

Supporting Project Scoping: The Scoping Wheel

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Abstract

Design research educators give students real-world problems to prepare them to innovate upon graduation. Educators typically spend significant time scoping real-world projects for students. Furthermore, students should graduate with the ability to scope projects. By supporting students to scope we can simultaneously teach a vital ability and reduce the scoping burden on educators. We conducted a task analysis to identify the expertise novices needed, and created a tool to support novices scoping called *the Scoping Wheel*. We present the tool here.

I. Introduction

Design thinking educators must prepare students to solve real-world problems. ABET Outcomes underline this goal, stating that students need to learn the ability to design “to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability” as well as “identify, formulate, and solve engineering problems (outcomes c) and e) [4]).

Real-world Project-based Learning is a common way to organize design thinking programs. Students work in teams to take on a challenge supported by educators [1], following a design process [5], and sometimes work with a client organization [2]. While it is straightforward to identify grand challenges such as poverty and climate change, it is much more challenging to scope tractable real-world challenges.



Figure 1: Students using the Scoping Wheel to scope tractable real-world challenges

Design thinking educators spend a significant amount of time scoping real-world projects for students. Furthermore, in order to provide learners with challenges that lead to productive learning, design thinking environments do not give students experience in scoping projects. *In this work we present the Scoping Wheel, a tool to help novice designers scope projects.* To create this tool we examined the expertise required for scoping projects for project-based design thinking with real-world challenges.

II. Methods

Setting: This study took place within a design thinking extracurricular program with 800 university student members based at 21 universities in the US. The program, Design for America [7], has 5 full-time members of staff. Each year students form over 50 multidisciplinary teams of 4-6 members and work on identifying and designing solutions (products or services) to problems in their local community. Example project challenges include bed-bugs in low-income housing, and reducing deaths from hospital acquired infections. Due to limited staff members, students scope most projects.

Study: Following a human-centered instructional design process for educational design based research [3,6,8] we explored the expertise involved in scoping. We interviewed two experts (20 and 5 years experience scoping projects as design thinking educators) and three novices (undergraduates with 1-2 years experience) about how they undertook recent scoping activities. The experts had worked on projects such as bio fuel transportation systems, fitness equipment, and school design. We compared the differences in expert and novice knowledge using task analysis [10,11] and knowledge mapping techniques [9] to highlight what support novices need. We also conducted a review of both our expert HTA and concept map with our experts and a third expert (20 years experience) to resolve inconsistencies and check for completeness.

We conducted two rounds of testing. Firstly we conducted formative evaluation on early iterations, including 1-1 novice evaluation, group evaluations, and participant observation (over 6 months [12]) regarding comprehensibility and desirability [13]. Secondly, at the time of writing we are testing how the tool affects novice ability to rate different projects.

III. Findings

We found that project scoping is often a lengthy process in which those scoping draw upon a wide range of different sources for inspiration (newspapers, research, walking their local area). Our experts spent weeks or months contemplating different options. While doing this they drew on a set of guiding principles to help them make decisions. Novices charged with scoping had a similar process, but they reported fewer principles that they drew on to make decisions. We a) defined *guiding principles*, and b) created the *Scoping Wheel* to help learners reflect as they scope. The *guiding principles* are:

- 1) *Daring*: Challenges that society values. Novices often selected challenges that experts perceived as less important, in particular challenges that the novices themselves experienced.
- 2) *Feasible*: Challenges that projects could access (users, context etc.) in a domain they could influence. Experts considered accessing problem contexts (e.g. local clients or users). Furthermore, experts considered restrictions (e.g. legal, political, technical).
- 3) *Applicable*: Challenges that occur outside of a few limited contexts. Experts

avoided challenges that encouraged solutions that only functioned in one context, could not scale to multiple sites, and that resembled service learning. One expert gave an example of a project to avoid in which a client asked the team to make their website look “more modern”.



Figure 2: The Scoping Wheel

The Scoping Wheel (Figure 2): We supplemented the guiding principles with questions related to each principle that novices can answer about a given project. The goal was to help novices understand the principles by applying this to their scoping efforts. Based on initial testing we chose to make it into a wheel because a) we wanted to convey the sense that the goal was to find challenges that fit the intersection of the three principles, b) so we could include guiding questions on the outside of the wheel that experts asked themselves when assessing a potential challenge, and c) positive response from learners to this graphical treatment.

IV. Conclusion

Scoping takes significant amount of time for already busy design thinking educators. Furthermore, ability to scope projects is important in its own right. If educators always scope projects for students they will deprive them of important learning experiences. This could mean that students are less able to initiate their own projects, leaving us with fewer successful intra- and entrepreneurs. Future work could also focus on educator scoping. Just as professionals who are already classed as experts still use job aides to work more efficiently, this work could be extended to test and further develop how these tools can support design thinking educators scoping efforts.

VI. References

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