
An educational perspective on design thinking learning outcomes

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Abstract: Design thinking has emerged among the must-have skills for the twenty-first century and a driver for innovation in organizations, and the demand for training in design thinking is high. An educational model which started from the heart of Stanford University (d.school) soon caught the attention of many organizations and educational institutes. There has been a heated debate around design thinking in business press and the Harvard Business Review devoted the edition of last September to topics around design thinking. Considering the popularity of design thinking and the growing demand for learning this methodology around the globe, it is important to ask key questions, including: What do individuals learn when they learn design thinking? What are the expected learning outcomes of design thinking education? We take a close look at the literature on design thinking through the lens of learning theories and suggest a conceptual framework for the expected outcomes.

Keywords: Design thinking; Learning outcomes; Innovation; Organizational change; d.school; Professional training; Design thinking education; Affective learning; Creative confidence; Skill training; Cognitive learning; Mindshifts.

1 Introduction

Today organizations are seeking for creative ways for solving the complex and intertwined challenges they face. An approach that offers a set of tools and principles to address ill-defined and complex problems is known as design thinking (Kolko 2015). With its human-centred approach to innovative problem solving, design thinking has become increasingly popular in the last decade, reaching the attention of an ever-growing audience from different cultures and sectors around the globe (Schmiedgen et al. 2015). Consequently there is a growing demand for design thinking education (Withell & Haigh 2013).

The educational model started at the Institute of Design at Stanford University (aka d.school) bringing students from across different disciplines together to work on real life challenges using the methodology of design thinking. This unique method soon attracted the attention of different institutes and organizations. Today, design thinking is being taught in over 60 educational institutes around the globe, in various formats, including supplemental trainings, as a course in an existing curriculum, in workshops and as its own degree program (Goldman et al. 2013). In addition, many individuals and institutions are building similar educational models inspired by d.school in diverse locations around the world (Royalty et al. 2014).

As organizations try to find creative ways to solve key challenges and generate value for their users within a rapidly changing market and context, the ever increasing enthusiasm around design thinking in the managerial realm is clear. Companies like P&G, JetBlue, Intuit, and SAP have embraced design thinking and incorporated it in their company culture (Korn & Silverman 2012) and the number of organizations that look into design for solutions continues to grow.

Today, Design thinking has emerged as an inevitable module in executive trainings and a large number of freelance trainers, executive training programs and business consultancies are offering design thinking trainings. However, the trainings vary in depth and format, ranging from one to three-day workshop formats (mostly offered on introductory level), to certificate programs over several study terms. Apart from real life trainings, there is a growing number of online formats for teaching design thinking, from online trainings inside corporations (e.g. Developing Software Using Design Thinking by SAP) to Massive Open Online Courses (e.g. Design Thinking for Innovative Problem Solving by Darden School of Business) (Taheri & Meinel 2015).

Considering the relative novelty of the field as well as the wide variety of formats in which it is taught, it is time to raise the question: What people learn as a result of taking part in a design thinking training? What are the expected learning outcomes of design thinking? Addressing these questions is important from several aspects. First, considering the growing uptake by organizations as well as educational institutions that are attempting to set up similar educational models to d.school, it is important to define clear learning outcomes for design thinking education. Despite the common characteristics of design thinking trainings, such as radical collaboration or the use of open and flexible workspaces, it is important to note that educational methods rarely work as expected when they are imported to other cultures, if the expected learning outcomes are not first made clear (Royalty et al. 2014). Moreover, the existing formats vary in length and depth

among providers, thus defining clear learning outcomes will help instructors and course designers to communicate achievable learning objectives and to manage the participants' expectations within a given setting.

This conceptual paper builds on Goldman et al.'s (2012) attempt to find out what people learn as a result of design thinking, and aims to shed light on the learning outcomes of design thinking from the perspective of educational research. The result of this work will help both course designers at the university level and corporate design thinking trainers to identify measurable learning objectives that will inform their curriculum design. It therefore further contributes to the research community by providing a clearer understanding of the field of "design thinking education" and the development of innovation capabilities of employees and other training participants.

In this paper we first provide a brief overview of design thinking and its origin. We then take a closer look at educational research and different domains of learning outcomes. Next we present the learning outcomes of design thinking emphasized in the existing (and relatively young) research on the topic. Finally we suggest a conceptual framework, informed by educational research as well as our experience as practitioners and subject-matter experts.

2 Design thinking education

Most design thinking education as we know it today has its origins in the Hasso Plattner Institute of Design (aka d.school). Founded by Larry Leifer, Terry Winograd and David Kelley who is the co-founder of the world-renowned design agency IDEO, the original program invited students from all graduate programs at Stanford to take a design course and learn to solve problems in a creative way (hpi.de, 2016). Their radically different learning environment compared to traditional campus courses, gained the attention of many educational institutes which became interested in mimicking the model as well (Perlroth 2013). In 2007 Hasso Plattner, a co-founder of SAP, founded the HPI School of Design Thinking (the sister institute of d.school) in Potsdam, Germany. As more academic institutes around the world are following the trend, there is a rapid increase in the number of educational institutes that are adapting design thinking in one way or another.

At this point it is worth noting that there is no universal definition of design thinking and there are clear disparities among experts regarding the general understanding of design thinking (von Thienen et al. 2010), let alone its expected learning outcomes. While some perceive it as a creativity method, others claim it to be the state-of-the-art methodology for innovation. A recent study by Schmiedgen et al. (2015) shows that design thinking plays a very diverse role in different organizations and companies; from a methodology that helps to gain empathy for the users, to an attractive recruiting tool.

Devising a universal definition of design thinking is beyond the confines of this paper, rather for the sake of this work we refer to design thinking as a human-centred approach to innovative problem solving, which draws from the unique ways that designers work and think (Brown 2008; Martin 2009). This perception of design thinking has gained traction in managerial debate¹. Today design thinking is not an unfamiliar

¹ For an extensive review on discourses around design thinking see Johansson-Sköldberg et al. (2013).

term among the business press, to the point that Harvard Business Review allocated its September edition (2015) to design thinking.

The design thinking process can be described by the following five phases: empathize, define, ideate, prototype and test (Bootcamp Bootleg 2009). Although different variations of this process with less or more phases can be found in literature on design thinking, they all share the following three core activities: data gathering (through exploratory and often qualitative user research), idea generation, and testing with the users (Liedtka 2015).

3 Research approach

This paper bridges the gap between theoretical models of learning outcomes and prior research on design thinking. Based on the authors' aim to create an overview of the state-of-the-art research in design thinking education and its existing and communicated learning goals, the following research questions guide the theoretical investigation:

- Which learning outcomes can be found in publications on design thinking?
- How do current models of Design Thinking education fit into educational models of learning objectives?

Considering that the term design thinking originated from IDEO's way of problem solving (in the late 90s) and rather practice-oriented, the academic research on the topic is relatively young. One of the inspiring literature resources behind this work is the HPI-Stanford Design Thinking Research Program (HPDTRP), which is an academic collaboration between the Hasso Plattner Institute in Potsdam, Germany and Stanford University (since 2008). The research program is one of the pioneers in academically investigating how and why design thinking succeeds or fails (hpi.de, 2016).

The learning outcomes derived from the literature are matched with a model of learning outcomes by Kraiger, Ford & Salas (1993) that distinguishes between three domains of learning outcomes.

Theoretical framework

The theoretical framework applied in this work is a classification scheme of learning outcomes by Kraiger et al. (1993). In an attempt to create a conceptual basis for evaluating learning and to provide guidelines for researchers in training evaluation, they integrate research from a number of different disciplines. They draw from Bloom's (1956) and Gagne's (1984) taxonomies, and advocate a multidimensional view to learning outcomes. The framework suggests that learning may be evident from changes in skill-based, affective and cognitive states of trainees.

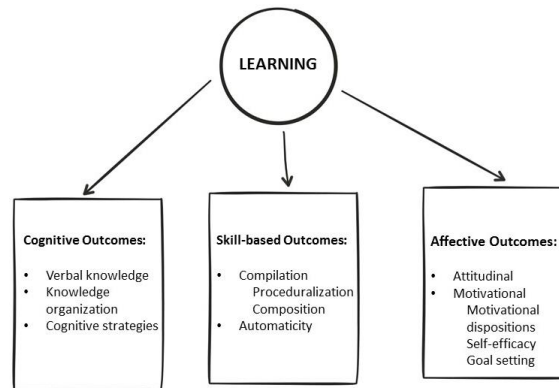


Figure 1 Domains of learning outcomes.

Source: Kraiger et al. (1993).

Figure 1 depicts the three categories of learning outcomes and their relevant learning constructs; the cognitive category includes verbal knowledge, knowledge organization, and cognitive strategies. The learning constructs most relevant to the skill-based outcomes are compilation and automaticity. Finally, the key learning outcomes related to the affective category are attitudinal outcomes and motivational outcomes such as dispositions, self-efficacy and goal setting.

Taking this conceptual scheme as a guideline, we look into learning outcomes of design thinking suggested by literature and discuss the results. Our aim is to shed light on the importance of taking a multidimensional view on learning outcomes of design thinking training.

4 Design thinking learning outcomes

While success stories about the application of design thinking in solving complex challenges in various fields are plentiful in business press (e.g. the Keep the Change account service by Bank of America), scholars have tried to explore different aspects of design thinking and the dynamics behind its success. With the growing enthusiasm around teaching and learning the methodology, defining the learning outcomes of design thinking has been the focus of some scholars work. In this chapter we present the learning outcomes of design thinking in the literature.

Perhaps one of the most often heard learning goals of design thinking is *creative confidence*: the belief in one's own creative abilities (McKelvey 2013). According to the three domains of learning outcomes as mentioned by Kraiger et al. (1993) creative confidence is among the affective outcomes.

Rauth et al. (2010) define design thinking as a learning model with the ultimate goal of achieving creative confidence. Through semi-structured interviews with the teaching experts of design thinking schools in Potsdam and Stanford, the development of creative confidence as “a development of trust in one's own creative skills” was mentioned as one of the outcomes of design thinking education. Four out of 18 interviewed experts named creative confidence as the ultimate goal of such education. The authors propose the following pyramid model for the development of creative confidence through design thinking education.

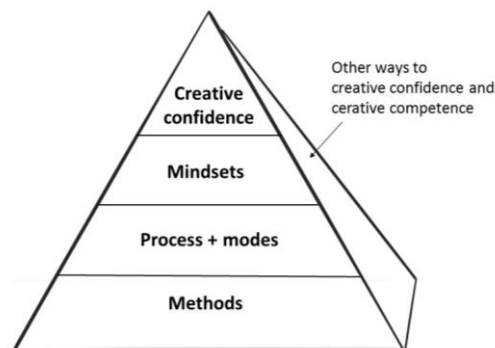


Figure 2 Development of creative confidence and creative competence through design thinking by Rauth et al. (2010).

Source: Jobst et al. (2012).

The model suggests that methods such as brainstorming, empathy and prototyping serve as a basis, and are followed by modes of working and different process stages. The different mindsets related to design thinking such as bias towards action and human-centeredness develop upon fluency in the process stages. In this model methods are perceived as tools in pre-scripted trainings, that trainees can practice multiple times, rather than as skilled-based learning outcomes. The authors suggest that approach implies a strong moderation and guidance from coaches, which consequently leads to difficulties for individuals to apply their learnings outside of training environment.

Another study that explores creative confidence as the main outcome of design thinking education is done by Jobst et al. (2012) who try to define and operationalize the concept. Through exploratory observations they identify parallel aspects between students' learnings at the schools of design thinking in Potsdam and Stanford, and four sources of self-efficacy – “beliefs in one's capabilities to organize and execute the

courses of action required to produce given attainments”- described by Bandura (1977). Thus they suggest that the construct of self-efficacy can be used to conceptualize the notion of creative confidence in design thinking. Although this construct proves to be a good step towards conceptualizing and measuring creative confidence as an affective learning outcome, the potential learning outcomes in cognitive and skill-based domains are neglected.

On the topic of creative confidence, Royalty et al. (2012) suggest a model (Figure 3) that presents the statement of achievement in design thinking over time and through gaining experience. Their model is built on the following concepts: The concept of creative self-efficacy by Tierny and Farmmer (2002) which refers to one’s belief in his/her own capacity to be creative; A research by Sternberg (2006) on creativity that suggest six prerequisites for creativity: intellectual ability, knowledge, styles of thinking, personality, motivation and finally the environment; And Rauth et al.’s (2010) study that sees design thinking as a path towards creative confidence and their pyramid model presented earlier.

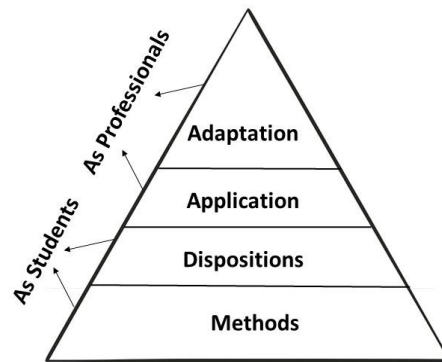


Figure 3 Conceptual model for stages of achievement in design thinking.

Source: Royalty et al. (2012).

In this model the first level refers to design thinking process and basic skills. The dispositions level refers to Tierny and Farmer’s (2002) creative self-efficacy – a construct that can be used for conceptualizing creative confidence as Rauth et al. (2012) suggested. As individuals gain more experience they move beyond what was learned and towards adapting design thinking to real world contexts. The final and ultimate level refers to applying the learnings in novel ways. Thus their conceptual framework includes both schooling of design thinking and applying it in more professional context. Considering Kraiger et al. (1993)’s work, the importance of skill-based learning outcomes becomes significant in this model. Since the application of design thinking in real life is highlighted, learning and developing a set of skills as part of the learning process becomes crucial. On the other hand a high level of cognitive understanding is needed in order to adapt design thinking in novel ways.

Although not placed as an ultimate learning outcome, both Rauth et al. (2010) and Royalty et al. (2012) mention cognitive outcomes of design thinking –so called design thinking mindsets - in their models. However mindsets are considered to be developed as

the result of fluency in the process stages and methods, and not as outcomes that can be reached in diverse ways.

Goldman et al. (2012) try to answer the question that what students learn as a result of participating in a design thinking course and how their progress can be measured, applying a reciprocal research and design (PR&D) methodology. In their attempt to capture and measure the learnings of design thinking they differentiate between design thinking skills and processes, and mindshifts, which they define as “epistemological viewpoints and developmental journey towards design thinking mindsets” and “often synthetic to other skills and processes”.

The authors suggest rubrics for assessing skills that are needed in different process steps. They point out that some skills are exclusive to design thinking (e.g. skills related to human-centeredness) while others are used in different domains (e.g. interviewing and prototyping). The skills are not always specific to one process step and may be applied to different steps (e.g. interviewing for empathy phase and testing). Besides the skills and process steps, they identify the four following mindshifts for design thinking: Human-centeredness, experimental, collaborative, and metacognitive, that fall into the domain of cognitive learning outcomes based on Kraiger et al. (1993). The study focuses on capturing the human-centred mindshift; thus they develop a performance-based assessment task and a reflective-based task which they test with students with three levels of experience with design thinking: novice, intermediate and skilled.

The result shows the differences in the development of human-centred mindset among individuals with different level of experience with design thinking. This study is significant since it draws attention to cognitive as well as skill-based learning outcomes, opposed to affective outcomes. However their work places more value on mindshifts (cognitive outcomes) as an underlying structure of a trained design thinker.

On the effects of d.school pedagogy on the professional outcomes of the alumni, Royalty et al. (2013) conduct qualitative studies with d.school alumni and present the characteristics they reported. The result shows that the pedagogical methods applied in d.school have an impact on the professional outcomes of the graduates. Interestingly the participants mentioned the importance of d.school in their current career choice without being prompted. This implies that affective outcomes continue to be present after schooling ends. They also point out that the alumni not only showed strong belief in their creative ability to solve real world problems (creative self-efficacy), but they translate this confidence into action and change their environment. As a result they introduce a new construct called “creative agency”.

Finally, in a recent study Royalty et al. (2015) suggest that if organizations are to support design thinking, creativity-oriented measures need to be developed as opposed to the traditional measurements for executional behaviour. Thus they create a scale for measuring the construct of creative agency introduced earlier. They imply that creative self-efficacy (which is often linked to creative confidence) is insufficient, as it lacks the emphasis on the application aspect.

5 Conceptual model

We observed different approaches adapted by scholars in understanding and capturing the learning outcomes of design thinking: from expert interviews (Rauth et al. 2010), survey and interview with alumni (Royalty, 2014), to various ethnographic techniques (Goldman et al., 2013).

The authors would argue that although the aim of design thinking education is not to create designers, but rather creative problem-solvers, in order to have an impact, there is a set of skills that need to be learned as a result of a design thinking course. Neglecting the role of skill-based outcomes might be a reason while some have problems applying their learnings after training, a problem that often appears after off-site trainings as opposed to informal learning within the usual working context. Yet the acquisition of skills is especially crucial when organizations invest in trainings with the hope of having their employees apply their learnings within their organizations afterwards.

Thus unlike the two variations of pyramid models by Rauth et al (2010) and Royalty et al. (2012), we suggest that in the journey of developing design thinking capacities, skill-based, affective and cognitive outcomes are all of crucial importance and strongly interrelated (see Figure 4).

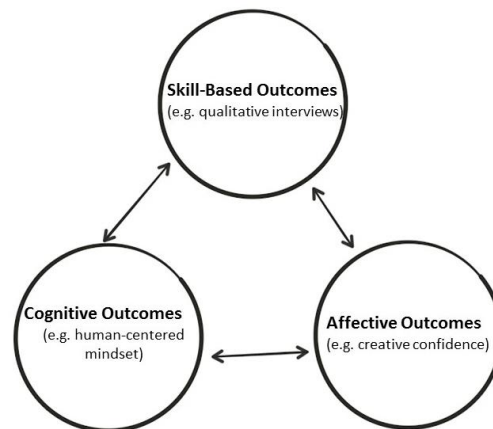


Figure 4 Conceptual model for design thinking learning domains.

We suggest that instead of prioritizing one learning domain, all three are developed in parallel and in an interconnected way. While the development of design thinking mindsets is important, the skills which support and nurture these mindsets also need to be emphasized. On the other hand, while design thinking trainings create a safe environment for failing and experimenting for trainees so that they develop beliefs in their own creative ability, the development of skills which foster their creative agency is important. Otherwise too much emphasis on affective and cognitive outcomes (especially in shorter training formats) may result in *creative overconfidence* and a lack of supporting competences and skills.

On the other hand, a great understanding of methods or the ability to apply certain skills is of little value without the confidence to enter unknown territory and embracing ambiguity.

6 Conclusion and future work

This paper investigates design thinking education through the lens of an educational model of learning outcomes. The authors argue that although design thinking is a relatively new topic and has gained significant traction, especially from the managerial realm in the last decade, it can benefit from the theories in the more established fields such as educational research.

The result shows that there is a strong emphasis in the literature on the affective outcomes of design thinking, such as creative confidence, and on the cognitive outcomes, such as mindshifts. However, the authors would point out the threat of neglecting the skill-based outcomes; as this may eventually result in unrealistic expectations about what can be achieved in a training and applied afterwards. This is especially the case in professional trainings where individuals hope to apply their learnings within their own working context.

Moreover, this has potential dangers for educational trainings of future innovators and leaders at the university level. Neglecting the skill-based outcomes may lead to educating individuals with creative over-confidence, who lack the skills and knowledge to apply their creativity.

The debate around design thinking is not always enthusiastic and positive, and there are those, especially in business press, that perceive design thinking as just another business fad. We believe that some of these critical views might be result from mismatched expectations. While believing in the potential of design thinking as an innovative problem solving methodology is achievable in a short workshop format, developing design thinking mindsets or skills might require more time and effort. Moreover, not all individuals will acquire them at the same pace. Thus we suggest that communicating achievable learning outcomes regarding each domain (affective, cognitive, and skill-based) is important for an effective training, both in university and professional contexts.

Finally regarding the development of diverse domains of learning over time, based on our observations and experience as trainers in the topic, the authors suggest the following conceptual model:

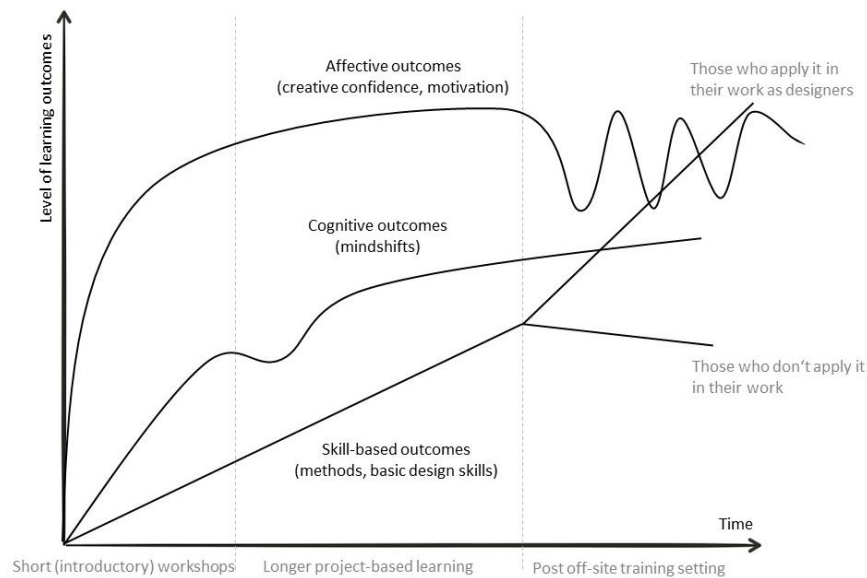


Figure 5 Conceptual model of expected outcomes of (current) training formats

This model suggests that affective outcomes such as creative confidence and believing in the potential of design thinking can be achieved in early stages of experience with design thinking (e.g. in a short and pre-scripted workshop format). Cognitive outcomes can also be reached during early experiences with the methodology. For instance, participants might understand the value of talking to users or working in interdisciplinary teams. On the other hand, although participants go through hands-on activities early on and apply several skills (e.g. interviewing users), the lack of critical feedback regarding the skills -especially in short workshop settings with focus on productive outcomes and learning experience - results in rather slow development of skill-based learning, especially for those who have no prior expertise in those skills (e.g. no prior experience with user research).

Thus although the design thinking way of working can be experienced in a short format with guidance from a coaching team, in order to develop related skills and deeper level of cognitive understanding, more time and constructive feedback on practice is needed. It is worth noting that skills related to empathy work (e.g. qualitative interview and immersion) are of significant importance in applying a successful project using design thinking. Identifying needs and insights about the user serve as inspiration for innovative solutions, and identifying those latent needs is enabled through skills related to empathy work.

A potential for future work is to test the model presented above, ideally with students going through design thinking education who are gaining experience with the methodology over a longer period of time.

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