Using the power of design thinking to enhance creative, innovative and collaborative learning in the post secondary classroom.

Design Thinking Based Learning: a Teaching Guide

Dr. AnneMarie Dorland
Mount Royal University

Design Thinking is the deliberate practice of mental ambidexterity aimed at shifting reasoning and sensemaking practices within a culture of changemakers.

Design thinking is all about innovation, creativity and a change of perspective. To think like a designer, or to deliberately design how we think at all, requires dreaming of new ideas, taking the time to bring them to life and to test their strength, and being open to growth and failure as part of a learning process. Design thinking is a method and a mindset, a framework and a process, but most of all it is a deliberate approach to cognitive processing that keeps people at the centre of every process. As Tim Brown, Executive Chair of IDEO explains, "Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." (IDEO, 2020).

It is not hard to see why design thinking is becoming a critical problem-solving method in business and innovation (Liedtka, 2018). But what is less often understood are the significant benefits associated with design thinking based-learning for both learners and educators. **Design thinking based-learning offers effective solutions to common challenges to course design, class structure and learning delivery. It can also be used as a framework for significant learning experiences inclusive of all levels of the Fink taxonomy (2013), and as a catalyst for 21st century and future focused skill development and learning objectives (World Economic Forum, 2020).** Integrating design thinking based-learning into existing pedagogical approaches can:

- Give students the opportunity to view a learning challenge from a different perspective.
- Allow students to create and pursue a line of inquiry with a human centered approach.
- Encourage innovative thinking and creative problem solving.
- Support the development of self-paced and collaborative learning skills.
- Result in learning that is significant, meaningful and experiential.
- Enable a growth mindset among learners.

We know that using the mindset and methods of creative practitioners such as designers can transform the way that organizations and communities develop products, strategies, services and understandings. When we apply these mindsets and methods within a framework called design thinking, we use a series of divergent and convergent thinking practices to better understand key issues or problems, to foster empathy and user centered perspectives, to create multiple innovative and creative solutions to a single challenge, and to build and test possibilities in collaboration with the communities we are serving. For those of us whose goal is to foster creative, innovative, experiential and meaningful learning in our classroom, a design thinking framework can help us get that done at a very concrete level.

Design thinking is understood as a driver of positive and disruptive innovation (Kelley, 2013) – a series of organizational resources, theoretical perspectives and creative protocols that can seed positive innovation and organizational transformation in established corporate cultures (Brown & Wyatt, 2010). The use of design thinking as a driver of innovation and organizational transformation has been scrutinized for decades (Brown, 2009; Cross, 2011; Liedtka, 2015) in the fields of organizational behaviour, innovation and creativity management, and cultural industry studies. However, most of these investigations have addressed design thinking as a form of process creativity, which has contributed to the blurring of boundaries between this impactful mindset and studies of individual practices within organizations, teams and learning communities. What has driven recent growth of attention to design thinking in contexts outside of the creative industries (including higher education) [1] is a change of perspective: design thinking is increasingly characterized as a distinct innovation practice [2] (IDEO, 2019; Hassi & Laasko, 2011), one which can support and foster the development of creative problem solving and innovative leadership skills (Plattner, Meinel & Leifer, 2012) [3].

Given the evidence, why don't we integrate design thinking based-learning into more classes? It might be because instructors and administrators are unaware of the benefits, apprehensive about the implementation, and assuming that it is a process for designing a product or service, not designing how we think. The purpose of this teaching guide is to provide instructors with the background, tools and context they need to successfully integrate design thinking based-learning into their classrooms. Increasingly, PSE instructors

are seeking new ways to integrate experiential, WIL and active learning practices into their classrooms. Mount Royal University provides an ideal environment to experiment with these collaborative and engaging pedagogical approaches, with small class sizes and close connections to our student teams. Design thinking based-learning provides a complementary approach for many of these frameworks, and this teaching guide is intended to provide guidance on implementing design thinking based-learning effectively in the online, face to face and remote classroom environment.

This teaching guide is divided into three parts: what is design thinking based-learning, and what use does it have as a pedagogical framework; how can we integrate design thinking based-learning into teaching in the post-secondary classroom; and, what is the impact of using design thinking based-learning with students as partners in post-secondary or higher education learning environments.

In part one, we will introduce the design thinking framework, and provide evidence for the ways that it promotes and improves learning in undergraduate education. In the second part of this guide we will share on 15 different exercises that can be used in online and face to face classroom settings and provide some context for how they align with the larger design thinking framework. Finally, we will explore the alignment of design thinking with pedagogical approaches commonly used in our PSE context (including experiential learning) and provide pilot study evidence for the impact that design thinking based-learning can have on critical skill acquisition and creative competency development among undergraduate students.

Together, we will answer these questions.

- What is design thinking and how does it translate into a learning model or pedagogical approach?

- How will design thinking based-learning improve learning? What is the theoretical basis and pedagogical rationale for design thinking based-learning?

- What is the evidence that design thinking based-learning promotes and improves learning? And how convincing is that evidence?

- Which students are most likely to benefit from design thinking based-learning? And for which learning tasks is it most appropriate?

- How can discipline-oriented PSE instructors integrate design thinking based-learning into their classrooms? How are design thinking based-learning learning tasks structured?

We face challenges in teaching and learning at the post-secondary level: we struggle to move our classes beyond the understand-and-re-member model of direct instruction and, as Fink has outlined, we face difficulty when trying to figure out "what teaching activities [we] might use besides the two traditional standbys: lecture and discussion" (2013, p.xi). The future of our students requires us to support the development of their innovation, creativity, interpersonal and self-directed learning skills. But to do that we often focus on the introduction of new content or new programs in higher education contexts: solutions that require enormous commitments, resources and departmental or institutional support. In this teaching guide, we've outlined a new path forward – one that may have an equally positive impact on student's development and acquisition of the critical characteristics identi-

fied in the Education 4.0 Initiative while requiring far less institutional resources or commitment. Adopting design thinking based-learning tech-niques, integrating a design thinking mindset, or including design thinking methods in teaching and learning at a post-secondary level can help instructors across disciplines to support the en-hancement of innovation and creativity skills, the establishment of interpersonal skills, the acquisi-tion of self-paced learning skills and student en-gagement with collaborative or problem-based learning practices.

I hope that this teaching guide helps you find a new way to integrate design thinking-based learning as a pedagogical approach in your classes, and that this new set of tools proves a valuable addition to your teaching and learning practice.

WHAT IS DESIGN THINKING?

Design thinking has been framed as a mindset, method, practice, process, and magical silver bullet for those seeking to transform what Simon refers to as "the existing to the preferable" (1968). In this section of the Design Thinking Teaching Guide we will explore two critical questions. What is design thinking and how does it translate into a learning model or pedagogical approach? And what is the theoretical basis and pedagogical rationale for design thinking-based learning?

The practice of design thinking, a general term used often to describe the work of connecting creativity and innovation within an integrative series of divergent and convergent social practices has grown exponentially since it's conception in the systems engineering world of the 1960s and popularization in the fields of business in the earlier part of this century (Brown, 2008). Increasingly, design thinking (framed as a practice, protocol or mindset) is being applied as a problem-solving heuristic in fields as diverse as K-12 education (Samberg, 2018), health care (Roberts, Fisher, Trowbridge & Bent, 2016) and spiritual development (Berrett, 2015). Design thinking is most often understood as an iterative and cyclical series of divergent and convergent stages through which individuals and teams can effectively solve human centered problems (Dorst & Cross, 2001). As Tschimmel and Santos (2018) have suggested, effective use of design thinking processes and protocols relies on the designer's ability to simultaneously consider human needs, the available resources and the constraints and opportunities of a presented challenge. Most commonly, this is achieved through team based and participatory protocol or process exercises grouped into five main categories: empathy, problem definition, ideation, prototyping, and testing (Rodgers, 2013).

Defining design thinking.

Design thinking is most effectively framed as a tested and established approach to meta cognition: a process of designing how one thinks about human centered challenges and needs and of deliberately engaging in the deliberate practice of mental ambidexterity aimed at shifting reasoning and sensemaking practices within a culture of changemakers (Dorland, 2018).

Design thinking as a discourse, a method of problem solving, and a model of creative work is grounded in both empathy, and an ongoing cycle of divergent and convergent thought – a grounding that is reflected in its development as a discourse since the 1960s and in the popular models used in its application. Prompted by the initial use of computer programs for problem solving in the early 1960s, the First Conference on Design Methods was held in London in 1962. Many designers interested in the history of the discourse, including Szczepanska (2017), trace the beginnings of the design thinking to this date, as it heralded a wave of academic debate about the role of methods and theories of designing for change, or as Buckminster Fuller called it, design science (1965). In fact, it was Archer who introduced the term "design thinking" to the world, launching the discourse that has come to stand in for so much creative work in his Systematic Method for Designers (1965), though the term itself is often attributed to Simon's understanding of the process as a unique, methods based approach to a commonly defined and understood problem. This definition of designing as a problem-solving activity, one that could be deployed without aesthetic expertise towards a knowledge-based solution – or as Simon put it, as "a process which aims to improve existing environments into preferred ones" (1968) – formed the basis for the now ubiquitous model for the design thinking process.

Central to the formulation of design thinking as a method for problem solving was the co-evolving understanding of wicked problems (Rittel & Webber, 1973), or problems that (among other characteristics) lack an inherent logic that signals when they are solved: a definition that marked design problems as wicked or interdisciplinary, multi consequential, and relational, as opposed to tame, single disciplinary problem types. As was made evident in Rittel and Webber's work on urban planning, the twinning of rudimentary design thinking models and understandings of wicked or design problems as those that are "unique, ambiguous, and [have] no definite solution" (1973) provides context to an understanding of both the method itself, and the important role of ambiguity in knowledge work. Design thinking was understood at the time to encompass a unique knowledge of design methods, and it was at this intersection between Simon's scientific notion of design thinking as an attempt to shift the possible to the preferable, Archer's identification and definition of design thinking as unique aspect of design practice and Papanek's identification of the social role of designers (1971) that design thinking discourse was fully initiated. Design thinking immediately spread like wildfire, and the discourse grew in the work of McKim (1972) (who proposed "express, test, cycle" as an iterative adjustment to the original Simon model) and other scholars interested in large-scale complex social and environmental issues until it didn't. By 1975 the term had all but dropped off the map, where it remained until it was resurrected and redefined by the field of design studies.

Researching Design Thinking

The subsequent focus on defining design thinking as a creative practice and ability marked the first major foray from the field of design studies into the discourse. Initiated in the early 1980s, the movement from within design studies to define the term more fully as located within 'design' developed out of examinations into what Cross later termed "process-creativity" (1997, p. 427). This caused a shift in the debate around design thinking – with the framework of a way of knowing or a general resource for design characterized by the cognitive aspects of design practice and creative process emerging as the dominant definition. Of note in this effort to define design thinking as somehow "designerly" was Lawson's study of design cognition in the context of architecture and urban planning (1979) which provided the vocabulary used by Cross in his proposal of "designerly ways of knowing" (1982). This idea that "there are things to know, ways of knowing them, and ways of finding out about them that are specific to the design area" (Cross, 1982, p. 22) situated design thinking as a cognitive practice firmly based in instinct and forms of intuition that are unique to designers.

As Buchanan suggested, this positioned design thinking as a "neoteric art" – a new systemic discipline of practical reasoning and argumentation (1992, p. 22). This resonating proposal that design thinking was indeed "designerly" shaped understandings of the methodology as both an explicit process in which creative practice could be vocalized and shared (Bucciarelli, 1984; Schön, 1983) and as an intuitive and tacit way of knowing based on an extension of visual thinking (McKim, 1972), ambidextrous thinking (Faste, 1994) and creative practices of leaping and bridge

building (Cross, 1997). As Kimbell proposed, by focusing on "what designers do, think and know, [and] implying that this is different to what non-designers do" (2011, p. 298), this shift drew our attention to a new wrinkle: namely that design thinking meant thinking like a designer. By incorporating the language of the studio into the larger design thinking discourse, the debates around how designers solve problems ignited by Simon (1968; 1973) crystallized into a 'process' approach to innovative problem-solving that focused more clearly on the teachable and transferable aspects of a scaffolded method[1].

Ideating New Ways to Work with Design Thinking

This sense of ownership held by the field of design studies did not last long: the early 1990s brought with it a divergent thought cycle where Simon's original three-part model was exploded into a five-part framework. While Richard Buchanan worked to reconnect design thinking with its roots in social, environmental and interdisciplinary problem solving (most notably in his 1992 book Wicked Problems in Design Thinking, where he rejected the notion of design thinking as a science and promoted design thinking as a way for "professionals" to use "insight" into solving Rittel's wicked problems), the use of the discourse quickly became a market differentiator for design firms and academic programs. Some used it to describe the invisible work practices of creatives generally (Raff, 2012), some used it to value creative work generally (Dorst, 2011) and some started to use it to describe knowledge work generally (Dorner, 1999). Real evolutionary change in this discourse came when the international design firm IDEO adopted the terminology to define both their work and their working process. In 1991, IDEO developed and launched their five-part cycle of design thinking, a move which introduced terms that I will use here (such as ideate, or the rapid development of ideas to be either rejected or moved into prototype) into the outside – non-design – world.

Figure 1. Simon's Model of Design Thinking. (Simon, 1968).

Figure 2. IDEO Design Thinking model (IDEO, 2017).

Figure 3. d.School Design Thinking Model (d.school 2010; 2016).

1. This shift in the discourse was made especially evident in Buciarelli's work on engineering design (1984), Schön's work on architectural practice (1983), Rowe's work on design practice (1987), and Faste's proposal of ambidextrous thinking (1994).
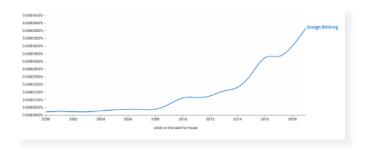
2. Additionally, managerial discourse also began to focus on design thinking practices as organizational maneuvers (Hassi & Laakso, 2011; Liedtka, 2015), as well as on empirical studies of organizations outside the space of cultural production who made use of design thinking structures (Carlgren, Elmquist, & Rauth, 2016; Carr, Halliday, King, Liedtka, & Lockwood, 2010; Rauth, 2015; Seidel & Fixson, 2012).

Suggesting that a design thinker is simply one who knows there is never a right answer to a problem, researchers such as Tim Brown proposed that by following a proprietary, non-linear and iterative process that he called "inspiration, ideation and implementation", the design process itself could convert problems into opportunities (T. Brown, 2009) [2]. Reshaping the design thinking discourse to focus on "a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" (IDEO, 2017) shifted the discourse out of the studio and into leading academic design programs at the post-secondary level (such as Standford's d.school, and the Illinois Institute of Technology) and in K-12 education (Koh, 2015; IDEO, 2017a). This is visible at the most surface level through Google's NGram Viewer's tracking of the term "design thinking" 2000 to 2019, which indicates that use of the term increased by more than 550% during that time (Google Books, 2020).

Prototypes for Design Thinking Methods

Once design thinking had been established as appropriately creative and designerly, and once some ideation work had been done outside of the studio, about how it could be applied, the prototyping began. The sheer number of business books trying to appropriate design thinking terminologies for their professional discursive practice (Carr, Halliday, King, Liedtka & Lockwood, 2010) highlights the desire to replicate the success of the models proposed by Simon, IDEO, and d.school.

This shift of perspectives, marked in the early 2000s by the adoption of design thinking as a marketable skill set by innovation and management studies (T. Brown, 2009; T. Kelley, 2005; Martin, 2009; Pink, 2006) positioned design thinking as a "way of looking" (D. Kelley, 2013) rather than an ability or "designerly way of knowing" (Cross, 1982). Practices of design thinking

made concrete at this time diffused the discourse throughout the worlds of organizational studies, especially among those interested in how design thinking could foster innovation and refine a competitive advantage (Perks, Cooper, & Jones, 2005; Ravasi & Stigliani, 2012), and or even serve as a new form of organizational sensemaking (Abolafia, 2012). Each echoed the original definition but worked to transform and democratize this new "recipe for innovation" (IDEO, 2017b) or toolset that allowed designers and non-designers alike to become instantly creative and innovative.

Design thinking was increasingly held ransom by theorists focused on its application outside of the studio, despite desperate calls for its return from design scholars and researchers (Bauer & Eagan, 2008; Helfand, 2016; Millman, 2011). The positioning of design thinking as a strategic resource for organizations – an inherently empathetic and innovative act, distanced from the culture, education or community context of design practice and useful for anyone willing to adopt the theoretical approach – resulted in a call for the death of the term itself with Nussbaum's declaration of design thinking as a failed experiment (2011).

Testing Design Thinking in Practice

In what can be understood as a rejection of design thinking's movement towards applied innovation, new understandings of design thinking have begun testing the term as a way to describe an embodied, socially and materially informed practice (Kimbell, 2011; Shove, Watson, Hand, & Ingram, 2007). This latest movement within studies of design thinking re-sensitized theorists to "the embodied nature of professional design work, how designers and stakeholders involved in design processes move, what they think, what they do and how it feels" (Kimbell, 2009, p. 12)

This opened the door to considerations of the role of organizations and social context in design thinking practice and redefined design thinking as a service-oriented, human-centered,

user-focused and participatory approach within the work of designers (Rodgers & Yee, 2015). As Julier has noted, this turn from design as a problem-solving activity to design as a problem-processing activity mirrors the shifts in design practice from multi-disciplinary approaches to interdisciplinary approaches (2000).

Design Thinking as a Discourse and a Discursive Practice

The field of organizational studies has also created space for the discourse to flourish in examinations of working and managerial practices. By reframing design thinking as a set of practices for decision making (Calabretta, Montana & Iglesias, 2008), or a set of practices of prospective sensemaking (Stigliani & Ravasi, 2012) the discourse of design thinking has indeed reached far wider audiences than it would have had it stayed inside the studio (Liedtka, King, & Bennett, 2013). Studies of organizations now position design thinking as a form of capacity building, simultaneously a method, a technique and a strategic art (Augsten & Gekeler, 2017; Johansson-Sköldberg, Woodilla & Çetinkaya, 2013) that acts to increase the capacity of an organization to address the challenges of innovation (Dunne & Martin, 2006; Tsoukas, 2003) while activating the mechanics of conceptual development with an awareness of user needs (Gruber, de Leon, George & Thompson, 2015). Still, in this field as well there are gaps in our understanding of what design led knowledge creation might require from the perspective of learning styles (Beckman & Barry, 2007) or cognitive perspectives (Stigliani & Ravasi, 2012), or what formal contribution a design thinking orientation can make to the economic bottom line of an organization (Storgaard, 2017). None the less, this discourse has been shown to demonstrate distinction in the field of organization studies, both inside the design sector (IDEO, 2014) and outside (Hassi & Laasko, 2011; Styhre, 2016; Wang, 2015) as a set of practices for product development (Cash & Kreye, 2017), and as a management concept (Hippel & von Krogh, 2016). In fact, many point

out that with the reframing of design thinking as simply "examined thinking" (Helfand, 2016), a "designerly way of knowing" (Cross, 1982) has been reconfigured as an organizational practice, rather than a creative one.

This most recent evolutionary stage has expanded the discourse to encompass the practices through which designers examine and understand what people do in their daily life, as well as the social implications of the designer's impact on material culture and the people with which they engage, as is argued in the work of Murphy (2015) and Yaneva (2013). In this way, design thinking discourse is now at its most pervasive, and expansive level to date, reaching out to include not only the methods, mindset and process of creative design practice, but also the co-production of knowledge and material experience through participation and collaboration made possible with the toolkit presented in the models described above.

As a discourse, design thinking has changed not only our understanding of how a designerly way of thinking and knowing (Cross, 1982) can be deployed towards innovative and creative ends, but also our larger understanding of who is a designer, what product or deliverable form a design should take, and how design work is (or should be) conducted. The same discourse that was made visible in design research came to dominate the field of design, and to stand in as both an explanation, and a surrogate, for an invisible process done by designers more generally. This discourse, as Helfand (2016) and Amatullo (2016) have proposed, has created a shift in the structure of the design organization, the work of design teams, and the practice of individual designers. But perhaps most notably, it has generated a shift in what designers produce: enabling an evolutionary change from a work practice that generated things to a work practice that generates thought (Bjögvinsson, Ehn, & Hillgren, 2012; Luck 2012).

The impact of this shift in what designers produce (from things or material products of culture to non-material problem solutions, or "things to know and ways of knowing them") is two-fold. First, it has opened the doors to designers and

design studios interested in playing an enhanced role in tackling the wicked problems of both the private and public sector, as identified by Steinberg (2012) in his work on design practice as leadership in the public sector. For design studios with an appetite for larger, less defined engagements, this cultural shift in the narrative around what design is – what counts as a design, what artefacts or "stuff" (Shove & Pantzar, 2016) created as an output of the practice – has created an opportunity to engage large scale, complex and creatively challenging projects. Also, it has allowed interested design studios to add to their portfolio of client services. No longer are designers limited to providing physical or digital solutions to the challenges faced by their clients. Instead, they can now offer research, problem definition, corporate workshops, participant engagement and testing as additional items to their service offerings (Amatullo, 2016).

What is design thinking based learning?

Defining design thinking based learning

Design thinking has also been positioned as a learning model, one which has been effectively deployed by businesses (Dorst, 2015) and post-secondary institutions (Riverdale & IDEO, 2011) to catalyze innovation and creative processes among employees and students. It has most often been framed by scholars from the fields of organizational behaviour as "a method for improving …outcomes related to innovation" (Liedtka, 2015, p. 925) but little research has been done on the model's effectiveness at instilling, enhancing or expanding specific skills within a post-secondary learning context. Indeed, there exists a gap in our understanding of the impact that design thinking processes and protocols can have on "the mobilisation of knowledge, skills, attitudes and values through a process of reflection, anticipation and action, in order to develop the inter-related competencies needed to engage with the world" (OECD, 2019). We do know that design thinking process and protocols can bolster and enhance existing research, creativity and learning tools within corporate and not for profit team based work (Cox, 2005) and that using design thinking as a pedagogical approach can help us achieve important learning skills and metacognitive thinking practices such as novel and adaptive thinking, transdisciplinarity, and empathy when working with institutional partners (Diefenthaler et al., 2017). In recent work, Hennessey and Mueller have described the potential and positive impact that design thinking frameworks can have for educators developing lesson plans but, as they note, there remain specific gaps in our understanding of how design thinking frameworks are best integrated into the classroom, and what their impact may be on skill and attitude change (Hennessey & Mueller,

2020). Though we have a good understanding of the role and impact of design thinking processes on innovation, health care, project management and creative industries, to date the research on the use of design thinking in the post-secondary learning context has focused on the products that students develop (including the quality of innovation and the type of student work) and not on the secondary skill set development that can come out of the use of this model as a pedagogical approach.

In an educational context, design thinking can be understood as a process of designing how you learn about a particular challenge, problem or complex issue. Design thinking based-learning introduces a structure for creative problem solving that includes five essential elements.

What is the evidence that design thinking-based learning promotes and improves learning?

The use of design thinking in the undergraduate classroom is not new: research suggests that design thinking can facilitate collaboration and innovation in the undergraduate classroom (Cupps, 2014), and could be used to engage students in a growth mindset perspectives, which, as Tseng, Kuo and Walsh (2020) have argued, can have long term and lasting effects on student success in their undergraduate education—especially in an online learning context. Chamberlain and Mendoza (2017) have framed design thinking as a research pedagogy in undergraduate

student work. Additionally, Hennesey and Muller (2020) have proposed that design thinking may form the bridge between project-based instruction and experiential learning required for achieving global competencies. The majority of research on the impact or effectiveness of design thinking in the undergraduate classroom has focused on the use of studio pedagogy within traditional undergraduate classrooms, which McLaughlan and Lodge (2018) suggest may serve to facilitate epistemic fluency. Design thinking based-learning supports what Anderson and Krathwohl (2001) call the cognitive process dimension of learning: a dimension which includes remembering, understanding applying, analyzing, evaluating and creating. Using design thinking based-learning in undergraduate classroom

situations of all kinds can also help us engage students in "significant learning experiences" (Fink, 2013) by supporting the goals of attaining foundational knowledge, developing application learning, surfacing the human dimension of learning, changing the degree to which students care about something, and learning how to learn.

To learn more, and for a full list of references, please visit doingdesignthinking.com

How is design thinking usually integrated into K-12 learning?

1. Problem identification phases of design thinking models focus on observing and learning from a community to formulate a situated understanding of their needs and problems.

2. Empathy phases of design thinking process models require design thinkers to reflect upon and share findings about human behaviours, and to analyze them using specific tools and protocols in order to achieve a nuanced understanding of the lived experience of their community of study.

3. Ideation phases of design thinking processes task design thinkers with defining the parameters for effective solution development, and with developing multiple possible solutions using experimentation and iterative practices.

4. Prototyping and testing phases of this cyclical model challenge design thinkers to create experimental prototype solutions in the form of concrete experiences, and to reflect upon the impact, functionality and alignment of those concrete representations of a line of inquiry with their initial reflective observations of the problem space.

What does it take to do design thinking-based learning?

It involves shifting sensemaking practices: Design Thinking is the deliberate practice of mental ambidexterity aimed at shifting reasoning and sensemaking practices within a culture of changemakers.

It involves the development of empathy through legitimate peripheral participation with user groups: Design thinking involves learning by doing, and enables creative problem solving through processes of problem identification, empathy, iterative idea generation, prototyping and testing.

It involves participatory and reflective research practices: Design thinking can include a variety of participatory thinking, learning, and doing practices (including qualitative research and creative process methods) and requires reflection.

It requires redesigning how we learn: Design thinking is often framed as a "designerly way of knowing" about the world, and a threshold practice for those interested in human centered work. It requires the promotion of failure, growth, iteration and prototyping as positive practices.

IMPLEMENTING DESIGN THINKING BASED LEARNING.

How can discipline-oriented post-secondary instructors integrate design thinking based-learning into their classrooms? How are design thinking based-learning learning tasks structured? What are some imaginative and creative strategies and techniques for challenging students? How can teachers adapt design thinking based-learning learning techniques to their courses and teaching goals?

Implementing design thinking-based learning in an undergraduate classroom can be an exciting, but daunting project. Many instructors believe that the implementation of design thinking based-learning activities as part of their discipline specific course offering will require a complete reframing of the classroom environment, or that they (or their students) may not have the skills required to effectively integrate design thinking based-learning into existing course assignments, activities and assessments. Though instructors must give careful consideration to how design thinking based-learning is integrated in their ongoing teaching and learning practice, it is in fact an inherently complementary framework for classes that already engage experiential, WIL or active learning principles. In fact, integrating design thinking based-learning can be as easy as enhancing reflective practices, shifting research focuses, or even inviting community members into the classroom space! This section of the teaching guide will provide 15 different exercises that can be used in online and face to face classroom settings and provide some context for how they align with the larger design thinking framework.

Design thinking based-learning techniques.

The design thinking based-learning learning techniques provided here are similar to recipes – feel free to substitute what is in your teaching and learning pantry as needed, and to adapt to serving size and number of guests. Our goal in providing these design thinking based-learning learning techniques is not to be prescriptive, but to generate new ways of integrating design thinking based-learning into the classroom, and to support new users of a design thinking based-learning framework with their practice. With that in mind, each learning technique presented here includes the five essential elements of design thinking based-learning:

- They support the shifting of sensemaking practices
- They include the development of empathy through legitimate peripheral participation with user groups
- They involve participatory research practices and reflection
- They require students to redesign how they learn in order to incorporate a "designerly way of knowing"

Many of the learning techniques presented here have evolved from a mix of collaborative learning techniques, commonly used corporate or institutional design thinking methods and the studio practices of designers. Industry leaders in the use of design thinking as a consultancy practice (including IDEO) have paved the way for integrating design thinking into a learning community, and their methods are available at ideo.com for those interested in how design thinking can be used with corporate or service-oriented teams. Other learning techniques that you will find here have been adapted from an ethnographic study of how designers in a digital marketing firm use design thinking principles in their client focused work (Dorland, 2018).

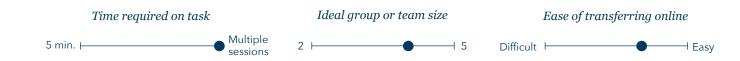# *Digital Storytelling*

Description and purpose

"A digital story is a short form media production that utilizes digital photographs, video footage, music, and sound effects in a coordinated and edited fashion to cohesively construct and present a story about some idea, issue, or aspect of life" (Castro & Levesque, 2018).

Generating empathy or demonstrating an understanding of the lived experience of participants or members of a target market can be a challenge for students unused to exploring different perspectives. However, integrating empathy skill development is critical for the effective implementation of design thinking based-learning at all undergraduate learning levels. This can be addressed using a digital storytelling approach to documenting evidence gathered during participatory research and user interviews. Using a digital storytelling approach to generate empathy for a participant group or target market requires the student to "tell a story of personal significance" about their learning in the participatory research stage of their work, using a digital format that incorporates a personal narrative (Walsh et al., 2008, p. 193). The student's final digital storytelling project will also be accompanied by a critical reflective statement.

As the term progresses, students should be documenting evidence about how a person or group experiences a challenge, issue, service or system in order to develop an understanding of the lived experiences of others. Students may document this evidence in whatever ways are most comfortable for them. Media that work well to create digital stories include: photographs, journal entries, videos, artwork, doodling, reflective templates, music, and audio recording. Students should save, organize, and store their media files a coordinated system throughout the term in order to save time when they are compiling their digital story. This means using a consistent file naming system so that they can find things easily. At the end of the activity, students will submit their digital storytelling assignments to the instructor. They will also complete a reflective statement about their learning process.

Preparation

Choose what forms of evidence students should collect in order to assemble a digital storytelling assignment. Decide whether students will generate their own line of inquiry, or whether you will work as a group to develop a common area of inquiry among the class. Consider giving students guidance on script writing, storyboarding and video recording, or connecting them with the appropriate resources. Plan for sufficient time, as this activity may need to be distributed over several sessions. If students are new to working with images and storytelling, provide examples of appropriate materials. If students have a background in this type of work, create a time frame that sets deadlines to help you and the students monitor the various steps.

Helpful tips from the field

Students may not have experience working with participants as partners in their evidence collection practices, so providing students with a short script that they can use when reaching out to someone is especially helpful.

Additional reading

De Castro, A. B., & Levesque, S. (2018). Using a digital storytelling assignment to teach public health advocacy. *Public Health Nursing, 35*, 157-164.

Walsh, C. A., Rutherford, G., & Kuzmak, N. (2008). Engaging women who are homeless in community-based research using emerging qualitative data collection techniques. *International Journal of Multiple Research Approaches, 4*(3), 192-205.

Implementation

1. Using brainstorming or individual idea generation techniques, develop a line of inquiry about a specific challenge, issue, service or system (as a class, or in groups)

2. Work in groups to establish the appropriate community of interest: these should be people that the students can connect with easily, and about who's lived experience of the identified challenge, issue, service or system the students will collect evidence.

3. Send teams away to collect evidence about someone else experiences a challenge, issue, service or system. Teams can use video, photo, found documents, audio or other media to collect and document the evidence.

4. Once students have collected the evidence of someone else's experience, engage them (as a team) in developing a script for their final digital story. The backbone of a digital story is a written script that students will read and record to form the main audio element of their story. To create a 2-3 minute video, they will need a script that is roughly 250 words long. To brainstorm ideas for a script first, students should first have a conversation or jot down some individual notes and thoughts. How they generate the ideas is up to them, but they will need to have some thoughts recorded on paper in order to move forward with writing a script. When they are writing the script, it's important to consider that people will be hearing their voice rather than reading their words. Students should be encouraged to try to write their story in the same way that they would speak it and to practice reading their script out loud.

- Prompt: While you are writing your script, ask yourself the following questions:
- Is the purpose of my story clear? Will the audience understand what I am trying to get across?
- Does my story flow effectively from one part to the next?
- How can I use images, rather than words, to tell my story?
- What is the title of my story?

5. Using the script that they have developed, coach students in drafting a storyboard for their final digital story. "A storyboard is a graphic representation that depicts a… description of how the story unfolds from beginning to end" (De Castro & Levesque, 2018, p. 159). The storyboard creates a "road-map" for the digital story. A basic storyboard consists of the written script with marks at the different points where students would like their images or other media to be placed within the story. A storyboard helps students to choose images and identify any missing images before they start video editing. It is also an opportunity to adjust their written script, as they may find that they can remove elements that are conveyed by their images. An easy way to create a storyboard is to number the images and other media in order and write the corresponding number into the written script, at the place they want the images to appear and disappear. Students should check that the digital images are labeled with the same numbers students have used in their storyboard.

6. Teams should then record their story. Students should be provided with a how-to document that provides detailed instructions about how to record their digital storytelling project using the campus resources available. Teams should estimate approximately one hour of editing per minute of video footage. Feel free to take advantage of the variety of media that is available – music, video, photographs, drawings, text, spoken word, etc.

7. Teams submit their digital storytelling project to the instructor for assessment.

8. Working individually, students should then write a critical reflective statement about their learning experience. The critical reflective statement that accompanies the digital story should be a maximum of 3 pages in length, and should include responses to the following elements:

- Compare your first understandings of the design challenge and your current state. What has changed? What has stayed the same?

- What was your most significant or important learning from talking with participants? Please explain why and connect this to the course learning outcomes described in the course outline.

- How has your opinion about the design challenge you have identified changed since you began your participatory research? After doing this research with participants, what aspect of the design challenge do you think is most important, and why?

- What aspect(s) of the design challenge will be the most important to address right away? What is one strategy that you will use in order to make a contribution to resolving the design challenge?

Online implementation

Follow the steps provided above, with the exception of in-person brainstorming sessions (step 1). Teams should collect evidence online – this might include publicly available photos or videos, screen captures of websites, or publicly available quotes from community members experiencing the identified line of inquiry. The storyboard component of the assignment can be done using Padlet (online sticky tabs that can be moved around to reflect a storyboarding experience). The reflective statement can also be submitted using a Google Form instead of as a written document.

Solo implementation

Follow the steps provided above but assign students to work individually.

Informance

Time required on task

5 min. |———●———| 1 hour

Ideal group or team size

2 |———●———| 5

Ease of transferring online

Difficult |———●———| Easy

Description and purpose

In order to generate empathy as part of the design thinking-based learning technique, students may have to learn to embody (rather than just document) the lives of others. The informance learning technique is a low-stakes way for students to "try on" an activity or practice that they want to better understand in order to build those empathy skills. Informance is the process of watching someone else do a task (from shopping to using a website) using ethnographic focused methodologies, and then performing the task using what you learned for a team of designers or design thinkers. This lets you find out what you know, what you are missing, and what assumptions you are making that your body surfaces during the process.

Students work in teams to learn about a specific activity (such as using a new type of sports equipment, doing a new kind of craft, serving food, or performing a work function) using observational research methods. This can involve traveling to a place of work, a service provider or a facility outside of the classroom during non-class time. They then gather in their groups of 4 to conduct an informed performance ("informance") of the activity to demonstrate the nuances of the practice – the cultural ideologies embedded in the practices, the skills or physical activities required to conduct the practice, and the objects or tools required to conduct the practice fully. Students then use ethnographic fieldwork methods to understand what this practice means to the culture at large, and what unseen or unappreciated elements of the practice are required for its full completion.

Preparation

Choose what kinds of practices students should go and learn about. Assign time for students work individually to observe the practice in action. Break students into teams and establish activity functions so that individual teams can report back findings to the class at large. Create classroom space for movement and "informance" of the practices selected.

Helpful tips from the field

This activity can be intimidating for students who are uncomfortable with performing, or even with charades. To help students dig deep, encourage them to explore the practice they are demonstrating as if they are a space alien trying to pass as human. What would their alien selves need to know to get by?

Additional reading

McDaniel, & Johnson, B. (2003). The paradox of design research: The role of informance. In B.Laurel (Ed.), *Design research, methods and perspectives.* Boston: MIT Press.

Implementation

1. Students form groups at your direction or by choosing partners and decide on a practice that they will use for their informance.

2. Students work individually to observe that practice in a real-life setting (by visiting a place of work, a service provider, a facility or an otherwise appropriate public area).

3. At the scheduled activity time, students gather in groups to share their "informance" of the practice with their team members.

4. All four students should share their informance with their team members.

5. When all four students have completed their informance, teams should document as many observations as they can using the following categories:

   • What expectations of how the world should work are embedded in this practice?

   • What tools or objects do you need to conduct this practice fully?

   • What skills or abilities do you have to acquire in order to conduct this practice fully?

Online implementation

Follow the steps provided above, with the exception of visiting a real-life location. Students can observe a practice in action by watching YouTube videos, films, documentaries or a household member. Students can continue to work in groups to share their informance with their team and to document their observations using online video conference tools (such as Google Meet).

Solo implementation

Follow the steps provided above but assign students to work individually, and to share a video recording of their informance with a partner in the class for observational analysis (and to conduct observational analysis on the partner's informance video in turn).

My fake podcast

Time required on task

5 min. |———————————●—| 1 hour

Ideal group or team size

2 |●———————————| 5

Ease of transferring online

Difficult |———————————●—| Easy

Description and purpose

One of the most difficult parts of working with empathy as a component of class based research is the developing the skills required to hold space for the stories of others, and to present the stories of others without reframing them for one's own purpose or simply sympathizing with their experience. The podcast interview assignment is an opportunity for students to work on their interview and listening skills, to learn to synthesize evidence to address critical challenges, to connect abstract concepts with real world experiences, and to evaluate conceptual models for challenge solutions.

In the podcast interview assignment technique, student pairs work to ask each other a series of scripted questions about a common experience that forms an important part of a larger line of inquiry. The interviewer will act as the facilitator, guiding the interviewee through the process of describing their lived experience. The interviewee will serve as a provider of evidence, sharing their lived experience. After completing this work, the students will switch roles. Students then work together to edit and compile the two interviews into a sample podcast and submit the audio file for assessment.

Preparation

Decide interview partners ahead of time. Determine the pair's roles and establish a time frame in which they should complete this assignment (for example, 20 minutes each for the interview processes and 1 hour for audio editing). Consider creating a handout with the appropriate interview questions. Choose a challenge for students to explore, and diagram it yourself to uncover different types of experiences that students can describe during their interview work. Request that students come to class with a digital device that can record audio (such as a smartphone, tablet or computer). Provide students with campus specific resources for audio editing, or with a list of commonly available audio editing software on different platforms.

Helpful tips from the field

Editing audio can often be as easy as using the voice memo tool in a smart phone to delete unwanted content. Get students reading in advance by providing a list of campus available resources.

Additional reading

Frayha, N., Brown, J., & Parker, D. (2019). A student affairs podcast as novel communication tool. *Canadian medical education journal, 10*(4), 99–101.

Goldman, T. (2018). The Impact of Podcasts in Education. *Advanced Writing: Pop Culture Intersections. 29.*

Implementation

1. Students gather in partners as determined in advance and are given the name of the specific experience that they will interview each other about. For example, if your larger line of inquiry focuses on developing an understanding of the patient experience for a nursing or medical school, you might assign the experience of "seeing a doctor" or "using an online medical consultation service" as your experience.

2. Interviewer #1 will ask interviewee #1 about a time that they experienced the identified topic and use question prompts to fully surface all aspects of the interviewee's experience. Interviewer #1 will record the interview on digital software.

3. Potential question prompts include:

- Tell me about a time when you experienced _____

- What was surprising about this experience?

- What did you not know going into this experience?

- What is the most similar thing you can think of to this experience?

- How did this experience change how you went about your day after that?

4. The students will swap roles, with interviewee #1 now in the role of interviewer.

5. Once both phases of the interview process are complete, students will work to combine the files into a podcast format conversation.

6. Students should submit their podcast assignment to the instructor for assessment.

Online implementation

Follow the steps provided above, with the exception of conducting the interview face to face. Students can record their interview content using video conferencing recording tools remotely, and compile the recordings using editing software collaboratively at a distance

Solo implementation

Follow the steps provided above but assign students to work individually, and to share their own experience in the podcast format.

Analogous Inspiration

Time required on task — 5 min. to 1 hour

Ideal group or team size — 2 to 5

Ease of transferring online — Difficult to Easy

Description and purpose

In order to engage in design thinking-based learning in an effective manner, students must first develop the skills they need to ask the right question, and to develop a clear and focused line of inquiry. Writing a strong research question requires looking outside of the assignment guideline and seeking inspiration in unlikely places.

In the analogous inspiration learning technique, students are given the opportunity to generate possible ideas about a general topic that may lead to a clear research question or area of inquiry. Groups will work to break down the components of the challenge that they are attempting to understand, and then to generate lists of situations, services, experiences or areas of research that share some, or even all of the identified components in order to derive inspiration about how the challenge is handled in those different settings. Analogous inspiration can help students unpack a complicated challenge and build new lines of inquiry from the separate pieces they identify. Since this activity also helps teams identify clusters of information or ideas, this learning technique can also help groups come to a common decision about the line of inquiry they will choose to pursue.

Preparation

Develop (in partnership with students, or alone as the instructor) a challenge area for students to focus on. Generate a backup list of analogous areas of inspiration to seed student discussion if required. Arrange your space to provide groups with the surfaces they need to post and arrange sticky notes (white boards, walls and chart paperwork well for this learning technique).

Helpful tips from the field

To help students dig deep into finding analogous sources of inspiration, get them to start each sentence with "you know where I've seen that before?". If that does not work, ask them to find an example that presents the opposite of what they are seeking – this can often kick start a discussion that can be helpful.

Additional reading

Friis Dam, R., & Yu Siang, T. (2020). *Affinity Diagrams – Learn How to Cluster and Bundle Ideas and Facts*. [Blog posting]. Retrieved from https://www.interaction-design.org/literature/article/affinity-diagrams-learn-how-to-cluster-and-bundle-ideas-and-facts on October 20, 2020.

Riserbato, R. (2019). *The UX Designer's Guide to Affinity Diagrams*. [Blog posting]. Retrieved from https://blog.hubspot.com/service/affinity-diagram on October 20, 2020.

Implementation

1. Form groups of 3 – 5, and provide each student with slips of paper, sticky tabs or index cards for brainstorming.

2. Share the challenge that you are seeking to break down into component parts and indicate a timeline for this portion of the activity.

3. Students should then work individually to break the challenge down into as many smaller bits as possible, and to document each on a separate index card.

4. When the time is up, have one group member gather all of the cards/tabs/slips and mix them up (face up) on a table or adhere them to a wall/chart paper.

5. Instruct the teams to discuss what they have generated, and to organize their brainstorming documents into related groups.

6. Students should then work individually to brainstorm as many analogous areas of inspiration as possible for each group of ideas, and to document each on a separate index card. For example, if they identified that part of the challenge is a lack of information, they should think of other places where a lack of information is well addressed (recipe books, IKEA instruction manuals etc.). If they have identified that part of the challenge is that you need personal coaching to succeed, they should identify other areas where personal coaching is used (the gym, psychotherapy etc.).

7. When the time is up, have students document the general themes of the component part groupings and the possible sources of inspiration on a shared document for future work.

Online implementation

To implement this activity online consider having teams work in a shared online document (such as a Google Doc) to generate as many component parts as possible and then to use the editing function to group them accordingly. Or try using breakout rooms in a video conferencing software (such as Google Meet) to have students brainstorm out loud, and task one group member with being the recorder who documents the ideas. If you are implementing this idea online, students can also pull web links to document sources of analogous inspiration, which can be added to the same shared document.

Solo implementation

This assignment can be implemented for individual students by having timed brainstorming sessions followed by individual grouping of the generated ideas. Individual students can then generate analogous sources of inspiration based on their assembled idea bank.

Question Formulation Technique

Time required on task

5 min. ├────────●────┤ 1 hour

Ideal group or team size

2 ├──────────●──┤ 5

Ease of transferring online

Difficult ├●─────────────┤ Easy

Description and purpose

Formatting a question can be one of the most difficult parts of any research process, and it is fundamental to taking a design thinking-based approach to learning in any field. The Question Formulation Technique supports students as they work to develop their own lines of inquiry and helps them build their question asking skills.

Preparation

Develop a claim that students will use to explore the question formulation technique. The claim can be focused on any topic or subject area but should be somewhat controversial in tone. Develop a slide or other way of presenting the claim for students to use throughout the class.

Helpful tips from the field

For this particular learning technique, the more contentious the statement the better. Finding a claim that will allow students to generate questions about the claim that represent all sides of the issue. Be prepared to moderate a vigorous discussion, as students will have many questions about each issue!

Additional reading

Rothstein, D., & Santana, L. (2011). *Make just one change: Teach students to ask their own questions.* Cambridge, MA: Harvard Education Press.

Implementation

1. Form small groups of 4 – 5 for the process

2. Start the process by presenting the claim to the students (should be in written form somewhere, so students can see it)

3. Task one: groups must brainstorm questions to explore the claim. This is about "freewheeling" – generating as many questions as possible, without judgement (10 minutes). Rules at this step:
   - Do not debate or attempt to answer the questions
   - Write down every single question
   - No statements allowed - turn statements into questions

4. Host a large group discussion about closed and open-ended questions. Have the group establish definitions for (a) a closed question, and (b) an open-ended question (5 minutes)

5. Task two: groups modify the questions they've recorded. Instruction: Change all open-ended questions to closed questions. Change all closed questions to open ended questions. (10 minutes)

6. Host a large group discussion: What are the advantages and disadvantages of asking each type of question? Record responses on whiteboard or flip chart (5 minutes)

7. Task three: groups must select three questions they would like to explore further. This is a consensus forming task (not just one question per person) (5 minutes)

8. Groups report back their top three questions. Record responses on whiteboard or flip chart (5 minutes)

9. Identify themes amongst the questions and discuss which questions stand out the most. Why? (5 – 10 minutes)

10. Large group debrief – what did you learn about asking questions through this process? How will you use this in your inquiry processes moving forward? (5 – 10 minutes)

Online implementation

As this activity requires large group discussion, it can be difficult to implement online. If you need to use this activity in an online environment, consider assigning students to breakout rooms, and having them accomplish each step in small groups with one student designated as the "reporter" who brings back findings to the large group discussion.

Solo implementation

This assignment can be implemented for individual students by following only steps 2, 3, 5, 7 and 9.

Participatory Interviews

Time required on task

5 min. |———●———| 1 hour

Ideal group or team size

2 ●————————| 5

Ease of transferring online

Difficult |————————●| Easy

Description and purpose

Understanding a problem fully can allow students to develop a rich line of inquiry, and there is often no better way of understanding a problem than to interview someone about their experiences. The purpose of this tool is to assist students in conducting interviews. When students are interviewing collaborators or participants in person, the conversation can be organic and generative. However, when conducting online interviews (through a tool like Google Meet or Zoom) or when working with a participant to understand user needs in an online environment, students often struggle to lead the conversation in a meaningful way. This tool can be used to support students in their efforts to interview participants and collaborators in that online space.

Preparation

Develop an initial area of inquiry that students should explore in their interview work. Consider creating space for students to practice interviewing with peers or share examples of successful interviews and discuss them as a group before doing this learning technique.

Helpful tips from the field

Whenever possible, it is ideal for students to conduct their interviews in the interviewees space. For online work, this is made easier through the use of video conferencing. In face to face interview settings it will require students to travel to meet their interviewees, but it is worth it for the chance to see the context in which an interviewee lives or works.

Additional reading

Rowley, J. (2012). Conducting research interviews. *Management Research Review, 35*(3/4). 260-271.

Implementation

1. Task student pairs with finding an interviewee who will be able to join them on a 10 minute interview during class time (online). This interviewee should be able to teach them about something that may be relevant to their future line of inquiry.

2. Student pairs should develop a list of potential questions that they will ask their interviewee (individual work, 5 minutes), each focused on something they need to understand or confirm about their line of inquiry.

3. Student pairs should share this list of potential questions with participants in advance of the interview (by email) in order to encourage transparency and trust.

4. Teams should structure the interview in two parts:

    •   Part A: The students will interview the participant using the provided list of questions. The students should set a timer on the screen so that the participant knows how long this will go for (set to an agreed upon time).

    •   Part B: The participant will teach about the identified area of focus the students as if the students have never heard of the challenge or encountered the area of inquiry before in their lives. The students should set a timer on the screen so that the participant knows how much longer to go for – this portion of the interview should not take longer than three minutes.

    •   Part C: The students should take turns to mirror back what they have learned to member check their data by re-teaching the participant and being open to corrections.

5. Students should then review the questions with the participant again to ensure that they haven't unearthed any new perspectives or new information, and add those responses to those from Part A.

Online implementation

This activity is directly suited to online implementation, and if students are doing it outside of class time you could ask them to document their experience using a reflective statement model at the end of their interview process.

Solo implementation

This assignment is suited to solo implementation, with no variation from the above aside from having students work alone.

Backwards idea generation

Time required on task

5 min. ●————| 1 hour

Ideal group or team size

2 |————●————| 5

Ease of transferring online

Difficult |●————————————| Easy

Description and purpose

The purpose of this tool is to assist student teams to using abductive reasoning to generate new solutions for an identified challenge. Students often struggle with the iterative development of ideas, especially in a group setting where social pressure can cause individuals to edit their thoughts before sharing them with the larger team.

In the Backwards Idea Generation assignment, students work in teams to forecast a future scenario, and then to use their detective skills to surface potential forms of evidence for how that imaginary future may have come to be. In this learning technique students engage in group discussion and sorting exercises to discover the creative ideas already buried in the scenario that they shared, which gives them an opportunity to reframe idea generation as a process of excavation rather than invention.

Preparation

Assign students to groups or decide how students will form teams. Decide what the challenge area or line of inquiry that students will be pursuing will be or decide on a way to come to consensus as a class on a particular challenge area. Consider creating a sample completed assignment for students to review in order to familiarize them with the process of Backwards Idea Generation. The purposes of this brainstorming exercise is to create an extensive list of new ideas, so creating a challenge for the class that is specific and unique will be important. Gather together sticky tabs and large sheet chart paper for team use.

Helpful tips from the field

This activity can often get fairly raucous, especially if specific time limits are not imposed. Consider having a bell, gong or sound effect on your phone to give students a warning about when their time is up for both idea generation and thematic sorting!

Additional reading

Rietzchel, E., Nijstad, B., & Stroebe, W. (2006). Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection. *Journal of Experimental Social Psychology, 42*(2). 244 – 251.

Paulus, P.B., & Brown, V.R. (2007). Toward more creative and innovative group idea generation: A cognitive-social-motivational perspective of brainstorming. *Social and Personality Psychology Compass, 1*. 248 – 265.

Implementation

1. Students gather in teams of 3 – 4 as directed and are provided with a description of an existing challenge that aligns with classroom learning objectives. For example, in a Bachelor of Social Work class this might be "Social isolation can be more harmful than expected, according to Psychology Today, leading to actual physical pain and hormone imbalance. By educating the public with ways to successfully promote social interaction, social workers can help lonely individuals improve overall mental, physical and spiritual health".

2. Teams work together to draft a short story about a future when this challenge is solved (one paragraph). This should begin with "Once upon a time (challenge statement about the present state). But today _____ (description of an ideal future state)". Teams should write this short story on their chart paper and post it in a visible spot for all of their team to see.

3. Students should then work silently to jot down (on sticky tabs) as many possible interventions that they can think of that were required for this imaginary future state to become a reality. This might look like "we implemented a ___ system" or "we invented a _____": the most important part is that students are imagining all of the interventions that humans made in order to make that state a reality.

4. Teams should collect all of these intervention sticky tabs on the chart paper, and to thematically categorize them into intervention types.

5. Using a dot-ocracy or heat mapping technique, students should select the most interesting (not the most viable!) of all of the interventions in each category and prepare to share them with the class.

6. Teams should elect a representative to share their top intervention ideas with the larger class group.

Online implementation

This activity is difficult to implement in a team setting online. Please see directions for solo implementation.

Solo implementation

To use this learning technique solo, students can respond to the provided prompt using a time limit to guide their work, and then categorize their interventions into thematic groups individually. Students can then share back their most interesting interventions on a Google Document or similar with the larger class.

Ideation triads

Time required on task 5 min. ●————————— 1 hour

Ideal group or team size 2 ——————●——— 5

Ease of transferring online Difficult ——————————● Easy

Description and purpose

Ideation triads are a brainstorming technique where students generate ideas that build on each other but are not limited in response to ideas that came before. Instead of traditional brainstorming, where students will each share different ideas on a theme until they have exhausted their mental list, ideation triads require students to work in groups of three to create a wide range of possible solutions to a question or problem in an additive manner.

To participate in an idea triad, students will gather in teams of three and will take turns adding an idea to the "pile" of ideas generated by the triad. Each new contribution must build on an idea that has been submitted (using a "yes, and" model) but students may not validate, challenge or otherwise comment on the quality of any ideas that are contributed in this process. This is an especially intensive form of brainstorming, because each student must contribute on their turn (whether or not they have some-thing new to add!). The process of the idea triad continues in the round until the time limit has been reached, which means that ideas generated at the end of the process are often much more creative and based on abductive reasoning than those generated at the beginning of the process.

Preparation

Assign students to groups or decide how students will form teams. Decide what the question or chal-lenge that students will be pursuing will be or decide on a way to come to consensus as a class on a particular challenge area. Decide how you will indicate the beginning and end of each round of idea generation. Select a process for students to share their experience with the larger classroom at the end of the activity.

Helpful tips from the field

There is always a point in this learning technique when students stall. To keep the ideas flowing, circu-late among the teams to encourage them to share either a variation on the last idea provided, or even the opposite of the last idea provided. This can get the discussion moving again.

Additional reading

Barkley, E., Major, C., & Cross, K.P. (2014). *Collaborative Learning Techniques. A Handbook for College Faculty*. Jossey-Bass. San Francisco: CA.

Implementation

1. Ask students to form teams of three and give them the question.

2. Explain that the purpose of the assignment is to come up with as many possible ideas to help solve the challenge or to answer the question, and that group members will take turns (moving in a clockwise manner) to respond. Let teams know that interrupting, challenging, evaluating or discussing the ideas will interrupt the flow, and so should be considered illegal behaviour.

3. Each student should document their own idea on a sticky tab, list or chart paper so allow a bit of time for students to gather and arrange the supplies they need for this docu-mentation.

4. Let students know how many times they will go around the loop (ex. 10), or if you will be ending each round at a specific time (ex. 10 minutes).

5. Ask one student in each group (#1) to state an idea or to answer the question out loud, and to document their idea. Then, moving clockwise, each student should repeat the process. When the team returns to student #1, they continue around the circle until the round is ended by the instructor.

6. Have students review and discuss the idea solutions or question answers generated by the process to discuss the learning process (5 minutes).

Online implementation

To implement this activity online consider using a threaded discussion board or a shared word processing document (such as a Google Doc). Assign students an order of participation, and have each student contribute to the discussion board or document in order as outlined above.

Solo implementation

To use this learning technique solo, students can respond to the provided prompt using a time limit to guide their work, and then can reflect on the ideas they generate in a reflective statement template.

Mix tape mashup

Time required on task — 5 min. ●———— 1 hour

Ideal group or team size — 2 ●———— 5

Ease of transferring online — Difficult ————● Easy

Description and purpose

One of the primary difficulties with the ideation process is how challenging it can be for students to move away from existing solutions or expected responses. Social pressure, a lack of effort, or even a lack of information can limit student responses to questions or challenges. The mixtape mashup learning technique introduces an element of bizarre fun to the process, making idea generation into a playful activity rather than an onerous one.

In the Mix Tape Mashup learning technique, students work in teams of 3-4 to smash together existing practices, objects or concepts to develop something wholly new. They then present their mashed creation to the larger class for discussion. This learning technique allows students to engage in ideation while also becoming more aware of or familiar with the specific characteristics of existing practices, objects or concepts.

Preparation

Assign students to groups or decide how students will form teams. Decide on a list of "ingredients" that students will be using for their mashup. If, for example an Introduction to Biology class is working on forms of organism classification, you might pull 20 different organisms for use in this activity. Create a series of cards, or a presentation slide with all of the "available" items that students can mash together for display during the activity. Decide on a time limit for this learning activity. Consider attaching the available items to a folder in which students can submit their solutions.

Helpful tips from the field

Mashups can be a lot of fun, and students often enjoy this activity. To ensure that you are meeting your learning objectives, be sure to ask students to list key characteristics of the concept or information they are using in the mashup process, and to identify how combining/mixing these concepts impacts the original knowledge.

Additional reading

Barkley, E., Major, C., & Cross, K.P. (2014). *Collaborative Learning Techniques. A Handbook for College Faculty.* Jossey-Bass. San Francisco: CA.

Implementation

1. Form groups of 3 – 4, and take a few minutes to describe the activity, timelines and the expectations.

2. Demonstrate what a mashup can look like by projecting examples or sharing examples of previous work. Explain that a mashup of two available items must be a wholly new item of its own but must possess characteristics of both sources.

3. Present students with the available items, and task them with working in their teams to develop, describe and draw their mashup response. Students may choose two of the available items for mashing in order to create their response.

4. Repeat the process if time permits.

5. Students should then "pitch" their mashup to the larger class by describing the new creation in detail (even with a name!) and showing their drawing of the mashup. Students should be specific about the characteristics selected from each source, and the ways in which the new creation differs from the original two sources.

6. For an added level of engagement and complexity, combine teams and mash the mashups.

Online implementation

To implement this activity online consider using video conferencing software for students to work in breakout rooms using the guidelines outlined above.

Solo implementation

To use this learning technique solo, students can generate mashups which they then share with their classmates in an online shared document (such as a Google Doc).

Process document

Time required on task

5 min. |————————●———— Multiple sessions

Ideal group or team size

2 |————————●————| 5

Ease of transferring online

Difficult |————————————●—| Easy

Description and purpose

In the process document learning technique, students focus on prototyping an idea, and on documenting the process of that prototyping work. Prototyping can be difficult to integrate into a concept based course, as often students are not generating a new object or service but are rather synthesizing information or analyzing evidence for their claims in a research paper or project. In the process document learning technique, students document the way that they came up with ideas for applied or analytical work (mental prototyping), detailing each stage of their work and providing visual evidence for how they engaged in that process (in the form of images of outlines, notes, photos of the team working at the library, google search histories etc).

The process document learning technique encourages students to reflect on their process in action, and to fully explore different areas of inquiry during their applied or analytical work. At the end of this assignment, students submit a document (web based, or PDF based) that supports their final project with evidence of how they engaged in their learning, and a narrative of why they made the choices they did in the final work.

Preparation

Assign students to groups or decide how students will form teams. Decide whether students will be creating a web based (website, blog or PPT) version of the process book, or if they'll be submitting a print document. Consider providing examples of process books that have successfully been completed in your area or field as examples. Develop a schedule of check ins, progress milestones and final reviews to support students in this multisession assignment.

Helpful tips from the field

Process documents can help students focus on their prototyping work during a major assignment, but this is an assignment that requires the instructor to work hard to keep students on deadline and on task. Having multiple Silly First Draft check ins, progress checks or paired reviews can be very helpful.

Additional reading

Ko, A. (2015). *Info 360: Process Books.* [Website resource]. Retrieved from https://canvas.uw.edu/courses/990530 on October 20. 2020.

Brunner, L. (2011). "A "digital process book" learning tool for the design studio: Concept and development". *Art and Design Conference Proceedings, Presentations and Posters. 6.*

Implementation

1. Form groups of 3 – 4, and take a few minutes to describe the activity, timelines and the expectations.

2. Conduct a brief discussion about what kind of evidence/things students may want to include in their process document: this could include any evidence of their work (from sketches to notecards to images of text message chains).

3. Conduct a brief discussion of how students may want to structure their process document: they might want to follow the assignment guideline and share how they approached each component, or they might decide that their journey involved some major u-turns or evolutions and to divide the document into phases of understanding.

4. Share the assignment that this process document will pair with, and outline expectations, timelines and assessment processes.

5. Students will collect evidence of their process and integrate it into a narrative or story of how they developed their understanding or analytical based project work over the rest of the time assigned during the term.

6. Students will submit the process document to their instructor along with their final assignment.

Online implementation

To implement this activity online consider having students submit an online version of the process document, which might be a website, blog, Google Slides presentation or Prezzi.

Solo implementation

To use this learning technique solo, students can collect evidence of their individual process, and submit assignments individually. This can also be an interesting way of exploring different functions within a group.

Low fidelity prototypes

Time required on task

5 min. |———————●———————| 1 hour

Ideal group or team size

2 |————————●————| 5

Ease of transferring online

Difficult |————————●————| Easy

Description and purpose

A key element of prototyping in a design thinking based learning framework is developing prototypes that are low fidelity (and thus easily adjusted after user feedback). This can be a challenge for students used to submitting only finished or polished work. Ideally, a prototype of a product, idea, service (or anything else) should be specific, but not finished: the function of the prototype is to make ideas visible for someone else, and to seek feedback about those ideas to generate the next phase of work. In the low fidelity prototype assignment, students produce a total of three low fidelity prototypes of an assignment, and individually obtain feedback about each prototype from at least two classmates. The goal is to encourage students to use low fidelity prototyping as a generative learning technique, to help students decide which prototype of their work shows the most promise, and to get feedback about how each prototype can be made even better. The prototype will need to have enough detail that a classmate can provide feedback using the three shot approach:

- What is this? (describe exactly what is in front of you in detail)
- What is the intention/what is this about? (describe what you think the intention of this prototype is: to convince, to argue, to persuade, to educate, to inform…)
- How can it be better? (describe a few ways that the prototype can grow or improve).

This learning technique requires students to develop three low fidelity prototypes outside of class hours, and for the instructor to schedule class time for round-robin style feedback in pairs. As an outcome of this learning technique students will develop a wider variety of approaches to a single assignment while strengthening their prototyping skills as part of their course work.

Preparation

Prepare students to create three low fidelity prototypes of their assignment by discussing the role of the low fidelity prototype and what a low fidelity prototype may include or exclude. Ask students to bring three low fidelity prototypes of the same assignment to the selected class date. Create a slide or presentation with the three shot critique approach to facilitate discussion in each round. Decide whether to group students into triads or to allow students to select their own feedback group. Task students with developing a brief (30 second) script or statement that they will share with their triad to explain the intent, focus or goal of the prototype before asking for feedback.

Additional reading

Paris, B.M. (2019). *Providing Written Feedback: Developing Evidence Based Practices.* Presented at the Conference on Postsecondary Learning and Teaching: Exploring Experiential Learning, University of Calgary, Calgary, AB.

Liu, N., & Carless, D. (2006) Peer feedback: The learning element of peer assessment. *Teaching in Higher Education, 11*(3). 279 – 290.

Implementation

1. Form groups of 3, and take a few minutes to describe the activity, timelines and the expectations.

2. Ask students to number themselves off (1, 2, 3) to determine the order of presentation.

3. Task student 1 to share their script or statement with their group (30 seconds). Use an agreed upon sound or tone to stop the statement sharing after the allotted time.

4. Instruct students 2 and 3 to share feedback about the three prototypes using the three shot method outlined above. Student 1 should take notes but should not discuss the feedback with their group.

5. Repeat the process with student 2 as presenter, and then with student 3 as presenter. Each student will receive feedback on their three prototypes from two students.

6. Students should then work to incorporate feedback into their assignment, evidence of which may or may not be a part of the assessment protocol.

Online implementation

To implement this activity online consider having students submit an online version of their prototypes and think about having their partners share feedback in a shared document (such as a Google Doc).

Solo implementation

This assignment is difficult to conduct individually, as it relies on feedback from others.

Helpful tips from the field

Seeking feedback can be especially difficult and emotionally challenging for anyone, and especially for undergraduate students. Having a discussion about a low fidelity prototype takes some of the pressure off for students, as the ideas aren't quite fully baked (and so aren't indicative of any student's best effort). By keeping the focus on the "draft" nature of the prototypes and by encouraging students to bring in the minimum discussable version rather than a polished piece of work, we can ease some of that burden and develop stronger feedback delivery and reception skills.

High fidelity prototyping

Time required on task

5 min. |———●———| 1 hour

Ideal group or team size

2 |———————●—| 5

Ease of transferring online

Difficult |———●———| Easy

Description and purpose

Prototyping can also be enormously useful in team based work, as it can serve to bring an idea to life quickly, and to offer an opportunity to develop a nascent idea collaboratively with generative feedback. In the high fidelity prototype learning technique, a team is tasked with generating a low fidelity prototype of a single idea, and with user testing that prototype in collaboration with their classmates. They then write a report about the discoveries that they have made regarding the successes, failures and possible adaptations of their idea based on the feedback they have received.

Preparation

Prepare students to create three low fidelity prototypes of their assignment by discussing the role of the low fidelity prototype and what a low fidelity prototype may include or exclude. Ask students to bring one low fidelity prototype of an assignment to the selected class date.

Helpful tips from the field

One of the challenges of seeking and hearing feedback is the emotional barrier that students often put up. Feedback can be stressful and can feel like judgement. To mitigate this, provide students with guidance about what they can talk about (the prototype) and what they can't (the team or team members). To enforce this practice even more, consider banning the word "I" or "we" and ask teams to discuss the prototype as if it is the work of someone else.

Additional reading

Huisman, B., Saab,N., van Driel, J., & van den Broek, P. (2018). Peer feedback on academic writing: Undergraduate students' peer feedback role, peer feedback perceptions and essay performance. *Assessment & Evaluation in Higher Education, 43*(6). 955-968.

Robinson, S., Pope, D., & Holyoak, L. (2013). Can we meet their expectations? Experiences and perceptions of feedback in first year undergraduate students. *Assessment & Evaluation in Higher Education, 38*(3). 260-272.

Implementation

1. Form groups based off of your existing assignment structure.

2. Task teams with selecting a single idea to pursue in prototype form from their brainstorming or ideation work. Students should reflect on feedback from the instructor and from peers in order to select the one idea that will be developed into a high fidelity prototype. They should also discuss as a group which direction they have explored appear to be the most promising, which ones can be abandoned, and what the minimum discussable version of the idea may be.

3. As a team, students then create a single high fidelity prototype of their idea. This prototype should be developmental (and not polished) but must include enough information so that classmates can provide feedback.

4. As a team, students then draft a testing script with specific questions they will ask classmates: this can include questions such as what is the function of this prototype, does it work, why or why not? What would have to change in order to make it better? Students are challenged to ask questions about the usefulness of their prototype, not its useability.

5. Pair student teams together and ask students to select one representative to speak about the idea, one to record feedback, and one to serve as the interviewer. Team one can then speak about the idea and interview team 2 using the script they have developed.

6. Repeat the process with team 2 as presenters and interviewers seeking feedback about their own assignment using their own script.

7. Students then work as a team to write a report about the discoveries they made during the prototyping process, the successes they identified and the failures they plan to address before moving forward.

Online implementation

To implement this activity online consider having teams submit an online version of their prototypes along with a digital document including their descriptive statement and scripted questions. Other teams can then review the prototype, the description, and the script (and respond to the questions in the same document). Online implementation of this learning technique also opens the doors to having various class members (and not just members of one team) weigh in about the prototype. To do this, task all students to respond to at least two groups online.

Solo implementation

This assignment is difficult to conduct individually, as it relies on feedback from others.

Think-aloud interviews

Time required on task

5 min. ├───────●───────┤ 1 hour

Ideal group or team size

2 ├●─────────────┤ 5

Ease of transferring online

Difficult ├──────────────●┤ Easy

Description and purpose

Testing an idea to see what does not work, as opposed to testing an idea to prove that we are right, is a critical characteristic of design thinking-based learning. The Think Aloud Interview Technique can be used to help students develop the skills they need to test ideas and to reflect upon a human centered approach to participation in the testing process. In keeping with the think aloud method proposed by Bohn-Gettler (2018), this learning technique is designed to be semi-structured in order to allow for responsiveness to the context of the ongoing discussion.

Preparation

Create a quiet and private space for students to conduct their think aloud interviews. Decide how to pair students. Consider providing students with a handout or guide to the questions they will pose as "researchers". Frame this learning technique within the final stages of a larger assignment to ensure that students have a testable solution to discuss.

Helpful tips from the field

This interview technique requires the researcher to pay very close attention to both physical and verbalized feedback. One thing that can help students prepare for this work is to have them conduct think aloud protocols as drills: consider tasking the entire class with doing a 20 second think aloud protocol describing their morning routine of brushing teeth or a product in their bag. This can get the ball rolling and remove some of the emotional stigma from describing thoughts out loud from the activity.

Additional reading

Bohn-Gettler, C. (2018). The complexities of comprehension: Conducting think-aloud studies with multiple interacting variables. *Sage Research Methods: Cases.* London, UK: Sage Publication Ltd.

Fontana, A., & Frey, J. H. (2000). The interview: From structured questions to negotiated text. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Handbook of Qualitative Research* (2nd ed., pp. 645-672). Thousand Oaks, CA: Sage

Implementation

1. Divide students into pairs, and provide them with the timeline, instructions and expectations of the activity. Prepare students to present back key findings to the larger group. The Think Aloud Interviews should be conducted in a meeting room or other quiet setting, so send students to the appropriate space inside or near the classroom for this work.

2. Each student will have an opportunity to be the researcher and the participant. The researcher should sit beside the participant, and should take notes about the pace of speech, non-verbal communication (including pauses, smiles, mis-readings), silences and variations in tone and volume (Fontana & Frey, 2000).

3. The participant should answer the following questions when asked by the researcher:

   • I'd like you to read over this _____. While you read it, can you talk me through your understanding of _____? (insert specific learning outcomes or task outcomes here)

   • I'd like you to re-read the _____ section and talk me through how you would describe it in your own words.

   • Prompt: keep thinking aloud!

4. The researcher should take notes on what they learn from the user test, and how the user responded to particular sections of the challenge solution, assignment or product that they are reviewing.

5. Students should swap roles and repeat the process.

6. When the time for each round is complete, students return to class and present back one key finding each to the larger group.

Online implementation

This activity can be conducted online using video conferencing software (Google Meet or similar), but students may find it more challenging to document the physical or emotional reactions of the participant in this medium. Think Aloud Interviews can also be recorded by individual students in advance for submission to "researchers" as part of an asynchronous course offering.

Solo implementation

This learning technique is not well suited to solo implementation.

Structured controversy

Time required on task

5 min. |————————●——| 1 hour

Ideal group or team size

2 |————————●——| 5

Ease of transferring online

Difficult |————●————————| Easy

Description and purpose

Sometimes testing an idea in design thinking based-learning requires considering it in collaboration with others. The structured controversy learning technique helps students assess and discuss a larger challenge from different perspectives and enhances the testing phase of the design thinking cycle by formalizing the discussion and review process. Not unlike human centered or user centered design testing practices, the structured controversy learning technique places participants (students in their roles as controversy members) into the role of localized experts and authorizes them to present their findings about how an idea, solution or assignment can be evolved in an iterative manner.

Preparation

The structured controversy requires the instructor to manage multiple groups on tight timelines: consider running a "mock" structured controversy with groups in advance to develop an understanding of how the learning technique can be implemented. Task students with identifying a controversial "be it resolved" statement about the larger topic in advance, preferably one that is focused on the larger assignment structure. Structure your class space in groups of four and consider preparing a timeline slide to keep all groups on track.

Helpful tips from the field

Structured controversies can be an engaging and exciting way to debate an issue from a variety of perspectives, but to make the most of this work students must have taken on "perspectives" that are different than their own. Consider encouraging students to bring props, or even costumes, to bring their perspective to life. Students may also find it helpful to engage in one of the interview techniques presented in this teaching guide in preparation for their structured controversy work.

Additional reading

Steiner, S., Brzuzy, S., Gerdes, K., & Hurdle, D. (2003). Using structured controversy to teach diversity content and cultural competence. *Journal of Teaching in Social Work, 23*(1-2), 55-71.

Bruen, J., Crosbie, V., Kelly, N., Loftus, M., Maillot, A., McGillicuddy, Á., & Pechenart, J. (2016). Teaching controversial topics in the humanities and social sciences in Ireland: Using structured academic controversy to develop multi-perspectivity in the learner. *JSSE-Journal of Social Science Education,* 18-25.

Implementation

Preparing Students for the Structured Controversy Class Session

1. Assign students to teams of four, and task them with identifying the topic or focus of their Structured Controversy (it must be related to the assignment or course theme). As part of this, groups must develop a resolution statement ("be it resolved") that will guide their preparation work. One example is "Be it resolved that the social assistance program should be dismantled and replaced by a basic income so that all families can afford to meet their nutritional needs" (Mueller, 2018).

2. Each student will prepare for their structured controversy by finding, reading (listening or watching) and summarizing two sources that can provide different perspectives on the "be it resolved" statement. Perspectives can include individual (role-based) perspectives, group perspectives, or disciplinary perspectives. It should be the student's goal to identify evidence and arguments that they can use in support of at least two perspectives regarding the issue, as they will need to be prepared to speak to those perspectives during the Structured Controversy exercise (it is okay for students to bring copies of your support materials with them to use during the Structured Controversy). It is essential that students come to the Structured Controversy class period well prepared.

Conducting the Structured Controversy Class Session

1. Dedicate one class period to the Structured Controversy exercise. During the exercise, students are expected to present and/or argue for two different perspectives on the issue that the group has chosen. The purpose of Structured Controversy is not to "win" a debate, but to uncover the various perspectives and arguments pertaining to the issue in question.

2. Present students with the Rules of the Game:

   - The purpose of this exercise is not to "beat" your team members, but to uncover the many perspectives and arguments pertaining to the question/controversy.

   - The purpose of this exercise is to learn more about the scope of the topic that you have chosen in relation to the theme of "feeding 9 billion people."

   - One person speaks at a time. There is absolutely no interrupting by any other group member when someone has the floor. You may take notes on what is being presented by colleagues with another perspective, and you may address these issues only when it is your turn to speak.

   - Time frames will be strictly adhered to. Your job is to state your argument or present your evidence in as clear and concise a manner as possible.

   - You are allowed to refer to your reading/support materials but remember you have only a short time (3 – 4 minutes) to present your perspective.

   - Every person must speak at least once during both rounds.

3. Conduct the structured controversy using the following timeline:

Activity	Timing
Discussion with team about your personal stance on the issue: the group should have a discussion about how they feel about the issue at hand (from a personal perspective as students in the class).	5 minutes
Reflection and preparation: students should work individually and in silence for 3 minutes to prepare for the Structured Controversy debate.	3 minutes
Each team member summarizes one perspective on the issue, and the evidence that supports that perspective.	4 x 4 minutes each = 16 minutes total
Discussion / debate about the merits of the evidence supporting each perspective	10 minutes
Reflection and preparation: students should work individually and in silence for 3 minutes to prepare for the second round of the Structured Controversy debate.	3 minutes
Each team member summarizes a different perspective on the issue, and the evidence that supports that perspective	4 x 3 minutes each = 12 minutes total
Open discussion – informal	5 minutes
Meet back and debrief with large group	15 - 20 minutes
Completion of individual reflective template	5 minutes

4. After the Structured Controversy exercise, students will submit a written reflection on the experience. The reflection can be up to 2 pages in length. Guidelines for this written portion of the assignment are:

- Briefly describe (1) the most challenging part of the Structured Controversy for you, and (2) the most rewarding part of the Structured Controversy for you

- Describe the most important thing you learned while participating in the Structured Controversy (preparation and/or the in-class exercise)

- Briefly describe the evidence that you used as part of the Structured Controversy process, including how you evaluated the quality of that evidence

- Outline your own personal opinion on the resolution, including the evidence that supports your opinion. Describe whether or not your opinion changed during the Structured Controversy process. Did you change your mind? Why or why not?

- Briefly describe how you will apply your learning during the Structured Controversy throughout the remainder of the term

Online implementation

This activity can be conducted online using video conferencing software (Google Meet or similar) with breakout rooms: instead of grouping students at tables simply provide student teams with breakout rooms and recall them as needed for individual preparation and group discussion debriefs. The reflective statement can also be presented as a Google Form or online questionnaire.

Solo implementation

This learning technique is not well suited to solo implementation.

Special forces testing squad

Time required on task
5 min. ├────●────┤ 1 hour

Ideal group or team size
2 ├──────●──┤ 5

Ease of transferring online
Difficult ├────────●┤ Easy

Description and purpose

Testing ideas, products or assignments to learn how they meet identified objectives can be challenging, especially in a classroom environment or among peers. The Special Testing Forces Squad learning technique takes students out of their existing peer dynamics, and tasks each with assuming the role of a special testing forces squad: summarizer, connector, investigator, proponent or critic. Tasking testing groups with assuming these roles allows students to focus on their analytic work rather than on the group process. This learning technique is especially useful when tasking groups with testing their own work or their own ideas before a final submission or review.

Preparation

Select an assignment that requires students to conduct a critical analysis and break out the appropriate roles for team members. Consider aligning the roles on the teams with the type of roles that are actually played by members of your discipline or career field.

Helpful tips from the field

Students can find it challenging to stay within their designated roles during this learning technique, so providing them with a model in advance (either in person, or with helpful examples) can be excellent preparation. If you are using online breakout rooms for the discussion, it can also be helpful to drop in on each group during the learning technique, and to task one student as the "reporter" for the larger team at the end of the mission.

Additional reading

Swanson, E., McCulley, L. V., Osman, D. J., Scammacca Lewis, N., & Solis, M. (2019). The effect of team-based learning on content knowledge: A meta-analysis. *Active learning in higher education, 20*(1), 39-50.

Implementation

1. Form student groups based on previous assignment work, and assign each team member a squad role for this assignment:
   - The Summarizer is tasked with listening to the group discussion and surfacing insights.
   - The Connector is tasked with looking for ways that the assignment or results of the student work can be connected to the outside world or to larger concepts/learning objectives.
   - The Investigator is tasked with asking questions. They must ONLY use questions in this discussion.
   - The Proponent is the defense attorney for the work: they are the cheerleader and defense against all other commentary.
   - The Critic is tasked with finding the gaps, problems and missing elements in the work presented.

2. Present the work for students to review (this might be a podcast, lecture, assigned reading, video or presentation) and summarize their squad mission: to provide a critical analysis of the work presented.

3. Give teams class time together to discuss and analyze the work, and to prepare their findings in either an oral or written presentation.

4. Students should present their analysis to the larger class in whatever way best suits the assignment: this can be short oral presentations, infographic or poster presentations, written assignments made public on a website or shared discussion board etc.

5. Students should complete an individual reflective statement discussing the learning process and the impact it will have on their personal practice.

Online implementation

This activity can be conducted online by presenting work to students in advance of the class and breaking them out into rooms on video conferencing software (Google Meet) for the discussion.

Solo implementation

This learning technique is not well suited to solo implementation.

CHANGING HOW WE LEARN WITH DESIGN THINKING.

What is the evidence that design thinking based-learning promotes and improves learning? And how convincing is that evidence? Which students are most likely to benefit from design thinking based-learning? And for which learning tasks is it most appropriate?

In this section we'll explore the alignment of design thinking with pedagogical approaches commonly used in our post secondary context (including experiential learning) and provide pilot study evidence for the impact that design thinking based-learning can have on critical skill acquisition and creative competency development among undergraduate students.

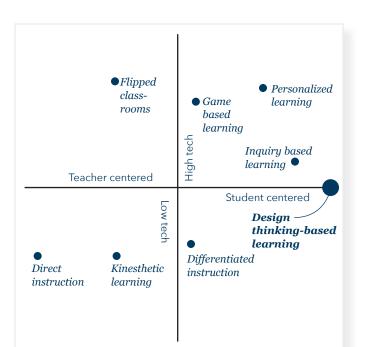# Developing creativity, innovation and collaboration through design thinking based learning.

Using a design thinking learning model in first year introductory classes has been shown to help students to develop the following key skills identified by the World Economic Forum (2020) as critical for the future of learning, and to improve engagement in personalized, problem based, collaborative and lifelong learning practices.

The enhancement of innovation and creativity skills (including complex problem solving, analytical thinking, creativity and systems analysis);

•   The establishment of interpersonal skills (including a focus on interpersonal emotional intelligence);

•   The ability to engage in personalized and self-paced learning models (including those requiring reflective practices) and;

•   The ability to engage in problem based and collaborative learning practices (including those requiring a growth mindset).

In a study of a multi section, first year survey course, survey data indicated that students who participated in a design thinking model of learning reported higher levels of confidence in their innovation, creativity, interpersonal and learning skills than those who participated in an experiential learning focused section of the same class. They were more likely to rank empathy, testing through iteration and seeking feedback as useful problem-solving strategies than their counterparts.

Perhaps most importantly in the framework of Fink's significant learning experience taxonomy: they reported higher levels of confidence in their innovation, emotional intelligence, collaborative or problem based learning and self-paced learning skills than their peers who took the same class but did not engage in design thinking based-learning. When surveyed, the majority of students who have engaged in design thinking

Flipped classrooms ·
Game based learning ·
Personalized learning ·
Inquiry based learning ·
Teacher centered
High tech
Student centered
Low tech
Design thinking-based learning
Direct instruction ·
Kinesthetic learning ·
Differentiated instruction ·

based-learning felt that they were creative, collaborative, able to solve problems in new ways, and able to develop new skills for learning. This indicates that design thinking-based learning can promote both confidence in, and application of, these key skill sets. These finding suggest that using a design thinking framework within a first-year undergraduate learning engagement may be an effective way of meeting World Economic Forum Education 4.0 Initiative goals (World Economic Forum, 2020), establishing significant learning experiences (Fink, 2013), and enhancing cognitive process dimensions of learning experiences (Anderson and Krathwohl, 2001).

Additionally, students who used design thinking models of learning were more likely to demonstrate a growth mindset, and to use reflective practices in their learning work than their experiential learning counterparts (Dorland, 2020). This finding is especially interesting in light of important role that a growth mindset can play in the achievement of all of the international, significant learning experience and cognitive processing goals outlined above. Students who were immersed in design thinking through this case study reported a growth mindset score of 4.53/6 (compared with 2.93/6 in the experiential learning sample). This finding may indicate that design thinking is an effective way at introducing, establishing or enforcing the mental flexibility, failure tolerance and resilience required for growth mindsets to flourish. Indeed, design thinking could be used to engage students in a growth mindset perspective, which, as Tseng, Kuo and Walsh (2020) have argued, can have long term and lasting effects on student success in their undergraduate education—especially in an online learning context.

I hope that this teaching guide helps you find a new way to integrate design thinking-based learning as a pedagogical approach in your classes, and that this new set of tools proves a valuable addition to your teaching and learning practice.

The mindset, method and means that make up design thinking based learning are available to us all, and are especially helpful for instructors struggling to move classes beyond the understand-and-remember model of direct instruction that can dominate both our online and face-to-face teaching approaches.

The future of our students requires us to support the development of their innovation, creativity, interpersonal and self-directed learning skills. But to do that we often focus on the introduction of new content or new programs in higher education contexts: solutions that require enormous commitments, resources and departmental or institutional support. In this teaching guide, we've outlined a new path forward – one that may have an equally positive impact on student's development and acquisition of the critical characteristics identified in the Education 4.0 Initiative while requiring far less institutional resources or commitment.

Adopting design thinking based-learning techniques, integrating a design thinking mindset, or including design thinking methods in teaching and learning at a post-secondary level can help instructors across disciplines to support the enhancement of innovation and creativity skills, the establishment of interpersonal skills, the acquisition of self-paced learning skills and student engagement with collaborative or problem-based learning practices.

To learn more, and for a full list of references, please visit doingdesignthinking.com

MOUNT ROYAL
UNIVERSITY
1910