Inscribing a Designer Mindset to Instructional Design Students

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Guiding Questions

- What is the core of design thinking?
- How is a designer's mindset different from other professional mindsets?
- How can we best teach ID students to design?
- How do designerly tools like frame experiments support students in developing design judgment and developing awareness of ethics, including their responsibilities as designers?

Identification of Key Terms and Concepts

- Design judgment
- Designerly tools
- Frame experiment
- Design ethics
- Design failure

Chapter Overview

In this chapter, we focus on building a designer's mindset among instructional design (ID) students by using frame experiments as an instructional method. We provide the theoretical foundation of frame experiments with a sample scenario of their use and conclude by sharing specific instructional activities that instructors may use to build design judgment.

Case Study

Kim is teaching Instructional Design Practice—an introductory ID course for master's students. Her students are working in groups, each of which completes an instructional design project. Kim teaches from a design thinking perspective, and she is speaking with one group just starting their work.

Team Member A: *"We've talked about it, and we plan to start with an analysis. Like the model in our textbook."*

Kim: *"OK, what kind of analysis do you think is appropriate?"*

Team Member A: *"Well … we're not sure. We're developing a lesson on fractions for 9-year-olds in an after-school program, so, maybe—talk to a teacher?"*

Kim: *"Yes, sure." [nods approvingly] "And what kinds of ideas do you have for the lesson itself?"*

The students look at each other, hesitating.

Team Member B: *"Uhm. Should we really be doing that before the analysis? Before we have all the facts? I mean—we might design the wrong thing and then it would be our fault for skipping a step in the process. If we stick to the process, it will come out right."*

Kim had half expected the pushback, but she hopes they will go along with her for a minute.

Kim: *"Let's try...Have you pictured anything about what the lesson might be like?"*

After a second….

Team Member B: *"I thought … maybe … it could be a workbook? I used a lot of math workbooks in school!"*

All team members nod.

Team Member C: *"I've seen a cute math workbook online—we could use that; it looked so fun!"*

Kim: *"Well … let's think about a workbook just as a possibility. Who is using it—and where did they get it?"*

Silence. Then ...

Team Member A: *"The kids are using it, obviously. And they get it from the program—person."*

Kim: *"Makes sense. They work on it alone?"*

Team Member B: *“They might need help. I wonder if the people at the program know how to help them?”*

The team begins to speculate on who works at the after-school program, whether they are prepared to teach fractions, and how much nine-year-old can learn independently. They establish that none of them have been teachers, and only one has a child of his own, still just a baby.

Team Member D: *“I think we need to visit an after-school program instead of a school teacher.”*

Kim has been listening and now interjects.

Kim: *“Maybe also ask them where they get materials for the kids? Do they have a budget? A photocopier?”*

A team member interrupts.

Team Member A: *“Oh! Maybe we should create an app? Then it’s kind of free. And it could be customized for each kid. We could use a strategy of individualized learning because we don’t know if each kid is starting at the same place.”*

Team Member B: *“I thought they went to after school programs because they are behind in school.”*

Kim: *“The public program here in town includes academics, but the kids actually choose their own activities based on their interests.”*

Team Member D: *“Will they even choose math?”*

This student slaps her forehead with her palm.

Team Member D: *“This project is going to be harder than I thought!”*

Team Member A: *“Well, we don’t know...We totally have to start with a context analysis!”*

Theory and Processes

Design Thinking as a Distinct Form of Reasoning

The designer's mindset is arguably a capacity that every human has, and it represents "the oldest human tradition" (Nelson and Stolterman, 2012, p.11), although a scientific mode of thought is often privileged in instructional design practice (Smith & Boling, 2009). Dorst (2011) offers a clear explanation of how design thinking is distinguishable from other forms of reasoning. These are *Deduction, Induction*, *Abduction-1,* and *Abduction-2*.

Deduction Form of Reasoning. *Deduction* is a form of reasoning in which we know the "players in a situation we need to attend to [WHAT]" and the rules that will govern HOW they operate together (Dorst, 2011, p. 523). This reasoning allows for a safe prediction of results, like predicting the movement of planets. Dorst represents this as a formula:

WHAT	+	**HOW**	*leads to*	***???***
(thing)		(working principles)		(observed result)

Induction Form of Reasoning. *Induction* is a form of reasoning where we know the "what" and the "results," but we lack the knowledge of the "how" (working principles). This reasoning is used to generate hypotheses or theories, subjected to falsification or confirmation— the core act of science:

> [...] in the sciences, inductive reasoning informs 'discovery,' while deductive reasoning informs 'justification.' These two forms of analytical reasoning help us to predict and explain phenomena in the world (Dorst, 2011, p. 523).

This form of reasoning could be displayed using this formula, as suggested by Dorst (2011):

WHAT	+	***???***	*leads to*	**RESULT**
(thing)		(working principles)		(observed result)

Abduction-1 Form of Reasoning. *Abduction-1* is a form of reasoning where we know the aspired value (rather than a specific result) and the "how" (working principles) that will help us achieve that value. However, we do not know the "what"—it could be a device, a service, an experience, or a whole system. This form of reasoning is used for conventional problem-solving where outcomes solve a particular problem in a given context, and the working principles are known. Examples include software designers who rely on computer science principles to create computer applications or engineers who rely on the laws of physics to design bridges. Dorst's (2011) formula represents this reasoning as shown:

???	+	**HOW**	*leads to*	**VALUE**
(thing)		(working principles)		(aspired)

Abduction-2 Form of Reasoning. *Abduction-2* is the most complex form of reasoning because we do not know the "what" *or* the "how"; we only know the value to which we aspire. Abduction-2 is a challenging form of reasoning since one has to figure out what to create (the "what") without a working principle (the "how") that can be trusted to lead to the aspired value. The "what" and the "how" must be created simultaneously. Open and complex problems in design require this form of reasoning. As an example, designers, scientists, and engineers involved in space exploration programs created space vehicles (the "what") in parallel with discovering the working principles of low-orbit maneuvers (the "how") through experimentations and several design failures. Dorst's (2011) formula for Abduction-2 is this:

???	+	***???***	*leads to*	**VALUE**
(thing)		(working principles)		(aspired)

Framing Form of Reasoning. To manage the complexity of the Abduction-2 form of reasoning, Dorst (2011) argues that experienced designers rely on a well-known strategy called *framing,* placed in the formula as shown:

WHAT	+	**HOW**	*leads to*	***VALUE***
(thing)		(working principles)	*frame*	(aspired)

Schön (1983) explains that framing is the creation of a new perspective from which a problematic situation can be approached. In framing, statements or metaphors are used to describe the problem at hand and, simultaneously, to suggest a working principle (the "how") that can lead to the solution (the "aspired value"). A framing statement includes a presumption: "IF we look at the problem situation from this viewpoint, and adopt the working principle associated with that position, THEN we will create the value we are striving for" (Dorst, 2011, p.525). An instructional designer might approach the problem of increased injuries on the job framed by clients as a lack of safety knowledge and skills among employees. Reframed as a lack of space/time management in the factory, the designer can consider several solutions, which may not include safety training.

Compared to disciplines/professions predominantly based on analysis (i.e., deduction and induction) and conventional problem solving (i.e., Abduction-1), Dorst's typology clearly differentiates design thinking from other types (1997; 2006). In practice, though, this distinction is not as clear-cut as in theory:

> [...] *design is not one way of thinking: it is a mix of different kinds of thinking, building as it does on induction and problem solving. It also inherently contains quite a bit of strict analytical reasoning, as rigorous deduction is needed to check if design solutions will work* (Dorst, 2011, p.525).

The Designer Mindset

The *designer mindset* refers to the knowledge designers use *and* the ways in which they use that knowledge (Nelson & Stolterman, 2012). Both are evident in the designerly activity termed the "frame experiment" (Schön, 1983). A frame experiment is a form of *thought experiment* in which designers imagine and consider, in more or less detail, different ways of viewing a problem, thus, generating multiple statements/frames, as noted earlier. During a frame experiment, particular constraints are brought to the foreground while others move to the background. Such an experiment can reveal both new information about a problem and gaps in designers' knowledge about that problem. Frames can also be used to suggest where design effort needs to be focused on at a given point in a project.

The frame experiment is a distinct feature of designing but may not be familiar to those who have been asked to approach primarily problems that are well-structured or solvable. "Solvable" problems are situations where (a) the answer to a problem may be discovered via sufficient analysis (Dorst, 2011; Goel, 1995), (b) the answer is embedded within the components of the problem (Archer, 1979), and (c) where one best solution to a problem exists (Petroski, 1992). None of these is true for design. Design problems are not solvable; they are only addressable and shapeable.

We will address several important aspects of designerly behavior by examining the frame experiment and demonstrating its utility in teaching design: 1) the use of *designerly tools*; 2) engagement in *design judgments* (distinct from decision making); 3) *awareness of ethical concerns* as a part of designing*;* and 4) use of *in-process design failure* as a means of exploring and methodologically moving through the design space, as well as iterating on one's understanding of the design process.

The Frame Experiment as a Designerly Tool

Designers do not solve problems, as we have noted. They engage with a design space, and in that space, they use *tools*, which could include methods, techniques, approaches, technological means, and theories (Stolterman et al., 2008). Tools are used to navigate, raise awareness, work through challenging tensions, and negotiate the form and structure of design outcomes. Much like a woodworker with a range of tools to shape wood in different ways, or a chef who carries a fully stocked knife roll, the designer builds a collection of external and internal tools to structure and support their design work. These tools are termed *designerly* because they afford, but do not dictate, design actions (Stolterman et al., 2008) in the same way that, for example, specific process models may do (e.g., 4C/ID model, Reigeluth & An, 2020).

As an example, Boling and Gray (2015) describe sketching as one such designerly tool that can support ID activity. Many other designerly tools exist—from evocative methods to structured toolkits; from a conceptual vocabulary that highlights the indeterminate and creative nature of design work (Yanchar et al., 2010) to means of building a shared vocabulary to communicate with diverse stakeholders (Spector, 2002). While many of these tools enjoy more currency in fields of design outside of ID, Lachheb and Boling (2018) have found empirical

evidence for a designerly approach to tools and their use among instructional designers in diverse contexts.

The frame experiment is a *designerly* tool. It facilitates exploration and moving through or shaping a design space, actions more appropriate to design than fully goal-directed and stepwise problem-solving. The frame experiment supports the designer's work without guiding it, can be appreciated by the designer in multiple ways, and is not used exclusively for one specific design activity.

Building Design Judgment Through Frame Experiments

Designers' activities encompass more than simple decision making. For example, multiple complicating constraints and needs within a design space have to be considered, evaluated and prioritized, for determining possible paths forward. This requires complex and overlapping judgments to be made, which are not easily reduced to "making a decision." Nelson and Stolterman (2012) have identified 12 design judgments as "[...] essential to design. [They do] not replicate decision making but [they are] necessary" (p. 139) for doing so. In this sense, design judgments are different from design decision-making: judgments are the means to achieve "wise action" (p. 139), or—in other words—good design decisions. The range of different judgments—studied in more detail during everyday ID practices by Gray et al. (2015)—demonstrates that the designer's engagement in judgment is continuous and layered, with non-deterministic links between judgments and decisions. Additionally, guidance for developing design judgments among ID students is discussed in Lachheb & Boling (2020).

Building Ethical Awareness Through Frame Experiments

While engaging in a frame experiment, designers implicitly privilege, or foreground, certain kinds of design knowledge and constraints over others, calling into play critical and ethical concerns. In considering design alternatives, the designer must both consider their own character and values and the emergent values and constraints that are discovered throughout the frame experiment (Gray & Boling, 2016). Designers are responsible for recognizing and responding to the concerns surfaced during frame experiments; in fact, several design scholars have argued that designers must be the guarantors of their design (e.g., Cross, 2001; Lawson, 2005; Nelson & Stolterman, 2012; Petroski, 1992, Schön, 1983). The responsibility for design success or failure, and for how the design privileges certain stakeholders over others, cannot be placed elsewhere–say in a prescriptive model—than the designer.

> *Designers must accept responsibility for all they design. This accountability must be an integral part of their character. Designers should be relied on to fulfill obligations, not only to their clients, but also to a higher authority, one that is concerned for the sake of others and the environment in which we all live*. (Nelson & Stolterman, 2012, p. 211)

In this sense, the frame experiment allows for a safe space where questions of ethics, values, power, and privilege can be brought to the foreground and addressed early on in the design process. This not only promotes the idea that designers are the guarantors of their designs, but also brings a sense of rigor to the work that design students are about to do and for their future work once they become designers in practice, as Campbell et al. (2005) argued.

Using In-process Design Failure (petit failure) in Frame Experiments

Finally, as the designer works through the frame experiment in a dialogic manner, their exploration is not always solely goal-directed. In contrast, the frame experiment allows the designer to actively move about the design space as a means of understanding both the coherence of the design frame and the possibilities that may exist within that space. Thus, this movement—sometimes viewed through the lens of *ideation* or *iteration*—reveals the potential, or even the likelihood of, in-process design failure. This failure can be seen as productive and future-oriented rather than conclusive or final. We refer to this form of failure as *petit* failure in that it is not indicative of a damning indictment on design choices that leads to inevitable summative failure but rather a small and often generative failure that points towards other more salient design possibilities.

Schön (1983) described design students experimenting with different design solutions so they can reframe the design problem and/or test the adequacy of their hypotheses (i.e., the working principles; the “how”) of a design problem at hand. Schön did not use the term ‘failure’ per se. However, it does appear that such a process lends itself to the concept of design failure; design students experience *petit* in-process design failure that plays a generative role in their design process as a reflection-in-action. As Schön (1983) stated:

> *The experimentation [the design student referred to earlier in the text] has conducted prior to the design review has made him aware of a conflict of appreciations. But he does not yet perceive it as a fundamental dilemma demanding for its resolution a significant change in one or both sets of values. In order for this to happen, he would have to carry out another sort of inquiry, one that would reveal both the intractability of his dilemma and an alternative approach to overall organization of the building [he is designing]. (p. 136)*

Design tools—such as the frame experiment—as well as movement within the frame, design judgment, and ethical awareness, can be used to promote this form of early failure. The ultimate goal of the petit failure is understanding the broader coherence of the design space and the most productive framings of that space. This view privileges a subjective and emergent sense of design value and opportunity, rather than a rationalist vision of design that is primarily reductive and could result in the wrong type of logical reasoning.

Professional Practice

The case of Kim and her design students reveals patterns of designerly thinking through what Schön calls a "frame experiment," part of a broader engagement with *problem framing* (Dorst, 2015) that focuses on Abduction-2 as a form of reasoning.

> *"When [the designer] finds [themself] stuck in a problematic situation which [they] cannot readily convert to a manageable problem, [they] may construct a new way of setting the problem—a new frame which, in what I shall call a 'frame experiment,' [they] tr[y] to impose on the situation."* (Schön, 1983)

The Frame Experiment as a Designerly Tool

Frame experiment is undoubtedly an unorthodox approach when viewed in relation to traditional IDT models. As one of Kim's students noted: "*We plan to start with an analysis. Like the model says*." This reveals how this frame experiment could be perceived as unsystematic, messy, and unorganized. After all, why spend time speculating about a design context when the design model does not say to do so? However, as shown in the dialogue between Kim and her students, the frame experiment allowed the design students to identify additional aspects of design complexity through their discussion. They discovered many hidden facets of the design project that they have not thought of—a student slaps her forehead with her palm and says: "*This project is going to be harder than I thought!*" This engagement with the frame experiment brings the designer's role in the project into the center—placing the responsibility of design success/failure on them, not the process or the model they follow.

The Frame Experiment and Design Judgments

In the frame experiment, Kim and the students were continuously addressing different facets of the design situation as a form of sensemaking. This demonstrates how design judgments are formed continuously as a means of understanding the design space. It also demonstrates how design judgments support subsequent action. Each statement a design student has made revealed a set of layered—and often hidden—design judgments. For example, when a student said, "*I thought … maybe … it could be a workbook? I used a lot of math workbooks in school!*" they were evoking a *deliberated off-hand* design judgment, as they bring to their consciousness previous judgments that have led to successful practices and opening them to the possibility of adaptation or use. Whereas when one student said, "*I think we need to visit an after-school program instead of a school teacher*," they were evoking a *navigational* design judgment as they were considering a path, plan, or certain manner (of individual, disciplined preference) in approaching a task or a challenge to get to a desired state. These judgments were shaped by *core* design judgments—values or thoughts that are buried deep within each individual in the form of personal beliefs (Boling et al., 2017).

The Frame Experiment and Design Ethics

In the dialogue between Kim and her students, one student suggested reproducing a math workbook they saw online as their design solution, with a complete disregard of the context or how it could be used. Another student suggested creating an app to host their instructional solution. While these two ideas seem legitimate as an outcome of a brainstorming activity, each highlight different levels of ethical awareness among these students as it relates to potential social impacts. If not inspected further, these design decisions may allow the designer to create something and "move-on" without activating true and meaningful empathy with their target audience. Tactfully, Kim did not shut the ideas down by calling them unethical but treated them as frame experiments. The process of questioning the idea itself and its feasibility by Kim allowed the team to identify other design alternatives and think more deeply about their design context.

The Frame Experiment and Design Failure

In the dialogue between Kim and her students, the team speculates on who works at the after-school program, whether they are prepared to teach fractions, and how much a nine-year-old can learn independently. After speculating, they established that none of the students had been a teacher, and only one has a child of his own—still a baby. This speculation allowed them to decide on visiting an after-school program and give up on the idea of talking to a school teacher. The students experienced a *petit* design failure that allowed them to quickly learn from their mistaken assumptions and actively seek a new design direction to explore possibilities within that space. Giving up an old idea and coming up with a new idea is essentially a process of ideation or iteration where each idea is put first to a logical test: IF we do this, THEN we will get this.

Connecting Process to Practice Activities

Implementing a Frame Experiment as a Designerly Tool

- ID instructors can plan frame experiments into design cycles as an instructional activity.
- Repeating the frame experiment multiple times is crucial to:
    a) inscribe a designer mindset
    b) emphasize a different focus/lens each time a frame experiment is conducted

As noted in the case study earlier, Kim is emphasizing in this frame experiment "how to get started" and "what are the preliminary ideas" students had before they get started on their project. In a future frame experiment, the focus can be on:

- The knowledge that the students acquire about the project's context (i.e., the working principle; the "how")
- How such knowledge can afford sound decisions that lead to the aspired value

Resources Needed & Tactics to Use. Instructors should carefully allocate time and resources for this activity to be repeated throughout the term, through:

- Constant check-ins with the students
- Team debrief sessions
- Not using traditional textbooks as they may be counterproductive, unless the instructor consciously helps students reconcile their classroom experiences with an approach prescribed by prescriptive models

Implementing Frame Experiments to Teach Design Judgments

Engaging design students in frame experiment affords them:

- The opportunity to evoke and reveal the design judgments that precede their design decisions
- To be conscious of their design judgments

Such design judgments, regardless of their perceived "quality," drive the design process and impact the design outcomes, even when designers claim an "objective," data-driven approach.

Discussions of design constraints during frame experiment should not be dominated by one voice, either the instructor's or any single student.

Resources Needed & Tactics to Use. One possible instructional activity to accompany the frame experiment is the design reflection:

- Such reflections will be *reflections-on-action* (Schön, 1983), where design students look back at what they experienced in the classroom with their teammates, "to make sense of what happened, what worked well, what did not work well, why taking one design approach seemed to be better than the other, etc." (Lachheb & Boling, 2020).
- In these reflections, they focus on the design judgments they heard from each other or expressed themselves.

Implementing Frame Experiments to Promote Design Ethics

One possible instructional activity that accompanies the frame experiment is asking students to respond to scenarios or context cues and ask, in an explicit manner, questions about the presented scenarios related to ethics, values, power, and privilege.

Resources Needed & Tactics to Use. Questions raised to students could be:

- Similar to what Kim asked: "*Do they have a budget? A photocopier?"*
- Additional questions: "*Who will benefit from this design the most and who will be disadvantaged?" "What if there are students with learning disabilities and/or special needs?" "What if this design ends up on "the shelf" since teachers will not buy-in into it?*"

These questions can be addressed through collective and individual reflections, as they bring to the foreground ethical concerns early in the design process.

Implementing Frame Experiments to Engage in Petit Design Failure

One possible instructional activity that accompanies the frame experiment is to plan sessions when students share their early design proposals proactively, and the instructor engages with them through questions that point to "holes in their thinking".

Resources Needed & Tactics to Use. Instructors can:

- Use "What if [this] happens?" type of questions
- Plan to share new details about the design project during the frame experiment discussion.

New details should prompt students to diverge from a certain path, come to a stop, and spend time thinking about the new path that ought to be taken. This is similar to when Kim said, "*The public program here in town includes academics, but the kids actually choose their own activities based on their interests."* These new details revealed to the students a new design constraint and pointed to a "hole in their thinking" when they proposed designing a math workbook, not an open-ended solution for kids' interests.

This instructional activity is best to be planned and executed in early design critique sessions, where initial plans, ideas, thoughts, and processes are still being drafted and not committed to. This way, design students experience petit and productive failure, not a kind of a massive failure that evokes anxiety and stress about their class performance. After all, learning experiences need to be ethically driven and motivated.

Reflections and Accounting for Project Timelines

Frequently ID classes center on one project that lasts over a term (often 16 weeks). This provides students and the instructor with ample time to practice, reflect, iterate, and, most importantly, traverse a design space in a disciplined manner. The key considerations in planning a course are:

- Providing students with the opportunity to reflect on their design work
- Constantly visit their design judgments, ethical awareness, and what they learned from their *petit* design failure

- Reflections should not be arbitrary and/or presented to students with the simple instruction of “think about it.”

Carefully considering the role of the reflection as a driving force that allows students to navigate through their design project a reflection opportunity after a major design milestone is completed—for instance, when a design draft is formalized or after presenting beta testing their prototypes.

It might also be beneficial to consider:

- A course in which reflections are crucial milestones in themselves, each following a rapid design sprint
- Each project spans four weeks—three weeks of design work and one week of presentations/critique and reflections.
- Smaller-scale design projects, with tighter timelines, emphasizing the mastery of different design competencies in chunks, with design reflections framed as the last milestone in the design process and the beginning of the next design project. Such a design would also emphasize opportunities to practice frequent frame experiments.

Recommended Readings

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