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Research paper

Design-based Pedagogy: Investigating an emerging approach to teaching design to non-designers

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ABSTRACT

Teaching design to non-designers is a popular way to drive innovative and creative thinking. However, very little is understood about the pedagogical approach. This paper presents a definition for Design-based Pedagogy and catalogs a list of corresponding variables collected through a survey of experienced design and design thinking instructors. We demonstrate that this learning environment is robust in comparison to a variety of educational frameworks. The variables identified can help researchers and educators better understand what supports engaging design education.

1. Introduction

Design is a core engineering activity [31]. It exists as a process of engineering [7,19] and as a means of educating engineers [10,29]. For this paper we will use Simon's definition of design, a course of action aimed at changing existing situations into preferred ones [30]. Bernard Roth is experienced in using design to both solve engineering problems and educate generations of successful designers [11]. Roth has helped lead the Design Division within the Mechanical Engineering Department at Stanford University for over 50 years. He is also a founding member of the Hasso Plattner Institute of Design (the Stanford d.school). The d.school is an institute that teaches design to non-designers to develop their own creative potential. For our purposes non-designers are people who are not designers by profession nor are in school to become professional designers. In many ways the d.school continues an education philosophy Roth developed early in his career through a series of creativity workshops [20, 22]. For him, creativity and design can positively affect the entire scope of a student's life [23]. This paper explores the nature of how design is taught to non-designers—specifically as a means to enhance students' creative potential. The primary analysis is to compare the variable components of this type of design instruction to three known educational frameworks.

This topic is increasingly relevant due to the proliferation of new design courses, programs, and institutes open to students from all disciplines [17]. Many of these have the moniker *design thinking* [6] or *human-centered design*. Both terms refer to ways non-designers can use design to solve problems. Much of the promise of design is in its process. Specifically it is billed as a process that can be used to work on ambiguous or "wicked" problems [5]. These are large problems that cannot be solved within the confines of any one design field (i.e. mechanism design, graphic design, architecture). In fact, beginning in the 1990s many firms such as IDEO and Frog Design began using design thinking to address business problems,

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often successfully competing against conventional business consultancies. Acumen is a social impact organization dedicated to addressing global poverty. Human-centered design is a central component of its approach. Employees throughout the organization, regardless of their professional background, practice design. The expansion of design outside academia has had an impact in the classroom. Many practitioners, armed with experience in the real world, have returned to higher education and have partnered with instructors—who have their own expertise in design—to teach design to non-designers.

2. Background

Much is known about how interdisciplinary teams apply design in real world contexts [16,26]. The design techniques, skills, and abilities that work in the professional world are well codified. These are taught to non-designers through learning experiences—often courses and workshops. However, much less is known about the pedagogy of teaching design to non-designers. There is some initial work investigating the mechanisms of instruction [25,32]. A case study of a course at the Stanford d.school provides a description of what a longer learning experience can entail [18]. There is also a body of research on how design can be used to teach specific content. Design-based Learning [9] and Learning by Design [15] are both examples of using a design process to teach non-designers specific content—in these cases science. These approaches have been successful in leveraging design to scaffold strong student learning and teacher instruction. The literature suggests that teaching design to non-designers is unique and can be an impactful form of education.

The results of this paper seek to extend what is known about teaching design to non-designers by filling in some gaps in the existing body of knowledge. The work mentioned above on the mechanisms of instruction primarily focus on two institutions—the Stanford d.school and the HPI School of Design Thinking. However, this pedagogy is used in many more locations. Those cases should be more represented in the literature. The work on design as a conveyer of content largely resides in the primary and secondary education space. Although it is relevant, a more concentrated effort on higher education is necessary. Additionally, this paper centers on teaching design to non-designers for the purpose of instilling a broader belief in one's own creativity, rather than conveying specific subject content like gravity or simple machines. To that last point, the Stanford d.school was initially developed as a way to develop students' creative confidence [14]. More precisely, the Stanford d.school works to enhance self-efficacy [2] around creativity. This is an overarching psychological construct, which suggests that the design pedagogy used to accomplish this goal is different from the pedagogies used to teach specific content.

To further explore this particular design pedagogy we must define what we mean by teaching design to non-designers. The definition must encompass how design is taught in higher education in places like the Stanford d.school. It must also clearly differentiate this practice from related but fundamentally different pedagogies such as Design-based Learning and Learning by Design.

Design-based Pedagogy (DBP) is an educational environment with instructional scaffolds that allow students to solve problems through the practice of design. It has five main attributes:

1. Audience—primarily for non-designers.
2. Challenges—the projects are open-ended and exist in a context that extends beyond the classroom.
3. Team—students work primarily in interdisciplinary teams.
4. Practice—the way in which students problem solve is driven by a process or principles that designers typically engage in.
5. Creativity—a major outcome is to enhance student creativity.

In DBP students behave like designers in order to solve problems. They work on design teams to accomplish this work. DBP can exist within a course, a workshop, or even an entire program. It should be noted that designers are not excluded from this way of learning. In fact, designers may often take leadership roles within DBP. The first attribute implies that the level of design taught may be very familiar to most designers. DBP is highly contextualized because students work on real world challenges. The composition of students and the nature of the challenge determine the instruction. As a result, there is no default coursework or projects. It is therefore, an extremely flexible environment. DBP instructors are the designers of this learning environment.

DBP is an emergent form of education. It is similar to existing paradigms but has unique attributes. There is no prior work investigating how instructors design these learning environments. Given its increasing popularity it is critical to understand how strong a pedagogy DBP really is. Are there glaring inadequacies? Does it provide a new set of best practices? This leads to the primary research question of this paper.

To what extent is DBP a robust educational environment?

To answer this question we compare DBP to three known learning environment frameworks. If DBP holds up well under scrutiny of all three, we will consider it robust. Each framework approaches education from a different perspective. However, they all tend to focus on the overall learning environment not on particular activities. DBP, like any learning environment, can be examined on multiple levels. The make up of a particular lesson or the interpersonal dynamics of a single team are examples of a more detailed level of analysis. And while that would certainly be worthwhile, this paper investigates how the environment is designed as a whole. We believe understanding the big picture can inform future, more directed research. Thus we chose frameworks with a fairly wide scope. As a result, the frameworks do not prescribe individual activities; rather, they provide principles for how lessons can be designed.

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