster better communication, mutual understanding, and engagement between students and villagers, to develop interpersonal skills and build community links among them. Fifth, to transfer practical building skills and knowledge of materials that promulgated the concept of sustainability, with locally available and sustainable materials, utilizing local wisdom and green building concepts. And finally, to empower villagers with transferable skills to develop and expand their own communities.

Working on the development, design and construction of a real-life project, students work closely with the professional and experts such as architects, engineers, surveyors, and local carpenters to complete the project to a range of standards. Supported by professional and academic staff from relevant faculties and department, students were guided for the entire process, developing knowledge that is transferred through peer-to-peer learning, applying knowledge beyond classroom teaching.

With a longevity of more than fifteen years, the Wu Zhi Qiao Project – PolyU Chapter and School of Design Service-Learning Programme has successfully completed over twenty-three projects in nineteen villages. Including fourteen footbridges, six village centres, eight village facilities and a series of community enrichment projects in seven provinces in China and two Prefectures in Japan. The project has impacted over 2000 University Students from Hong Kong, The Chinese Mainland, and overseas to benefit in the with collaborative stagiest of more than 80,000 Chinese villagers.

Figures 1–3 (pages 110-112): Feungshan Village, Wu Zhi Qiao (Bridge to China) (2017): Gabion bridge design and build in Feungshan Village, Qianjiang District, Chongqing, China. *Source: author.*

Figures 4–6 (pages 113-117): Light for the village (2017): Installation of solar light panels and village improvement projects in Datan Village, Zhangjia County, Gansu, China. *Source: author.*

Figure 7 (previous page): WHARF Liming Village Wu Zhi Qiao (2018): Bailey bridge design and build in Liming Village, Lijiang, Yunna, China. *Source: author.*

Figures 8–10 (this and next page): Design and build for remote community, Japan (2019) Pavilion Design and Build in Keihoku, Japan. *Source: author.*

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Bio

Michael Chan is a senior teaching fellow of the School of Design, The Hong Kong Polytechnic University. He is an architect who is active in a range of design-build projects, amongst whch are the Eco-bridge education project in Shannxi, Gansu, Sichuan, Guizhou and Guangxi providences in mainland China spanning more than 15 years. He was a member of the School of Design's Service-Learning Task Force, Service-Learning subcommittee and the School of Hotel and Tourism Management School Board, judging panel of Hong Kong Scholarship for Excellence Scheme (HKSAR), and the vice chairman of HKDSE Applied Subject Committee (HKSAR). In addition, he serves as member of the Management Council of the Wu Zhi Qiao (Bridge to China) Charitable Foundation and project leader of the WZQ service-learning programme. He is recipient of the 2020 Faculty Award for Outstanding Education Achievements.

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ABSTRACT:

Facilitating Tacit Knowledge Construction: Re-Examining Boundaries of the Design Studio Environment

Aruna Venkatesh

122–127

Design knowledge, for its most part, is tacit. The embedded and inherent nature of tacit knowledge implies that it is a cognitive and internal construct acquired through the design act of doing. However, it is also socially constructed through shared experiences, collaborations and interactions. The design studio is a dynamic, pedagogical site that facilitates the construction of tacit knowledge through its myriad of interactive spaces. Online and virtual platforms offer opportunities to extend the learning boundaries of its social realm. Studies in the influence of these spaces on tacit knowledge construction are currently insufficient.

An interpretive study was conducted in different studio environments within the Environment and Interior Design discipline of the School of Design, The Hong Kong Polytechnic University to further the understanding of tacit knowledge construction in blended learning environments.

#tacit knowledge acquisition

#knowledge construction

#blended studio learning

The design studio retains its status as a 'signature pedagogy' (Shulman 2005) unique to the design discipline as it provides a flexible infrastructure needed for the design process. As a learning mode that "accepts uncertainty, serendipity and happenstance" (Crowther 2013, 19) it is also the site for tacit knowledge acquisition.

Tacit knowledge which is closely associated with design cognition continues to feature in design educational discourses because of its difficulty in transference and articulation. It is difficult to articulate because, as quoted by Donald Schön "Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action" (Schön 1985, 21). As is implied in the quote, tacit knowledge is often considered as an internalised, individualised, and embodied process mainly constructed through the act of doing. In other words, a constructivist approach complements and encourages tacit knowledge acquisition.

However, the overemphasis of tacit knowledge as an innate ability often overlooks its socio-cultural dimension (Mareis 2012). According to Jens Loenhoff, tacit knowledge is collective, differentiated, and context-specific. It is "socially shared, because it is the result of agents' successfully coordinated and co-produced action" (Loenhoff 2015, 24). This is also in line with well-known socio-cultural perspectives of constructivism such as Vygotsky's zone of proximal development and Bruner's Scaffolding theory.

The dynamic nature of the studio environment provides opportunities for social interactions and sharing experiences that scaffold tacit knowledge acquisition. Increasingly, the boundaries of the studio are extending towards the virtual realm that offers online platforms to extend learning beyond the studio. Studies have shown that leveraging the tacit knowledge of individuals in an online community could provide opportunities for situated learning (Oztok 2013). At the same time, learners of today are wired differently; they prefer visual and social learning through the internet, which impacts learning behaviour.

While these have implications for tacit knowledge acquisition, intensive studies in the connection between tacit knowledge and online learning are insufficient. Therefore, research was conducted in the Environment and Interior Design (EID) discipline of the School of Design, The Hong Kong Polytechnic University to study the facilitation of tacit knowledge construction through a blended learning environment in the context of interior design studios. Physical, digital, and online environments, as well as social media environments that also serve as learning environments were considered as blended learning for the purpose of this study. Schön's theory of reflective practice and constructivist theories were applied to generate criteria for tacit knowledge acquisition, which also served as a conceptual framework for data collection and analysis.

This interpretive study was conducted using six focus groups in the EID programme. A focus group consisted of two to three students from years 2 and 4 from the programme. Students and their respective tutors were observed and interviewed in two design projects as part of the studio subjects. Observations were also conducted by being a member of social media groups organised by the tutors. Audio and videotaping were, used after obtaining the consent of the participants.

Significant findings revealed through the empirical research were:

1. Active engagement in an experiential learning cycle constructs tacit knowledge irrespective of whether it is a physical or online setting. Students preferred resolving issues with tutors

through the physical acts of sketching or modelling (fig.1) However, as opined by a tutor, if students have the cognitive maturity of visualising their designs, they could participate in online or digital reviews.

2. The physical studio activates cognitive and sensory stimuli that lead to unexpected discoveries and visuospatial encounters, triggering tacit knowledge construction (Suwa, Gero and Purcell 2000, 252). These interactive experiences may not be replicated in an online studio. However, according to a tutor, the blending of crafting skills and powerful computer visualisations could become a unique skill set that spatial designers possess. Thus, the overlap may lead to newer forms of tacit knowledge constructs.

3. A student mentioned that online discussion did not afford for other design discussions that could be provoked by the physical environment (fig. 2). Likewise, a tutor asserted that critical thinking that is developed from hearing, comparing, and understanding discussions of analysis and synthesis could not be taught in an online system.

4. Existing Blackboard Learning Management System was seldom accessed by students who preferred faster interfaces like WhatsApp.

5. Social media was mainly used for disseminating students' works, scheduling meetings, or for casual conversations. Students preferred a face-to-face discussion to avoid text misinterpretations and delay in response. Amongst others, unfamiliarity or lack of technological resources could be some of the reasons for misconceptions and reluctance to use the above platforms.

However, when used effectively, online studios can offer readily available platforms for critical discussions and networked collaborations even across various design communities. Shared knowledge that is generated can be converted into easily accessible and time-stamped knowledge artefacts. Thus, the online has the potential to extend the social dimension of the physical and thereby, scaffolds the physical studio.

Similarly, digital artefacts and interfaces provide new dimensions to learning by doing. The capitalisation of technologies, such as augmented and virtual realities, and also advanced haptic interfaces, which have not been mentioned, can develop new kinds of cognitive skills for spatial understanding in interior design.

The blending of the two environments provides a multiplicity of interactive experiences, different media for explication, alternative contexts for situated learning, and strengthen critical reflective skills. Based on the findings and literature review, a framework was proposed that can help extend learning from the physical to the online environment.

To conclude, a blended learning studio stimulates creativity and enhances the acquisition of tacit knowledge through newer forms of understanding and discussions. According to Peggy Ertmer and Timothy Newby, these new learning contexts and tools provide increased opportunities to construct knowledge round-the-clock (Ertmer and Newby 2013, 69).

It also means challenges and opportunities for design education to develop new pedagogical methods. This study is limited but provides insights into the potential of these alternative studios as emerging studio pedagogy.

Figure 1: Exploring haptic interfaces in the context of blended learning settings. Testing spatial and elemental possibilities and their digital translations. *Source: author.*

Figure 2 (next page): Year 2 Studio review, the merger of digital technologies with interior development. *Source: author.*


Endless Space

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Bio

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