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Beyond teaching instructional design models: exploring the design process to advance professional development and expertise

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Abstract Instructional Design literature provides descriptions of established models that are particularly helpful for novices learning the patterns and approaches that have historically proven successful. However, it does not provide as much information about the design process in its largest sense. The popularity of established ID models may cause instructional designers to limit their approaches and isolate themselves from alternate views of design. The authors present a synthesis of the literature of design in general with specific approaches cited in fields including architecture, the automotive industry, engineering, fashion, the performing arts, as well as instructional design, and conclude with a discussion of what ID might adopt and adapt from other design disciplines to foster professional development and expertise.

Keywords Instructional design · Instructional systems design · Instructional technology · Educational technology

Instructional Design/Technology faculty assist and support the professional development of instructional designers. As such, they should be able to articulate the concepts and procedures specific to instructional design (ID) as well as the concepts and procedures of design in general (Bannan 2017; Boling 2017; Gibbons 2009; Fortney 2017a, b; Gibbons et al. 2014; Smith and Boling 2009). Teaching

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established ID procedures is a daunting task; gaining an understanding of universal issues associated with the design process in general is an added challenge.

We know from our experience writing the textbook, *The Essentials of Instructional Design* (Brown and Green 2016) that our field produces and disseminates a great deal of information about the procedures common to ID, namely analysis, design, development, implementation and evaluation: the ADDIE approach. The literature provides descriptions of established ID models which are particularly helpful for novices learning the patterns and approaches that have historically proven successful (Boling 2017; Fortney 2017a, b; Gibbons et al. 2014; Richey et al. 2011). Instructional design literature, however, does not provide as much information about the design process in its largest sense.

In instructional design/technology programs of study, we learn about and teach the models that are well researched and/or established as best practice, but we may overlook the nature of the design process in general (Bannan 2017; Boling 2017; Fortney 2017a, b; Gibbons et al. 2014). As Smith and Boling (2009) observe, the popularity of our ID models may cause instructional designers to limit their approaches and isolate themselves from alternate views of design.

Research we conducted on designing online instruction in higher education settings (Brown and Green 2010) led to our observing a tension between rationalized design, which is instruction prepared using detailed and inflexible templates, and design developed without the use of limiting guidelines (in the context of online instruction in higher education this was observed operationally in settings that imposed a rigid design template even though the institution generally supported academic freedom). This is reminiscent of Ritzer's work (2008) in which he articulates the key concepts of a rationalized society: efficiency, calculability, predictability and control. Rationalized procedures lead to more reliable outcomes, but they limit opportunities to innovate. An example taken from Ritzer's work is the fare at a fast food restaurant will be more predictable and economical than the fare at a unique, haute cuisine establishment, but the unique, haute cuisine establishment has greater freedom to create new and different menu offerings and dining experiences (Ritzer 2008). Instructional Design's successful models may be providing rationalized, safe, and satisfactory results overall, but following these models as rigid templates does not allow for the exploration and innovation necessary for the improvement and expansion of ID.

Other design fields have taken approaches that differ from restricting themselves to a small set of prescriptive and descriptive models, some of which have led those fields to next-generation design methods (Gibbons et al. 2014). In comparing our field's descriptions of the range of possible design approaches, we are concerned that ID faculty may not find adequate resources within the discipline's literature to articulate fully the design process. If faculty are unable to describe and discuss the design process generally, they may be confining student perceptions and fostering or perpetuating an overly narrow view of both instruction and design. We may be limiting ourselves and our students by repeating accepted practice without encouraging innovation that could drive forward better designs and more effective instruction; we may be constraining the vision of our students to a view of what has worked in the past without inspiring them to experiment with innovative media and techniques.

To continue this important conversation among those who teach instructional design, we set out to answer the following questions:

- How is the design process in general defined?
- How do other fields approach the design process?
- How do other fields foster experimentation and innovation?

The following is a synthesis of the literature of design in general with specific approaches cited in fields including architecture, the automotive industry, engineering, fashion, the performing arts, as well as instructional design. We conclude with a discussion of what ID might adopt and adapt from other design disciplines for its own purposes.

The design process defined

The word "design" is used often and in a wide variety of ways. Generally, it refers to depicting a plan for the creation of an object or system. Joan Earnst Van Aken of the Eindhoven Centre of Innovation Studies at Eindhoven University of Technology states, "Design may be as old as modern man. Hand-held rock tools and primitive dwellings may have been designed, i.e. the makers of such artefacts may have reflected on the functions, materials, shapes and other aspects of the artefact to be made, before the actual physical work started" (Van Aken 2005, p.380). Communication Design professor Juliette Cezzar describes the design process as a form of communication management that involves understanding the problem at hand and proceeds to developing a solution for that problem (Cezzar 2015).

In describing the design process used by engineers, the website teachengineering.org (funded by the National Science Foundation) lists seven steps that are followed iteratively to solve problems: ask; research; imagine; plan; create; test/evaluate; improve (redesigning as needed; Teach Engineering: Curriculum for K-12 Educators ND). In their book, *Universal Methods of Design*, Martin and Hannington (2012) describe five phases of the design process:

1. Planning, Scoping, and Definition
2. Exploration, Synthesis, and Design Implications
3. Concept Generation and Early Prototype Iteration
4. Evaluation
5. Launch and Monitor

There is a strong similarity between this process description and the ID field's own ADDIE-oriented design descriptions. A notable difference is the "exploration" mentioned in the engineering process, which is generally absent from instructional design descriptions.

Design thinking

Tim Brown (2008), the CEO of the international design and consulting firm IDEO, notes, "Historically, design has been treated as a downstream step in the development process—the point where designers, who have played no earlier role in the substantive work of innovation, come along and put a beautiful wrapper around the idea" (p. 86). Brown indicated that instead of focusing on the product from the beginning of the process and creating various versions of the product, design has focused on making an existing product better. This approach, however, has evolved over the past decade. According to Brown (2008), "Now, however, rather than asking designers to make an already developed idea more attractive to consumers, companies are asking them to create ideas that better meet consumers' needs and desires" (p. 86). This evolved approach has led to the popularity of a design process known as design thinking.

DiRusso (2016) wrote, "Design thinking is a title that has been used widely outside of the design industry to describe the way designers work, with emphasis on the cognitive aspects that direct a design approach" (p. 3). Although design thinking has historical roots that often are traced back decades, DiRusso indicated that the foundation and development of design thinking has been credited to Peter Rowe's (1987) book *Design Thinking* and the work of design consultancy from IDEO and the Design School at Stanford University (Institute of Design at Stanford 2015). According to DiRusso, however, others (e.g., Martin 2009), "have asserted that design thinking is an amalgamation of methods borrowed from practices such as business, marketing and the creative arts" (p. 3). Beckman and Barry (2007) wrote, "The history of academic understanding of the design process—developed in a field often referred to as design theories and methods—displays both a need to make design thinking explicit and a need to embrace the many disciplines that are engaged in some way in design" (p. 26).

The design thinking process has different approaches that have operationalized into different methodologies. Despite the different approaches (and subsequent methodologies), the philosophy is similar—it is human-centered, collaborative, iterative, and focused on the design of multiple solutions. Brown (2008) states, "The design process is best described metaphorically as a system of spaces rather than a predefined series of orderly steps. The spaces demarcate different sorts of related activities that together from the continuum of innovation" (Brown 2008, p. 88). Owen (2007) explained design thinking as the "obverse of scientific thinking"; rather than examining "facts to discover patterns and insights, the designer invents new patterns and concepts to address facts and possibilities" (p. 16). According to Brown and Wyatt (2010), "Design thinkers look for work-arounds and improvise solutions and find ways to incorporate those into the offerings they create. They consider what we call the edges, the places where 'extreme' people live differently, think differently, and consume differently" (p. 32). This design experience can "feel chaotic to those experiencing it for the first time" (Brown 2008, p. 88).

As we mentioned, various approaches to design thinking have been developed into different design thinking methodologies (e.g. Brown 2008; Institute of Design at Stanford 2015; Liedtka et al. 2013; LUMA Institute 2010; Rowe 1987). A methodology that is popular currently in design thinking was developed at the Design School of Stanford University (https://dschool.stanford.edu). There are five elements to this methodology: empathize, define, ideate, prototype, and test (see Table 1).

Although the elements of design thinking are generally depicted visually and textually as linear steps, in practice this design method is fluid and organic. Multiple solutions are designed as prototypes and tested before the final solution is determined. The outcome is a solution that solves a complex problem using a human-centered approach—one that takes into consideration the behaviors, needs, and preferences of those the solution is designed.

Design thinking, though influenced by user-centered design, is a departure for how a solution to a problem is designed. At the core of design thinking is a human-centered design approach based on empathy for the user. This involves interacting with users to understand their environment, their behaviors, and their overall experience. This allows the designer to build empathy for those the design is intended by personally experiencing how users think and feel about a problem. This direct interaction with users allows the users to be part of the design process as a "co-designer" (Institute of Design at Stanford 2015). In contrast, user-centered design typically does not directly involve the end user in the design process in such direct and explicit approaches that are used in design thinking.

Design variation and complexity

Design approaches might be viewed as existing on a linear spectrum that ranges from "minor modifications of an existing design" to "radical innovation." The design discussion presented by Van Aken (2005) is based on experiences in

Table 1 The elements of the design thinking methodology from the Design School of Stanford University

Element	Description
Empathize	Gain a personal understanding of the users for whom a solution is being designed. Engage in personal experiences with the users in their environment by observing and interacting with the users, and immersing in what the users are experiencing
Define	Determine the specific challenge that needs to be addressed and define a problem statement that will be used to design multiple solutions
Ideate	Explore multiple solutions for the users by generating ideas first and then evaluating the ideas and their feasibility as solutions
Prototype	Create simplified physical forms of solutions that the design team and users can interact with and experience to test out functionality
Test	Get feedback on more robust prototype solutions to increase empathy for users and determine the next iterations of the prototype solutions or whether new ideas for solutions need to be generated

architecture and innovation management. However, this seems to apply to any multipart design project. Van Aken points out that professional designing requires experimenting with alternatives. This allows for departures from evolutionary designs, which Van Aken refers to as variant designs (2005). Radical innovation designs look even less like earlier designs; these are designs that often surprise, and sometimes shock a design community (e.g. the debut of fashion designer Mary Quant's "miniskirt" in 1964 (Bourne 2014).

Although most if not all design projects are in some way complex, they range from relatively simple object designs, such as that of a boot scrape, to massive system projects such as community planning. Instructional designs range in complexity from making minor revisions to an instructional tool (e.g. flashcards) to the creation of a completely new curriculum. This range in design complexity and variation can be visualized by vertical and horizontal coordinates beginning at a 0,0 point of "no new product, no change" and increasing in either complexity, variation or both (see Fig. 1).

Describing exactly what constitutes the increments of variation or complexity is difficult. Much depends on the specific situation and circumstances in which the design is prepared. The range of variation relates to how different the new design (or design process) is from previous designs. Van Aken (2005) refers to designs that are small adjustments based on traditional models as "evolutionary." An example might be the addition to an established automotive design of a small hatch in the roof that lets in light and air (a "sun roof"). There is no significant change to the automobile essential mechanisms; the addition separates the new design from the old design only slightly. Govindarajan and Trimble (2010) suggest that innovative designs can be "sustaining or disruptive" (page xii), defining innovation as anything that is new to the participants and has an uncertain outcome.

In our observation, the majority of new designs and design processes tend to be evolutionary. They make adjustments and improvements to established designs.

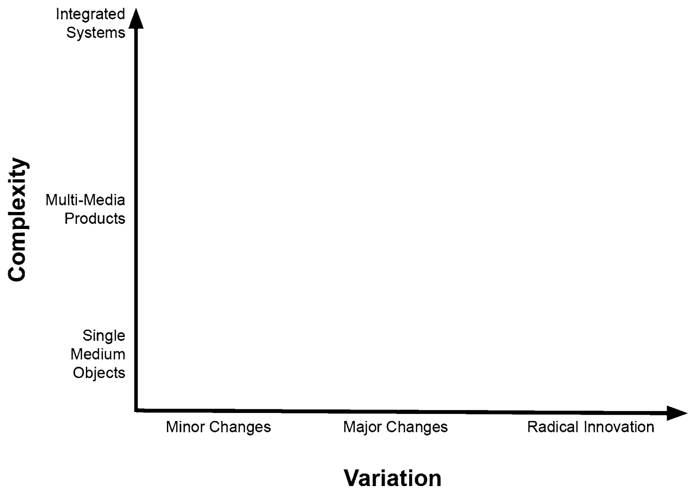

Fig. 1 Range of design complexity and variation

This is also reflected in Tim Brown's (2008) comments about the design process mentioned earlier. Radically innovative designs are comparatively rare because these carry with them the greatest amount of risk. An example of a radically innovative design might be the locomotive railway. In the early 1800s, the design for a passenger train performing a function similar to horse-drawn carriages was a radical innovation (Lo 2015); investing in the production, organization and deployment of train services was at that time high-risk activity.

Discussing this range of design variation with instructional design students is important. As young designers take on their own projects and clients they should understand the nature of design variation and the potential risks and rewards associated with both adhering closely to traditional approaches, experimenting with radical innovation, and the possibilities of design opportunities that exist somewhere between these two extremes.

Compared to variation, complexity is a bit easier to describe. Complexity refers to the number of different media, participants, techniques, technologies, and/or procedures specified by the design itself. A design for a simple, backyard fire pit might be placed toward the bottom of the complexity range since it requires a limited number of media (e.g. stone and sand) and a few measurements. The design for a commercial passenger airplane might be placed much higher on the complexity line because it requires a large variety of media (e.g. metals, plastics, textiles, glass) as well as specific length, width, and depth measurements for thousands of parts. Furthermore, the airplane requires design consideration for processes that include the safety and comfort of a large group of disparate passengers.

As with variation, discussing the range of complexity with instructional design students is critical. As young designers take on their own projects and clients they need to consider the nature of the project itself in terms of the number of variables involved in the project and the variety of skills the project requires. Understanding the complexity of a project helps designers as they consider whether they have the skills to complete such a project and whom they might add to a design team to best ensure a project's success.

Spaces for exploration and radical innovation

There is a famous quote attributed to John Culkin, "We shape our tools and, thereafter our tools shape us" (Davis 2016; Quote Investigator 2016). Davis (2016) warns, "We need to remember that our behaviors and attitudes are shaped by the tools/technologies we use," (p. 1). The ID community typically relies heavily on general design models that present a simple, practical algorithmic approach to the instructional design process (Bannan 2017; Boling 2017). This approach helps emergent designers understand the traditions and essentials of ID, but overreliance on these models may blind the field to different and potentially better approaches. The question arises, *Where do we showcase "out of the box" approaches and innovations?* As we considered the problem we looked at how other design disciplines answer this question. Numerous design disciplines organize and support events that present innovative works.

- Automobile designers regularly present novel designs in the form of "concept cars" at events that include the North American International Auto Show (EyesOn Design 2017).
- At events like New York Fashion Week (NYFW 2017), clothing designers show original and groundbreaking collections that push the boundaries of their field.
- In the performing arts, events like the Edinburgh International Festival provide opportunities to view, "unique collaborations, world premieres, [and] new takes on classic works," (Edinburgh International Festival 2017).
- London's Serpentine Gallery has a Pavilion program supporting architectural exploration (Serpentine Galleries ND); international architects or design teams are annually invited to erect a temporary structure outside the gallery.

At each of these events and others like them, expert practitioners present and review innovations that may change their field… or not. There is room within these events to present "out of the box" ideas that serve only to stretch the imagination and challenge the designers' view. It is an opportunity to reflect on the tools and technologies that shape their field and consider whether change is needed to improve their work and what new media and techniques might be incorporated into current practice.

Fortney (2017b) notes there are numerous opportunities to view instructional design cases. However, we are not aware of opportunities to see and reflect upon radical innovation or out-of-the-box ideas that capture the imagination without the demands of immediate implementation. We think it well worth exploring a possible showcase of concept designs, unique collaborations, new takes, and groundbreaking collections similar to those presented in the events described above. At the point of teaching the foundations of ID we envision a possible activity requiring advanced students to try radically innovative approaches for the purpose of experimenting beyond the current models and practices of the field, and to reflect on this activity to expand students' understanding of the design process in general.

Discussion and conclusion

As we examined the nature of design in terms of its articulation by members of design fields other than ID, we confirmed our initial concern that teaching the established models of ID is not enough to produce practitioners ready to contribute at their highest potential to the field in ways that cause it to expand and improve. As faculty members who teach instructional design, we need to find ways to articulate the design process in general; to introduce the concepts of design complexity and variation; to make greater use exploration as part of the ID process; and to find ways to showcase innovative work produced by expert designers.

Emergent instructional designers, students in ID programs, need to study and apply the rationalized approaches to establish fundamental understanding of the field's most reliable techniques. However, there ought to come a point in the instructional designer's education and practice in which he/she explores other approaches as a part of both personal professional growth and advancement of the field overall. Similar to the shows and exhibitions in which other design fields showcase the experiments of advanced practitioners, ID might find it useful to create opportunities for advanced designers to share exploratory ideas realized in production but not constrained by the concerns of an institutional client.

Instructional design students might also benefit from applying the Design Thinking approach that focuses on encouraging empathy in the early stages of a project. The current ID models stress a more clinical approach during initial project analysis. The addition of empathetic approaches, which include engaging in personal experiences with the users in their environment by observing and interacting with the users, and immersing themselves in what the users are experiencing, might help designers create interventions that are more than merely satisfactory; that are engaging, delightful and empowering learning experiences.

We regard all that we have presented up to this point as the beginning of a much larger conversation among those of us who teach instructional design. Design as a process in and of itself, and the development of design skill in other fields have their own literature that needs to be explored more completely. The progress of instructional designers from novice to expert needs to be more thoughtfully studied as well. It is our hope that this article provides talking points with which the field may continue its exploration to better educate succeeding generations of instructional designers. We have included an appendix which includes recommended resources for design theory, practice, and thinking. To be sure, more research is recommended as we consider how best to serve our students and the field itself.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix: Recommended resources for design theory, practice, and thinking

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