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Failing to Learn: Design Thinking and the Development of a Failure-Positive Mindset in the University Classroom

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Failing to Learn: Design Thinking and the Development of a Failure-Positive Mindset in the University Classroom

Abstract

Meaningful and impactful learning experiences are rife with failure. And yet, students struggle with framing, tolerating and attributing failure in a positive manner within the post-secondary learning context. This paper explores whether using design thinking as a pedagogical approach might help students learn to tolerate, reframe and attribute failure in a more productive way. Findings from this comparative study of 600 undergraduate business students enrolled in a common first year marketing class reveal the ways in which design thinking-based learning approaches might be used to re-orient student's conceptions of failure as a part of their creative problem-solving skill development process. Students were surveyed to learn more about how they perceived the concept of failure within their learning, to whom they attributed failures within their learning, and how well they tolerated failure as a part of their learning experience. Results from nearly 400 responses to the online survey suggest that integrating design thinking focused approaches to learning into the post-secondary classroom has a positive impact on the development of a student's self-reported failure tolerance and may change the way that failure is attributed and framed in students' descriptions of their individual learning. I find that design thinking-based learning might be used as an effective pedagogical approach in classes where the development of a failure-positive mindset is considered an essential competency or learning objective, and I offer practical recommendations for educators seeking to develop a failure-positive mindset within their learning communities.

Les expériences d'apprentissage significatives et percutantes sont en proie à l'échec. Et pourtant, les étudiants ont du mal à encadrer, tolérer et attribuer l'échec de manière positive dans le contexte d'apprentissage postsecondaire. Cet article explore si l'utilisation du design thinking comme approche pédagogique pourrait aider les élèves à apprendre à tolérer, recadrer et attribuer l'échec d'une manière plus productive. Les résultats de cette étude comparative de 600 étudiants en commerce de premier cycle inscrits dans un cours de marketing commun de première année révèlent les façons dont les approches d'apprentissage basées sur la pensée conceptuelle pourraient être utilisées pour réorienter les conceptions de l'échec des étudiants dans le cadre de leur compétence créative en résolution de problèmes. processus de développement.

Keywords: Failure, design thinking, design thinking-based learning, failure tolerance, failure attribution, failure framing

Introduction

Though we know that it is a critical aspect of successful learning practice, little is known about the ways that educators might foster and develop a failure-positive mindset in their learning communities. This study explores whether using design thinking-based learning as a pedagogical approach might help students to rewire the way that they tolerate, frame, and attribute failure as part of their learning experiences. While professional innovators and creatives often encourage to learn from, and even celebrate, their failures as a key aspect of generating creativity (Paulus & Nijstad, 2003) within their learning and their development (Runco & Jaeger, 2012), we seldom encourage students to do the same. In this study, I was especially interested in whether design approaches to thinking used in the creative industry (such as design thinking-based learning) could be employed in the post secondary classroom to serve as that form of encouragement. For example, would design thinking-based learning enhance or boost established key skills such as the development of a failure-positive mindset within student learning communities in the same way as it does for professionals.

Using design thinking-based learning models to foster, develop, and enhance this failure-positive mindset is becoming increasingly common within creative economy enterprises (Markusen et al., 2008) where the deliberate generation of forms of "productive failure" as a learning tool for knowledge workers and cultural producers alike is understood as vital to success (Kapur & Bielaczyc, 2012). Nevertheless, failing is still – in the eyes of many students in our learning environments – failing. How then can learners develop a failure-positive mindset they require for success? And might design thinking-based learning help learners to embrace, rather than struggle with failure, as part of their learning practices?

This study examines the effect that engagement with a specific form of creative skill development – design thinking-based learning – has on the failure tolerance, framing, and attribution practices of undergraduate students. An analysis of survey data collected from students enrolled in a first-year marketing course makes clear three unique ways in which design thinking-based learning may help rewire students' attitudes towards failure as a part of learning, ultimately contributing to the development of a failure-positive mindset. Drawing from theories of failure attribution (Weiner, 2011) and failure framing (Edmondson, 2018) this study presents a new understanding of the ways in which design thinking-based learning can be used as an effective way to help students embrace, rather than struggle with, failure in their learning practice.

Framework of Failure Attribution

Students are not always aware that struggles, ambiguity, and failure are key tenants of the learning process, and a fear of failure can dominate the affective

experience of learning in the post secondary classroom (Whittle et al., 2020). Instead, students often attribute failure to personal failings, rather than to their learning and growth (Forsyth et al., 2009); a form of causal thinking that can directly affect their learning and motivational outcomes (Fishman & Husman, 2017). Understanding how students perceive failure, and how they develop this critical skill set, is complex. We know that students frame their failure experiences as being more consequential or more serious when the failed task is important and difficult, and that they are likely to attribute failure to circumstance (such as a lack of resources or having the wrong information). In a study of college students, Lee and Lynch (2018) have demonstrated that frustration due to a lack of competence, mastery-oriented goals, and controlled forms of motivation are directly associated with negative affective responses to failure experiences – factors that are present in many of our classrooms today.

Of key importance are the ways that students (and other learning individuals) attribute causality to failure. First, failure can be attributed internally, or to the person to whom the failure has befallen; secondly, to an entity such as a challenge, task, or role; or third, externally, or to circumstance (Weiner, 2011). According to the research on failure, it is most likely that learners who experience an unexplained failure attribute it externally or to circumstances beyond their control, rather than internally or to their own personal disposition or skill (see Figure 1, below). Conversely, when learners receive an explanation for their failure, such as that it is part of a cyclical and iterative process of learning, they are more willing to put the blame on themselves (Mattila & Patterson, 2004; Srivastava & Gosain, 2020). Learning how to re-attribute failure from a function of circumstance to a lack of personal skills has been identified as key for individuals with innovation positive skill sets who are seeking to improve their explorative learning behaviours (Yang et al., 2018) and their co-creation practices (Sugathan et al., 2017).

Figure 1

Expected Framework of Failure Attribution

	Person	**Entity**	**Circumstance**	
Low likelihood of attribution				High likelihood of attribution
	Failure due to a personal disposition such as a lack of skill	Failure due to an unfair challenge or high levels of task difficulty	Failure due to a lack of resources, having the wrong constraints etc.	

Note. Adapted from Weiner, 2011.

A contextual framing of causes for failure and the dialectical processes associated with failure (De Keyser et al., 2021) enables us to also examine the way that

organizational work groups frame types of failure as either blameworthy or praiseworthy (Edmondson, 2001). Studies of failure framing (or the tacit beliefs that teams hold about how to respond to failure incidents) indicate that types of failures (preventable, complexity related, or intelligent) can be arranged on an emotional spectrum (see Figure 2, below) from blameworthy (preventable failures such as deviance, inattention, or lack of ability) to praiseworthy (intelligent failures such as hypothesis, exploratory, or explanatory testing), with complexity-related failures (process inadequacy, task challenges, process complexity, or uncertainty) located somewhere in the messy middle (Cannon & Edmondson, 2001; Edmondson, 2011).

Figure 2

Expected Framework of Failure Blameworthy and Praiseworthy Categories

Blame Worthy	**Preventable**	**Complexity Related**	**Intelligent**	Praise Worthy
	Deviance Inattention Lack of ability	Process inadequacy Task challenge Process complexity Uncertainty	Hypothesis testing Exploratory testing Explanatory testing	

Note. Adapted from Cannon and Edmondson, 2001.

This framework is challenged, however, when failure is framed within a design thinking-based learning perspective. When viewed through this lens, failure is often characterized as iteration or ideation (Macklin & Sharp, 2019), rather than a misstep attributed to individual characteristics, contextual situations, or procedural limitations. Failure within design thinking is reframed as a cyclical and evolutionary process of "idea testing" and "idea generation" used to convert problems into opportunities (Brown & Katz, 2019). By taking a design thinking approach, learners may be able to increase their failure tolerance, or an ability to reimagine failure as productive to their learning, rather than diminishing the same. Heightened levels of failure tolerance reflect the belief that, as Cameron et al. (1987) suggest in their foundational work on the subject, failing can be both functional and dysfunctional at the same time. Design thinking-based learning also supports a failure risk-free environment, which, as researchers have suggested, may enhance experiential learning opportunities in the post-secondary space (Phillips et al., 2018).

The Study

Purpose

As a teaching faculty member with a focus on creative practice development – a disciplinary field that values and requires failure as part of the learning process - I was interested in learning more about different ways that I could convert the experience of learning in the classroom from one that appeared to be failure-avoidant to one that was more failure-receptive. This study assessed students' experiences of participating in one attempt at executing that difficult conversion (the integration of design thinking-based learning approaches into an existing course design). Through this study, I investigated the following three research questions:

1. How does design thinking-based learning impact the way that students tolerate failure?

2. How does design thinking-based learning change the frames through which students view failure?

3. How does design thinking-based learning change how students attribute failure in their work?

This study contributes to a gap in the literature on pedagogical approaches to creative-capacity enhancement, most specifically with respect to the development of the critical skill set required for success in the creative economy and creative career pathways (Creely et al., 2019; Manalo & Kapur, 2018). In an effort to integrate this SoTL study into my own teaching development and the local priorities of my department and faculty (Fanghanel, 2013; Felten, 2013), I prioritized a methodological approach that served as an opportunity for reflection which contributed to continuous improvement in the course design for our wider team.

Method

To explore how design thinking-based learning impacted the ways that students tolerated, framed, and attributed failure in their work, I conducted a qualitative survey. I sampled 600 students enrolled in a common foundations course in the marketing department of an undergraduate Bachelor of Business Administration program by inviting them to participate in a 10-question online survey about growth mindsets, failure experiences, and creative practice. Recruitment for the survey was done through a marketing student participant pool program, where students (the majority of whom were in their first year of study) were invited to take part in four surveys throughout the term and rewarded with a bonus grade for participation. The data collection for this study was done in the winter of 2020, immediately prior to the introduction of changes to our program delivery modality due to the COVID-19 pandemic.

The students sampled for this survey were enrolled in one of 15 sections of the same Introduction to Marketing course, two of which were taught using both design thinking-based learning approaches and experiential learning approaches to in-class engagement (with the remainder taught using experiential learning focused approaches only). The 15 sections of the course that served as the sample for this study were taught by a coordinated faculty team, using a shared syllabus, course outline, assessments, assignments, and learning objectives. While the in-class activities varied between the two sections, the assignments and assessments were coordinated across all sections. Key differences in pedagogical approaches between the two sections are outlined below (see Figure 3).

Figure 3

Learning Activities Used in Class (Sample A and Sample B)

	Learning activities used in class (Sample A and Sample B)	
Class number	**Sample A (Experiential Learning)**	**Sample B (Experiential Learning + DTBL)**
1	• Case study • Reflective practice	• Warm up activity • Case study with a focus on empathy development. After action review and group discussion.
2	• Case study • Reflective practice	• Warm up activity • Case study with a focus on problem definition • After action review and group discussion.
3	• Applied research project design activity • Reflective practice	• Warm up activity • Applied research project design activity, with a focus on ideation • After action review and group discussion.
4	• Interactive simulation • Reflective practice	• Warm up activity • Interactive simulation with required prototyping activity • After action review and group discussion.
5	• Team contract • Reflective practice	• Warm up activity • Team contract and class discussion about participant informed testing of solutions • After action review and group discussion.
6	• Simulation activity • Reflective practice	• Warm up activity • Simulation activity • After action review and group discussion.

In the design thinking-based learning enriched sections of the study (sample B), students used tools that corresponded to the five most commonly used stages of the design thinking process: empathy development, problem definition, ideation, prototyping, and user testing. Open educational resources that outline the teaching activities and assessment strategies used with the sample B classes, as well as a review of the background of this approach, can be found in a Design Thinking-Based Learning Teaching Guide developed for use in this course.

Participants

The participants were divided into two samples for the purposes of data analysis. Students in sample A (n=480 students) were enrolled in sections that focused on the use of experiential learning (Kolb, 1984) and lectures to deliver the course content. Students in sample B (n=120) were enrolled in sections that employed design thinking-based learning in addition to the experiential learning approaches (see Table 1 below). In total, we recruited 600 students for this study, and received a total of 366 complete responses from both samples combined. Sample A generated 284 complete responses (59.2% completion rate) and sample B generated 82 complete responses (68% completion rate).

Table 1

Information About Study Participants

	Study Participants	
	Sample A	**Sample B**
Total number of responses	284	82
Total number of non-responses	196	38
Percentage of respondents from total sample surveyed	59.2%	68%
Percentage of total survey responses (samples A and B)	77.5%	22.5%

The Survey

The survey was administered online by a program coordinator without direct ties to the individual sections of the course or to the enrolled students, using Qualtrics (an online survey data collection and analysis tool). Students were provided with a one-time-use link to the online survey, which consisted of a series of ranking, Likert and short answer questions (please see Appendix 1 for a full list of the questions related to failure asked in the survey). Participants were asked to elaborate on their feelings about the failures they experienced as part of the class (failure tolerance), their identification

of the reason or cause for these failures (failure attribution), and to consider how these failures were framed within their experience of their learning (failure framing). Several questions on the survey related to growth mindset development are not included in this analysis. Responses from the two samples were differentiated by their origination code, and students were not informed of the difference between the two samples (A and B) while taking part in the survey – the questions remained identical in both versions. Students had one week to participate in the survey, and one reminder was sent (via email, in the same manner as the original recruitment invitation) 24 hours before the survey was closed to all participants. This research study was completed in compliance with the University's Human Subject Research Ethics Board guidelines and received ethics review and certification prior to initiation.

Data Analysis

After the term was over, and all student grades had been submitted and appealed, I analyzed the survey data to find out how the use of design thinking-based learning approaches impacted students' tolerance, framing, and attribution of failure within their learning experiences. To take an inductive approach to surfacing key concepts – and to generate a new theory of how design thinking-based learning might help students develop failure-positivity – I employed descriptive statistical analysis (Devore & Berk, 2012) to examine the ranking question data and thematic content analysis (Braun & Clarke, 2006) to surface commonalities (or themes) from the short answer survey data.

Three questions asked students to either rank or rate their experiences of failure on sliding scales from 0 to 100. These questions were analyzed using descriptive statistics to establish measures of central tendency in relation to their reported confidence levels. T-tests were then run to determine if there were significant differences between the two samples. For each of the ranking or rating questions, I also asked a required short answer follow-up question ("Tell us more"). The first order concepts, second order themes, and resulting aggregate dimensions (Corley & Gioia, 2004) that emerged from these data provided a new point of view through which to see the ways in which the different pedagogical approaches impacted the development of a critical capability (a failure positive mindset) within the samples of students. The collected short answer responses were first read broadly as a whole to develop a contextual understanding of the participant perspective presented in the survey data. Individual participant's statements were then examined for commonalities (or themes) to better understand the impact of design thinking-based learning on the development of a failure positive mindset. After a second review of the data set with an eye to alignment and representation, the final coding themes used demonstrated a high level of inter-rater reliability, and these final coding themes were used to generate further thought about the role and nature of failure within learning practices, while prioritizing the respondent's localized experience (Putnam et al., 2014).

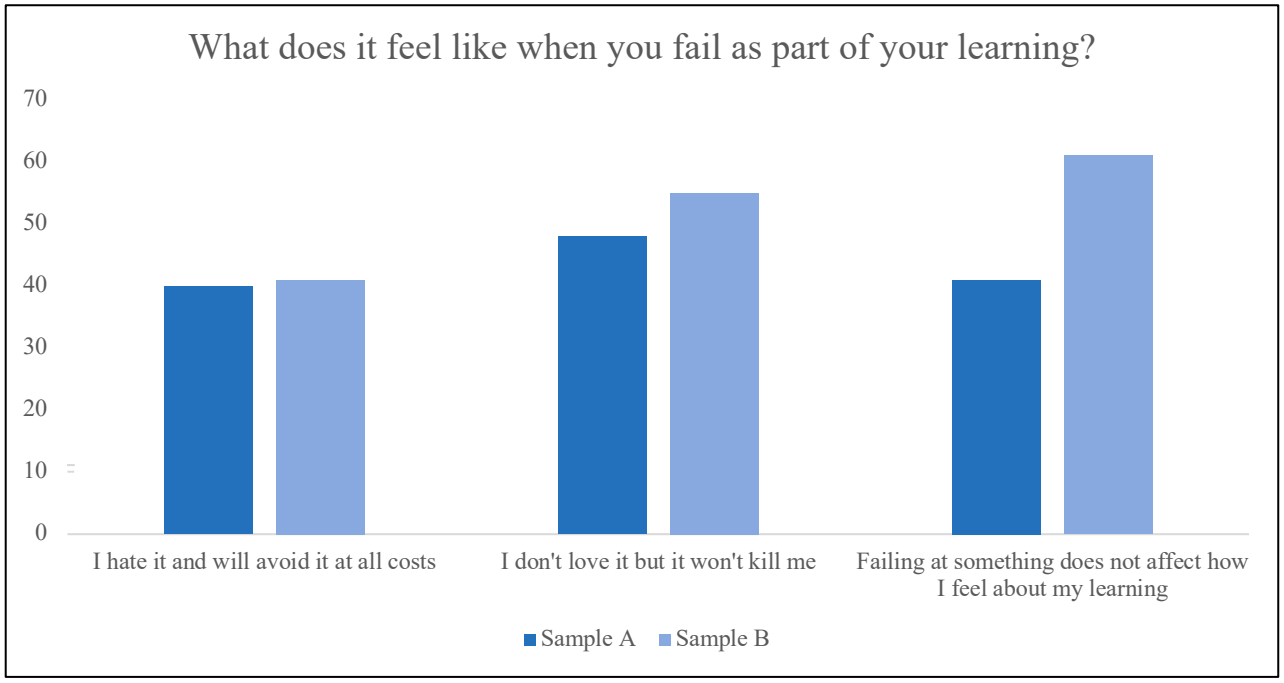
Findings

Tolerating Failure

When I asked students what failing felt like as a part of learning (with 0 indicating strongly disagree and 10 indicating strongly agree) and to record their answers on a sliding scale, the responses were very similar between the two samples - no one likes failing, and it appears that design thinking-based learning approaches do not magically convince students that failing feels good. That said, there are some differences in how likely students were to agree with the statement that "Failing at Something Does Not Affect How I Feel About My Learning." For example, 61% of students from sample B, the design thinking-based learning focused classes, selected the above as their response, compared to only 40% of students in sample A, which might indicate some effect of the iterative and divergent nature of design thinking-based learning approaches to iterative or failure positive learning (as seen in Figure 4 below).

Figure 4

Sample A & B's Responses to Question 6: What Does it Feel Like When you Fail as Part of Your Learning?



Note. Responses are presented as percentages of the total sample in each case.

In short answer questions related to this question, most participants from sample A (the control sample) reflected on the circumstantial nature of failure, the undesirable characteristics of failure, and the destructive aspects of failure incidents. In total, 29% of

participants in sample A discussed the way that failure thwarted their innovation, creativity, or learning. One participant commented that:

> "We only have so much time. If we fail along the way, it sounds great, but it can really slow me down. I don't have much time for screwing up when I have to restart everything I've done."

However, in sample B (the design thinking-based learning focused sample), participants reflected on the constructive (65%) and enabling (48%) aspects of failure in their learning. Nearly all short answer responses in this phase of the study included reflections on the role of accepting the failures of others on the team, and of mobilizing failure as a constructive force. One participant noted that:

> "I don't know if I'd want a team member who didn't want me to fail. That's why our team is strong now. We're not catching each other out we're just catching each other because we're all going to fail if we're being creative enough."

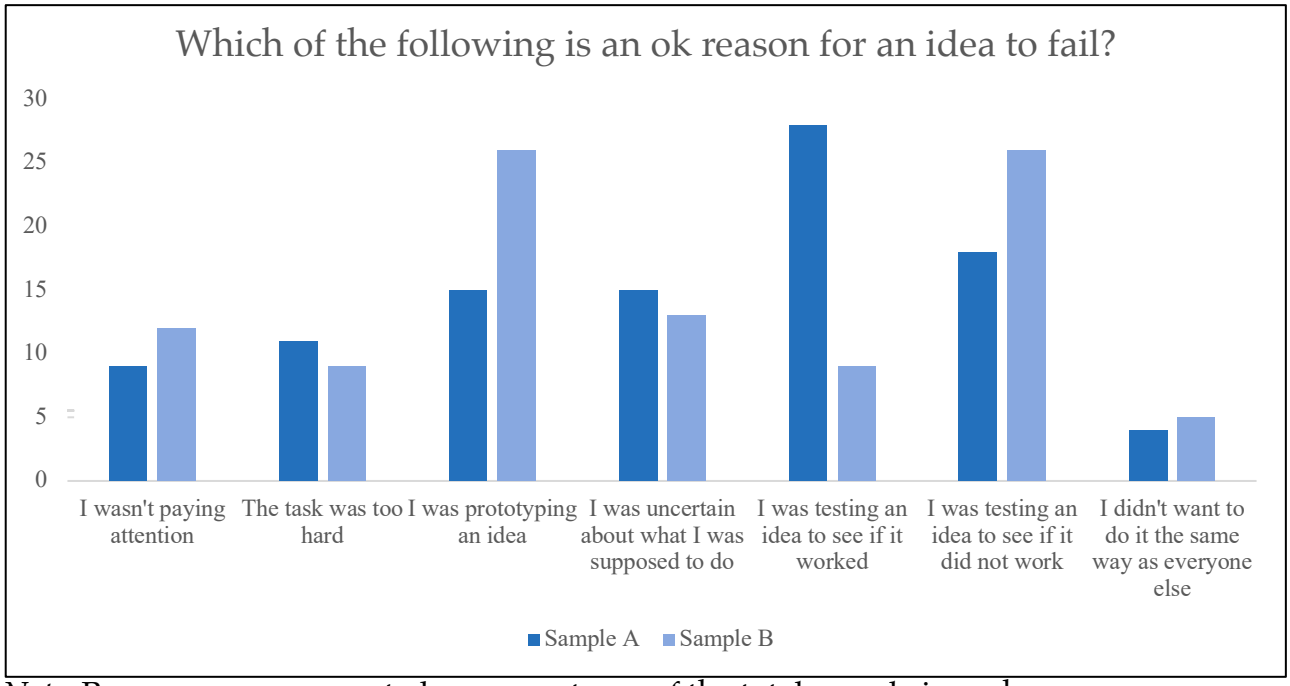
Data from the survey responses revealed that after engaging in design thinking-based learning, sample B participants reported a higher personal tolerance for failure in their learning practice. Participants shared many examples of the ways in which their personal tolerance for failure shifted after the intervention of design thinking-based learning, and actively described the ways in which they welcomed, accepted, and encouraged failure within their own work and in the work of their colleagues. After taking part in classroom engagements that focused on design thinking-based learning, participants shared positive descriptions of failure instances, a marked difference from the instances described by those from the control group (sample A), which were primarily negative and associated with both personal and systemic intolerance for failures.

Reframing Failure

When I asked students to select an acceptable reason that an idea might fail from a list of possible causes, the top response for 28% of the control sample was "I was testing an idea to see if it worked." This prioritization of hypothesis testing or exploratory testing as an acceptable form of failure reflects the expected model of failure framing (from blameworthy to praiseworthy) described in the organizational studies literature (Cannon & Edmondson, 2001; Edmondson, 2011). Conversely, the most often selected responses for the design thinking-based learning sample (sample B) were in a direct contradiction to what we would expect to see on a typical failure attribution spectrum (see Figure 5 below). A total of 52% of all sample B participants selected reasons such as "I was prototyping an idea" (indicative of process complexity related failures) and "I was testing an idea to see if it did not work" (indicative of uncertainty related failures) as their (tied) top choices (at 26% each).

Figure 5

Sample A & B's Responses to Question 8: Which of the following is an ok Reason for an Idea to Fail?



Note. Responses are presented as percentages of the total sample in each case.

When asked to elaborate on their reasons for selecting one of these options, many students from sample A (29% of respondents in the control section) discussed failure as a barrier to success, specifically referencing the impact that failure had within their understanding of the course content. Participants framed failure as overwhelmingly unacceptable, sharing that:

> "You can't just fail and expect a gold star. We don't take this class because we want to be bad at it. And after all this studying, if we keep getting it wrong it gets us down."

> "If I fail it is not ok. Failing in this course would just be embarrassing."

In the short answer question responses from sample B, the most common theme was that failure was desirable. 37% of participants from the sample that took part in design thinking-based learning approaches referenced the ways that failing was good, needed, constructive, lucky, or useful. The focus on framing failure as praiseworthy, including preventable failures associated with a lack of ability, was a common theme in short answer responses from this sample.

"You have to test your idea, or you won't know what doesn't work. You're lucky if you find it it's a failure because then you can find out what's right, even when it's your fault."

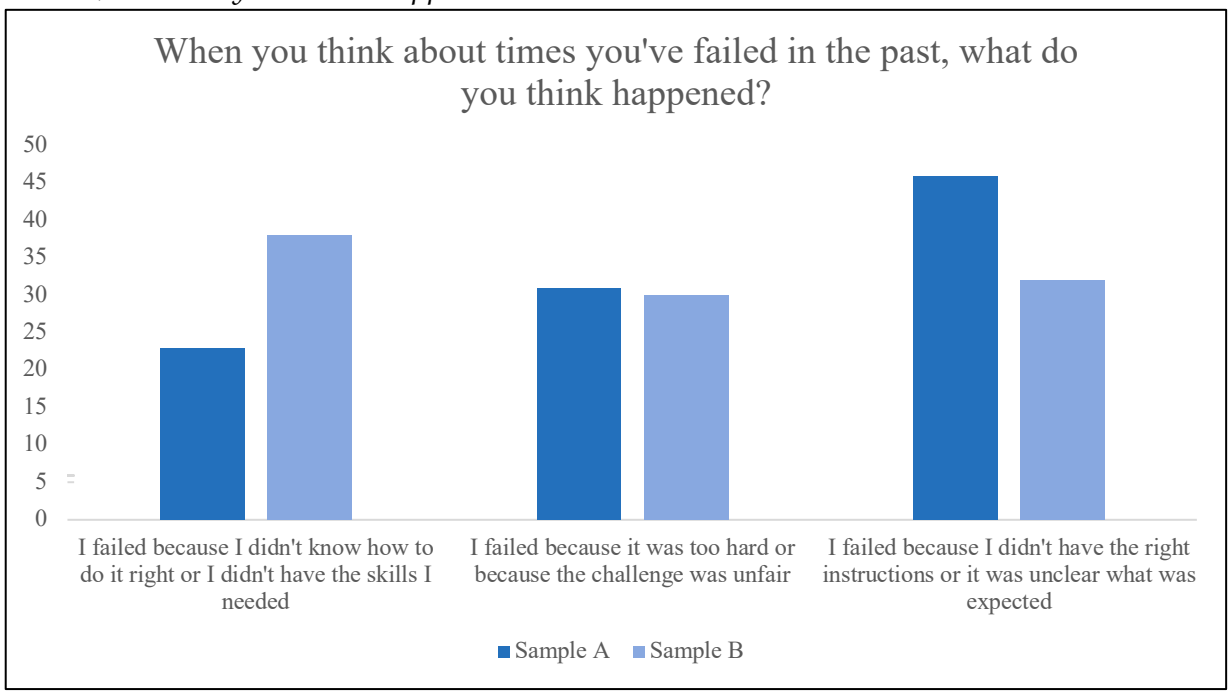
"If I wasn't failing then I wouldn't be learning anything in this class, right?"

Reattributing Failure

Perhaps the most distinct difference between the two samples of student learners was their perspective on failure attribution. Students in sample A (the control group sample) attributed failure focused experiences to circumstance – a lack of resources, incorrect constraints, or unclear expectations for success (46% of respondents in sample A). Students in sample B took a different approach, overwhelmingly attributing their failures from the class context to their own growth process – 38% of respondents from this sample selected "I failed because I didn't know how to do it right or I didn't have the skills I needed" (see Figure 6 below). According to the research, it is far less likely that individuals attribute failure to their personal disposition or lack of skill; to see such a large percentage of this student population select this as a first choice was unexpected in the data analysis.

Figure 6

Sample A & B's Responses to Question 11: When you Think About Times You've Failed in thePast, What do you Think Happened?



Note. Responses are presented as percentages of the total sample in each case.

The most apparent consensus within the coded short answer responses was regarding this theme of failure attribution: fully 89% of respondents from sample A (the control sample) attributed their most recent classroom failures to circumstantial difficulties, including a lack of resources, time, team capacity or contextual information. In the short answer question responses associated with failure attribution, participants from sample A were much more likely (>36%) to attribute their most recent failures to circumstance than to the complexity of a task at hand.

> "It is never easy, but when it falls apart it's more likely part of not having the right tools than anything. If we don't have the right instructions, it's not easy to do a good job and that's not always our fault."

Short answer responses from sample B also demonstrated a thematic prioritization of the role of circumstantial forces on failure, but several respondents (23%) also mentioned their own lack of skill as a contributing factor. Many framed this form of attribution in a positive manner. For example:

> "When I fail it's probably my fault, even if I don't want to see it. But when I look back, I can see that I just didn't know enough yet."

Discussion

This study explored how design thinking-based learning approaches might contribute to the deliberate development of the failure tolerance, framing, and attribution skills (Edmondson, 2018; Weiner, 2011). Findings revealed that after participating in design thinking-based learning, participants had a higher tolerance for failure in their innovation work, were more likely to take personal accountability for failures in the innovation process, and to reframe complexity related failures as being "praiseworthy" (Cannon & Edmondson, 2005). The analysis of survey responses from both sample A and sample B student groups illustrate the ways in which design thinking-based learning approaches could support the development of a failure-positive learning practice by enabling students to learn to tolerate, frame, and attribute failure in new ways. This small study of the impact of a design thinking-based learning approach in the undergraduate classroom demonstrates that design thinking training may enable students to *embrace,* rather than *struggle* with failure in their work.

These findings suggest that design thinking-based learning approaches might have a positive impact on the ability of students to acknowledge failure, and to attribute it appropriately as part of a failure positive mindset. Taking part in design thinking-based learning appears to have given participants a plausible and generative *reason* for failure as a part of their learning work, effectively rewiring students' understandings of why the failure occurred and providing credible evidence for the cause of the failure event in such a way that they were increasingly likely to, as predicted by Mattila and Patterson (2004) and Srivastava and Gosain (2020), attribute formative failures to

internal causes such as their personal disposition or lack of skill (as indicated in *Figure 7* below).

Figure 7

Evidenced Framework of Failure Attribution After Design-Based Learning

Low likelihood of attribution	**Circumstance**	**Entity**	**Person**	High likelihood of attribution
	Failure due to a lack of resources, having the wrong constraints etc.	Failure due to an unfair challenge or high levels of task difficulty	Failure due to a personal disposition such as a lack of skill	

The findings also indicate that after taking part in design thinking-based learning participants were more likely to reframe complexity related failure as praiseworthy. Without design thinking-based learning experiences, participants were most likely to categorize complexity related failures as being neither blameworthy nor praiseworthy. Instead, these types of process inadequacy, task challenge, process complexity, or uncertainty related failures were mitigated using rhetorical strategies, in keeping with the model of framing failure proposed by Cannon and Edmondson (2005). This is potentially problematic, as failures categorized as "complexity related" are a critical and generative component of learning for any student (Cannon & Edmondson, 2005; Edmondson, 2012).

In contrast, these findings indicate that design thinking-based learning may help students to reframe complexity related failures as praiseworthy attempts at learning and as positive forms of social practice (as outlined in *Figure 8*, below) - rewiring students' beliefs about the blameworthiness or praiseworthiness of different forms of failure, and enabling them to position a wider (and more learning focused) spectrum of failure-forms within the framework of praiseworthy intelligent and complexity related challenges (using the spectrum proposed by Edmondson in 2012). This appears to be a function of, as Schippers et al. (2014) predicted, the generative practice of team reflexivity: a practice which forms a central component of the design thinking-based learning process.

Figure 8

Evidenced Framework of Failure Blameworthy and Praiseworthy Categories

Blame Worthy	**Preventable**	**Intelligent and Complexity Related**	Praise Worthy
	Deviance Inattention Lack of ability	Hypothesis testing Exploratory testing Explanatory testing Process inadequacy Task challenge Process complexity Uncertainty	

In many aspects of their learning journey, students are penalized for failing and for attempting iterative, prototyped or pilot focused forms of threshold concept acquisition. Students that try, and fail, often are left without recourse when there is not adequate support for generative and positive forms of failure in the classroom. This data suggests that integrating design thinking-based learning as a pedagogical approach might create the space required for students to integrate failure as part of their learning, embracing the process of failing in small and low-stakes ways rather than struggling with failure as a challenge to their ability, identity, or learning. We know that design thinking, when practiced in the classroom, can enhance the divergent thinking capabilities, the creative problem-solving abilities, and the abductive reasoning skills of our students. The data from this study of undergraduate students enrolled in a marketing class suggests that design thinking-based learning could also help students develop a valuable and important capability: a failure positive mindset. To help students develop this failure positive mindset in their learning practice outside of a strictly design thinking-based learning pedagogical model, educators might consider:

1. Integrating design thinking-based learning approaches into existing classroom work in the form of learning activities, warm up exercises, and team-based challenges.

2. Leverage existing pedagogical approaches by integrating failure-focused iteration into the "active experimentation" (Kolb, 1984) phase of experiential learning practices.

3. Reward failure within the prototyping of ideas using a design sprint model in early stages of work on assignments.

4. Model failure tolerance by establishing peer review, draft submission, and early feedback practices as part of assignment design.

Limitations

This research presents a look into only one instance of the effect of design thinking-based learning on a relatively small group of students (within a much larger sample), and as such the scope of the conclusions drawn from this data set are limited in two key ways. First, the sample of students participating in sample B (the design thinking-based learning sample) in this study brought to their work a preconceived awareness of the value of design thinking, and a culturally enforced appreciation for design thinking processes due to their class discussions about the approach throughout the term. In future studies it would be worth examining the impact of design thinking-based learning on students who had not discussed the principles of the model in to mitigate the limitation in the data collected here. It may also be worth exploring the role of integrating this reframing of failure on assignments and tests used to assess performance in the two sections of this class; though I did not review the impact of integrating design thinking and failure positive mindsets on the students' grades, this may be an especially rich area for further study.

Though participants indicated a willingness to reflect upon their own innovation processes as part of this research work, I understand that self-ratings of innovation, failure-focused or creative skill sets are rarely reliable and are most often tinted by the team dynamics and social expectations of a classroom culture. The issue presented by asking participants to self-assess their comfort with difficult topics, such as failure, may have presented a limitation within the data collected. In future studies, I would like to integrate observational and interview work into the data collection process to tease out additional facets of the failure positive mindset and its development.

Conclusions

The picture that emerges from this survey is one of existing failure mindsets being reshaped and expanded as students negotiate embracing, rather than struggling with failure as a part of their learning practice. The findings from this study suggest that using design thinking-based learning as a pedagogical approach within a first-year class can help students develop the critical skill set of a failure positive mindset. Additionally, initial data indicates a positive correlation between design thinking-based learning experiences and the development of the failure tolerance, attribution, and framing skills necessary for creative and innovative practice development. These findings reframe design thinking-based learning, currently understood as essentially a five part research and development process that focuses attention on the user, or the ability to frame problems, to visualize, and to build prototypes (Carlgren et al., 2016), as a valuable way to develop a critical capability required by our students for their future

growth and success The findings of this study demonstrate that design thinking can be used to nurture and support the development of failure tolerance, that it enables participants to reattribute the causes of failure in a constructive and innovation-positive manner, and it may enable learners to reframe the impact or role of failure in their work.

By repositioning design thinking-based learning as *more* than a creative idea generation process, educators may be better able to understand the additional capabilities, mindsets, and cognitive capacities that the process enables within the classroom environment. Data from this survey of students enrolled in either a control-sample (with an experiential learning focus) or a design thinking-based learning sample demonstrate that this pedagogical approach may enable students to deliberately develop creative and innovative skills within an existing learning culture. Doing so may effectively allow students to design their thinking in a way that enables them to be more failure tolerant, better at framing failure in an innovation-positive way, and more open to incorporating failure as an innovation process or practice. Reframing design thinking-based learning to foster and nurture an important capability such as the failure-positive mindset opens the door to further and more systematic examinations of how SoTL researchers and practitioners alike might expand the use of design thinking as a pedagogical approach.

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Dr. AnneMarie Dorland is an Assistant Professor in the Bissett School of Business at Mount Royal University, where she teaches marketing, branding, and creative strategy. In her research work she brings together her experience as a creative industries scholar, an organizational ethnographer, a graphic designer, and a brand strategist to explore the drivers of organizational creativity and the development of creative capacity as a part of learning, working and leading. Her teaching and research are dedicated to understanding the problem-solving practices of the creative economy and to sharing evidence based approaches for creative capacity enhancement and creative economy policy design. In her work at MRU she is also an Associate Director with the Mount Royal University Institute for Community Prosperity's CityXLab, where she leads a team of student researchers curious about the changing nature of Canada's creative and cultural future. Dr. Dorland is a contributor to several international publications on how we might adopt the practices of creative thinkers to help organizations - from health care to education to the energy industry - develop and enhance their creative capacity to become better problem solvers and more innovative thinkers. She is relentlessly optimistic about the ways that amplifying creativity in our organizations, our teams and our classrooms can help create meaningful and innovative change. To learn more about Dr. Dorland's work, please visit creative-capacity.com

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