The Education DesignShop: Broadening Non-Designers’ Solutions for Big Issues

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ABSTRACT

Education in America can benefit from innovation. Creating problem-solving and inventive, innovative thinking from a diverse array of people and experiences can help redefine and reinvent this important public mission. Hackathons are collaborative, short sprints that offer such collaboration opportunities. While usually coding marathons, hackathon-type events like an Education Designathon and Education DesignShop have been developed by the researcher to tackle broad, systemic issues, here within the context of education, with tools and processes from design thinking. Two research questions are explored, with novel metrics and methods developed for each: 1) How do non-designers transform into design thinkers from the Education DesignShop? and 2) How do educational projects from the Education DesignShop workshop model address systemic changes? In the first pilot study of this thesis, an Education Designathon event emphasizes on this designerly mindset and the projects. Fourteen ingredients critical to the successful recipe of a hackathon, or Designathon-type event were identified. A further iteration, the Education DesignShop, was implemented with design thinking as a problem-solving approach to help in solving broad, systemic issues while also teaching people new ways to collaborate and form sustainable solutions. Eight key components are identified with a structure established around just-in-time modules that teaching design thinking and challenge participants to apply these methods towards their re-designs of the education system. Projects in the Education DesignShop show a larger number of designerly attributes and are farther along Anderson’s Continuum of Systemic Change. Policy implications suggest ways to support further propagation of design thinking to address problems around education.
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CHAPTER 1

INTRODUCTION

In the late 1800s, a group of Harvard professors got together to decide what education make it into newly-founded high schools across America (Hertzberg, 1988). At the time, America was largely agricultural and children were needed for farm work. Children played a role in everyday maintenance so they were practiced in making and building at home. Their education at school then became based the humanities, classic literature, and deep analytical thinking, topics not covered already at home. Today, in 2015, communities are navigating how policy can bolster hands-on making in the classroom, and how to revamp education altogether. Strategies include proposals for a more agile student development through the Next Generation Standards (“Next Generation Science Standards,” 2015), updated visions for the Engineer of 2020 (Engineering, 2005), and more informal, extracurricular pathways like the Maker Movement education initiatives (MakerEd, 2015). With such complexities, interdependencies, and passionate stakeholders in the game, our educational system quickly becomes one of society’s wicked (Rittel & Webber, 1973), ill-defined problems (Buchanan, 1992).

Engineers have long applied engineering design processes to solve technical problems, particularly ill-defined and wicked problems (Buchanan, 1992). Recently, such strategies for
creative problem solving have been more broadly applied to business solutions (innovation) and larger, systemic problems that are multi-disciplinary or trans-disciplinary. Empathy-led human-centered solution strategies have been labeled design thinking (Brown, 2008). Design thinking has been applied to audiences beyond engineers or engineering students to non-technical people to solve their problems.

In parallel, the rise of the Maker Movement has come to make spaces and tools more available, and allowed for Making and hacking to go from an individual activity to one that can be done in groups (Cambridge, 2015). Hackathons are short sprints where people come together to use their technical and design talents to tackle divergent solutions around a shared theme or similar technology (Jansenn, n.d.). This practice has grown to include Designathons and Makeathons to introduce non-technical participants to these activities as well. A challenge is how to best immerse non-technical participants in collective problem-solving activities to contribute to solving society’s wicked problems, like those found in education.

The author has created and implemented a series of design thinking workshops for non-designers. This thesis explores the Education Designathon and the Education DesignShop and how it can be used to broaden non-design thinkers to tackle big issues and big ideas.

**PROBLEM STATEMENT**

Design thinking is becoming more accessible as useful ways for technical and non-technical people to solve ill-defined and difficult problems. This work investigates how a designerly hackathon called The Education DesignShop can help support the skills and abilities needed to develop a design thinking mindset (Lande, 2012). The Education DesignShop also serves as a test bed to explore how thought leaders from education can adopt a design thinking mindset and how that may change the types of problems they seek to tackle and how it might help with
developing larger, system strategies to improve educational solutions from a policy perspective. Specifically, the two research questions explored in this thesis are:

1) *How do non-designers transform into design thinkers from the DesignShop?*

2) *How do educational projects from the DesignShop workshop model address systemic changes?*

These research questions have been pursued with new measurement methods developed for each.

**RATIONALE**

Creative problem-solving strategies come from design practice. These are usually used to solve focused problems in product development. With the rise in popularity of design thinking, such approaches are becoming more mainstream for areas of big, systemic, complex issues such as education, healthcare, poverty, etc. This leads to a question of impact: does one replace the existing workforce with new, design thinking-trained personnel to problem solve and advance the field, or does one educate the existing workforce in design thinking and use their institutional knowledge as empathy pieces to within the field.

Based upon a belief that design solutions methods can be learned by a broad spectrum of individuals, this work develops a short-term workshop, or “crash course” on design called The Education DesignShop. Education is the topic or context in which design thinking is applied.

The Education DesignShop approach has policy implications related to:

- professional development for prospective participants,
- administrative freedoms to undertake non-conventional problem-solving methodologies,
- open-source sharing of information for hackathon-type events, and
- organizational structures that impede or support trans-disciplinary collaboration.
THE RESEARCHER

The researcher first formally learned of design thinking practices from her advisor, David R. Wallace, in the senior capstone design course at MIT, 2.009 Product Engineering Processes. Without every terming it “design thinking,” students were taught the rationale and mindsets a proper designer engaging in a product design process would need to have. While the focus was on creating a physical product at the end of the semester, I went on to wonder what would happen if these same tenets of design were applied to non-engineering problems prevalent in our society, like education, healthcare, or poverty. I explored the design thinking literature and practice with an interest in sharing the power of design thinking for solving problems beyond engineering.

When it was time to transition from undergraduate research projects around energy to a new scope of graduate work, analysis and reflection drove me to the awareness that our systems of education may be an even deeper root cause of the many technical challenges our society was facing. My new research interest turned towards impacting the systems of education. The coupling of these graduate investigations as part of a Dual Master’s program blend the applications of the work seamlessly: using a mechanical engineering design process framework to inform the way the policy decisions can be written to affect society’s complex issues.

ASSUMPTIONS

Based on prior experience and background as a student, teaching assistant and instructor in design courses, the researcher was rather familiar with the instructional approach being examined. Familiarity with the habits, activities and traditions of the 2.009 course and general design practice may have hidden general peculiarities about design and engineering. As such,
efforts have been made to rely heavily on participants’ written responses during their transformation through the experiment to support my own observations.

**RESEARCH APPROACH**

This research employed mixed methods, a combination of quantitative and qualitative methods, as it evolved through deeper and deeper research questions. An Design-Based Research Methodology was used to narrow down and refine the core research question iteratively.

The Methods section describe the design of the Education Designathon when the research question was whether or not it was useful to think about “hacking” education. Ultimately, the Education Designathon became a pilot study for the optimization of collective problem-solving for solutions that compete with traditional research ventures on innovation metrics like feasibility, novelty, variety, quantity, and quality. The question matured into challenging how “designerly” a hackathon could become.

After much analysis of the Education Designathon results, the Education DesignShop was born as an optimization of how to most quickly teach non-designers design thinking and how to most quickly produce re-designs of the education system. The design-based journey through which the event design decisions made is also documented in the Methods section.

With data from the DesignShop, the research interest focused upon studying the effect of design thinking as a transformational tool of participants and projects of the DesignShop. For this investigation, the work is decomposed into what became this thesis’ two major research questions:

1) *How do non-designers transform into design thinkers from the DesignShop?*

2) *How do educational projects from the DesignShop workshop model address systemic changes?*
Using definitions of design thinking, the characteristics a design thinker could develop, eight nested questions are developed to examine the performance of participants and teams that would illustrate their transformation as design thinkers. Then, the challenges of systemic issues are matched to the attributes of being a design thinker, and six questions are developed as claims for testing which participants’ projects are more systemic and designerly.

**SUMMARY OF KEY FINDINGS**

Sixteen hackathons from the Education Designathon formed the basis for 14 guiding event parameters to make a recipe for general hackathon or, specifically, Education Designathon success. Observations of team hacks revealed that the core difference between hacking and designing was in problem identification and brainstorming. Models of innovation and a set of independent variables are suggested that relate solutions emerging from three core problem-solving environments: Research projects, Hackathons, and Designathons.

The Education DesignShop was a further iteration. It was born as a model that leverages the assets of hackathons and design thinking methodology for innovation in wicked problems. The experiment produced 25 redesign proposals for education systems. The event parameters were synthesized into eight key features that distinguish the modified features of this event from other hackathon types.

Novel analytical methods showed that the Education DesignShop participants transformed into successful design thinkers after their experience. The Education DesignShop projects excelled in attributes of both designerly projects and systemic change. This analysis led to a characterization of what a design thinker looks like, and what designerly projects look like.
Five conference papers have been published around this body of work by the researcher. Some large portions of this thesis were first published in one of these five publications and can be found in original form through the following venues (in chronological order):


4. Harvey Mudd Design Workshop IX, Claremont, California, USA—*The Education DesignShop: Transforming Non-Designers into Design Thinkers through Real-World Project-Based Learning* (Artiles, 2015)


**ORGANIZATION**

Beyond this introductory chapter, this work is composed of eight additional chapters, described below for ease of navigation:

**CHAPTER 2. LITERATURE REVIEW** — Frames an understanding of existing work in the space with previous literature.

**CHAPTER 3. METHODS** — A breakdown of the steps to design both events—The Education Designathon and DesignShop—and the metrics conjured to analyze the resulting participants and projects from the events.

**CHAPTER 4. PILOT STUDY** — A look at the first experimental event, the Education Designathon, and its resulting hackathons whose lack of systemic affect inspired the design of the Education DesignShop.
CHAPTER 5. RESULTS — Breaking down the resulting projects that emerged from the DesignShop and the survey data that allows us to track the participants’ transformations as design thinkers.

CHAPTER 6. FINDINGS — Meaningful interpretations of our results and insights into the event structures that made the Education Designathon and Education DesignShop unique.

CHAPTER 7. POLICY IMPLICATONS — Considerations of the interface of public policy to support, enable, and foster design thinking in our society as an established default problem-solving methodology.

CHAPTER 8. CONTRIBUTIONS — A summary of research highlights that are significant to the communities of hackathons, design thinking, problem-solving around big issues, and policy interventions.

CHAPTER 9. FUTURE WORK — An array of research proposals to continue building on the work of the Education DesignShop and the contributions to societal, collaborative problem-solving through design thinking.
CHAPTER 2

LITERATURE REVIEW

This chapter provides a review of the background, existing literature and documented events, that provided context and informed the design of the experiments (both the Education Designathon and the Education DesignShop). The documentation of hackathons served to inspire the design of the Education Designathon. Design thinking (and the curriculum of MIT course 2.009) served to inspire the constructs and implementation of The Education DesignShop event.

HACKATHONS FOR COLLECTIVE PROBLEM-SOLVING

The hacker culture has expanded across nations and disciplines. Originally used to describe someone who makes furniture with an axe, this makeshift nature reflected onto the first programming-oriented use of the word, one who makes “a quick job that produces what is needed, but not well” and then matured to include [one who makes] “an incredibly good, and perhaps very time-consuming, piece of work that produces exactly what is needed” (Raymond, 2003). Hackathons are gatherings of programmers to collaboratively code in an extreme manner over a short period of time on whatever he or she wants (Jansenn, n.d.), and strive to embody the tone of “No Talk, All Action”. US Deputy CTO for government innovation Chris Vein commends hackathons as exceptional "sensemaking" tools for government, encouraging
agencies to use hackers’ talents to solve in creative and imaginative ways that they would never have done themselves (Llewellyn, 2012).

Hackathons are focused on a challenge, or theme, and aim to maximize the talents of its audience: some boast a rigid structure for its participants while others embrace the open-ended nature of playful and exploratory interaction not directed towards any goal (Raymond, 2003). For example, the Education Hack Day in Baltimore’s high school brought together developers, designers, and educators for 36 hours to create usable applications. Project ideas were formed by using the Educator’s Wish List in the developers’ discussion and having children and teachers vote on them. The next morning the highest voted ideas were developed and 36 hours later functional demos were showcased and prized based on concept, execution, and application to the educator’s problems (Beck, 2011).

Hack-driven solutions are promising. Results from these early education-oriented hackathons hint at the promise of making educational reform a “hackable” — transparent, dynamic, and approachable— challenge to hackers that already have the problem-solving tools. Government agencies like the Department of Energy have jumped on board, creating the Energy Data Initiative (Kalin, 2012) to improve energy data and encourage innovation at hackathons. They continue to support Application Programming Interfaces, or API’s, and sponsor other hackathon events, such as the Clean Web Hackathon that offers two tracks differing in time and product maturity (“Boston CleanWeb Hackathon,” 2013).

REMIXING HACKATHONS FOR EDUCATION

In order to understand current methods for innovation within the education system, the author looked at many events, most executed in the format of a “hackathon”—a marathon of hacking, or coding and tinkering, usually overnight. While all open with a theme of education, there are
many variables that make each one unique: some focus on a narrower sub-theme (“RemixEd Hackathon,” 2013); some provide datasets otherwise disclosed to big government (“Mass EduData Challenge Hackathon,” 2013); some explicitly connect teachers with need and programmers with ability (“Education HackDay - Baltimore,” 2011); some target policymakers’ incorporation of “‘new world’” policies and involve students (“EU Hackathon,” 2012). Even at this work’s Education Designathon, the projects seemed to lack a systemic thoroughness that implied a level of quality that might compete with the detail of a research project.

While interdisciplinary and exciting, the attempts at innovation in the education system exhibited by hackathons and the Education Designathon failed to include guidelines for participants’ problem-solving approach. As Albert Einstein put it, "The significant problems we face today cannot be solved at the same level of thinking we were at when we created them."

One enabler of methodical problem-solving is the Action Collab™ (“ISKME Action Collabs,” 2013) organized by the Institute for the Study of Knowledge Management in Education (ISKME) wherein facilitators lead participants through exercises embedded in a design thinking framework in order to innovatively solve their “Design Challenge”.

**DESIGN THINKING NEED-BASED DISCOVERY**

The analysis of the Education Designathon occurred as the researcher began her work as a mentor for 2.009 Product Engineering Process (Wallace, 2014), the MIT Mechanical Engineering. Curiosity began to set in as to what would happen if these systemic education issues were attacked with the same format and structure that designers in 2.009 were using, shown in Figure 1. Research into the concept of thinking like a product designer, but solving non-tangible solutions revealed results that pointed to the field of what was being referred to as “design thinking”.

25
Design thinking first appeared in Herbert A Simon’s 1969 book The Sciences of the Artificial. Since then, more than four decades of scholars have attempted to define and apply “design thinking” to various systems (product design, architecture, healthcare, etc.). Often called 21st century skills, design thinking offers problem-solvers a new departure from traditional standstills in problem solving.

Design thinking is probably most famously championed today by the international design consultancy, IDEO. To date, IDEO has grown to include in its core mission the expansion of design thinking through toolkits and neatly packaged methods. The following are five sets of methods provided by the IDEO DesignKit (http://www.designkit.org) (IDEO, 2014). DesignKit presents them as part of three different overall goals of the design thinking process—“Inspiration. Ideation. Implementation.”—each in a different color of orange, teal, and green, respectively. DesignKit was born towards the end of 2014 as a reframing of IDEO’s HCD Connect: “Hear. Create. Deliver.”—a place for Human-Centered Design methods. At the time
that the DesignShop was being designed, they were framed as HCD methods, as previewed in Figure 7.

These methods were loosely parsed into the five stages of the design thinking process framework by the d.school—empathy, define, ideate, prototype, test—according to which stage they were most useful in. The methods were used to augment the content of the lessons taught during the lecture modules of the DesignShop.

Figure 2 IDEO's DesignKit methods for "Inspiration", here re-grouped for use during the d.school’s design thinking step of “Empathy”.

![Diagram of IDEO's DesignKit methods for Inspiration, re-grouped for use during the d.school's design thinking step of "Empathy".](image-url)
Figure 3 IDEO's DesignKit methods for "Ideation", here re-grouped for use during the d.school's design thinking step of "Define".

Figure 4 IDEO's DesignKit methods for "Ideation", here re-grouped for use during the d.school's design thinking step of "Ideate".
Figure 5 IDEO's DesignKit methods for "Ideation", here re-grouped for use during the d.school's design thinking step of "Prototype".

Figure 6 IDEO's DesignKit methods for "Implementation", here re-grouped for use during the d.school's design thinking step of "Test".
Figure 7 IDEO’s HCD Connect methods, a precursor to DesignKit, and an aide in the development of the DesignShop.

David Kelley of IDEO also established a partnership with Hasso Plattner to found the first d.school, or design thinking school, at Stanford (d.school, n.d.-b). They’ve grown to establish courses and research groups that build on our understanding of design thinking and its many applications. Their token diagram for the design thinking process can be seen below, in Figure 8.

Figure 8 Stanford d.school process of design thinking (d.school, n.d.-a).
Because design thinking is such an amorphous process, sometimes considered a “universal process,” there exist (far too) many versions. The Henry Ford Learning Institute offers a particularly illustrative and design-consistent process diagram, below in Figure 9. With design thinking processes, it seems context is everything, as illustrated by Schmiedgen’s compilation in Figure 10 of some of the many processes with the message that what’s important is the correct use of their message, even if the vocabulary is not identical.

There is a basis in representations of the engineering design process in mechanical engineering (Ulrich & Eppinger, 2007) and others used to teach in the classroom. The MIT course uses the latest edition of their Product Design and Development textbook.

![Figure 9 Henry Ford Leadership Institute's rendition of the design thinking process (Kreinbring, 2015).](image)
DESIGN THINKING IN EDUCATIONAL CONTEXTS

This section documents and analyzes attempts at integrating design thinking into the education system. In general, there are three levels at which design thinking is most commonly referenced in the education system. They are, from the bottom-up:

1. Transforming assignments in the classroom so that students take a design thinking-based approach to their homework or projects.
2. As teachers and educators plan and deliver their assignments, coursework, and teachings inside the classroom, in a way that is more responsive to their user (the student) and their needs.
3. As a tool for writing policy for the education system, trying to crack down on the root of the problem(s), and trying to meet your user needs (or, settle your constituents worries) (InnovationTools.org, 2013).

Design thinking and maker thinking are on their way to being infused into schools with recent developments in non-traditional educational spaces such as the Art & Science Prize, NuVu High Schools, and “Innovation Schools” (Education, 2010) like the Up Academy and the Boston Green Academy. To drive home effective change in the education system, however, there needs to be more: design thinking needs to be established as an embedded problem-solving paradigm.

IDEO is an example of a company validating the engagement of using design thinking to tackle systemic issues. They’ve designed a school system— Innova Schools in Peru— “from the ground up,” they’ve challenged a community’s contribution in the transition to renewable energy, and created a birth control support network for young women (IDEO, n.d.).

In order to create a fleet of design thinkers in the education system, mostly through the training of existing teachers and administrators, the Nueva School of San Mateo, California offers the Nueva Design Thinking Institute for teachers to go through the experience of learning and applying design thinking to a design challenge, and then take home with them a binder of materials for curriculum development around design thinking (Saxe, n.d.).

The impacts of design reach far beyond education. In a piece titled “Forget B-School, d.school is hot” (Korn & Silverman, 2012), the Wall Street Journal surveys a number of influential companies like Intuit, Nordstrom, JetBlue, and Capital One that are jumping on the corporate innovation bandwagon through the lens of design thinking.
SUMMARY

An overview of hackathons and design thinking is covered. Applications of this collective problem-solving approach when applied to education and other wicked problems prompts a need-based discover of design thinking which reveals a broader space filled with toolkits, design thinking institutes, and corporate strategy initiatives.

Design thinking has become a well-established practice in industry. A challenge is now leveraging this untapped potential for application beyond technical or business areas, to the public sector, as well.
CHAPTER 3

METHODS

This research employed a mix of methods—some quantitative, some qualitative—as it evolved through deeper and deeper research questions. An overarching Design-Based Research Methodology was used to narrow down and refine the core research question with each iteration. A summary of data collected and the methods by which they were retrieved can be found in Table 1.

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<th>Research Motive</th>
<th>Data Collected</th>
<th>Methods Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of Education Designathon</td>
<td>Hackathon attribute insights</td>
<td>Observations of hackathons</td>
</tr>
<tr>
<td></td>
<td>Current education challenges</td>
<td>Interviews of EdExperts, Synthesis of findings</td>
</tr>
<tr>
<td>Design of Education DesignShop</td>
<td>Useful elements of the DesignShop</td>
<td>Thematic analysis of Designathon hacks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coaching interviews with Professors, Group interviews for feedback of event proposal prototype, One-on-One Interviews with stakeholders</td>
</tr>
<tr>
<td>Track Performance of Designathon Projects</td>
<td>Final Presentations Footage</td>
<td>Audio-video recordings of final presentation pitches</td>
</tr>
<tr>
<td>Track Performance of DesignShop Participants and Projects</td>
<td>D1. 25 Interviews from Education Experts</td>
<td>One-on-one recorded interviews, transcribed</td>
</tr>
<tr>
<td></td>
<td>D2. Application Data from Participants</td>
<td>Online form for background history, self-assessments, and reflections through likert scales, multiple choices, and empty text boxes Used to create metrics: a Mean Design Score and a Total Disciplinary Score</td>
</tr>
<tr>
<td></td>
<td>D3. Pre-Event Surveys</td>
<td>Open-ended design prompts</td>
</tr>
<tr>
<td></td>
<td>D4. Documented Artifacts throughout the Event</td>
<td>Self-directed pictures of work throughout event Audio recorders at tables</td>
</tr>
<tr>
<td></td>
<td>D5. Team Facilitator Handbooks</td>
<td>Quantitative and Qualitative status reports at every module of the event</td>
</tr>
<tr>
<td></td>
<td>D6. Final Presentations</td>
<td>Audio-video recordings of final presentation pitches</td>
</tr>
</tbody>
</table>
The methods outlined below begin by describing the design of the Education Designathon when the research question was whether or not it was useful to think about “hacking” education. Ultimately, the Designathon became a pilot study and the question matured into challenging how “designerly” a hackathon could become. The Education DesignShop was born as an optimization of how to most quickly teach non-designers design thinking and how to most quickly produce re-designs of the education system. The design-based journey through which the event design decisions made is also documented in the methods sections below.

With data from the DesignShop, the research interest focused upon studying the effect of design thinking as a transformational tool of participants and projects of the DesignShop. For this investigation, the work is decomposed into what became this thesis’ two major research questions:

1) How do non-designers transform into design thinkers from the DesignShop?

2) How do educational projects from the DesignShop workshop model address systemic changes?

Using definitions of design thinking to outline the characteristics a design thinker should have, eight nested questions are developed to examine the performance of participants and teams that would validate their transformation as design thinkers. The challenges of systemic issues are
matched to the attributes of being a design thinker, and six questions are developed as claims for testing which participants’ projects are more systemic and designerly.

**EXPERIMENTAL EVENT DESIGN AND DATA COLLECTION**

The two sections that follow document the experimental set up that occurred in order for the two central questions to be analyzed. In here lies an explanation of the design methods and the data collection methods employed to bring the Designathon of 2013 and the DesignShop of 2014 to fruition.

*Design of the Education Designathon*

The Education Designathon began as investigation into using collective brainpower to crack, or hack, the education system. From the researcher’s original notes:

IDEA: *Bring MIT brainpower together to think about how to fix the education system.*

GOAL: *Many ideas, as tangible as possible, and ready to be implemented.*

Initial, in-person observations were made at the Music HackDay hackathon (“Music Hack Day Boston 2013,” n.d.) and informal interviews were conducted with organizers of the event to understand elements of what made their hackathon unique and successful.

The EdExperts in Table 2 were invited to participate as Challenge Experts, that is, to pose a challenge to the hackers for the weekend. The invitation included a high-level motivation and objective for the event, details on the proposed structure, and samples of the kinds of EdExperts, Challenges, and Solutions that could be exhibited by each of the three Topics.

Next, meetings were set up with these EdExperts to understand the kinds of research questions and issues they were involved in solving that they could provide context for at the Designathon. These insights were later distilled into what would become the information listed
on the Designathon website to attract and inform prospective hackers, summarized in the table below.

Table 2 EdExperts and the 16 challenges presented to hackers of the EduDesignathon (abridged version)

<table>
<thead>
<tr>
<th>Topic Challenge</th>
<th>EdExpert</th>
<th>EdExpert Challenges to Hackers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems Re-Thinking</td>
<td>MIT Office for Education and Innovation Technology</td>
<td>OEDIT needs your help in figuring out how we might break out of the model of whole courses, to smaller modules that help you learn what you need to learn, when you need to learn it. They are actively developing software and tools to help faculty and students link course content to learning objectives and assessment. How might you rethink your educational experience at MIT with these tools?</td>
</tr>
<tr>
<td>MIT Scheller Teacher Education Program</td>
<td>Scot is also involved in moving the education framework from a factory model to a customizable template that adjusts to students' strengths and weaknesses. The flaw of averages has indicators based on class average, so how do we begin to incorporate space for varying metrics for different student's improvements in certain areas?</td>
<td></td>
</tr>
<tr>
<td>Match Schools</td>
<td>Match is in need of a faster system that identifies what works and what doesn't work in the classroom in a timespan shorter than the current year it takes to circulate feedback. Deeper information is also needed to understand why a student learned material or not and translate this information into best practices.</td>
<td></td>
</tr>
<tr>
<td>Center for Curriculum Redesign</td>
<td>Fadel encourages us to think critically about what we are really supposed to be learning and how the curriculum of the 21st century will evolve. Then, what kind of movement will need to occur to make this transition?</td>
<td></td>
</tr>
<tr>
<td>Experienced Teachers</td>
<td>Local area teachers will conduct a discussion workshop where they will open up to students and share their experiences. Teachers will identify existing needs in and out of the classroom and work with students to identify new opportunities.</td>
<td></td>
</tr>
<tr>
<td>Hands-On Learning</td>
<td>D-Lab Education</td>
<td>There are many challenges faced by our partner schools around the world, including limited resources, large class sizes, language barriers and entrenched pedagogy. D-Lab: Education challenges you to develop innovative tools / processes to support teachers in offering more hand-on, interactive learning opportunities in low-resource settings.</td>
</tr>
<tr>
<td>MIT Edgerton Center</td>
<td>Current lab setups are designed for large space set up and long set up times that are not possible in most high school classes with block scheduling. Ed will help students develop a portable, quick setup toolkit to make hands-on projects more accessible. How could 2.007 be hosted as an online course?</td>
<td></td>
</tr>
<tr>
<td>Digital Learning</td>
<td>The Education Arcade</td>
<td>The commercialization of these tools has turned educational software into an market thirsty for profit, often misleading consumers with advertisements that mask educational value. The Education Arcade is interested in a method to evaluate learning software for its educational content so the benefits of each are made more transparent.</td>
</tr>
<tr>
<td>MIT Open CourseWare</td>
<td>OCW is interested in aggregating and analyzing feedback (like YouTube comments) to encourage learning-positive behavior and identify quality resources. OCW would also benefit from tools that match content to learners, esp. high school students.</td>
<td></td>
</tr>
<tr>
<td>MIT Office of Education and Innovation Technology</td>
<td>He will show us around the MIT Data Warehouse and the State and U.S. Department of Education datasets</td>
<td></td>
</tr>
<tr>
<td>Center for Curriculum Redesign</td>
<td>Trending educational technologies aim to teach concepts and content. New educational technologies should focus on teaching skills and character. Students should understand existing tools that aim to do this and co-design an online tool for students to develop the skills they cannot do independently.</td>
<td></td>
</tr>
<tr>
<td>Khan Academy</td>
<td>An API will be available for hackers. Data analysis is an underused tool</td>
<td></td>
</tr>
</tbody>
</table>
to understand patterns, such as identifying which students are struggling or why students are getting problems wrong. **Visualization tools** can also be further developed to provide teachers with new knowledge maps or student reports.

<table>
<thead>
<tr>
<th>BLOSSOMS</th>
<th>Hackers are challenged with creating a BLOSSOMS lesson of the Monty Hall 3-Door problem. Video needs to be creatively entertaining and mathematically correct using probability arguments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT Office of</td>
<td>The Office of Digital Learning is interested in one question: What is the core value proposition of residential learning that digital learning can't provide? Students should explore core differences and design tools, system structures, and/or new platforms that illustrate these fundamentals. Students should explore the future model of education and how residential and digital learning will interact.</td>
</tr>
<tr>
<td>Digital Learning</td>
<td></td>
</tr>
<tr>
<td>edX</td>
<td><strong>Scale a class across time and space, allowing professors and course teams to save time grading</strong> and presenting so that they can focus more energy on connecting with their students and sharing their educational ideas more broadly. She will also ask attendees to think about the learner's experience by implementing scalable assignments, gradable simulations, and cloud-aware input devices - anything that would make the student experience on edX more engaging and instructive.</td>
</tr>
<tr>
<td>iLabs</td>
<td>iLab is dedicated to the proposition that online laboratories - real laboratories accessed through the Internet - can enrich science and engineering education by greatly expanding the range of experiments that the students are exposed to in the course of their education.</td>
</tr>
</tbody>
</table>

A website (www.edudesignathon.com) was made to attract the hackers and get them to sign up through the EventBrite event page. EventBrite is a web platform that gives event organizers a central location to direct all their participants for registration and confirmation details. A screenshot of the homepage of the website can be seen below in Figure 11. Screenshots of the other pages can be found in **APPENDIX A**.
In addition to an event website, a poster was created for advertising around campus, as seen in Figure 12. As for budget, the original subtotal estimates put the Education Designathon at around $30,000. Due to resource constraints, the cost was brought down closer to $8,000.

The weekend of March 9th, 2015, the Education Designathon, came together as a 39-hour long hackathon with a twist. The event took place in an open space with machine shop access where hackers, or designers, could use power tools and materials to build. Teams were given a $50 budget per person to buy materials or outsource work. After opening remarks by Woodie Flowers, eleven Education Experts (EdExperts) representing all three subtopics gave 5 minute Challenge Presentations. These Challenge Presentations introduced the challenges and daily work of the EdExperts. After Challenge Presentations, participants were invited up to pitch their own ideas or projects to recruit team members. Twelve half-hour to hour-long workshops by EdExperts took place over the next 2 hours, with some overlap forcing participants to prioritize the topics most interesting to them. The twelfth workshop consisted of teachers, mentors, and faculty from around MIT poised to give feedback to the participants on their ideas and current
projects. After lunch, lab safety trainings were offered to all participants who planned on using any machining tools. Little structure followed thereafter. As groups entered the brainstorming phase, some hackers still uncommitted dabbled from project to project before settling in with a team or pursuing their own idea. Some groups wasted no time and directly went out to buy materials from their budgets, some continued strategizing, some enjoying feedback from EdExperts still lingering.

The map of the space and schedule of events that was offered to the participants inside their pre-stuffed name badges can be seen below in Figure 13.

![Figure 13 Map of the space and schedule of events at the Education Designathon, folded and stuffed into the hackers’ name badge](image-url)

The Education DesignShop grew out of a desire to know whether design thinking could be taught to non-designers (namely policy makers, educators, students, and industry personnel) and have these very subjects apply these principles to innovate in the education system, all
within two days. The title of the event (now being licensed) embodies the idea of producing a design thinking workshop with the theme focus on education.

**DESIGN METHOD-BASED STRUCTURE: RATIONALE FOR THE DESIGNSHOP**

What follows is the documentation of the stages the author took to design and develop the Education DesignShop. Naturally enough, this was also within a design-based approach as depicted in Figure 38. As follows, each section highlights the major step of the design process, as illustrated in Figure 38, and the key action items within that process that, altogether, yielded the final proposal for the Education DesignShop.

**1. Problem Identification**

The first parts of this process were initial assumptions to be borne out in the implementation of the investigations. Beginning with the initial stipulation that education still suffers from various systemic challenges that need fixing (some are centuries old), the hypothesis posed was that what education really needs is a new method of problem-solving. It was observed that design thinking strategies common in product design were not present when approaching education reform: observations from frustrated conversations across various circles identified that key stakeholders (educators and policymakers, for example) were not communicating to find solutions that pleased (or were even informed by) both parties.

The author asked if the root of the problem was a lack of creativity and innovation in the education space. Thinking back to products born at the Education DesignShop we realized that while there were creative solutions at the bottom level from practitioners in the field (especially current students closest to the victimizing side effects), these rarely if ever trickled up to the high
level change agents that could have the power of implementation at various levels. Quick investigations into the backgrounds of policymakers confirmed that these key stakeholders were lacking creativity and innovation in their practice because they had not been trained with a background of assimilating these elements into their work’s problem-solving. Exploration of this hypothesis, however, revealed that regardless of the approach that key problem-solver takes, another root of the problem remained that that policy maker is too far removed from the real problems happening in the classrooms, for example, to understand enough of the problem he’s trying to solve.

If, hypothetically speaking, a policymaker had been trained with de-sign thinking elements and was somehow closely immersed into the everyday education routine, would our solutions look different? This revealed another element of the triad missing: the tools to fix the education system are still very limited and limiting to any new innovation. Space had to be accommodated for makers, such as engineers and de-signers, to have a chance to adapt their creative talents to the education space, too.

2. Brainstorming & User Studies

First steps included outlining what the event would look like if we could have limitless resources, ideal participants, and achieved goals. This envisioning is key to later specification checks to make sure that a mission-vision-goals statement has been fulfilled to some extent that is true to its purpose. Brainstorming drew inspiration from previous attempts to attack similar problems, such as the Education DesignShop. From the feedback survey that followed we learned users wanted a more narrow scope of topics. Tools to envision the final product, like a draft of the sessions that would occur was useful in helping my mentors visualize my prospects for the final event. Visionary tables like these are a good moment to remember the key design axiom that
“Real Data is Truth” (A. Herasimchuk, L. Wroblewski, J. Sonin, 2013) and that efforts to include real or simulated data from the beginning, will help frame a much more accurate view of the event.

3. Requesting User Input

First rounds of presenting the brainstormed versions of the Education Designathon were necessary as a way of getting user input from, in this case, the professor of the class and the advisor that would approve and oversee the end product. A promising visual tool was creating a tree hierarchy of all the possible options at each node of a decision to be made. This gives insight into the direction of the next steps that must be taken and researched further. To build resources and a knowledge bank of ideas and persons that could potentially be linked to the event, the author attended the “How to design a Course Workshop” at Harvard’s Graduate School of Education. There, we met another potential user. Meetings which coaching figures were helpful in prying answers to difficult questions like the goals for a successful event and the balance between a pedagogical and competitive event.

4. Prototyping: A Refinement of Brainstorming

In the case of this intangible product formation, a proposal for an event, prototyping often meant writing out the format and content of the event in various forms. Each set of questions required thinking of a different set of details, thus revealing new connections and interrelations. Perhaps most helpful to the exercise of answering different questionnaires is the iteration portion of answering each question as if it were the first time considered. Without copy-pasting from previous answer sets, a trend in the development and growth of the product can be tracked over time. Other useful tools whilst prototyping iterations were making timeline goals of the upcoming steps in the development of the product. This exercise is most helpful in identifying
what key decisions and actions need to be made from your status to the envisioned final product, as well as compiling a list of the resources available along the journey.

5. Requesting User Input

Almost every time design decisions are made, the user should be brought in for some feedback. At this stage, we created a survey that would be sent out to two types of people: potential users and potential expert mentors that spend a lot of time thinking about these issues already. While there are many ways to gather feedback more widely, in this case, open-ended questions with many options was a better approach over a binary or multiple-choice questionnaire.

6. Iterative Prototyping with Risks

The author used these survey results to make some formatting decisions and to inform myself of what topics interested potential users. Following advice, a list of specific roles and duties was made for the persons that would need to be involved in order to execute this type of event. We used the feedback to flag new key risks that would determine the success of the event, including how to really engage the underrepresented and most critical group, policymakers, in a tech-y event.

7. User Feedback

For the next iteration of feedback we created a refined event proposal that would be shown to different parties for their feedback (sponsors, student participants, and mentors). We attended the Students for Education Reform (SFER) (“Students for Education Reform,” n.d.) State Summit and led a session where these potential users were allowed to share their impressions and critiques of the proposal. The key to user feedback is that the more involved in the development of your product a person is, the more likely they are to jump on board and attend or advocate for
the product. The summit also opened pathways to future meetings with Massachusetts Representative Jeffrey Sanchez and Massachusetts Secretary of Education Matthew Malone to leverage potential resources between their office and my event. These comments from user feedback sessions were later used to create a tighter value proposition for sponsor recruitment.

Organization & Implementation

In order to reach the desired audiences near and far, students and non-students, a twitter account was created for the DesignShop (@EduDesignShop) and a website (edudesignshop.mit.edu) and logo were contracted to MIT student Annie Tang (http://annie-tang.com). A summary budget for the DesignShop can be found in Table 3 below. The categories correspond to the following breakdowns:

- **Food**: includes catering for final day’s reception, snacks throughout, and catered delivery of breakfast and lunch both days;
- **Materials**: includes all low-resolution prototyping materials for teams and the cost to make 25 DesignShop-exclusive whiteboards for teams;
- **Operations**: includes travel costs for certain mentors to attend, truck rentals for snacks and materials transportation, event space rental, award stipends, and transcription services for the 25 interviews.

<table>
<thead>
<tr>
<th>Source</th>
<th>Price Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Budget</td>
<td>9,398.30</td>
</tr>
<tr>
<td>Materials Budget</td>
<td>3,148.00</td>
</tr>
<tr>
<td>Operations Budget</td>
<td>14,335.58</td>
</tr>
<tr>
<td><strong>TOTAL BUDGET EXPENSE</strong></td>
<td><strong>26,881.88</strong></td>
</tr>
</tbody>
</table>
Team facilitators were recruited so there would be one for each team. An ideal facilitator was described as one with strong skills and experience in design and in team facilitation/coaching. As some facilitators were naturally skewed towards one side of the spectrum more than the other, a catered three-hour Team Facilitator Training Session was held the week of the DesignShop to meet each other and interactively share best tips for coaching design teams. The training session also included a walk through of the content, the schedule, and the event space.

Data Collection Mechanisms Throughout Event

As depicted in Figure 14, there were ten different methods of data collection around the Education DesignShop, chronologically:

- D1. 25 Interviews from Education Experts
- D2. Application Data from Participants
- D3. Pre-Event, Post-Event, and Post-Post-Event Surveys
- D4. Documented Artifacts throughout the Event
- D5. Team Facilitator Handbooks
- D6. Final Presentations Footage
- D7. Judges’ Scoring Rubrics
- D8. Post-Event Surveys
- D9. Post-Post-Event Surveys
- D10. Feedback Forms

The orange-boxed frames—D3, D8, and D9—were used for the bulk of the studies addressing the research question around a transformation of non-designers into design thinkers. The blue-boxed frame—D6—was used for the bulk of the studies addressing the research
question around a transformation of projects becoming more systemic and ‘designerly’ (See Section: Metrics for Systemic & Designerly Projects). The following sections dive deeper into the design and components of these ten methods and how they were implemented.

**EDUCATION EXPERTS**

To better frame the educational challenges that were going to be addressed at the Education DesignShop, 25 education experts from around MIT and the surrounding community were interviewed on their thoughts on the most pressing challenges in education. Their interviews were recorded and MIT graduate student Amy Loomis (www.amyloomis.com) was contracted to turn the footage into four content videos for the website: One 1-minute trailer video for the homepage, and three separate topic videos explaining each of the three Topic Challenges in finer
These videos were linked in the participants’ application (D2 below) so that they could make a more informed choice when choosing what Topic Challenge to be a part of.

The interviews were later transcribed through an online subscription service and then checked for accuracy. These transcripts were uploaded to a Google Drive that became an online forum for the chosen participants. These applicants that were invited to participate were asked to partake in a sort of Homework assignment wherein they had to read through and comment on at least two of the 25 transcripts that were online. This would get the participants warmed up on the topics, familiar with at least a baseline of information on the topics, and already sharing information and resources even before the event.

**APPLICATION DATA FROM PARTICIPANTS**

To attend the Education DesignShop, interested persons were asked fill out an application that gave the necessary information to optimize the make-up of the participant cohort. The application asked information around the person’s educational background, Topic Challenge preference, Insight & Experience (or, disciplinary background), Skills & Abilities around design thinking, Personality & Teamwork Ethic (including whether they were a cat or a dog person), and provided a space for to share their reasons for interest in the Education DesignShop. The application form can be seen in **APPENDIX B**.

This dataset painted a rich picture of the kind of person that the participant was. From this, two main attributes were born: A participant’s Mean Design Score, and their Total Disciplinary Score.

**MEAN DESIGN SCORE**

The first new metric developed is the Mean Design Score, the calculated average of the rating given for each of the five questions attempting to quantify a participant’s fluency with design
thinking practice. Screenshots of the five questions asked can be seen in Figure 15, as they appeared, with the grey help box to the right of each. These same questions were present in the Feedback Form and Post-Post-Event Questionnaire accompanying the Post-Post-Event Survey.

**TOTAL DISCIPLINARY SCORE**

The second metric developed is a participant’s self-reported familiarity, or ability to represent each of the four disciplines critical to the Education DesignShop. Table 2 below shows the questions asked. The questions were presented in the same format as the design thinking related questions above, each with the rating system from 1 to 5, where 5 was the most knowledgeable in the field, and 1 was the least. The lead-in question was: “Insight & Experience: We're matching teammates to have a diverse range of expertise and years in the field. Help us understand your background and what you could add to the team.” The Total Disciplinary Score for each participant became the sum of the ratings given to all four disciplines.
Figure 15 Five design thinking competency questions used for participants' self-assessment used to calculate participants' Initial Mean Design Score
Table 4 Four Questions Asked to Gauge Participants’ Level of Identification from each Discipline’s Perspective, on a Likert Scale from 1-5

<table>
<thead>
<tr>
<th>Experience as Policymaker</th>
<th>Experience as a Teacher/ Educator</th>
<th>Experience as a Student/ Learner</th>
<th>Industry Experience (Engineer/ Designer/ Entrepreneur)</th>
</tr>
</thead>
<tbody>
<tr>
<td>★</td>
<td>No experience</td>
<td>No experience</td>
<td>No experience</td>
</tr>
<tr>
<td>★ ★</td>
<td>One summer internship or equivalent</td>
<td>I’ve taught for the SAT’s or led office hours back in college</td>
<td>(n/a)</td>
</tr>
<tr>
<td>★ ★ ★</td>
<td>Mid-career staff to policy makers</td>
<td>Considerable experience with the process of teaching</td>
<td>I have used 5+ unconventional learning platforms or methodologies</td>
</tr>
<tr>
<td>★ ★ ★ ★</td>
<td>Somewhat more experienced</td>
<td>Formally taught in the classroom</td>
<td>(n/a)</td>
</tr>
<tr>
<td>★ ★ ★ ★ ★</td>
<td>Could be advisor to the Secretary of Education</td>
<td>Taught and designed the curriculum for multiple formats of classes</td>
<td>I’ve learned through multiple styles, formats, and platforms, including online, project-based, and industry-related learning</td>
</tr>
</tbody>
</table>

EVENT SURVEYS

A 20-minute evaluation of each participant’s problem-solving ability was conducted at three different points: Pre-event (before the event began), Post-event (in the immediate moment the event was over while the judges deliberated the winning teams), and Post-Post-event (in the 2-3 month timeframe after the DesignShop). These surveys asked three general questions and gave a box nearly the size of an entire 8.5”x11” sheet for the answer. The original surveys, as they appeared, are included in APPENDIX D.

The three questions are below, in the order they appeared in the evaluations:

Pre-Event Survey: You have been tasked to reverse an emergent trend of persons throwing trash away in the recycling bins. When these items are mixed, they are no longer recyclable. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.
Post-Event Survey: You work for a Fitness Center that has interested members, but they’re just not meeting their health goals and it is your job to keep them as customers. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.

Post-Post-Event Survey: You have been asked to stop the spread of mosquito-spread malaria in West Africa. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.

DOCUMENTED ARTIFACTS

The participants were instructed to document their work as much as possible, as it was good practice for designers. Team Facilitators were asked to help their teams do this. A generous donation from Dropbox provided 50GB of space to upload team pictures and data. The resulting data have been archived.

Additionally, each table had audio recorders that were on during the entire event: through the deliberations, the brainstorming, the critiquing, and the resolutions. The data are ready to be transcribed and coded.

TEAM FACILITATOR HANDBOOKS

Team Facilitators were given a handbook with prompting questions to standardize the collection of data on the participants. Each module came with a set of instructions for the Facilitator to help guide their team to that deliverable and with a unique set of questions (some quantitative, some qualitative) for the Facilitator to record observations regarding the performance of their team.

APPENDIX C includes the Handbook as was given to the facilitators.
FINAL PRESENTATIONS FOOTAGE

The 25 team final presentations were recorded by the MIT Video Productions. Every team was required to present their proposed innovations with or without slides, so long as they had a physical prototype to show with. Every team had the floor for two minutes to present, and then another two minutes for Q&A with the judges and the audience.

JUDGES’ SCORING RUBRICS

The judges were given a rubric template, seen in Table 5 below that had been shown to the participants during the DesignShop. They were asked to rate the teams on a score from 1 to 5 as they saw all the presentations live and they were encouraged to make notes for each team. At the end of the presentations, the judges had 20 minutes to deliberate which of the teams were going to win the myriad prizes. All of the judges’ rubrics and annotations were collected.

Table 5 Judges’ Rubric for the DesignShop Projects’ During Final Team Presentations

<table>
<thead>
<tr>
<th>Project Attribute</th>
<th>Description of Excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considers various perspectives</td>
<td>It is clear the team innovation incorporates the viewpoints of various users, including policymakers, educators, industry reps, and students. The project considers these and has taken active steps to gain feedback from these unique users, incorporate it, and make them feel included.</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Team solution acknowledges the implementation challenges and has creatively thought of ways to overcome these.</td>
</tr>
<tr>
<td>Creativity</td>
<td>Key aspects of the innovation have either never been tried before or will be novel in their area of implementation. Bonus points if there is an existing infrastructure that is used also for the design challenge.</td>
</tr>
<tr>
<td>Answers a key need in the education space</td>
<td>There is a clear need for the project solution. That need is undoubtedly fulfilled through direct or indirect methods that will regardless inevitably act on filling the expressed need.</td>
</tr>
<tr>
<td>Transformation occurs at the system level</td>
<td>The solution is at a scale much larger than an intra-classroom re-design of content presentation. There is careful thought to the dynamics and interdependencies that govern the system, and to how these may be used or adapted in a new way to satisfy the re-design of the system.</td>
</tr>
<tr>
<td>Dissemination &amp; Implementation</td>
<td>There is a reasonable plan for making the innovation real. Details have been thought through, such as the stakeholders that will need to be worked with in order to implement the innovation.</td>
</tr>
</tbody>
</table>
**POST-EVENT SURVEYS**

A second Event Survey, similar to the Pre-Event Survey above, was administered immediately at the end of the event, while the judges deliberated on the winners.

**POST-POST-EVENT SURVEYS**

A third Event Survey, similar to the first Pre-Event Survey above, was emailed to the participants during a period of two to three months after the DesignShop, until the majority responded. This timespan was offered so as to provide some measure of retention in the participant’s knowledge.

**FEEDBACK FORMS**

Immediately after the DesignShop, the participants were asked to fill out a feedback form regarding the event, including sections like: their agreement with our research hypothesis, their experience at the event, feedback to their Team Facilitator, feedback to the organizers in terms of logistics and content, and another chance to self-assess their (confidence in their) design thinking competency. The Feedback form can be seen in APPENDIX.

Two to three months after the DesignShop, the final Post-Post-Event Survey was sent out as part of a final Questionnaire. This form asked for a third time for the participant’s self-assessed (confidence in their) design thinking competency and their self-assessed identification with different disciplines.

**PARTICIPANT INTERVIEW INSIGHTS: A YEAR AFTER**

Nearly a year after the DesignShop, a few of the participants were invited to reflect on their practices of design thinking (or not) since the DesignShop. This sought insight into the ways in which participants were or were not using their DesignShop experience in their fields.
Interviewed were two policymakers (one legislative aide for a Massachusetts State Senator, the other the Executive Director of a non-profit to promote school policies in favor of children’s rights), one school teacher and FabLab director, and one student at RISD (Rhode Island School of Design). The participants were chosen for their diverse background and application settings for design thinking.

PARTICIPANTS’ TRANSFORMATIONS AND PROJECTS’ DEVELOPMENTS

The next two sections are an overview of the methods and metrics developed in order to extract meaning from the results of the two previous events, the Education Designathon and the Education DesignShop. It is in these two sections where the groundwork is lay to explore this work’s two central questions:

(1) How do non-designers transform into design thinkers from the DesignShop?

(2) How do educational projects from the DesignShop workshop model address systemic changes?

METRICS FOR TRANSFORMING NON-DESIGNERS TO DESIGN THINKERS

After the execution of the DesignShop, the data gathered were analyzed in a search for evidence that participants that attended transformed into design thinkers, as evidenced by an increase in their choice of problem-solving methodology. The author invented nine identifiable traits that can be expected of a design thinker, as can be seen in Table 6. These were used to propose a set of testable claims that could be observed from the extensive dataset, summarized here (hash tags are used to denote a part of the dataset and distinguish from common language):

• #evaluations: the Pre-, Post-, and Post-Post-Event Evaluations given to the participants,
• **transcripts**: the text that would emerge after transcribing the audio recordings of the teams working,

• **artifacts**: the photos and work documented and submitted by the teams,

• **handbook**: the Team Facilitator Handbook filled with observations as the team worked, the final team presentations that were recorded, and

• **presentations**: the final team project presentations at the end of the DesignShop.

<table>
<thead>
<tr>
<th>Defining a design thinker to be a person who:</th>
<th>Testable claims that can be observed in the data sets in bold</th>
</tr>
</thead>
<tbody>
<tr>
<td>References design thinking terminology and approaches a problem through some process (here taught as Empathy, Define, Ideate, Prototype, Test)</td>
<td>There is an increase in participants’ ability and competency to use design thinking as a problem solving strategy after the DesignShop.</td>
</tr>
<tr>
<td></td>
<td>• <strong>evaluations</strong></td>
</tr>
<tr>
<td></td>
<td>o Increase in number of design thinking words</td>
</tr>
<tr>
<td></td>
<td>o Increase adherence to the chronological flow of the process</td>
</tr>
<tr>
<td></td>
<td>o Increased number of referenced steps of the design thinking protocol</td>
</tr>
<tr>
<td></td>
<td>• <strong>transcripts</strong></td>
</tr>
<tr>
<td></td>
<td>o Individual mentions of the design thinking process</td>
</tr>
<tr>
<td></td>
<td>• <strong>artifacts</strong></td>
</tr>
<tr>
<td></td>
<td>o Uses methods known to design thinking</td>
</tr>
<tr>
<td></td>
<td>• <strong>handbook</strong></td>
</tr>
<tr>
<td></td>
<td>o Mentions of a team applying different approaches to problems</td>
</tr>
</tbody>
</table>
| Is receptive to feedback and mentorship | Mentors help teams develop more designerly ideas  
* #handbook  
  - Mention of how many times a mentor came over and helped  
  - Mention of whether a team’s idea changed after this help |
| Is empathetic to the end-user and their problem | Participant shows empathy to problem and end-user  
* #evaluations #transcripts  
  - Understanding of empathy and how to obtain it  
* #presentations  
  - Final project presentation that shows empathy to user |
| Uses prototyping for their ideas, both tangible and intangible: uses visual and material resources (post-it notes, white-board, prototyping materials) | Participants show clear use of tools (post-it notes, arts & crafts), both material and visual, to represent ideas and work  
* #evaluations  
  - Pre and post drawings  
* #presentations  
  - Visuals in final presentation  
* #artifacts  
  - Documented group materials of whiteboards, post-it sessions, prototypes, etc.  
  - Increased number of tools used  
  - Increased sophistication of tools used  
* #feedback  
  - Delta design thinking ability in 5 star rating  
  - Comments about aspects liked/disliked in Likert scale |
| Sees opportunities to connect problems across disciplines/culture | Pre-grouping workshop members based on “magic algorithm” elicits more effective groups.  
- We define effective as able to use a highly diverse disciplinary and informational knowledge-base.  
- By breaking down the aspects to this matching process we have found these parts are most critical.  
* Qualitative Data:  
  - #handbook  
    - Quote notes on group working together.  
  - #presentations  
    - If a group presents themselves cohesively and/or together enough. Do they look happy working together?  
  - #artifacts  
    - Good teams probably have more brainstorming sessions, contribute more, take funny pictures, have clever logo’s and team names?  
  - #feedback  
    - Comments on their group dynamics, what worked well and didn’t, etc.  
  - #evaluations #transcripts #handbook  
    - Use culturally aware vocabulary  
    - Consider multiple viewpoints  
    - Reference information from Community Forum or other outsider resources relevant to the topic at hand  
    - Use their mentors as platforms for references  
    - Use their “Research & Ideation” time to find connections, parallels, and benchmarks. |
| Can brainstorm in | Participant is effective at working with team to extract insights from all and build consensus |
The bulk of this work focused on testing the first claim of this table, that is, that:

- There is an increase in participants’ ability and competency to use design thinking as a problem-solving strategy after the DesignShop.
  - #evaluations
    - Increase in number of design thinking words
    - Increase adherence to the chronological flow of the process
    - Increased number of referenced steps of the design thinking protocol

For this, the Pre-Event, Post-Event, and Post-Post-Event Surveys were analyzed and coded for the five core design thinking steps of the d.school and IDEO process: Empathy, Define, Ideate, Prototype, Test.

First, the responses were read and every word considered part of the design thinking vocabulary was recorded. Second, the evaluations are read over and each step the participant suggests is logged, in chronological order, with a designated weight, or depth of appreciation for that step. This depth is reported on a scale of 0-3 where a 0 is a no mention, a 1 reports a slight mention, almost as if to check off a box that mentions the step in the process; a 2 reports a significant mention of the process, it’s importance, and/or how it might be executed; and a 3 reflects a deep appreciation of the step, some potential methods of execution, or even reasons
why it is important and warranted at the moment. After this chronological log was made, a global representation of the respondents’ appreciation for the design thinking step was coded. This recorded the overall depths of appreciation shown for each step of the process, at some point or another throughout the response. In our coding protocol, if a response simply mentioned the design thinking process step as if to check off a box, they simply received a 1 whereas if they cited specific methods they would use to build empathy, for example, they’d receive a 3.

Example answers during the Event Surveys and their rating would be:

- 0: Participant fails to mention any term or notion to suggest that they would employ “empathy” as part of their problem-solving process
- 1: Participant lists: “Step 1. Empathy”
- 2: Participant says: “I would empathize with my user through observation.”
- 3: Participant elaborates: “I would first visit my user in the field to observe them in their natural environment and be able to build empathy with their situation. I would take one-on-one interviews first, followed by a group interview of the community…[after explaining that they would build a prototype]…I would go back to my user and have them interact with the prototype to understand where the improvement opportunities lie.”

METRICS FOR SYSTEMIC & DESIGNERLY PROJECTS

The author’s first exploration into using hackathon models to achieve systemic change was the Education Designathon in Cambridge, MA during the spring of 2013. This was also the first-ever instantiation of a hands-on hackathon for education. It did so by framing the discussion of various Challenge Experts into three broad challenge areas: Hands-On Learning; Digital Learning; and Systems Re-thinking. While the event proved that great ideas can, in fact, come from having a hacking mindset towards education, it also showed the shortcoming of hackathon-
type products that can often lack the considerations of feasibility in implementation and impact. From this was born the need for a more structured event, and design thinking was introduced into the picture as a promising methodology to guide the formation of sustainable, feasible projects ready to be implemented for system-wide scale in education. Months after the DesignShop, another event attempted to bridge both spaces by creating a hackathon that interlaced some design thinking modules, but without the formulaic milestone guidance for the teams. This event, held at the Harvard Graduate School of Education, was largely influenced by the documented work of the Designathon and the DesignShop. A summary of these three events can be found in Table 7 below.

<table>
<thead>
<tr>
<th>Experiment Event</th>
<th>Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education Designathon at MIT</td>
<td>The first hands-on hackathon for education</td>
</tr>
<tr>
<td>Education DesignShop at MIT</td>
<td>A 2-day workshop for participants to learn and apply design thinking to education</td>
</tr>
<tr>
<td>Harvard Graduate School of Education: Education Hackathon</td>
<td>A hackathon for education that stressed the importance of using the design thinking process</td>
</tr>
</tbody>
</table>

Each of these experiments brought together a variety of different people to focus on a similar goal - developing ideas to help make education better. These events, however, differed in structure that, we argue, led to differences in team project outcomes (and participant transformations, as discussed in the second methods section). Events like the Designathon and HGSE Hackathon encouraged weekend-long tinkering projects with no expected thought of how to scale or implement project longevity. Contrastingly, the DesignShop gave the explicit requirement that projects should consider the ability to affect systemic change. By stating this goal for the DesignShop in conjunction with supporting workshops centered around design
thinking and the eight key DesignShop elements, projects that emerged from the DesignShop showed a greater thought detail afforded towards affecting a system.

**SIX SYSTEMIC SIGNALS**

The author invented six components as identifiable traits that can be expected of a project performing at a systemic level. These components, in Table 7 below, are used as a metric for locating projects, trait by trait, on a numerical scale of how systemic they are.

The author and her research assistant both engaged in this qualification by watching each of the recorded project presentations at all three experiments and coding them for a binary expression of each of the six systems signals.
### Table 8 Defining Six Systemic Challenges, Design Thinker Attributes, and Evidence of these in the Dataset

<table>
<thead>
<tr>
<th>Defining systemic challenges as problems that:</th>
<th>Design thinking is helpful, because design thinkers:</th>
<th>Evidence of this occurrence can be seen in the dataset where:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are multi-faceted</td>
<td>Teams consider all aspects of the problem</td>
<td>#evaluations #transcripts (especially during empathy and define portions) #presentations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mentions of various parts and remembering important parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#handbook #artifacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mentions team concern for getting to everything</td>
</tr>
<tr>
<td>Involve various people</td>
<td>Teams consider the many people involved in creating change</td>
<td>#evaluations #presentations #transcript</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#handbook #artifacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mention the systems in place to help implement solution</td>
</tr>
<tr>
<td>Involve various processes</td>
<td>Teams consider the many processes involved in creating change</td>
<td>#evaluations #presentations #transcript</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#handbook #artifacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mention the nuances in the process to help implement solution</td>
</tr>
<tr>
<td>Involve multiple dependencies</td>
<td>Teams consider system inter-dependencies</td>
<td>#presentations #transcript #handbook #artifacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• make mention of how their system will impact others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mention how other systems impact them: interrelationships, interdependencies, etc.</td>
</tr>
<tr>
<td>Are not focused on one person, but rather, a body of people</td>
<td>Teams focus on the user and how the user can help invoke systemic change</td>
<td>#presentations #transcript #handbook #artifacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• mentions of understanding that you must focus beyond just one user</td>
</tr>
<tr>
<td>Have impact at a system-wide scale</td>
<td>Team project shows transformation at systemic level</td>
<td>#presentations – From Anderson’s systemic change rubric</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A team focuses on the higher end of the rubric</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A team makes mention to including aspects of the higher end of the rubric</td>
</tr>
</tbody>
</table>

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MATRIX OF SYSTEMIC CHANGE

Research has been done on the classification of the stages of systemic change. According to Anderson’s analysis, there is a continuum of systemic change that can be mapped in a 2D space structured by six developmental stages and six key elements of change (Anderson, 1993). These six stages and elements of change are represented in the figure below for illustration of understanding.

<table>
<thead>
<tr>
<th>ELEMENTS OF CHANGE</th>
<th>MAINTAINENCE OF OLD SYSTEMS</th>
<th>AWARENESS</th>
<th>EXPLORATION</th>
<th>TRANSITION</th>
<th>EMERGENCE OF NEW INFRASTRUCTURE</th>
<th>PREDOMINANCE OF NEW SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUBLIC AND POLITICAL SUPPORT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NETWORKING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEACHING AND LEARNING CHANGES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADMIN ROLES AND RESPONSIBILITIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POLICY ALIGNMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 16 Anderson's continuum matrix of systemic change with six elements of change (going down, in rows) and six developmental stages (across in columns).

Each team presentation was coded and graphed onto Anderson’s continuum matrix. To the author’s knowledge, this is the first time Anderson’s systemic matrix is being applied in an investigation of projects emerging from a design thinking model.
SUMMARY

An overarching Design-Based Research Methodology is used to narrow down and refine the core research question with each iteration. The design of the pilot study of the Education Designathon is described and documented. The design of the Education DesignShop is catalogued. With these events, the research objective matured from challenging how “designerly” a hackathon could become, to later, an optimization of how to most quickly teach non-designers design thinking and most quickly produce re-designs of the education system.

Once data from the DesignShop was collected, the research interest concentrated on studying the effect of design thinking as a transformational tool of participants and projects of the DesignShop. For this investigation, the work is decomposed into what became this thesis’ two major research questions:

1) How do non-designers transform into design thinkers from the DesignShop?

2) How do educational projects from the DesignShop workshop model address systemic changes?

Using definitions of design thinking to outline the characteristics a design thinker should have, eight nested questions are developed to examine the performance of participants and teams that would validate their transformation as design thinkers. The challenges of systemic issues are matched to the attributes of being a design thinker, and six questions are developed as claims for testing which participants’ projects are more systemic and designerly.
CHAPTER 4

PILOT STUDY: DESIGNATHON

The Designathon was the first experimental event designed for this research endeavor. The following sections detail the results of the Designathon event that were later analyzed to inform the design of the next event iteration, the Education DesignShop. In addition, the 11 resulting hacks of the HGSE Hackathon are included as reference material. These projects form a third data set that is later compared for designerly and systemic maturity.

OVERVIEW OF SIXTEEN HACKS

Sixteen projects, or hacks, were demonstrated at the Final Presentations, ranging from a children’s book to a rotating table to a Google Chrome browser extension.

Table 9 Characterization of projects developed at the Education Designathon. a) Average number of team members. b) Hacks that were born at the Designathon and not before. c) Hacks that planned for continuation after the Designathon, according to Feedback Survey.

<table>
<thead>
<tr>
<th>HACKS</th>
<th>DESCRIPTION</th>
<th>TEAM MEMBERS</th>
<th>NEW IDEA</th>
<th>CONTINUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plexx</td>
<td>Portable learning of skills catered to your interests as determined by your activity on social media.</td>
<td>3</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TargetED</td>
<td>Student response system for real-time in-class feedback between students and professor</td>
<td>6</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Terminus</td>
<td>Interactive game run on the terminal of a Linux computer to learn navigation through the operating system</td>
<td>2</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>hack name</td>
<td>description</td>
<td>rating</td>
<td>web</td>
<td>创客化</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Quantum Circuit Simulator</td>
<td>Interactive quantum circuit simulator for use on the edX platform</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>The Little Book of Circuits</td>
<td>Children's book that teaches through interactive circuit elements embedded in the pages</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dynamic Table for Creative</td>
<td>High-top rotating table that syncs to computer screen so that commands are controlled by walking left or right around the table</td>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EduLinks</td>
<td>Dry-erase puzzle pieces assemble into curriculum maps and goals for educators and planners.</td>
<td>1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Arrow Pushing</td>
<td>Interactive software to teach most difficult chemistry theory through games, not assignments</td>
<td>4</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Speak Up!</td>
<td>Program processes audio input to evaluate communication skills</td>
<td>4</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Solar Gaming</td>
<td>Solar car interfaces with remote iLab (MIT) equipment</td>
<td>3</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>CLEAN</td>
<td>Website for collaborative work where solutions are posted to posted projects</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Global KidStory</td>
<td>Website for children to practice basic skills collecting traditional stories worldwide</td>
<td>3</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Dictionary of Numbers</td>
<td>Google Chrome browser extension to translate big numbers into more relatable context based on geography</td>
<td>1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Flipper</td>
<td>Database that takes housekeeping, grading, and working enables more experiential learning inside the classroom when in person</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Orange Narwhals</td>
<td>Build-It-Yourself kit materials that supplement online labs</td>
<td>1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>DropBite</td>
<td>Playful electrolysis circuit demonstration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>2.5</td>
<td>11 of 16</td>
<td>11 of 16</td>
</tr>
</tbody>
</table>

These 16 hacks have been grouped according to mission and core competency under two broad categories: (1) those that intend to facilitate the connection and communication across a learning community, and (2) those that use technology to enable learning within the community.
Table 10 Categorization of the two main types of hacks that emerged from the Designathon

<table>
<thead>
<tr>
<th>Connection &amp; Communication Facilitation</th>
<th>Technology-Enabled Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plexx</td>
<td>TargetEd</td>
</tr>
<tr>
<td>EduLinks</td>
<td>Terminus</td>
</tr>
<tr>
<td>CLEAN</td>
<td>Quantum Circuit Simulator</td>
</tr>
<tr>
<td>Global KidStory</td>
<td>The Little Book of Circuits</td>
</tr>
<tr>
<td>Orange Narwhals</td>
<td>Dynamic Table</td>
</tr>
<tr>
<td></td>
<td>Arrow Pushing</td>
</tr>
<tr>
<td></td>
<td>Speak Up!</td>
</tr>
<tr>
<td></td>
<td>Solar Gaming</td>
</tr>
<tr>
<td></td>
<td>Dictionary of Numbers</td>
</tr>
<tr>
<td></td>
<td>Flipper</td>
</tr>
<tr>
<td></td>
<td>DropBite</td>
</tr>
</tbody>
</table>

The categorization of hacks in Table 10 shows the bias of hackers towards projects that integrated technology to increase learning potential of a community of students or to facilitate the ordinary logistical needs of its users. Indeed, it was non-trivial for hackers to work towards the systemic change that the education needed, at least not from the unguided approach of a hackathon. Figure 17 captures the process of one of the more systemic hacks. On the left, the hacker had just finished mapping out what she considered were important dynamic relationships to capture in the conversations towards modified education systems. This visualization best encompassed System Re-thinking as it justly reflected the philosophical thinking and background instruction needed for proper system design, and is a tool for educators and planners sitting around a table making policy.
Figure 17 EduLinks, a hack by Gina Roberti to capture the direct and indirect influences each player, stakeholder, and theory has within the education system.

Figure 18 Moments captured from the Education Designathon. Clockwise from top left: a) Ed Moriarity from the MIT Edgerton Center engages hackers in a discussion around mobile tools for learning; b) A team discusses their hack’s vision and mission at the whiteboard; c) Olin teammates prototype their DynamicTable hack in the shop; d) Ed Burnell demonstrates his team’s hack, The Little Book of Circuits.
LOGISTICAL FEEDBACK

121 hackers registered through the Eventbrite website, 150 persons showed up at the door the day of the event, and approximately 80 stayed through to the end of the event. The following results are from a wrap-up questionnaire that was circulated among the participants of the event, and 21 of the 80 attendees returned responses. Overall, participants were satisfied with the event and showed a genuine interest in attending the event the next year. Seven of the 16 hacks used physical materials and tools for prototyping. Ten of the 16 hacks reported to be directly influenced by the EdExpert Challenge Presentations, though on a scale of 1 to 5 (where 1 is Very Helpful and 5 is Not at all Helpful), the average score of EdExpert helpfulness was 3.5.

HGSE HACKATHON HACKS

The Harvard Graduate School of Education’s Education Hackthon in October of 2014 was inspired by the online resources already published by the Education Designathon and later, by the Education DesignShop. Like many hackathons, an event registration page was made on the Eventbrite platform.

The format of the event did not require participants to learn, employ, or even practice design thinking. Suggestions were simply made for where in the design thinking process teams should be at different times throughout the event. These cues were implicit in the schedule for the main day, as follows:

• 9am: Breakfast/ Get swag/ Announcements and Team Confirmation
• 9:45am: Get in to your groups; zero in on your problem and identify your audience; determine framework for your solution.
• 10:30am: Begin sketching your solution (mockup, drawing, model)
• 11:00am: Begin testing your sketch, get mentor feedback
• 12:00pm: Lunch Keep iterating! Incorporate feedback
• 5:00pm: Begin thinking about your pitch
• 7:00pm: Go home!

Three event sponsors gave challenges for the hacking teams to address in their hack (teams had to be specific about which of the three challenges they were solving). The event space was not left open overnight. Below provides a brief description of the 11 hacks that were born out of the Hackathon.

Table 11 11 Hacks Emerging from the HGSE Hackathon

<table>
<thead>
<tr>
<th>Team</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ed2Go</td>
<td>Provides parents with any life situation with learning activity</td>
</tr>
<tr>
<td>2</td>
<td>Peak</td>
<td>Android launcher that transforms students’ phone into a learning environment when they're in class</td>
</tr>
<tr>
<td>3</td>
<td>Hacking Hope</td>
<td>Provide homeless with Wi-Fi enabled devices (mobile phones)</td>
</tr>
<tr>
<td>4</td>
<td>edX Beacon</td>
<td>Place beacons linked to edX content in remote learning locations, but starting in museums</td>
</tr>
<tr>
<td>5</td>
<td>WeKnow</td>
<td>Smartphone platform that is accessible on low bandwidth</td>
</tr>
<tr>
<td>6</td>
<td>Lexicon</td>
<td>Literacy testing app</td>
</tr>
<tr>
<td>7</td>
<td>Cloud to Ground</td>
<td>Access to learning in low connectivity areas</td>
</tr>
<tr>
<td>8</td>
<td>KiwiMT</td>
<td>A mobile-friendly multi-task project management tool that provides an overview of group progress and goals</td>
</tr>
<tr>
<td>9</td>
<td>Instacourse</td>
<td>Create online course content more easily</td>
</tr>
<tr>
<td>10</td>
<td>Rivet</td>
<td>App that encourages extracurricular learning through online community, MOOCs for extracurriculars</td>
</tr>
<tr>
<td>11</td>
<td>UpTell</td>
<td>Desegregation through multimedia conversations</td>
</tr>
</tbody>
</table>
SUMMARY

The Education Designathon engaged 80 hackers in an overnight weekend of hacking Three Subtopics within education. Sixteen hacks emerged that reveal two broad categories of intention from hackers: (1) Hacks that intend to facilitate the connection and communication across a learning community, and (2) Hacks that use technology to enable learning within the community.

Observations from the Designathon informed the design of the Education DesignShop, primarily it’s emphasis on integrating design thinking as a problem-solving structure taught to the participants. The HGSE Hackathon takes place a few short months after the Designathon and is highly influenced by the Designathon and DesignShop. The 11 hacks from this hackathon are also presented as they will be compared against other hackathon-like projects on measures of designerly and systemic maturity.
CHAPTER 5

RESULTS

Based on the lessons from the Education Designathon in 2013, the first Education DesignShop, or design thinking workshop, took place on May 3 and 4\textsuperscript{th}, 2014. The DesignShop is a 2-day workshop for interdisciplinary teams to first learn design thinking and then apply it to the education system. It brought together 25 of each students, educators, policymakers, and industry personnel (100 participants in total) to create innovative strategies for implementing solutions in the world of education.

What follows are the resulting 25 team final projects that emerged and mentions of the extensive dataset that this 2-day experience produced. The data is processed under newly developed metrics that look for markers of success in participants as well as in their emerging projects to answer this work’s key questions:

1) \textit{How do non-designers transform into design thinkers from the DesignShop?}

2) \textit{How do educational projects from the DesignShop workshop model address systemic changes?}
DESIGNSHOP: PROJECTS & ORGANIZATION

The Education DesignShop takes the core teaching outside of the traditional classroom and instead brings passionate community members from across the globe for a weekend at the Cambridge Innovation Center. Participants in the experiment ranged from ages 10 to 62, from 6th grade students at a private design thinking school to experienced policymakers in the education sector. Participants were given two days to re-design the education system whilst receiving a crash course on design thinking. Qualitative and quantitative data analysis of our mixed pedagogy and andragogy at the event yield implications for how design thinking may be effectively taught inside and outside of a K-12 classroom.

Overview of Twenty-five Projects

Below is a brief summary of each of the team projects categorized by those team members’ preferences for Topic Challenge.

While teams did not have to adhere to any Topic during the DesignShop, the participants’ ability to rate their preferred Topic of interest gave them agency in their team formation and provided the team with a unifying quality from the beginning. In all but two teams, the four participants shared the same top choice of Topic Challenge.

When these 25 projects were categorized into the kinds of intention behind them, a bias towards community connection and integration appears with 18 of the 25 projects attempting to connect some missing link between teachers, students, community members, industry experts, etc.
<table>
<thead>
<tr>
<th>Topic 1</th>
<th>Topic 2</th>
<th>Topic 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: One Vision: A mobile engineering bus that focuses on teacher development, specifically: curriculum, support group, and resources in your community by connecting everyone through an online site.</td>
<td>10: BIBO (Boxed In, Boxed Out), a series of alternate project prompts delivered in a box made to match the learning style of each student.</td>
<td>18: ALEX: An online, low-cost platform to connect students with mentors in their community that will show them what opportunities they have to work and learn from them. Provides minority students in high school that are good students but unaware of the vast array of resources available with awareness of their mentors’ life choices and career path.</td>
</tr>
<tr>
<td>2: REAL (Relevant Empowered Active Learning), a certification program for middle school students to solve problems in their own lives through Project-Based Learning.</td>
<td>11: Test+ enhances assessment through technology by adding practical observation into standardized testing models.</td>
<td>19: Full STEAM Ahead: An online mobile learning lab that connects classroom experiences with real-world experiences, providing greater access to STEAM opportunities in two key ways: 1) Access to resources for community and students, and 2) Access to curricular resources for educators. A merit-based system would give users badges for uploading and downloading lessons more lessons.</td>
</tr>
<tr>
<td>3: CommuniSchool Mentor Database, a website for professionals in the community to connect with teachers on projects they need help on in order to recruit student help.</td>
<td>12: proTEST! Arts integration in the classroom for fun project-based-learning in the classroom.</td>
<td>20: Machine learning algorithms in a program that turns qualitative data into the quantifiable data, like grades, so that the teachers can use more creative forms of assessment that mimic things that you see in the real world, like interviews, oral presentations, and writing prompts. This would increase the grading consistency and decrease the required time by of teachers’ effort.</td>
</tr>
<tr>
<td>4: matchMake, a website to match up makers and educators that would meet online and share materials with the world.</td>
<td>13: Ingenium, a shipping container filled with prototyping tools that is sent to the middle schools where the teacher is in need of the materials to implement projects for the curriculum.</td>
<td>21: STEM Community Liaison that links schools with STEM programs, the STEM industry looking for future workers, and the families in the community.</td>
</tr>
<tr>
<td>5: EdJAM, an online platform where teachers, students, administrators, and researchers can share best practices to remix lessons and share what worked and didn’t work.</td>
<td>14: LENZ, an arcade in the classroom that provides educational gaming lessons that gives each teacher a personalized timestamp of each child’s performance.</td>
<td></td>
</tr>
<tr>
<td>6: The PlayLab, a modular, shared space for administrators, teachers, and students to come together and play (sing, debate, explore, etc.) to increase creative engagement and curiosity and work collaboratively across the curriculum.</td>
<td>15: OpenBox, a subscription to a community of teachers, industry members, and community members that sends a real-world problem to your classroom as teachers democratically solve the problem with their students.</td>
<td></td>
</tr>
<tr>
<td>7: Truckalytics: A Yelp for “ed mobile trucks” that will tell you information for each potential truck, including: What will you learn?: What’s the value of learning this way?; and What are reliable reviews for this truck?</td>
<td>16: HOT (Hands-On Team Projects), a makerspace that hosts trained facilitators to empower youth in low-resource communities with practical learning opportunities using resources locally available.</td>
<td></td>
</tr>
<tr>
<td>8: Syllabuild: An online tool that allows students and teachers to build curriculum together with its own set of specific questions and resources and ideas. It generates buy-in and ownership of the course before it’s even begun.</td>
<td>17: Fail-Proof Epic Fail Journal, a weatherproof documentation tool for students to learn from their mistakes by encouraging documentation of experiences in a way that will help utilize, visualize, and understand successes and failures.</td>
<td></td>
</tr>
<tr>
<td>9: Catalyst, a program for professional development, sequenced learning, and a sequence of supports that begins</td>
<td>22: P2P Learning Tree: A program where students learn by teaching other students. Thus improving student achievement through greater student ownership and connection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23: The Dalus Network: A social network for education</td>
<td></td>
</tr>
</tbody>
</table>
with a “learning design-a-thon that produces a system of documentation and reflection to be assessed by other learners and educators.

24: LaunchED: A portable classroom that serves as a launch space that encourages students and teachers to collaborate on real world, hands-on projects that instigate learning and engagement by demonstrating the connection between what students are studying and the real world.

where teachers access tutorials made by other teachers and experts. Students build and share portfolios that incentivizes them to be creative. Access into the network lets users see what students are making, learning, and solutions on how solve certain things. Donors would be able to see where the need is the greatest, while students would be applying their social media and advertising skills.

25: Mix it Up Fridays, A cross-disciplinary course prompted by students who develop projects at the intersection of two disciplines.

Table 13 Education DesignShop Projects Categorized by Intention

<table>
<thead>
<tr>
<th>Connection &amp; Communication Facilitation</th>
<th>Enhanced Learning Experiences</th>
<th>Technology-Enhanced Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One Vision</td>
<td>10. BIBO</td>
<td>11. test+</td>
</tr>
<tr>
<td>2. REAL</td>
<td>12. proTEST!</td>
<td>20. Machine Learning</td>
</tr>
<tr>
<td>3. CommuniSchool Mentor Database</td>
<td>14. Lenz</td>
<td></td>
</tr>
<tr>
<td>4. matchMake</td>
<td>17. Fail-Proof Epic Fail Journal</td>
<td></td>
</tr>
<tr>
<td>5. EdJAM</td>
<td>25. Mix it Up Fridays</td>
<td></td>
</tr>
<tr>
<td>6. The PlayLab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Truckalytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Syllabuild</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Catalyst</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Ingenium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. OpenBox</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. HOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. ALEx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Full STEAM Ahead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. STEM Community Liaison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. P2P Learning Tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. The Dalus Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. LaunchEd</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It is interesting to note that of these 25 resulting projects, 15 were related to the maker-movement, digital fabrication, and/or hands-on learning. These are teams 2-6, 9-10, 13-17, 21, and 24-25. The fact that the majority (15 of the 25) of team projects were in some way part of the family of maker-movement/digital fabrication/hands-on learning ideals suggests that the maker
model is both engaged and reinforced with the format of the DesignShop. The maker spirit of the DesignShop allowed for people to be reminded of how powerful hands-on learning could be as they did it themselves. We believe the modules at the DesignShop reminded participants of the joys and efficacy of hands-on learning that resonate with the standards and beliefs of a maker education wherein you develop something on your own. The exception here was that with the DesignShop, some of these systemic solutions may resort to being abstract, conceptual, or even organizational, instead of easily materializing into a single tangible product. Nonetheless, the same maker spirit of discovery, exploration, and ingenuity presides. All 25 team projects, documentation of their development throughout the two days, and the Team’s Final Presentation are available on the gallery page at www.EduDesignShop.MIT.edu/gallery.html. Figure 19 above displays some of the formative moments throughout the DesignShop.
TRANSFORMATION OF NON-DESIGNERS INTO DESIGN THINKERS

Adherence to Design Thinking Stages: Aggregates at each step

The weighted charts in Figure 20 through Figure 24 illustrate the depth of appreciation that participants used when referencing each step in their survey responses. This depth is reported on a scale of 0-3 where a 0 is a no mention, a 1 reports a slight mention, almost as if to check off a box that mentions the step in the process; a 2 reports a significant mention of the process, it’s importance, and/or how it might be executed; and a 3 reflects a deep appreciation of the step, some potential methods of execution, or even reasons why it is important and warranted at the moment. Example answers during the Event Surveys and they’re rating would be:

- 0: Participant fails to mention any term or notion to suggest that they would employ “empathy” as part of their problem-solving process
- 1: Participant lists: “Step 1. Empathy”
- 2: Participant says: “I would empathize with my user through observation.”
- 3: Participant elaborates: “I would first visit my user in the field to observe them in their natural environment and be able to build empathy with their situation. I would take one-on-one interviews first, followed by a group interview of the community… [after explaining that they would build a prototype]…I would go back to my user and have them interact with the prototype to understand where the improvement opportunities lie.”
Figure 20 Percentage comparison of participants at each depth of implementation for the design thinking process step of Empathy. Here, a 0 represents no mention of the step and a 1 through 3 represent increasing depths of referencing.

Figure 21 Percentage comparison of participants at each depth of implementation for the design thinking process step of Define. Here, a 0 represents no mention of the step and a 1 through 3 represent increasing depths of referencing.
Figure 22 Percentage comparison of number of participants at each depth of implementation for the design thinking process step of Ideate. Here, a 0 represents no mention of the step and a 1 through 3 represent increasing depths of referencing.

Figure 23 Percentage comparison of number of participants at each depth of implementation for the design thinking process step of Prototype. Here, a 0 represents no mention of the step and a 1 through 3 represent increasing depths of referencing.
Figure 24 Percentage comparison of number of participants at each depth of implementation for the design thinking process step of Test. Here, a 0 represents no mention of the step and a 1 through 3 represent increasing depths of referencing.

Table 14 Inter-rater reliability percentage of agreement for averaged depth of understanding in each of the five process steps referenced in participant responses, across all three sets of data.

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>Empathy</th>
<th>Ideate</th>
<th>Define</th>
<th>Prototype</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Event</td>
<td>62.3</td>
<td>70.1</td>
<td>51.2</td>
<td>94.4</td>
<td>66.2</td>
</tr>
<tr>
<td>Post-Event</td>
<td>92.4</td>
<td>65.4</td>
<td>46.1</td>
<td>63.2</td>
<td>69.4</td>
</tr>
<tr>
<td>Post-Post-Event</td>
<td>59.8</td>
<td>74.4</td>
<td>66.5</td>
<td>68.6</td>
<td>82.4</td>
</tr>
</tbody>
</table>

Table 14 denotes the percent of agreement in the averaged weights of each step for each set of participant data. Each participant’s overall weight of appreciation for each design thinking stage was given as a percentage of the number of people placing at that overall weight. Then, for each design thinking stage, a weighted average of depth of appreciation was taken that represents the entire cohort’s depth of appreciation for that design thinking stage. This was done for all five design thinking stages, and for all three events. The figure shows how the participants transformed, as a cohort, in their overall depths of appreciation for each design thinking stage.
Adherence to Design Thinking Stages: Chronological Arc

Below is a time-lapse view of the chronological flow through the aggregate set of participants’ evaluations, comparing their answers in the Pre-Event Surveys (Figure 25), in the Post-Event Surveys (Figure 26), and in the Post-Post-Event Surveys (Figure 27). In this matrix layout, each bubble represents a node in the survey response where each number denotes how many participants mentioned that process in that order. The columns represent the chronological step over time. The rows represent one of the five steps in the process. In this representation, an ideal response that follows the design thinking process in perfect order (Empathy first, Define second, Ideate third, Prototype fourth, and Test fifth) would be shown in the diagonal form of an Identity Matrix, moving from Empathy in the top left corner denoting their first step, and ending with Test in the last bubble, row five, column five. The circle graph around each node overlays a gradient of the weights of each of those responses. That is, of the 32 participants in the Pre-Event Survey (Figure 25) that responded first with Empathy, 29.2 percent answered with such few examples that they were categorized at a weight, or depth, of 1 (represented by the light color), another 29.2 percent answered a bit more thoroughly and were categorized at a weight of 2 (the intermediate color), and 41.7 percent responded with sufficient examples and proficiency that they were given a depth of 3 (the darkest color).
Figure 25 Chronological flow of design thinking process within participants' responses in the Pre-Event Survey; n=93 participants.
Figure 26 Chronological flow of design thinking process within participants’ responses in the Post-Event Survey; n=85.
Figure 27 Chronological flow of design thinking process within participants' responses in the Post-Post-Event Survey; n=44.
To aide in the visualization of the evolution of the participants’ design thinking into a chronological flow as our process dictates, a conditional format was applied to the tables in Figure 28 below— the darker the blue, the greater the number of people that responded with that design thinking step for that step. The number of people that mention said design thinking stage are reported as a percentage of the number of participants that responded under the “Step X” column. The depths of appreciation each person had in their response are all averaged together into the “Weight” columns.

As event tables move from Pre-Event to Post-Event to Post-Post-Event, there is convergence of shading towards fewer hues of blues, that is, more participants are converging towards the same design thinking stages at each step. Furthermore, these blue cells are trending towards a downward slope, which aligns with the chronological order of a design thinking process. That is, as time passed, an increasing number of participants answered their design challenges in a format that follows a design thinking process.
Figure 28 Percentage of responders at each step and their averaged weights, with the formatting to highlight the biggest concentrations of participants at each design thinking stage for all three surveys: Pre-Event (top), Post-Event (middle), and Post-Post-Event (bottom).
CREATION OF MORE SYSTEMIC & DESIGNERLY PROJECTS

Six Systemic Signals

As was mentioned in the Methods Chapter, six characterizations have been invented to aide in identifying how designerly a project is. The author and her research assistant both engaged in independent binary coding of the projects from all three events, again in chronological order, the Education Designathon, the Education DesignShop, and the HGSE Education Hackathon. The inter-rater reliability coefficients for this coding practice are presented in Table 15.

<table>
<thead>
<tr>
<th>Research Claim</th>
<th>Cohen Kappa Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Teams consider all aspects of the problem</td>
<td>0.68</td>
</tr>
<tr>
<td>2.2 Teams consider the many people involved in creating change</td>
<td>0.72</td>
</tr>
<tr>
<td>2.3 Teams consider the many processes involved in creating change</td>
<td>0.74</td>
</tr>
<tr>
<td>2.4 Teams consider system inter-dependencies</td>
<td>0.70</td>
</tr>
<tr>
<td>2.5 Teams focus on the user and how the user can help invoke systemic change</td>
<td>0.42</td>
</tr>
<tr>
<td>2.6 Team project shows transformation at systemic level</td>
<td>0.62</td>
</tr>
</tbody>
</table>

The agreement across readers shows a promising understanding of team’s projects, but the low score of agreement on Research Claim 2.5 highlights the difficulty with interpreting a project that can "invoke systemic change." These areas demonstrated that projects produced by participants had much more focus on how to subsequently take the ideas they had developed over the weekend and put them into production. They also showed that they were much more focused on the systems that their projects could potentially disrupt and create change within. As you can see from Figure 29 through Figure 34 (representations of one reader’s coding), the projects from the DesignShop showed a considerably higher percentage of awareness that projects needed to focus on the many people and processes that work together to entice change. Similarly, projects from the DesignShop showed significant success at developing projects that
showed transformation at the systemic level (meaning that they were not one-off hackathon type products) and that there was obvious focus on the user that would be ultimately interacting with their work (see Figure 34 and Figure 33).

![Figure 29 Percent comparison of teams that did and did not consider all aspects of the problem in their project presentations.](image)

![Figure 30 Percent comparison of teams that did and did not consider all people involved in creating change in their project presentations.](image)
Figure 31 Percent comparison of teams that did and did not consider the many processes in creating change in their project presentations.

Figure 32 Percent comparison of teams that did and did not consider system interdependencies in their project presentations.

Figure 33 Percent comparison of teams that did or did not focus on the user and how the user can affect systemic change in their project presentations.
Matrix of Systemic Change

In Anderson’s continuum, “better projects,” or, projects that are more sophisticated in their thoroughness to affect systemic change lie on the bottom right of the matrix as these would have thought of the policy alignment that would enable the predominance of a new system. Upon reviewing the final projects of the teams across the three separate events and evaluating them on the breadth and depth that their projects took, it is apparent that the DesignShop brought out a greater number of teams that exhibit higher sophistication for instituting change with their projects. Compared to the DesignShop (see Figure 36), both the Designathon and the HGSE Hackathon (see Figure 35 and Figure 37, respectively) contained projects that had lower developmental stages than those of the DesignShop.
Figure 35 Anderson's Continuum Matrix of systematic project dependencies of Designathon teams.

Figure 36 Anderson's Continuum Matrix of systematic project dependencies of DesignShop teams.
### SUMMARY

The 25 projects born out of the Education DesignShop are categorized for their insight into the categories of projects that 100 passionate, design thinking-charged participants converged on. Participant Survey Data is coded to decipher individual transformations of these non-designers into design thinkers. Projects are coded for the six novel qualities of designerly projects. Anderson’s Matrix of Systemic Change is used to place each project emerging from the three different events somewhere on the continuum of sophistication.
CHAPTER 6

FINDINGS

Hackathons are observed and experimented with such that 14 ingredients are discovered in the recipe for success. The core difference between hacking and designing is found to be the extent of which the team is able to engage in problem identification and brainstorming. Models of innovation and a set of independent variables are suggested that relate solutions emerging from three core problem-solving environments: Research projects, Hackathons, and Designathons or DesignShops.

The DesignShop experiment produced 25 redesigns of education. The event parameters were synthesized into Eight key features that distinguish the modified features of this event from other hackathon types.

Quantitative and qualitative assessments are used to show the transformation of the DesignShop participants into successful design thinkers, as evidenced by their increased convergence to the process and their increasingly sophisticated use of design thinking elements. When addressing the ability of teams to look at systemic change, it is found that the DesignShop model clearly helped to transform participants to think about and create projects that kept scalability and longevity, especially when compared with projects from the Education Designathon and the HGSE Hackathon. The DesignShop projects excel in attributes of both
designerly projects and systemic change. This analysis led to a characterization of what a design thinker looks like, and what designerly projects look like.

**THE EDUCATION DESIGNATHON**

The Education Designathon supplements a traditional hackathon by incorporating two new sub-topics—Hands-On Learning and Systems Re-thinking— to the more common topic, Digital Learning. That is, it invites hackers to expand their hacking mindset outside of the of the usual software-based hack space. To attract a new kind of audience to the two new sub-topics, the name was adapted from hackathon to “Designathon.” It became increasingly clear during post-event analysis that the emphasis on design, and the elements inherent in the design process, differentiated low-level hacks from systemic and feasible re-designs of the education system.

*Event Structures as Recipes*

The author engaged in a variety of methods to become familiar with hackathons, a combination of (1) reviews of previous hackathons’ formats, (2) first-hand observations from participating in hackathons, (3) conversations with hackathon organizers, and (4) going through the exercise of planning, designing, and structuring a new hybrid version of a hackathon. From these combined methods, 14 ingredients were identified in the recipe of hackathons (and its new cousin, Designathons):
<table>
<thead>
<tr>
<th>14 Ingredients Hackathon Success</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Length of event</td>
<td>How many hours of hacking are there going to be in this marathon?</td>
</tr>
<tr>
<td>2. Overnight stay</td>
<td>Most hackathons are overnight. Will there be sleeping pods? Late night access to space and/or machinery? Will the building be open to come back in if you leave halfway for a break? Are you providing housing for out-of-town participants, perhaps through volunteer students on campus?</td>
</tr>
<tr>
<td>3. Number of participants</td>
<td>Will there be a cap? Will security detail allow you to take door sign-ups or only pre-registered participants? What does the cap depend on?</td>
</tr>
<tr>
<td>4. Application process</td>
<td>Will this be an open or closed event? Will you host the event registration on the more common HackerLeague or Eventbrite websites? Will you gather their information as part of an investigation? Will this require Institutional Review Board approval?</td>
</tr>
<tr>
<td>5. Award incentives</td>
<td>Will hack prizes be tied to sponsors of the event? Will monetary awards be a cash prize or a reimbursable stipend for participants to invest into their projects? Beyond monetary, can prizes support the execution of the hacks or projects in other ways: mentorship, coaching, first-round interviews into an incubator, etc.? Will a rubric for the top placing hacks be revealed at the event?</td>
</tr>
<tr>
<td>6. Mentorship provided</td>
<td>Will this come from sponsors, volunteers, “experts” in the community? Will there be facilitation of finding each other during the event: a match-making platform for the questions to find the answers? Will mentorship or feedback-seeking be mandatory to the hack? Will this be part of the scoring rubric?</td>
</tr>
<tr>
<td>7. Workshops offered</td>
<td>Will these come from sponsors, volunteers, “experts” in the community? Will they be pre-planned ahead of time, or offered upon request throughout the event in an “un-conference” format? Will these workshops occur before or after teams have formed? At the beginning of the event, potentially before teams know what they need, but to serve as an inspiration to them, or mid-way through the event with more specific purpose? Will you be able to forecast what needs the hackers will have?</td>
</tr>
<tr>
<td>8. Theme delineation</td>
<td>What will unify and attract your intended audience of hackers? Is the problem and theme encompassing enough to attract the levels of interest and expertise you’re looking for? Are you using language that will appeal to all users (small children and seniors, alike)? Will there be have one theme, or sub-themes? Will the theme narrow the focus or leave an open field of application and instead be around a tool development?</td>
</tr>
<tr>
<td>9. Challenge Presentation</td>
<td>Will this be up to the sponsor or combination thereof? Will hackers be allowed to come up with their own challenges? What information will be provided to the hackers to support their investigations of this challenge?</td>
</tr>
<tr>
<td>10. Team formation mechanism</td>
<td>Will teams be pre-assembled by the organizer or left to the hackers to form? Will this formation be left to whatever organic process the crowd decides, or will there be facilitation to help communicate interests by similar groups?</td>
</tr>
<tr>
<td>11. Project selection</td>
<td>Will there be a recommended process teams should follow in order to select their projects? Will teams be assigned a project that is unique to their team or might multiple teams work on the same challenges?</td>
</tr>
<tr>
<td>12. Medium of deliverable</td>
<td>Will there be requirements for the deliverable to be web-based, app-based, program-based, a physical prototype, etc.? Will this requirement inform a requirement for the hackers to use certain tools during their hacking process (from prototyping tools in the shop to sponsor-provided API’s or datasets)?</td>
</tr>
<tr>
<td>13. End-user</td>
<td>Will there be an opportunity or requirement for the hackers to interface with the</td>
</tr>
</tbody>
</table>
Overall, these 14 variables combine for what will make a hackathon an enjoyable experience. It’s important to note that a dependent variable that is not on this list, but an essential by-product of how these ingredients come together is fun: How much fun the event turns out to be will determine its reputation amongst hacker circles (in person and on the internet) which will, in turn, determine the probability of success for the second round of the event.

These ingredients can be seen as dials that are tweaked by organizers and sponsors of the event to achieve the environment most conducive to their goal. It is up to the organizers of the hackathon (or research designer, in this case) to delineate the scope of the hackathon by varying these 14 parameters.

Benefits of Designathons Serving Education: Making the Big Picture Enticing Again

Hackathons provide a getaway for coders and developers where they can focus ideation on the challenge before them without exterior distractions. As a hobby space for these ideas, the hackathon relieves the pressure that comes with similar processes, like in the job market where one’s employment might depend on the success of the idea. With this liberation comes a dismissal of the fear to fail and an open, fun idea development environment is born where creativity is welcome and more likely to lead to useful engagements. The time constraint of having less than 48 hours to go from ideation to prototype pressures the hackers to work more efficiently, learn more efficiently, and work with clear direction for a chance to meet their
deadline. Hackathons make their theme or challenge area “hackable” by granting access in ways that would otherwise not be open. Application programming interfaces, or API’s, are developed by industry leaders to make data sets available. The more hackable the challenge, the more freedom there is to exercise creativity and the fewer boundaries delimit solutions.

**Observed Behaviors: Hacking vs. Designing**

When organizing an event like a hackathon, it is critical to find the right question the event is trying to answer, and then the right model can be chosen by mixing the 14 afore mentioned ingredients. In the education space especially, the right question may be between a rock and a hard problem: a rock, like a hack that is kickable, can come in the form of a physical product demoed at the end of the hackathon, and the hard problem, innately intangible, is the complexity of scale in education that gets in the way of a kickable solution. Hacking a system like education challenges the traditional format of hackathons to create a quick, often tangible or testable, hack that can be demoed at the end of a weekend.

To re-think education at a system level requires more adherence to the design process than is usually practiced at hackathons. Key stages of this process include problem identification, brainstorming, research, prototyping, end-user feedback, refined prototyping, and evaluation. Hacking is but one of the components of the design process, effectively the prototyping stage. While it’s true that some ideating and brainstorming are necessary before any hacking can take place, a product will fit a theme best when the idea has been well-developed through critically thorough brainstorming and background research to identify the correct problem, especially when the end product is meant to fit into a complex system like education.
Problem Identification & Brainstorming: A Case for Formative Assessment

Affecting a system as large and complex as education should be seen as a design challenge rather than a hack challenge so that emphasis is placed on the initial stages of problem identification and brainstorming that are otherwise minimized in the “More Hack – Less Yack” (Schmidt, 2013) spirit of hackathons. It was appropriate for the Designathon to use its name change to draw emphasis on the more “designerly” mindset than the hacking mindset.

Observations of projects emergent from the Designathon, in conjunction with freelance mentorship of design teams in 2.009, indicate that the design stages of problem identification and brainstorming are most critical to the resulting quality of the product, or hack. The time and attention lent to these two stages differentiate between whether the participant is hacking or designing, and are critical to the quality of the hack developed.

Hackers approach the problem identification process by conducting a formative assessment that allows them to identify the causal variables at play and their relation to the challenge, as opposed to an otherwise summative assessment that would use pre-identified variables to try and alter the challenge. For example, a summative lesson on the physics of projectile motion would give the student the right kinematic equations and ask them to solve for x, the distance travelled, for given inputs of velocity, projectile mass, and gravity. A formative approach to the same lesson, however, would give the student the same inputs, this time including x, the distance travelled, and ask them to return the kinematics equation that governs the projectile’s trajectory as they play with the projectile. Similarly, rather than shy away from the large scale of education, one could break down the system into statistics that capture each failure. The Designathon would then open with 10 pre-chosen statistics and simply challenge the participants to hack away in order to improve these statistics. This formative assessment of the statistic leaves it to the hacker
to identify variables of influence and the interrelationships that lead to that statistic. The hacker
then hacks around their equation in an effort to affect change.

After conducting formative problem identification of the challenges, brainstorming is the
next most critical component of the Designathon as it maximizes the use of the diverse
backgrounds present at the hackathon. A successful performance at this stage looks like the
format of a charrette, a design-based, accelerated collaborative coined after the French term of
working up to the last minute (Institute, 2011). Charrettes have proved effective for
interdisciplinary groups working on a systemic issue with multi-objectives and multi-attributes.
Charrettes are an example that the expectation of some kind of tangible product at the end of the
event is significantly helpful in moving down the creativity and design process and not getting
stuck at philosophical discussions. Herein lies the multi-attribute challenge in Designathon
structure: valuing unique formative problem identification; generating as many diversified ideas
as possible; and pressuring results as tangible as possible (in a traditionally “unkickable” system).
Charrette formats are worth considering for inclusion in standard professional development and
training for staff members who would benefit from strategies for problem-solving.

The problem identification and brainstorming stages of problem-solving underline the
starkest differences between what is achieved in previous approaches and what is achieved in
design thinking practices. Non-designers tend to the dynamic of judgmental interference wherein
they cut ideas short of their creative potential and do not give them the chance to grow, develop,
or even transform into something that might be a suitable, if not great, solution.

This judgmental interference is unnecessary and detrimental at the brainstorming stage as it
truncates ideas while it is too early to know whether or not they could have become a viable
possibility. This truncation can come from endless pre-dispositions that are inherent to the
brainstormer’s psyche. Among these, the brainstormer can suffer from too much attention to pre-constructed limits (boundary conditions, assumed lack of access or zone of influence, lists of requirements), and/or from pathologically imposed constraints (complacency with the status quo, inherent resistance to change, unyielding preferences, fear of failure, judgment, unexpected consequences, and lacking the impetus for change). A design thinking mentality, then, is exactly the antithesis of judgment interference. Elements common to brainstorming under a positive design thinking mentality include: a vision-based set of goals, an experience-based specification sheet (as opposed to a constraint-based specification sheet), comfort with being risk averse, no judgment zones, and the perspiration of not giving up.

Figure 38 describes other elements of design thinking seen through the steps of the design process. It is important to note that many teams may go through the steps of the design process and still not practice design thinking. Design thinking is more than just a series of prescribed motions; it is an inherent re-wiring of thought that requires complete mental reform from the obstructions we have created in our brains in order to see pathways we would have otherwise not discovered.

Figure 38 A roadmap of the design process (black) and their inherent elements of design thinking (grey), beginning with Problem Identification, original work of the author.
**Modeling the Dynamics of Problem-Solving Spaces**

We often straddle one of two spaces when problem-solving: quick and weak solutions, or lengthy and worthy solutions. Nobody likes lengthy and weak solutions, and quick and worthy is infinitely harder to attain. Ideal Designathon event structures would use the ingredients of a hackathon to move the results generated from quadrant III to quadrant II, toward the quick and worthy results (See Figure 39).

![Figure 39 Regimes of results under different problem-solving events.](image)

Hackathons, Designathons, and traditional research endeavors all reach their goal of good results on different event time-horizons, or lengths of time allotted to the problem-solving.

While it is clear that the quality of solutions, or hacks, developed will increase with the amount of time spent on the problem, the relationship that governs these 14 ingredients parameterized over time to achieve quality results remains unclear. Figure 40 delineates a suggested relationship between Q, the quality of the results and t, the time spent hacking at that event. Our observation suggests that Quality is a function of the log of time, or $Q \propto \log(t)$, where $t_H$, $t_D$, 

105
and $t_R$ represent the optimized event time horizons for hackathons, Designathons, and traditional research, respectively. The plot reflects the inherent high yield scenarios for hackathons that are short in length but powerful in output. The y-axis marks the expected solutions: a basic solution meets predetermined functional requirements but does not show depth in thought or sophistication in the idea generated; an advanced solution shows depth of thought in problem identification, well thought-out and researched ideas, and potentially some end-user generated feedback that’s led to reiterations of the product; a proven solution would have also tested and evaluated the solution multiple times before releasing a solution. It is the goal of Designathons to use the interdisciplinary backgrounds of the participants and the pressure for some medium of a deliverable to force the flow of creativity and accelerate through the stages of problem identification and brainstorm, even if there is no time for testing and re-iterating.

![Figure 40 Proposed relationship of quality results and event time horizons for three approaches to problem-solving: hackathons, Designathons, and research.](image)

Once this relationship is understood, the next step towards assessment is to identify metrics to measure impact or success. These events strive to maximize the longevity factor—the life of
the product pursued after the event— and impact factor— the influence, or potential of influence, of the product from the event— of hacks. What are unclear are the variables that govern these two factors and increase yields. Hacks also fall into a hybrid category of product and research, and as such can borrow assessment methodologies from both fields. Once determined, these event time horizons and the average budgets allocated for each can be used in a cost benefit analysis for policy makers to better understand the expectations of their investments.

Though the Designathon attempted to have people focus on the critical stages of problem identification and brainstorming, simply urging the participants to focus on these was not enough to produce hacks that were considerate enough of the systems they were to be implemented in. These projects, with a lack of focus on clarity, feasibility, and need-appropriation, were not “designerly” enough.

**UNIQUE FEATURES OF THE EDUCATION DESIGNSHOP**

Four central principles for successful innovation guided the design parameters of the event. First, we build up from the premise that design thinking leads to innovative solutions, as is underlined in the many case studies Tim Brown provides in Change by Design (Brown, 2009). Secondly, as Brown points out, an underlying theme to innovative individuals is that they have built the creative confidence be think they are able and capable of producing new, never before seen solutions. Thirdly, innovators need more than the experience or the want to create change, they need the toolsets (both material resources and mental skills) to innovate. Among these, prototyping materials and an expansive capacity to see beyond the obstacles before you, are critical. Finally, the ideal innovator is a “T-person”, one that combines depth of experience (the vertical line) with a breadth of knowledge (the horizontal line).
With these values in mind, we created a unique, two-day event with an array of modules and resources for the participants. What emerged is a proof of concept for the right recipe of future innovation hubs, or workshop-type events: a rigorous adherence to design thinking, maintaining the excitement of hackathons, and layering years of experience through mentorship. The sections below describe some of the key elements that differentiate the DesignShop from similar hackathons or workshops. The findings are summarized in Table 17 below, along with the intuition that grew from these extensive observations.
<table>
<thead>
<tr>
<th>Eight Key Features of the Education DesignShop</th>
<th>Attributes</th>
</tr>
</thead>
</table>
| 1. Three topics attract similar minded individuals | • Ability to hit the ground running - knowledge of previous resources  
• Overlapping interests  
• Collective hype  
• Helpful when there is only a small amount of time to work together  
• **Value**: Connecting people together fast |
| 2. Open community of information dissemination | • Pool of common knowledge  
• Able to connect references  
• Gives participants a place to scaffold their knowledge and interests in subject area before arriving  
• Gives organizer less work to do in terms of figuring out/determining/structuring the event based on assumptions  
• **Value**: Able to find connections in an abundance of information  
• **Value**: Quick debrief on background of event |
| 3. Method to pre-assemble interdisciplinary teams | • Learn from each other  
• Gain different perspectives  
• Learn to connect  
• **Value**: Connecting and learning from others. |
| 4. Hands-on modules fostering design thinking | • Deeper learning of content and skills  
• **Value**: Solid understanding of practice and deliberate actions taken |
| 5. Flat hierarchy of mentorship throughout | • Take on fresh perspectives  
• Equally taking into account the perspectives of novices and those with years of experience  
• breadth and depth  
• You don’t know from whom you are going to extract the next thing you need  
• **Value**: All experiences are valid and useful |
| 6. Materials resources vast and available | • Gives structure to ideas  
• Decrease cognitive load  
• Guide conversation, express idea, show emphasis  
• Make ideas concrete  
• Better communicate emphasis, structure  
• **Value**: Using physical materials to structure your thoughts  
• **Value**: Understanding that different people have different constructs of the world they live in |
| 7. Prize-enabled continuation & execution | • Makes design challenge more real life, demanding to be taken seriously  
• Projects will be ready with extra push for real life/world  
• Sets participants on pipeline of scope of project  
• Shows that projects are valid and useful  
• Makes project execution a possibility for everyone, regardless of their |
monetary status

- **Value:** Celebrates ideas, rewards action

| 8. Encouraging "easter eggs" as delights throughout | - People learn better when they think you are excited to teach them  
- People learn better when they are excited  
- People see that you care and you are trying to shape a learning experience for them  
- Makes people feel like there is a greater importance of what they are doing  
- **Value:** people learn better since their learning environment is exciting and caring towards them |

## 1. THREE TOPICS ATTRACT SIMILAR-MINDED INDIVIDUALS

We begin the dissemination of the DesignShop with the idea that a participant will work in one of 3 Topic tracks: (1) Curriculum re-Design for STE(A)M, Integrating arts into STEM education; (2) Motivational structures in & out of the classroom; and (3) Resources and support structures for retention & diversity. While participants were not asked to innovate only within these topics at the DesignShop, reporting an ordered topic of interest in one’s application guaranteed that pre-assembled teams would share similar sub-thematic interests from the beginning. On the event website, each of the three Topics had its own list of questions meant to stimulate discussion and interest in the topic— and clarify the line of thought behind each— and each had its own 3-4 minute video. These videos were compilations of 21 interviews conducted with experts and users in some key facet of the education space. The videos told the story of each Topic and shared relevant information and inspiring opinions on the implementation of the Topic area at the DesignShop. Each of the three videos were embedded into the application for the DesignShop to facilitate the selection of the preferred Topics.
Table 18 Three Topics and Description of the Education DesignShop

<table>
<thead>
<tr>
<th>Curriculum Re-Design for STE(A)M - Integrating Arts into STEM Education</th>
<th>Motivational Structures In &amp; Out of the Classroom</th>
<th>Resources and Support Structures for Retention &amp; Diversity</th>
</tr>
</thead>
</table>
| Curriculum for all levels, in formal and informal learning environments, and spanning all learning methodologies. Participants in this Design Focus will attempt the humble challenge of deciphering re-vamps to the curriculum, all the while considering some of the biggest challenges present:  
  • How do we integrate the arts back into education? What new overlaps can we make between these fields?  
  • What does the STEAM curriculum of the future look like?  
  • What tools, projects, and resources can be made to facilitate this marriage?  
  • How might students work with accreditation officials to customize their curriculums?  
  • How might proper evaluation criteria emerge for interdisciplinary learning? | Participants in this Design Focus will spend their weekend redesigning the manifestations of raw inspiration throughout our education system. The kinds of questions that'll be motivating them include:  
  • What does the 2020 classroom look like?  
  • Flipped classrooms, MOOCs, Maker spaces, what's next?  
  • How can a hands-on curriculum be emulated in low-resource schools?  
  • STE(A)M fields as degrees lacking graduate work: should we address this in the curriculum?  
  • How can we make learning more appealing to a generation of increasingly busier students?  
  • What will happen to the changing landscape of technical vocations and comprehensive educations?  
  • Formal and informal learning: How can the two augment each other? | The fallout of extremist learning populations, the melding of inner and outer curricular support programs, and bridges from societal structures. Participants in this Design Focus will attempt to tackle complex problems, including:  
  • How can we increase low-income students in the higher education pipeline?  
  • How do we attract more students to STEM fields?  
  • How do we make parents a positive pillar of support?  
  • Can perception and social dynamics for women be improved?  
  • How might the Maker Movement be leveraged for resources to students?  
  • Are there Alternative Learning plans that can be adapted for wider audiences? |

2. OPEN COMMUNITY OF INFORMATION DISSEMINATION

The event had a promotional, informational website (www.EduDesignShop.MIT.edu) complete with a 1-minute trailer for the event (essential snippets from the 21 interviews) and even a twitter feed. Screenshots of this website can be seen in APPENDIX A. As it was important to uphold values of open communication, the 21 interviews were transcribed and posted online for the later chosen participants to have access to (not just the clips used in the Topic videos). These
transcripts were tagged and commented on to begin discussion of the ideas, and then participants were asked, as preparatory “homework” to choose two of the interviews to comment through and begin to share resources. The transcripts were hosted on Google Docs and disseminated as links on the Google+ Community Page for participants, mentors, and Team Facilitators of the DesignShop.

3. METHOD TO PRE-ASSEMBLE INTERDISCIPLINARY TEAMS

Design thinking is synonymous with user-centered design. This means that to innovate with a chance of proper adoption, the problem solvers need to work with the users of the product. In this case, the middle man was eliminated by developing the user to be the very problem solver by teaching them design thinking. Then, in order to ensure multiple perspectives in each team of problem solvers, teams of four were pre-assembled to have one stakeholder from each leg of the education system: one educator, one student, one policy maker, and one engineer/designer/entrepreneur. These disciplines were self-reported in a rating system as part of the application. The allocation of teams was based on three categories: their Discipline, their Initial Mean Design Score, and their ranking of DesignShop Topics. All 100 participants were assigned one of four disciplines (Educator, Student, Policy Maker, or Entrepreneur) based on their application responses. For each participant, an Initial Mean Design Score was calculated as the mean of five different self-ranked design thinking skills:

1. Rapid Prototyping,
2. Sketching,
3. Using Post-Its,
4. Brainstorming in Groups, and
5. Expressing Ideas Through Lego’s.
Each skill was ranked a whole number from one to five, with one being the least comfortable or inexperienced. The Initial Mean Design Score was the average of all five self-ranked skill levels. Finally, in the application, the participants were asked to select their first, second, and third choice of challenge Topics to work in. First, each participant was grouped into one of three Topics based on their first choice of DesignShop Topic. This first grouping was done to provide a common interest topic between each group created, even though the actual DesignShop never again stressed the need of sticking within that topic area. Within each topic, teams of four participants were created by a participant from each discipline type into each team of four. A Team Mean Design Score was then calculated as the average of each of the member’s Initial Mean Design Score. The residual term, in this case, became the difference between the Team Mean Design Score and the average of all the Initial Mean Design Scores within that particular Topic. Next, the Residual Sum of Squares—the sum of the squares of residual terms for teams in all three Topics—was used as the indicator value for this particular permutation of participants. This method of allocating participants into teams was repeated until settling for the set with the smallest Residual Sum of Squares.

4. HANDS-ON MODULES FOSTERING DESIGN THINKING

As design thinking would have it, the workshop modules at the DesignShop were designed to be interactive and hands-on in order to facilitate the quickest turnover rate from learning design thinking to applying the same principles. There were four types of modules that occurred over the two days at the DesignShop: a one-way speech, a workshop with some interactive exercises and questions for participants, a tutorial given by Professor David R. Wallace on tangible skills, and a team activity often moderated by a Team Facilitator. Next to each module listed in Table 20 is the number of votes received by the first 66 respondents (as many as were available at the
time of this paper) of the Feedback Survey immediately after the event when presented with this list and asked “If you had to do it again, which of these would you keep the same and NOT change?” In the top half of most voted modules lie both tutorials, while the least voted event was the opening Keynote Speech delivered by Massachusetts Secretary of Education Matthew Malone. While there are contentions to the truth in this dataset—most modules fit tightly within a 17-vote range (from 27 to 44); it is unclear how well each title reminds each the respondent of the actual activity during it; and many teams had team dynamics lead to personal failures during certain times of day, regardless of the activity— there is still reason to derive that the more favored modules were those concerned with the science and the principles behind ideation.

Table 19 Team Activity Modules and Deliverables

<table>
<thead>
<tr>
<th>Module in Team Facilitator Handbook</th>
<th>Team Activity</th>
<th>Sessions Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Team Meet-Up</td>
<td>Team name and logo</td>
</tr>
<tr>
<td>M2</td>
<td>Empathize and Reveal Presumptions</td>
<td>Association map of team motivation gathered from user interviews</td>
</tr>
<tr>
<td>M3</td>
<td>Identifying the Problem</td>
<td>50+ ideas from group brainstorming; 1 chosen central problem direction</td>
</tr>
<tr>
<td>M4</td>
<td>Research and Ideation</td>
<td>Association maps of root causes to central problem; decided root cause of problem to fix; top 2-3 ideas moving forward</td>
</tr>
<tr>
<td>M5</td>
<td>Refine Ideas and Prototype</td>
<td>Narrowing to central innovation; exploratory physical prototypes</td>
</tr>
<tr>
<td>M6_making</td>
<td>Group Critique Poster-MAKING</td>
<td>Groups make two posters: One explaining innovation, One asking questions for improvement</td>
</tr>
<tr>
<td>M6_reviewing</td>
<td>Group Critique Poster-REVIEWING</td>
<td>Suggestions for each team reviewed</td>
</tr>
<tr>
<td>M7</td>
<td>Iteration</td>
<td>Presentation and Prototype of Innovation</td>
</tr>
</tbody>
</table>
Table 20 Modules at the DesignShop, listed in chronological order, with the number of votes each received to be kept in a future iteration of the event (n=66 respondents in the Feedback Survey)

<table>
<thead>
<tr>
<th>Module</th>
<th>Type of Module</th>
<th>Votes to Keep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretary Malone Keynote</td>
<td>Speech</td>
<td>27</td>
</tr>
<tr>
<td>Intro to Design Thinking</td>
<td>Workshop</td>
<td>52</td>
</tr>
<tr>
<td>Visual Thinking &amp; Sketching</td>
<td>Tutorial</td>
<td>55</td>
</tr>
<tr>
<td>Team Meetup/ Ice Breaker</td>
<td>Team Activity</td>
<td>37</td>
</tr>
<tr>
<td>User Observations</td>
<td>Workshop</td>
<td>37</td>
</tr>
<tr>
<td>Empathize &amp; Reveal Presumptions</td>
<td>Team Activity</td>
<td>33</td>
</tr>
<tr>
<td>Ideation &amp; Creativity</td>
<td>Workshop</td>
<td>44</td>
</tr>
<tr>
<td>Identifying the Problem</td>
<td>Team Activity</td>
<td>41</td>
</tr>
<tr>
<td>Asking the Right Questions</td>
<td>Workshop</td>
<td>40</td>
</tr>
<tr>
<td>Research &amp; Ideation</td>
<td>Team Activity</td>
<td>38</td>
</tr>
<tr>
<td>Towards Pitching Ideas</td>
<td>Workshop</td>
<td>40</td>
</tr>
<tr>
<td>Power of Prototyping</td>
<td>Tutoral</td>
<td>40</td>
</tr>
<tr>
<td>Refine Ideas &amp; Prototype</td>
<td>Team Activity</td>
<td>38</td>
</tr>
<tr>
<td>Group Critique</td>
<td>Workshop</td>
<td>29</td>
</tr>
<tr>
<td>Feedback Session Prep</td>
<td>Team Activity</td>
<td>29</td>
</tr>
<tr>
<td>Feedback Session</td>
<td>Team Activity</td>
<td>31</td>
</tr>
<tr>
<td>Iteration</td>
<td>Team Activity</td>
<td>37</td>
</tr>
<tr>
<td>Final Team Presentations</td>
<td>Speech</td>
<td>41</td>
</tr>
</tbody>
</table>

5. FLAT HIERARCHY OF MENTORSHIP THROUGHOUT

It was important to deliver on the premise that for feasible, innovative solutions, one should put the user at the center, and this meant that participants at the DesignShop should represent all stages of users, including the adolescent students our education system serves. Our youngest participant was 10 years old, and another six were under the age of 18. It was important to democratize the learning at the DesignShop so that the youngest and oldest participants could feel that it was a safe and open learning environment. The hierarchy of mentors was flattened as much as possible while still providing the resources necessary for such a fast-paced environment. Each team of four had an additional Team Facilitator with two objectives: to moderate any person dynamics that might impair the functioning of the team, and to introduce design thinking tactics and activities if the team were to hit a wall in the innovation process. At first glance, it was not obvious who in each group was a participant and who was a Team Facilitator, but at second glance you’d notice the Team Facilitators sporting a colorful sequin bowtie. The Mentors
were invited to float in and out throughout the event and had all levels of expertise, some more and some less than our participants. To minimize any clash of seniority and make the Mentors more approachable, they were given a neon fedora to wear at the event, and each team table had a permanent empty 6th chair for the Mentor to be able to sit at when passing by. The panel of six judges was composed of some of the Mentors that had been floating around during the event, but were unannounced until the Final Presentations.

6. MATERIALS RESOURCES VAST AND AVAILABLE

A big emphasis was given to making a prototype for the team projects to show during the Final Presentations. Many great ideas are shared and readily available in the education space, but few are developed to the point where they are tangible enough to be visualized quickly and receive considerable feedback on. When groups of participants come together that have never worked together before, it is imperative that they be able to communicate ideas as precisely as possible, and a visual sketch and prototyping greatly facilitates this. Two key tutorials were given to level the playing field for participants that may not have as much experience with the hands-on materialization of ideas: Visual Thinking & Sketching and Power of Prototyping. The tutorials covered the “ABC’s of sketching, quick tips for representing ideas and dynamics of entities, storyboarding through idea narratives, how to use a hot wire cutter for blue foam and a box cutter for foam core, and examples of rapid prototyping for education sub systems.

Materials were available for every participant to use, with some budgeted on a per team basis to ensure there would be enough for each team to have access to the materials. A 4’ x 4’ double-sided whiteboard was hand-made for each team to have an equal canvas for their ideas. To support the brainstorming process, every team had dry erase markers, reams of white paper, post-it notes of various neon colors, and a multitude of pens, pencils, and various sharpies. To
support hands-on making, participants had access to blue foam, foam core, cardstock, cardboard, Popsicle sticks, straws, Play-Doh and shaping clay, pipe cleaners, various tapes and glues, scissors, box cutters, and cutting mats. Additionally, each team had a bowl with almost two pounds worth of Lego’s at their table. Figure 19 in the DesignShop Results Section above captures one of the many prototypes developed for the team projects.

7. PRIZE-ENABLED CONTINUATION & EXECUTION

It is not to say that gatherings of people breeding great ideas for the education system are not already occurring. But it is to say that there is a lack of continuation potential, of realistic prospects for implementation that always lingers after these very energetic encounters. The DesignShop designed its prizes for the competition aspect to move past the Education Designathon’s more traditional form of cash prizes. Normally, these cash prizes are not earmarked for any specific use. They are just a prize for the teammates that developed the winning projects. At the DesignShop, there were a series of tiered prizes, all designed to be an investment towards the continuation and execution of that team’s project after the DesignShop. Three prizes awarded a reimbursable stipend of $1,000 to three different teams so that they could invest in their project and be reimbursed by DesignShop funds. Another three prizes awarded the same, but for the amount of $500. Finally, three teams were awarded a 1-hour consultation prize, that is, the promise to personally meet with a key stakeholder organization that could, for one hour, discuss the team’s projects and next steps to implementation. The three organizations that sponsored the 1-hour sessions were: The Massachusetts Executive Office of Education, the Newton Public Schools Chief Innovation Officer, and LearnLaunch’s ed-tech accelerator program.
8. ENCOURAGING “EASTER EGGS” AS DELIGHTERS THROUGHOUT

Of course to have a successful and memorable event, small details in the execution of said event can often go a long way. There were some “Easter eggs,” or delighters, sprinkled throughout the DesignShop for the participants to enjoy, as in the case with the unique message on each participants nametag that read (upside down so the participant could be reminded of it while wearing it) design thinking-related quotes, like “Defer all judgments” and “Encourage crazy ideas”. Attention to detail made the participants feel like this event really was for them to be at the center of their learning. The bowls of Lego’s and materials readily available at the center of each team table facilitated a productive discussion. During some workshop modules, there would be interactive quizzes for which the participants could find the necessary papers and pens under their seats. There were also some small prizes—like classic “Fuzzy nose and glasses” and Nerf guns—for having excelled in quizzes throughout the workshops. These small prizes encouraged participants to continuing trying their best and afforded some surprise smiles for others. It is worth noting that while many of our conjectures are mere hypotheses informed by the qualitative observation of the event, the next step is to map out the embodiments of our conjectures to their mediating processes and intervention outcomes, as per Sandoval’s Conjecture Mapping (Sandoval, 2013).

CHANGES IN MEAN DESIGN SCORE AND TOTAL DISCIPLINARY SCORE

From the beginning of their DesignShop experience, participants’ self-assessment either 1) grew, 2) diminished, or 3) stayed the same. This could be a result of many things occurring during the participant’s DesignShop experience.

If their self-assessment 1) grew, it could be that the participant:
• grew more experienced in the attribute at the DesignShop and thereby can now report a higher confidence in the skill, or
• gained deeper understanding of the attribute and realized that they were, in fact, always able to do perform this at a higher level than reported, thereby increasing their confidence in the skill.

If their self-assessment 2) diminished, it could be that the participant:
• gained a deeper understanding of the attribute and realized that it was actually harder than they imagined and reported
• learned of others in the design thinking community that were perhaps more skilled than they were, causing them to adjust their measure of how able they were, now in regard to a larger context pool

If their self-assessment 3) stayed the same, it could be that the participant:
• both became more experienced
• already came in with a high enough level of design thinking competency that left little to no margin of improvement.

While there is not enough resolution in the survey question to deduce any one of these theories as the root cause for changes in participants’ self-reports, further insight would be reachable if deeper follow-ups were to be had with the participants. Future self-assessment metrics can be designed with an opportunity to let the participant reflect on their responses and how they’ve changed throughout their experience at the DesignShop. For example, it could be that in the post-event form, they can entire their new self-assessment in one page and then, after continuing on to the next page, they can be presented with their reported self-assessment at the
beginning of the study, the one they just entered in the page before, and the discrepancies. This would then prompt them to reflect on their change in self-assessment and capture what intuition the participant may have from their experience.

A recorded 44.1% of participants increased their Mean Design Score from the time the Application was administered to the Feedback Survey immediately after the DesignShop. The fact that a strikingly similar 43.6% of participants were still showing signs of increase in their Mean Design Score when calculated from the time of the Post-Post Survey suggests that these participants retained many of the lessons and confidence built around these abilities for over a month after the event.

![Figure 41](image.png)

*Figure 41 Self-reported design thinking fluency and disciplinary scores by participants across two time intervals after the DesignShop.*

There is insufficient data resolution to show how much a participant has used or practiced these principles in the time since the DesignShop, there is reason to believe that the participants whose Mean Design Score decreased may have suffered from lack of sustained use or, simply
put, once exposed to the actual practice of design thinking at the event, became more aware of the true value of reporting skills they may not have fully understood. Another phenomenon to note is the disappearance of the 15.3% of participants who at first thought that they were at the same level of design thinking ability as they were before the DesignShop, later realized in their Post-Post Survey that they had, indeed, been impacted in their ability to use design thinking skills. This group of 15.3% later self-reported an increase or decrease in their Mean Design Score.

The Total Disciplinary Score shows almost half of the participants increasing their ratings of familiarity with the other disciplines, some with as much as a five or six point increase, though the majority underwent a one or two point increase. These increases, especially at such high margins, imply that participants feel more well-versed and familiar with more disciplines than they did walking into the DesignShop, which is a significant step toward making empathetic, interdisciplinary innovators. This also suggests that this can double as a better method for teaching others about co-peers in the education space—instead of lecturing policymakers or entrepreneurs on what a professor does, they work with a professor through a series of modules and leave understanding how they think and would make certain decisions.

**ORGANIZATIONAL FEEDBACK**

Data was collected to understand how the eight key features of the DesignShop worked to effectively support non-designers into Design Thinkers. From evaluation of participant feedback we found that 79% of participants at the DesignShop said that they agreed or strongly agreed that their team benefited from being interdisciplinary. We also found that participants reported a perceived increase in ability to brainstorm in groups and use tactile visuals to help express their ideas as well as an increase in ability to empathize with others.
A part of the Post-Event Questionnaire that went out two-three months after the DesignShop asked the participants to add any last thoughts related to design thinking in reflection of their experience at the DesingShop. Some of these responses are provided in Table 21 below.

<table>
<thead>
<tr>
<th>Anything else you'd like us to know? (Relevant comments on skills related to design thinking…)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loved working visually--it really opened up channels of thinking</td>
</tr>
<tr>
<td>Love it - want chances to figure out how to teach to younger grades</td>
</tr>
<tr>
<td>I've got tons of Moleskins and carry one around with me everyone b/c I never know when inspiration will strike.</td>
</tr>
<tr>
<td>I have studied and participated in workshops amidst design thinking. I have taught Design Thinking for 3 years and have been a student teacher at workshops about Design Thinking.</td>
</tr>
<tr>
<td>I have now designed several labs and lessons about design thinking!</td>
</tr>
<tr>
<td>As a kid, I'd wake up to Lego creations from my Dad. He was often busy with work. I'd create a response.. this was our way to connect and have a conversation.</td>
</tr>
</tbody>
</table>

**Critical Insights from Participants**

Nearly a year after the DesignShop, a few of the DesignShop participants were invited to reflect on their practices of design thinking (or not) since the DesignShop. The names below are pseudonyms to protect their anonymity, and summarized in Table 22 below. Interviewed were two policymakers (one legislative aide for a Massachusetts State Senator, Abigail, and one the Executive Director of a non-profit to promote school policies in favor of children’s rights, Bonnie), one school teacher and FabLab\(^1\) director, Charlotte, and one student at RISD (Rhode Island School of Design), Debbie.

\(^1\) FabLabs, or fabrication labs, are “makerspaces” with, at minimum, the most necessary of machines and tools to create nearly anything. They are a product of research from the MIT Media Lab’s Center for Bits and Atoms, and they’ve grown into a network of over 200 labs in more than 40 countries. More information can be found in: http://www.fabfoundation.org.
Table 22 List of four interviewees invited back to speak about life after the DesignShop, a year after.

<table>
<thead>
<tr>
<th>Pseudonym of Interviewee</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abigail</td>
<td>Legislative Aide</td>
<td>Massachusetts State Senator’s Office</td>
</tr>
<tr>
<td>Bonnie</td>
<td>Executive Director</td>
<td>Non-profit to promote school policies in favor of children’s rights</td>
</tr>
<tr>
<td>Charlotte</td>
<td>School teacher and FabLab director</td>
<td>Independent, urban middle and high school in major city</td>
</tr>
<tr>
<td>Debbie</td>
<td>Student, upperclassmen</td>
<td>Rhode Island School of Design</td>
</tr>
</tbody>
</table>

The conversations were insightful, deeply reflective, and yielded many suggestions on how to improve design thinking’s readiness for implementation. These overarching themes are summarized below.

1. *One thing is knowing what design thinking is, one thing is knowing how to use it*

Workshops can only do so much to transform and capacitate novices to hit the ground running and apply design thinking to their every day jobs. For example, though Charlotte left the DesignShop sold on the methodology and its potential to transform the learning experience in the classroom, when she tried to take design thinking back to her peer school teachers, she had to first hire consultants to give a 4-hour introductory workshop to the staff, and then she followed up with another 4-hour workshop on implementation methods. For policymaker Abigail, design thinking still sounds like “classic group work plus prototyping”. She had a hard time distinguishing design thinking from collaboratively coming together and trying to be creative about forming a solution, and she wasn’t sure if design thinking offered more than that.
2. Transferability to system-level design is key

Currently, there is still a stigma around for who, exactly, could (and should) be using design thinking. There’s an understanding that it can be more easily applied in some contexts than in others, and this is derailing us from achieving the broad reaching implementation that the methodologies deserve. One policymaker talked about the awkwardness of applying design thinking at the state level where policy goals may be more abstract. In her example, a broad goal might be to leverage collective tax pools in communities that don’t have the resource pool to do this themselves—this is sometimes referred to as the “what” of the problem. Then, at the lower city-level groups would engage design thinking methods to design the realizable solutions, such as new green spaces for community gatherings or public art spaces for exchanges—here, the “how” of the problem. A—hopefully soon to be disproven—thought is that design thinking may not be fit because as policymakers, you’re combining the work of many implementation groups around you, but you’re not creating anything from scratch.

Additionally, there is an innate barrier to entry for policymakers and high-ranking officials positioned within some kind of hierarchical organization to use design thinking, simply because it requires a lot of time and people power, which are at a premium. For example, as our policymaker Bonnie asked, “How do you prototype something that is not a thing?” While the exercises of going through storyboards and model predictions of a newly designed program can be extremely helpful, it is often hard to have a quick turn-around iteration of a people-based programs since these data collecting methods tend to be paralyzed by the inertia of non-agile systems. A model of a cell phone’s proportions can be held and played with and almost directly yield insight into the parameters that can be edited to make the product more successful. In direct
contrast, it can take up to years before we understand the repercussions of an educational program’s effects on students, and even longer to pass through law.

There is a need for more easy-to-digest, cross-profession examples of the many implementations of design thinking that can delineate a clear value proposition. This is especially important for policymakers and professions in the business of affecting systems that may not identify with the phrasing of “service design” or “strategy design” as is popularly referred to by design consultancies.

Perhaps helping frame the differentiated value proposition of design thinking as a problem-solving approach in relation to those most commonly used in other professions would open up the understanding of the assets of design thinking.

A number of RISD students were asked to informally describe whether or not they thought design thinking could be applied to all kinds of problems (societal, systemic, people-based, abstract, etc.) and their responses were unanimously in agreement, stating: “it’s more of a means of coming to the solution that isn’t very dependent on the type of solution itself” and “it just provides a framework for how to approach problem-solving, and it can be manipulated and transformed to be best appropriate for any given problem.” Across the board there is agreement of the power design thinking can have, if implemented to the right people correctly.

3. Less toolkits, more experiences

This year was the first time RISD offered a design thinking course to its students, and even then, it’s mostly a cross-listed course by Brown students, Debbie asserts. Debbie described the conundrum it represents to ask her and her fellow designers if they are “design thinkers.” After taking classes like the entry-level Design Principles, she relates the kind of critical thinking
principles in design thinking to the kind of innate, or intuitive ways she already thinks through, being the designer that she is.

When you compare the transformative and trying curriculum design students undergo in their training, 2-day workshop models pale in comparison. Debbie calls for fewer toolkits that claim to do it all in just one .pdf document, and, instead, more transformative experiences based on the models that she and her peer designers were trained in. These lessons start from the bottom-up, with physical artifacts first, to understand how, in its basic applications, designers must be concerned with the environmental information that contextualizes your problem before they can think of a system’s interaction.

The suggestion here, then, is that whenever information is packaged into a digestible form, such as with IDEO’s Design Thinking for Educators Toolkit (IDEO, 2013), it be transferred over first with proper experiential learning experiences to ground the design practices that will then enable the participant to think like a designer and, eventually, engage in design thinking. The School Retool project (IDEO & d.school, 2015) by IDEO and the d.school do this well by first bringing principals together for a 5-day professional development workshop and then sending them off to their home environments with ready-to-use toolkits as reference.

**TRANSFORMING NON-DESIGNERS INTO DESIGN THINKERS**

There were 4 persons in the Post-Event Evaluations that showed Empathy at a level of 0 (not ever mentioned) whereas there were 36 persons in the Pre-Event Evaluations that did not mention Empathy. The general move towards the right side of the plots (and into the higher and deeper levels of usage for each step), suggest that not only did our participants increasingly reference the design thinking process as their problem-solving method of choice, but they also
more deeply understood each part of the process and were able to use convincing examples of methods they might employ when implementing each of the parts.

The graph in Figure 42 shows an aggregate average of all the weights at each depth, offering a visualization for how the participants evolved as a cohort. Consistently placing at a higher score than all other stages, the DesignShop participants began the strongest in the area of ideation and made the smallest increase in this area. The caveat comes in the kinds of ideation they were practicing: Before the DesignShop, most participants just gave solutions long before they understood the situation, context, or reasons there even exists a problem. Indeed, “brainstorming” is one of the easiest words to misuse. It is important to note that people are not lacking creativity to find solutions, but the creativity to find the right problem. The DesignShop in comparison to other hackathon models gives participants a framework to think within a framework and to then go out and ask the right questions to solve real challenges.
As illustrated in Figure 43 (zoomed out for perspective), at a high level it becomes clear there is gravitation of participants answering their problem-solving exercises using design thinking in the Post-Event Surveys right after the DesignShop: as participants move from Pre-Event to Post-Event to Post-Post-Event, there is a convergence of more and more participants towards responding with answers that are at the same design thinking stage at each step. Furthermore, the concentrations of participant responses also trend towards the chronological order of a design thinking process. That is, as time passed, an increasing number of participants answered their design challenges in a format that follows a design thinking process. Seeing this trend line in the Post-Post-Event Surveys conducted months after the DesignShop suggests that the methods captured a transformation that occurred in the long-term understanding of the person, and not in the short-term memory of the participant.

**CREATING MORE SYSTEMIC & DESIGNERLY PROJECTS**

The team final presentations from three different events were analyzed for sophistication of how designerly and systemic the projects were emerging. The DesignShop projects emerge as more sophisticated in both areas, even though all three events had explicit mentions of the
education system in their descriptions and challenges. It is postulated that a strict adherence to the design thinking process—by teaching the process to participants and pacing their project development around deliverables akin to these stages—is what differentiated DesignShop projects from those of other events.

The red and blue bars below display the project adherence to each of the six research claims from
Table 8 by aggregate for each event: (in chronological order of appearance, the Designathon, the DesignShop, and the HGSE Hackathon), in Figure 44 through Figure 46, respectively. The bar column represents each of the Research Claims R 2.1 through 2.6, from left to right.

Figure 44 Percentage of Designathon Teams that did or did not meet the six components of 'designerly' projects; n=16 teams.
The Education DesignShop projects reveal higher percentages of projects that coded for a positive adherence to the research claims. In example, the third attribute of a designerly project — Teams consider the many processes involved in creating change— is represented by 68% of
DesignShop projects but only by 8% of Designathon projects and by 18% of HGSE Hackathon hacks. Across all six attributes that define a designerly project, the DesignShop projects perform better than the projects emerging from the other two events. The DesignShop model suggests an effective way to produce projects that have an increased adherence to designerly principles.

When analyzed for the project’s’ systemic attributes as defined by the elements of Anderson’s continuum matrix, the DesignShop projects again spanned towards the rightmost side of the matrix. Figure 47 below offers a superimposed view of all three events so as to be able to compare them spatially in the continuum matrix against each other.

![Figure 47 Mapped matrix of team projects emerging from the experiments. In order of increasingly dark grey: The Designathon, The DesignShop, and the HGSE Hackathon.](image)

Projects on this right side of the matrix consider the elements of change in a system that are increasingly close to establishing the predominance of a new system.
One can see the differences in thinking supported at these events by taking a look at the difference in deliverables. One project that came out of the DesignShop, the PlayLab, was an idea to create a modular shared space to bring back play and exploration to the school day. This team discussed the implications that this type of space would have on students, teachers, administrators, and possibly the state. The team was sure to be aware of accommodations that may need to be made for different learning or accessibility styles as well as fitting within the constraints of a school day. The idea of the PlayLab showed thinking that affected a system rather than a single product that solved a possible problem. This holds a stark comparison against some projects from the HGSE Hackathon. At the HGSE Hackathon, InstaCourse, a team that aimed at making it easier for anyone to create an online course faster, paid little attention to the current issues surrounding online course building or the impediments that stood in the way. This team focused only on the person who would be building the course but not the possible students that would be using it or the administrators that may need to get on board. The differences in these projects show that it is possible for a group of people to come together and develop ideas that can create real change for the problems our society currently faces and do so with scale and longevity as a crucial aspect of it.

**SUMMARY**

The 16 team project hacks of the initial Education Designathon supported the discovery of 14 event parameters that form the recipe for a hackathon or Designathon success. Observations of team hacks revealed that the core difference between hacking and designing lay at the extent of which the team is able to engage in problem identification and brainstorming. Models of innovation and a set of independent variables are suggested that relate solutions emerging from
three core problem-solving environments: Research projects, Hackathons, and Designathons or DesignShops.

The Education DesignShop experiment produced 25 redesigns of education. The event parameters were synthesized into Eight key features that distinguish the modified features of this event from other hackathon types.

Quantitative and qualitative assessments were used to show the transformation of the DesignShop participants into successful design thinkers, as evidenced by their increased convergence to the process and their increasingly sophisticated use of design thinking elements. When addressing the ability of teams to look at systemic change, we found that the DesignShop model clearly helped to transform participants to think about and create projects that kept scalability and longevity, especially when compared with projects from the Education Designathon and the HGSE Hackathon. The DesignShop projects excelled in attributes of both designerly projects and systemic change. This analysis led to what may be the first characterization of what a design thinker looks like, and what designerly projects look like.

This DesignShop model leverages the assets of hackathon models for innovation and collaboration in big, collaborative platforms. Testimony from participants eleven months after the DesignShop reveals that there are clear challenges to implementation of design thinking in the real-world setting by novices.
CHAPTER 7

POLICY IMPLICATIONS

With so many unconventional ways to impact society’s biggest issues, it becomes inevitable to consider the importance of the policies for success of such endeavors like the DesignShop. There are multiple pathways for policy standards to influence the success of events like the DesignShop, including, but not limited to policies on: professional development for prospective participants that want to take time out of their schedules to attend the DesignShop; administrative freedoms to undertake unconventional problem-solving methodologies in the regular day-to-day operations, open-source sharing of information from government regulators for hackathon-type events, and organizational structures that impede or support trans-disciplinary collaboration between end users of all kinds.

The success of the DesignShop also provides hope that there is another problem-solving method for policymakers to engage in—a design thinking-based exploration of the problem. Exploring more examples of methods to prototype innovations that are “people-based” as opposed to “gadget-based” will be fundamental in this segment capture. This will help us yield better examples of how to use design thinking to go from the design of things to the design of ideas and strategies to the design of systems. It seems there is currently a tension between problem-solving methods to be applied for one problem as opposed to for a set of interrelated
problems. This detailed information needs to be packaged down to the bite-sized detail where policymakers can see its worth, be convinced of its potential, and can use it to their benefit. We need to better paint the before and after picture, and help policymakers and citizens and prospective future design thinkers better understand how exactly they’ll be able to transform through design thinking, as this will help us move design thinking into the curriculum and minds of a global network of improved problem-solvers.

Below is a survey of a few of the interface points between policy and design thinking and suggestions for how we can have both engage in a symbiotic, supporting relationship.

SOLVING BIG ISSUES WITH DESIGN THINKING

![Hierarchy of problem-solving approaches emphasizing the value of a design-based methodology.](image)

As illustrated in Figure 48, while most problems in the education system are solved from a research-based, crisis management-based or linear, milestone-based approach, a design-based approach has the ingredients to yield more unique, creative, and effective solutions for the education system. We now call for a reform in the problem-solving approaches of the education
system: to move from constraint-based approaches to a design-based approach by infusing design thinking into the minds of education stakeholders.

There is vast opportunity to applying design thinking as a driving approach to fixing the education system. Elements of this framework will inherently excite end users since they have been consulted from the beginning; iteration of prototypes will weed out the bad ideas early on. Most importantly, thorough problem identification and brainstorming will open new pathways and solutions that will, theoretically, take more accurate stabs at the root of a problem.

At the product level, the Education Designathon demonstrated there was space for creativity and innovation in educational tools if certain education challenges were approached with a design thinking framework. Examples of these tangible products included, among others, DynamicTable—a rotating high top table that connects to a computer’s monitor such that restless kids would have to walk around the table clockwise to scroll the page up, and counterclockwise to scroll the page down; as well as The Little Book of Circuits—a children’s book with integrated circuits that allow for a parent and child reading pair to interact and learn directly from the book.

While design-based approaches are common in tangible engineering and design products like DynamicTable and the Little Book of Circuits, they are only now beginning to prove themselves in their application to systemic challenges, like education. This next step is imminent. The challenge of using design thinking in education rests in that policy makers—currently the power holders, or stakeholders, in the education space—are trained otherwise. As the international design consultancy firm IDEO explains, “the natural tendency of most organizations is to restrict choices in favor of the obvious and the incremental. Although this tendency may be more efficient in the short run, it tends to make an organization conservative
and inflexible in the long run. Divergent thinking is the route, not the obstacle, to innovation” (Brown, 2009).

TOWARDS A SOCIETY OF DESIGN THINKING PROPAGATION

Design thinking is slowly making its way into government through initiatives like the Office of Personnel Management’s Innovation Lab that hosts resident design thinkers to help branches of government through tight situations. More and more government data is slowly being made available at organized hackathons, and organizations like Code for America are showing the worthwhile effects of giving young, passionate talent a seat at the table.

IDEO has taken on systemic issues like poverty, health, and education with their design thinking toolkits. The levels of systemic maturity in the projects of the DesignShop prove that it’s a worthwhile endeavor to teach design thinking to lay citizens and have them, too, apply design thinking.

The Education DesignShop is a model in which innovative teaching and thinking can happen. It is important to note the success that the Education DesignShop has had at bringing together and teaching concepts to both students as young as 9 and adults as old as 63. The fact that the Education DesignShop caters to such a wide range of participants, and is successful at doing so, gives insight in to how the structure of hackathons, Education Designathons, or Education DesignShops should take shape in the future to support a myriad of non-traditional engineers and the value-added by opening these types of events to the any willing participant.

Current pedagogy in education does not capture the ability to step back and ask a question about a problem before trying to solve it. Events like the DesignShop allow participants to learn how to solve a problem by asking questions first, like a traditionally trained engineer. The structure of
the DesignShop could be used in the future to support the shift to project-based learning and having our citizens understanding how to create empathy.

**SUMMARY**

Beyond an increasingly well-education workforce, integration of design thinking methods in professional development areas, like that of the Education DesignShop, can support the growth of a force of creative problem-solvers for today’s most interdisciplinary and interdependent challenges. The National Academy of Engineering’s Grand Challenges (“Grand Challenges for Engineering,” n.d.) demarcate 14 of these interrelated problems that would benefit from this kind of workforce. Attention is called to the varying kinds of problem-solving approaches and the ways that design thinking provides a differentiated, human-centered approach. In addition, design thinking methods provide a greater margin of inclusivity for personalized learning styles to be incorporated into the workforce.

However, training, educating, and transforming the existing workforce is no easy feat. More than just a toolkit, the Education DesignShop reveals principles that help make hackathons and Designathons happen more effectively to transform (1) the participants and (2) the problems in education and beyond into innovative solutions.
CHAPTER 8

CONTRIBUTIONS

An investigation into hackathons yielded 14 ingredients in the recipe for hackathons, listed in Table 16. Clarity was brought to the difference between a hackathon and a more design heavy exploration of a problem, and deduced the major difference to the core process stages of problem identification and brainstorming.

An Education Designathon was founded as the first-ever hands-on hackathon for education. Sixteen hacks were born that weekend that hint at the possibilities of hackers working passionately to solve education. Models for which to begin thinking about the impact of hackathons in relationship to Designathons and to research projects were suggested, and three variables, $t_H$, $t_D$, and $t_R$, were suggested as the critical limits that govern the optimal time over which a hackathon, Designathon, and research should take place, respectively.

When the Education Designathon was conceived, the researcher was also a Lab Instructor for an extraordinary team of freshmen Toy Designers for MIT’s trademark 2.00b Toy Product Design course. After hearing of the researcher’s updates during her journey of crafting the first-ever hands-on hackathon, two of these exceptional 5 consulted the researcher to help build the foundation of what would become the first non-thematic hands-on hackathon at MIT: MakeMIT.
A new design thinking roadmap was offered and a new workshop format with milestones influenced by MIT courses was born: The Education DesignShop. Eight key features were identified as unique attributes that made for the experience to achieve as much as it did.

In the development of the DesignShop, a number of metrics were designed to measure the transformation of the participants throughout the event, as well as to measure the resulting projects. The table below provides a description of these metrics.

<table>
<thead>
<tr>
<th>Contribution (Method or Metric)</th>
<th>Definition</th>
<th>Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Design Score</td>
<td>The average of five design thinking attributes that participants reported in a self-assessment, once in their Application to the DesignShop, and again in their Post-Post-Event Questionnaire</td>
<td>Measures creative confidence of subjects. Suggests how the participants' self-reported assessments grew, diminished, or stayed the same in the time since the DesignShop.</td>
</tr>
<tr>
<td>Total Disciplinary Score</td>
<td>A quantification of participants' experience in each of the four backgrounds present at the DesignShop</td>
<td>Measure of participants' comfort levels in relating to backgrounds other than their own.</td>
</tr>
<tr>
<td>Application questions</td>
<td>See Form in APPENDIX B</td>
<td>Form for capturing self-assessed information from prospective participants.</td>
</tr>
<tr>
<td>Participant Selection Algorithm</td>
<td>Uses the residual sum of squares to pre-assemble teams that are guaranteed to be interdisciplinary, interested in the same Topic Challenge, and have a similar Mean Design Score across all teams.</td>
<td>Ability to pre-assemble teams that begin on an equal footing of design skill and topic interest, and adjustable to whatever attributes are priority. In these efforts, once the team is guaranteed a variety of disciplines, the middle man is eliminated by acknowledging that the participant teams are the very users in our problem definitions, and then developing them to be the very problem solver by teaching them design thinking.</td>
</tr>
<tr>
<td>Characterizations of a Design Thinker</td>
<td>1. consider all aspects of the problem. 2. consider the many people involved in creating change 3. consider the many processes involved in creating change 4. consider system inter-dependencies 5. focus on the user and how the user can help invoke systemic change 6. project shows transformation at systemic level</td>
<td>Deeper definitions to contextualize and identify a transformation.</td>
</tr>
<tr>
<td>Chronological</td>
<td>Coding schema that leads to a step-by-step breakdown, with weights at each node.</td>
<td>Visual adherence notable by the</td>
</tr>
</tbody>
</table>
A visualization of the adherence (or lack thereof) to design thinking process in a design solution can be represented by concentration towards darker hues and the diagonal of the chart.

| Characterization of a systemic challenge | 1. Are multi-faceted  
2. Involve various people  
3. Involve various processes  
4. Involve multiple dependencies  
5. Are not focused on one person, but rather, a body of people  
6. Have impact at a system-wide scale |
|----------------------------------------|---------------------------------------------------|

A novel breakdown of systemic issues, insights into the skills it would take to tackle these kinds of challenges.

<table>
<thead>
<tr>
<th>6-Attribute Rubric for successful projects that are systemic and designerly</th>
</tr>
</thead>
</table>
| 1. Considers various perspectives  
2. Feasibility  
3. Creativity  
4. Answers a key need in the education space  
5. Transformation occurs at the system level  
6. Dissemination & Implementation |
| Provides benchmarks for quality projects that solve a need after being developed under an ideal design thinking mantra. Can be used to evaluate project proposal’s level of sophistication. |

<table>
<thead>
<tr>
<th>14 Ingredients in the Design of a Hackathon-type event</th>
</tr>
</thead>
</table>
| 1. Length of event  
2. Overnight stay  
3. Number of participants  
4. Application process  
5. Award incentives  
6. Mentorship provided  
7. Workshops offered  
8. Theme delineation  
9. Challenge Presentation  
10. Team formation mechanism  
11. Project selection  
12. Medium of deliverable  
13. End-user involvement  
14. Amenities |
| 14 design attributes to consider for successful organization. |

<table>
<thead>
<tr>
<th>8 Key Features for the success of a DesignShop</th>
</tr>
</thead>
</table>
| 1. Three topics attract similar minded individuals  
2. Open community of information dissemination  
3. Method to pre-assemble interdisciplinary teams  
4. Hands-on modules fostering design thinking  
5. Flat hierarchy of mentorship throughout  
6. Materials resources vast and available  
7. Prize-enabled continuation & execution  
8. Encouraging “easter eggs” as delighters throughout |
| 8 attributes of a workshop that can help to make the event better, more streamlined, and unique to an event with similar goals. |
A variety of sources throughout the development of this work contributed to information that suggest the kinds of categories for innovation that are hot today— that is, what areas of the education system are ripe for innovation. These sources include:

- the Designathon EdExperts and the 16 Challenges they provided hackers,
- the trends in the 16 resulting hacks from the Designathon,
- the 25 interviews of education experts used when framing the three Topic Challenges of the DesignShop,
- the trends in the 25 resulting projects from the DesignShop, and
- the trends in the 11 resulting hacks from the HGSE Hackathon.

Time and time again we are reminded that the world needs more engineers. Although the world is certainly in need of mechanical, chemical and electrical engineers, there is also the more general fact that world needs more people who think like engineers. By teaching the frameworks in which engineers think to non-engineers, the world may perceive itself differently.

The data from the DesignShop show that non-designers—or those who have not been traditionally trained in design or design thinking—can begin to think and act upon their ideas like a Design Thinker would over the course of a weekend. By making this workshop model available to people young and old with a variety of background experiences and education levels, these projects show immense creativity and concern for finding solutions to solve systemic everyday problems. The eight components of the DesignShop are part of the main reason for this change. Topics to attract like-minded individuals, an open online space for research and information, effective team creation, hands-on learning workshops, mentors for help, free use of
materials, prizes to motivate, and surprises throughout facilitate a collaborative learning space that is engaged, focused, and eager to create projects.

These eight components helped push the DesignShop participants above and beyond to think about their project and its implementation in a way that it could have a real place in the world and affect real people. By applying these methods to future hackathons projects will likely show similar results where participants think about, work on, and continue beyond the hackathon projects that evoke real solutions to real problems. These methods do not only apply to the area of Education. By taking these components and adapting them to hackathon themes of other societal or systemic issues, the projects born from it are likely to have a much higher chance of making a real impact on the world.

The DesignShop is a model in which this type of teaching and thinking can happen. It is important to note the success that the DesignShop has had at bringing together and teaching concepts to both students as young as 9 and adults as old as 63. The fact that the DesignShop caters to such a wide range of participants, and is successful at doing so, gives insight in to how the structure of hackathons, Designathon, or DesignShops should take shape in the future to support a myriad of non-traditional engineers and the value-added by opening these types of events to the any willing participant. Current pedagogy in education does not capture the ability to step back and ask a question about a problem before trying to solve it. Events like the DesignShop allow participants to learn how to solve a problem by asking questions first, like a traditionally trained engineer. The structure of the DesignShop could be used in the future to support the shift to project-based learning and having our citizens understanding how to create empathy.
CHAPTER 9

FUTURE WORK

PUSHING POSSIBILITIES OF HACKATHONS THROUGH DESIGNATHONS

Hackathons continue to draw crowds of creative intellectual capacity in rapidly growing numbers. Events like Hacking Medicine and a new branding of hackathon, an Impactathon, are on the rise, while open resource platforms for problem-solving NovoEd and Open IDEO also continue to expand. The FabLab motto is relevant here: a place that provides is “Open Source, [and becomes an] Open Resource”.

Observations from The Education Designathon reveal a deeper question of optimization: is there an optimal investment of our resources (time and money) that yields better solutions for ill-defined problems? Assuming one could invent better solutions, where, then, would they stand against the performance of traditional research ventures on innovation metrics like feasibility, novelty, variety, quantity, and quality, as depicted in the figure below?
Figure 49 Qualified metrics comparing Hackathons, Research Ventures, and a DesignShop.

Future research should focus on finding the critical limits, $t_H$, $t_D$, and $t_R$, that govern the optimal time over which a hackathon, Designathon, and research should take place, respectively. One approach is to borrow methods of measuring maturity research as were developed in Leong’s dissertation (Leong, 2011). For its counterpart assessment of the concept or product two authors provide a beginning methodology—(Brent & Nelson, 2009; Schreier, 2012)—that would aid in finding the critical limits. Once determined, these event time horizons and the average budgets allocated for each can be used in a cost benefit analysis for policy makers to better understand the expectations of their investments. In order to move towards the Pareto Optimal of solutions, an algorithm must be developed as a tool to know when one should take a problem to a set of researchers, a set of hackathon organizers, or a set of DesignShop participants.

This can also be found through inductive methods by studying existing solutions that emerged from these different problem-solving methods. One could use project maturity metrics and the likes to design measures of how interdisciplinary, promising, and feasible, projects are,
then run these for hackathons, designathons, designshops, and research-produced solutions, and solutions produced through more traditional means like a Blue Ribbon Committee, Task Force, and consultancy.

**FURTHER UNDERSTANDING OF DESIGN THINKING**

In order to track the progress of design thinking instantiations with more resolution, we need more refined assessment metrics, or, at the very least, clear markers to recognize when design thinking is undoubtedly occurring. This will be useful both to learn how to identify design thinking done and done well, and how to identify when one is acting like a design thinker, that is, exhibiting qualities that are typical of a design thinker. We should push the limits of design thinking by exploring more vigorously where and how it can be applied and implemented. Through this exploration we will be able to delineate the boundary conditions and learn the optimal spaces for which this work can be pushed.

This can lead us to understand what methods and skills are most distinct to teachers, policymakers, lawyers, etc. so that we can cater our training to them. We could employ The Design Exchange (https://www.thedesignexchange.org) to compile the methods that best supplement the traditional trainings of certain disciplines so that one can find a catered, augmented experience by field-type.

**MORE DATA FOR ANALYSIS**

Even with such a big experiment and data set, the information collection was inconsistent because of faulty participants that compromised the data’s ability to be statistically significant. Instead, these numbers give qualitative measures and intuition into the relationships of certain attributes that might inspire more controlled studies, with larger participation numbers, so that
these dynamics may become statistically determined. The following is a review of the dataset yet to be reviewed and the kind of insights that it may spark.

*Participant Transformations as Correlates to Team Performance*

Closing the gap of analysis by matching participants’ transformations with their teammates individual participations and seeing how teams as a whole transformed. Then, this can be matched to the placing of the projects according to the judges’ scoring rubrics. Deeper insights will be extracted if the audio recordings are transcribed and coded for the design statements of the participants throughout the DesignShop. A big part of the transformation the participant is undergoing is still unspoken for in the audio recordings but can be measured through the acceleration or deceleration of one’s heart rate, among other metrics. The author suggests future design thinking engagements make use of Pentland’s hanging markers that track social interaction beyond what the eye can measure (Pentland, 2010).

*Development of team interest and insights*

Thematic analysis could be done of the DesignShop’s 25 projects and compare these with how closely they relate to its team members’ original interests as expressed by their ranking preferences in the Topic Challenge.

*Online Project Visualization*

This is a proposal for an online resource with interactive displays of information and navigation of this work. Most notably, this would become a resource for the kind of work that occurs in this space within this community, that was connected by the researcher’s candid investigations, including mixed methods like knocking on doors and sending hundreds of emails for connection.
Education is an afterthought, but a common one, of the application for the great research that’s already occurring at MIT.

**Matching Participants’ Impressions: Feedback as Insights**

Initial reviews of the feedback suggested a trajectory for the kinds of insight we might gain. Shown in Table 24 below, these have been broken up into the two biggest camps of feedback: suggestions and thumbs-up celebrations of something that went well. The numbered items suggest multiple people were suggesting the same concept.

<table>
<thead>
<tr>
<th>Suggestions</th>
<th>Thumbs-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.1 More time to develop, to learn</td>
<td>T.1 Kudos for a maintaining interest during the weekend</td>
</tr>
<tr>
<td>S.2 More examples of design thinking</td>
<td>T.2 Timing was good</td>
</tr>
<tr>
<td>S.3 Refined TF roles: giving them time to look</td>
<td>T.M Miscellaneous</td>
</tr>
<tr>
<td>the schedule</td>
<td>Good speakers/energizing speakers</td>
</tr>
<tr>
<td>S.4 More specificity of deliverables:</td>
<td></td>
</tr>
<tr>
<td>expectations/timeline</td>
<td></td>
</tr>
<tr>
<td>S.5 More bonding with team Activities for</td>
<td></td>
</tr>
<tr>
<td>warm-up</td>
<td></td>
</tr>
<tr>
<td>Time to settle into each other (perhaps</td>
<td></td>
</tr>
<tr>
<td>a Kick-Off night the evening before)</td>
<td></td>
</tr>
<tr>
<td>S.6 More focused on theme Use Topic Challenge</td>
<td></td>
</tr>
<tr>
<td>Preferences to be more efficient and</td>
<td></td>
</tr>
<tr>
<td>focus team</td>
<td></td>
</tr>
<tr>
<td>S.M Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>no competition format so that participants</td>
<td></td>
</tr>
<tr>
<td>feel less bad about their ideas</td>
<td></td>
</tr>
</tbody>
</table>

In order to objectify this work’s conclusions more so, the results of the likert scale questions asked in the Feedback form can be used to match (or reveal gaps) the hypothesis of this thesis. These questions asked participants to rate and explain their agreement with the
hypothesis that “The Education DesignShop is an effective model for innovation in the education system. It harnesses the creative and energetic atmosphere of a hackathon and layers in the knowledge and expertise of a research project by adding mentors to the mix.”

The feedback questionnaire goes on to ask the participant to rate elements of the DesignShop as they contributed to their learning experience.

Finally, the questionnaire asks for the participant’s candid feedback for their Team Facilitator and for the organizers of the DesignShop (the author) in terms of logistics and content. The last two questions ask the participant for a reflection of their most memorable learning experience at the DesignShop and then for their thoughts on which modules they would keep or get ride of, and why.

*Thematic Insights into Education’s Challenges*

The 25 interviews of education experts conducted in preparation for the DesignShop were transcribed through an online subscription service and then checked for accuracy. These transcripts were uploaded to a Google Drive that became an online forum for the chosen participants. These applicants that were invited to participate were asked to partake in a sort of Homework assignment wherein they had to read through and comment on at least two of the 25 transcripts that were online. The participants warmed up on the topics and became familiar with at least a baseline of information on the topics, and already sharing information and resources even before the event. These comments have all been archived but not yet analyzed. Tracking the number of comments that any section receives would give insight into what passages were most novel, for the participating audience, which were most disputed, and which were most cross-referenced throughout the work. If coupled with a transcription of the audio recorders, one could
also see which parts of the passages, if any, were referenced later throughout the Education DesignShop.

*Extending Work Forward*

This work is a start. The rich and vast dataset captured at the Education DesignShop leaves many additional research questions for exploration. The researcher is excited about the continual possibilities to make impact with future research directions. Some of these questions include:

- What revelations can the audio transcripts of team’s successes offer us in understanding the way a team “jives” and the ways a design thinker is made?
  - How do these patterns correlate to the more successful teams?

- Are there use patterns in the kinds of prototyping materials used by teams? What is the most physical a systemic redesign can get? Can we learn new interpretations of prototyping uses from these non-designers to inform design pedagogy?

- Teams had Lego’s and modeling clay in the bowls as centerpieces of their work stations. Are there patterns teams exhibited when prototyping—did the teams that “play” the most during the event register deeper conversations and produce richer prototypes?

- If given the space to add their own definition, could one-on-one interviews with participants reveal new attributes to categorize design thinkers, as shaped by their experience?
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DesignShop as a Model for Teaching Design Thinking to Non-Designers and Achieving
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As a Template for Creative Idea Hubs in the Space of Hands-on Learning, Digital


APPENDICES
APPENDIX A

EVENT WEBSITES

EDUCATION DESGINATHON
Got Hack?

The Education Design-A-Thon is a hackathon for educators, learners, and education thinkers. Designers, educators, and educators from K-12 to higher education will come together to tackle some of the biggest challenges in education and design multi-disciplinary solutions, formed around three common goals:

- Digital learning
- Media literacy
- Equity of learning

Participants will have access to a hack room and a workshop shop, prototyping materials, and a 3D printer to develop their ideas. EdExperts from the field will introduce their challenges and help provide guidance to participants.

The event will take place at the MIT Media Lab on March 9-10, 2013. Learn more about the event at http://mitedu.mit.edu/designathon

Prizes!

2 Best Overall Hack, 3 Honorable Mentions in each category, and 4 Special Prizes will be awarded.

$1,000 1st Place: Best Overall Hack
$750 2nd Place: Best Overall Hack
$500 3rd Place: Best Overall Hack

Guidelines for Best Overall Hack:

- Provides a solution to an identified need
- Creative "Wow Factor"
- Well-designed experience, execution, and implementability
- Considers impact and adoption into educational practice

4 Recognition Awards

Best contribution to EdX's MOOC platform
Best contribution to student learning and engagement
Best contribution to digital literacy
Best innovation to an existing course

Additionally, students can enter their hacks in a competition and win up to $15,000 for their use of technology to enhance learning at MIT's EdX platform.

Get Inspired

Meet our EdExperts

Register Now!
Hands-On Learning

D-Lab

MIT Edgerton Center

Digital Learning

MIT Office of Digital Learning

edX

iLabs

MIT Office of Education and Innovation Technologies

The Education Arcade

MIT OpenCourseWare

Match Schools

Match Education

MIT Scheller Teacher Education Program

Digital Learning

MIT OCW

168
EDUCATION DESIGNSHOP WEBSITE
APPENDIX B

APPLICATION FORM

Education DesignShop Application

Name *

First

Last

Email *

Affiliation *

Title *

Website

School Level *

- Still rocking the middle school scene
- Currently being awesome in High School
- Making magic in a Trade or Vocational School
- Still finding myself in College
- More or less completed a College or Trade school
- More or less completed a Graduate or Professional Degree
- Bill Gates is my hero...Who needs school?!
- Prefer Not to Answer

Rank which Design Focus you'd like to work in during the DesignShop. You may select a focus area in which you've been interested for years or one that just freshly piqued your interest. Just keep an open mind and be ready to dive in.

TOPIC 1
Curriculum Re-Design for STE(A)M – Science, Technology, Engineering, (Arts), and Mathematics
Almost ready for submission!
Please review the following terms.

Birthday

MM / DD / YYYY

By submitting this application,
I understand that this is a research event and that data gathered
will contribute to an MIT Master's Thesis.

I understand I will have to sign Consent Forms at the
registration desk of the event (And that if I am a minor I should
bring my signed forms with me: Participation, Minors
(https://www.dropbox.com/s/q38n0qldshgmbvm/consenttoparticipate_minor.doc)).

* Yes, I agree.
* No, I do not agree.

Resources and Support Structures for Retention & Diversity

Insight & Experience
We're matching teammates to have a diverse range of expertise and years in the field.
Help us understand your background and what you could add to the team.

Experience as a Policymaker *
★★★★★

Experience as a Teacher/Educator *
★★★★★

Experience as a Student/Learner *
Skills & Abilities
Help us understand your fluency with some of the skills you’ll be using at the DesignShop.

Rapid Prototyping
Including: cardboard, foam core, foam and hot wire cutter, hot glue, popsicle sticks, etc.
Excluding: 3D printing, laser cutting, and machining

Sketching to visually communicate ideas

Using Post-it notes to succinctly capture and represent ideas.

Experience as a Student/Learner

Experience in Industry (Engineer/Designer/Entrepreneur)

Brainstorming in groups

Lego's and using them to express ideas

Personality & Teamwork Ethic
Help us understand your personality and teamwork style so we can better match you with teammates that you’d want to spend your weekend with!

I most identify with...
On a relaxing Friday night, would you rather:

- Sit at home, reading a book
- Hang out with my friends
- There's no such thing as a relaxing Friday night
- Other

Quick! Cat person or dog person?

- Other

Sorry, I'm allergic to all things cute

When working in a team...

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I'm usually the leader organizing and delegating tasks.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I'm usually the most outspoken and vocal about ideas.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

I'm usually more concerned about the bird's eye view than the finer details. | 1 | 2 | 3 | 4 |
I'm usually more analytical than creative. | 1 | 2 | 3 | 4 |
I'm usually organizing team outings and prioritizing team dynamics. | 1 | 2 | 3 | 4 |
I'll usually fight to make sure everyone hears my idea before moving on. | 1 | 2 | 3 | 4 |
It is more important that everyone feel good about pursuing a lesser idea than some teammates feeling bad pursuing a better idea. | 1 | 2 | 3 | 4 |
I usually think before I speak (rather than figure it out as a speak out loud). | 1 | 2 | 3 | 4 |
My energy is usually highest at the beginning of a project (rather than at the end, after much work). | 1 | 2 | 3 | 4 |

Anything else you'd like us to know?

Relevant comments on your usual team dynamics and team work preferences...

You at the DesignShop

In this first year of the DesignShop we can only take 25 of each students, educators, policymakers, and industry personnel (100 participants in total). Help us understand why you should be in this first group!
Tell us about your most memorable learning experience *

Please describe why you’re interested in participating in the DesignShop *

How do you think attending the DesignShop will affect you personally? *

Anything else you’d like us to know? *

Include links to your portfolios, CV’s, or any last words to help us choose you!

Almost ready for submission!
Please review the following terms.

Birthdate
MM / DD / YYYY

By submitting this application:
I understand that this is a research event and that data gathered will contribute to an MIT Master’s Thesis.

I understand I will have to sign Consent Forms at the registration desk of the event (And that if I am a minor I should bring my signed forms with me: Participation, Minors (https://www.dropbox.com/s/q38n0qldxhgnvb/consenttoparticipate_minor.doc)).

☐ Yes, I agree.
☐ No, I do not agree.
Team Facilitator’s Handbook

Reminders

- Make sure your audio recorder is ON, in “SP” mode and in the upright standing position every time you and your team are at your workspace.
- For every Team Module, flip to that sheet in front and have on your clipboard.
- Dropbox folder for your team to upload to their personal sub-folder: email: edudesignshop@mit.edu, password: edsonmay3and4, 2014
- Finally, keep your phone on you and on loud where you can hear it and the time updates throughout the day! This will allow for communicating slight schedule changes and timeline reminders when an activity’s time is almost up.
- Coffee, fruits, and sugary snacks are available in the Venture Cafe space to your discretion! Help yourself! Plan your team’s snack breaks for when they are down or get tired. Please change our
- Materials can be checked out from the HQ space. See the Materials Recording Sheet with more info.

- About this handbook. We recommend you read through the instructions and deliverables before the Team Activity begins so you are ready as they come in. They should not wait on you for instructions and should feel free to start and organize themselves.
- Note: There are a lot of questions for you to reflect on during (and especially) after each Team Activity. This is because you are our Most Valuable Player as a documen-ter witnessing the Participants first hand (not as a design thinking expert, so it’s okay to let them make mistakes!). I wish I were there, but since I can’t be, I’m counting on you to tell me all the juicy, design thinking-relevant anecdotes through these questions (p.s. when I say GDoc, I mean the ‘Team Facilitators—Techniques’ Google Doc we reviewed at the Training.).

Remember, we’re here to innovate. Have fun!

If you have any questions, just text, call, or come on down to the HeadQuarters Area right next to the entrance to Venture Cafe, Jessica (305.962.4552) and Filip (202.560.0358).
Materials Recording Sheet

Also available... (Please make note of what your team uses in the Activity Sheet so we can both replenish borrowed materials and document for research)

- Scissors
- Rulers
- Measuring tapes
- Peel-it rulers
- Blue-Foam & Hole Wire Cutter
- White Foam Core
- Hot glue guns
- Pipe Cleaners
- Popstake sticks
- Day and shaping tools

- Arduino UNOs
- Raspberry Pi Model Bs
- USB A-B cables
- Wavemem Shields
- SERVO motor/Servo Shield
- Servo shield
- Stepper Motor 12V 400mA
- Small Sensors
- Sensors/Actuators
  - ProxSense
  - Glue
  - Actuated valve
  - Force Sensitive Resistor
  - Resistor

180
TF_M1: Team Meetup (35 mins)
Deliverable: 1 Team Logo, 1 Team Name
Submitted to Dropbox Folder

Before this: They were just given the Welcome Intro by Jessica, and the Sketching tutorial by David.

Instructions: When Jessica gives the instruction, leave the Venture Cafe room and go to your team table (number is on your badge! Shhhhh). When your teams arrives, greet them with the same level of excitement! They're so happy to be learning from you!

- As soon as everyone in your team arrives, start your first intro Meet & Greet activity (you can choose one from the TF google doc).
- After warming up to each other, have everyone go around and share their background and personal goals with the Education DesignShop. In particular, why are they there? You can choose to do this through an activity on the GDoc.
- Have your team come up with a Team Name and Team Logo. This is a team-building activity and a chance to practice their recent sketching tutorial. Also, the name and logo will be used in the gallery to identify the teams (smarter than just the Team Number).

Deliverables: It's important they learn the value of documentation, like any good designer. Have them take a picture of all their sketches (the good, the bad, and the ugly) when they decide on their final submission for the logo.

After this: They will go learn about how to make proper User Observations and ask the right questions, or how to empathize with a problem when they themselves are also users.

TF_M1: Team Meetup (35 mins)
Follow-up Questions

1. How much involvement did you have during this activity?
   
   - Barely Spoke
   - Spoke about half of the time
   - Practically led the session

2. Number of mentors that came to talk to your group ______

3. Did anyone reference the material from the "workshop" module before it?
   If so, to what extent?

4. Overall, how was the energy in the room when you walked in?
   
   - Pretty bland
   - Excitable
   - Doing somersaults

5. Did anyone try to figure out who represented the four disciplines in the group?
   If so, to what extent?

6. Notice anything?
TF_M2: Empathize & Reveal Presumptions (50 mins)
Deliverable: Association Map of Team Motivations
Submitted to Dropbox Folder

Instructions:
- Have your teams pair up and practice good User Observation techniques, particularly: Show me, Draw it, Why’s, Think aloud, Be specific.
- Have them share out loud with each other, and

Deliverables: Documentation! Like any good designer, have them take a picture of ALL their maps, notes, and connections.

TF_M2: Empathize & Reveal Presumptions (50 mins)
Follow-up Questions

1. How much involvement did you have during this Activity?
   - Barely Spoke
   - Spoke about half of the time
   - Practically led the session

2. Number of mentors that came to talk to your group: ___

3. Did anyone reference the material from the “workshop” module before it?
   - If so, to what extent?

4. Overall, how was the energy in the room when you walked in?
   - Pretty bland
   - Excitable
   - Doing somersaults

5. Did anyone try to figure out who represented the four disciplines in the group?
   - If so, to what extent?

6. Notice anything?

7. How personal were the stories?

8. How objective was mind-mapping?

9. How much did they adhere to the methodology vs. improvised/winged it?
   - Improvised Completely
   - Somewhat informed
   - Tried to strictly
TF_M3: Identifying the Problem (40 mins)
Deliverable: Pictures of 50+ ideas generated per person;
Group Brainstorming, 1 Central Problem direction
Submitted to Dropbox Fold

Instructions:

•See GDoc for creative Brainstorming practices.
•Have Individual Brainstorming session for 15 mins (Shoot for 20 ideas+). Have them share their ideas to the rest of the team. Sharing should happen at about 5 minutes per person.
•Sketches should be BIG and VISUAL so that they can present their work quickly and with as FEW words as possible.
•Now, classify ideas into groups and have the participants downselect to ONE Central Problem Area to solve in!

Deliverables: Documentation! Have them take a picture of ALL their maps, notes, and connections. Have them submit one central problem direction and why they have chosen this one.

TF_M3: Identifying the Problem (60 mins)
Follow-up Questions

1. How much involvement did you have during this Activity?
   1. Barely Spoke
   5. Spoke about half of the time
   10. Practically led the session

2. Number of mentors that came to talk to your group: ____

3. Did anyone reference the material from the “workshop” module before it?
   If so, to what extent?

4. Overall, how was the energy in the room?
   1. Pretty bland
   5. Excitable
   10. Doing somersaults

5. How many ideas generated per person? (Name and Number)

6. Notice anything?

7. What was their chosen processes of individual vs. group brainstorming?

8. What was their chosen processes of down-selecting?

9. How much did they adhere to a methodology vs. improvised/winged it?
   1. Improved Completely
   5. Somewhat informed
   10. Tried to strictly keep to methodology
TF_M4: Research (30 mins) & Ideation (60 mins)

Deliverables:
- Association Maps of many root causes to central problem
- Decided General Root Cause to eliminate or fix;
- Ideation Documentation
- Top 2-3 Ideas moving forward

Submitted to Dropbox Fold

Instructions:

- Now that you have your Central Problem Area, dive into the research to confirm/validate that your hypothesis. Is there someone that's already tried this? How can you leverage existing solutions into your innovation? Ask to meet with Mentors for some feedback on what they've seen done before.

- Understand what's been already done, and how the research informs that you're on the right track.

- Share your findings with your group and how you think this informs you to propel forward or change direction (maybe there’s a slightly different root cause than you thought!)

- Ideate Multiple solutions to this root cause. Get feedback from mentors. Note this version of the solution is the most like your innovation right now.

- Decide on doing group or individual brainstorming during the Ideation Section (see GDocs).

- Get at least 2 Mentors’ thoughts for each idea.

Deliverables: Documentation
- Have them screenshot some research mediums (Interview Transcripts, Google pages, Mentors, books, etc.)
- Association Maps of many root causes to central problem
- Decided General Root Cause to eliminate or fix;
- Ideation Documentation
- Top 2-3 Ideas moving forward

TF_M4: Research & Ideation (90 mins)

Follow-up Questions

1. How much involvement did you have during this Activity?

- Barely Spoke
- Spoke about half of the time
- Practically led the session

2. Number of mentors that came to talk to your group ___

3. Did anyone reference the material from the workshop module before it?
   If so, to what extent?

4. Overall, how “visual” were their ideas on post-its?

- 99% words
- Big pictures, mostly got message across
- 0% words

5. How many ideas generated per person? [Name and Number] Was this in different stages?

6. Notice anything?

7. What was their chosen processes of individual vs. group brainstorming?
   How did they share with each other?

8. What was their chosen processes of down-selecting?

9. How much did they adhere to a methodology vs. improvised/winged it?

TF_M1: Team Meetup (35 mins)

Deliverable: 1 Team Logo, 1 Team Name

Submitted to Dropbox Folder
TF_M5: Refine Group Ideas & Prototype (100 mins)
Deliverable: Narrow down to central innovation;
MAKE a couple of exploratory physical prototypes;
Leave with one final innovation to pursue

Instructions:
Please upload your pictures from yesterday to Dropbox folders!

For now:
- Encourage them to explore the different dynamics and interactions and dependencies that
  their innovations would produce.
- Work with mentors to refine ideas and "test out" solutions.
- Explore a couple (2-3) potential final ideas through prototyping. One option is to split up the
  team and have each pair work on one prototype. Then come together and choose that final
  idea. This milestone should be celebrated! Do a blood-warming activity from the GDvC!
- Start thinking and taking notes on what you want to say in your final presentations.

Deliverables: More documentation! Take pictures of them doing some of it, and have
them take pictures of the many stages of their prototypes. They do not have to have a finished
product to take a picture of it! Leave this stage with a final innovation that they’re going
into. In the next activity, they’ll have to do something for just that innovation.

TF_M5: Refine Group Ideas & Prototype (100 mins)
Follow-up Questions

1. How much involvement did you have during this Activity?
   - Barely Spoke
   - Spoke about half of the time
   - Practically led the session

2. Number of mentors that came to talk to your group: ___

3. Did anyone reference the material from the "workshop" module before it?
   If so, to what extent?

4. How was their energy, compared to the first day?
   - Pretty bland
   - Excitable
   - Doing somersaults

5. Did any new thoughts develop overnight?

6. Notice anything?

7. What was their chosen processes for refining the ideas from so many to one?

8. What was their chosen processes for prototyping? Split up work v. all on one prototype?

9. Did they begin modeling more than one idea or just one from the beginning?
TF_M6: Group Critique Poster-MAKING (30 mins)
Deliverable: 2 posters (one explains, one asks questions)

Instructions:
- This is an exercise in figuring out what are the MOST essential elements of your innovation.
- Make 2 posters & 1 prototype:
  - 1 poster EXPLAINING your innovation. Use as many pictures and as little words.
  - 1 poster ASKS critical questions that you want answered by your neighboring group. This is a chance to get info, feedback, and user input from your neighbors, and also get an extra perspective from fresh eyes.
- 30 minutes is short and challenging on purpose. To make sure that you really weed out unnecessary stuff and put the bare minimal on your posters. Remember they should keep it short and visual because their neighboring teams will come around and have only 10 minutes to read and understand the innovation and give their feedback (answering questions and leaving their own questions).

Deliverables: 
- More documentation! Take pictures of them doing some of it, and have them take pictures of the many stages of their prototypes. They do not have to have a finished product to take a picture of it.
- Leave this stage with your table cleared and 2 posters clearly laid out and a prototype clearly laid out for the neighboring group to come around and easily see what your innovation is.

TF_M6: Group Critique Poster-MAKING (30 mins)
Follow-up Questions

1. How much involvement did you have during this Activity?

   Barely Spoke  Spoke about half of the time  Practically led the session

2. Number of mentors that came to talk to your group: ...

3. Did anyone reference the material from the "workshop" module before it?
   If so, to what extent?

4. How was their method for making a poster?

   Improved Completely  Somewhat informed  Tried to strictly keep to methodology

5. What materials and for what did they use? Who used them?

6. Notice anything?

7. What was their chosen processes for choosing what goes on the posters?

8. What was their chosen processes for prototyping? Split up work vs. all on one prototype?
TF_M6: Group Critique poster-REVIEWING (30 mins)
Deliverable: 10 minutes at each group, help them out

Instructions:
• Your group has 10 minutes to review each group. They should answer questions that the team posed on their questions poster, and they should also leave any comments or feedback on the rest of the prototype as they see fit! Use lots of post-it notes!

Deliverables: More documentation! Help them stay on time! 10 minutes at each group, and then go to lunch!

TF_M6: Group Critique REVIEWING (30 mins)
Follow-up Questions

1. How much involvement did you have during this activity?
   - Barely Spoke
   - Spoke about half of the time
   - Practically led the session

2. Number of mentors that came to talk to your group: ___

3. Did anyone reference the material from the “workshop” module before it?
   If so, to what extent?

4. How was their energy, compared to the first day?
   - Pretty bland
   - Excitable
   - Doing somersaults

5. What did they like and didn’t like? Any comments in particular that stood out?
   What were their reactions to the team’s innovation?

6. Notice anything?

7. How did they organize to give feedback? Altogether or all individually?
TF_M7: Group Iteration until 3:15!
Deliverable: Presentation!

Instructions:
• Please take note of what materials they used! Specifically, Arduino-types!
• After the presentations, re-group with me in HQ for your going away thank you present!

Deliverables: More documentation, please!
• By 3pm: Upload any digital media to your Team’s Dropbox and Subfolder: FINAL PRESENTATION
• By 3:15pm: Be in the Venture Cafe, with your prototype, ready to present.
  • Presentation: Need to have a sort of Prototype. Digital media is optional.

TF_M7: Iteration until 3:15!
Follow-up Questions

1. How much involvement did you have during this Activity?
   - Barely Spoke
   - Spoke about half of the time
   - Practically led the session

2. Number of mentors that came to talk to your group: ___

3. How did they like the Critique? Was it helpful?

4. How was their energy, compared to the first day?
   - Pretty bland
   - Excitable
   - Doing somersaults

5. What did they like and didn’t like? Any comments in particular that stood out? What were their reactions to the team’s innovation?

6. Notice anything?

7. How did they organize to go into the final stretch? Altogether or all individually?
You have been tasked to reverse an emergent trend of persons throwing trash away in the recycling bins. When these items are mixed, they are no longer recyclable. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.

Your name: ________________________
You work for a Fitness Center that has interested members, but they're just not meeting their health goals and it is your job to keep them as customers. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.

Your name: ________________________________________

You have been asked to stop the spread of mosquito-spread malaria in West Africa. Please describe the steps you would follow to address this task. Remember, there is no wrong answer, but you only have 20 minutes for this activity.

Your name and email: _______________________________________________________


Participants: Edu DesignShop Feedback Form

This is a follow-up for attending the Education DesignShop. Please carefully read the following questions in order to complete the survey. As this is a research venture, your honest thoughts are greatly valued and will be considered for next year’s (potential) iteration.

HYPOTHESIS: The Education DesignShop is an effective model for innovation in the education system. It harnesses the creative and energetic atmosphere of a hackathon and layers in the knowledge and expertise of a research project by adding mentors to the mix.

Please rate your agreement with the hypothesis *

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Briefly explain your answer. *

How familiar are you with the hypothesis or its overall subject? Check all that apply, *

- Direct experience/first hand knowledge
- Have closely followed debate/discussion on the subject
- Somewhat familiar with various opinions on the subject
-
Not familiar with the subject
☒ Not familiar with debate/opinions on the subject

Do you think that your position regarding the hypothesis is: *
☐ That of the majority
☒ A minority opinion
☐ Or that positions regarding the hypothesis are evenly divided
☐ Don’t know

Has your opinion on this hypothesis or its subject changed? Please indicate when: *
☒ Now, as you reflect on the DesignShop
☐ After the second day of the DesignShop
☐ After the first day of the DesignShop
☐ Opinion has not changed

If your position has changed, what factors influenced that change?

At the Education DesignShop, would you say that you... *

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>No Opinion/Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>learned (or reinforced) the principles of design thinking</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>learned (or reinforced) how to apply design thinking</td>
<td>☑</td>
<td>☑</td>
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<td>☑</td>
</tr>
<tr>
<td>got help on the design process through Workshops led by Jessica</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<td>☑</td>
</tr>
<tr>
<td>got help on the design process through Team Activities</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<td>☑</td>
</tr>
<tr>
<td>learned from your Team Facilitator</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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</tr>
<tr>
<td>and your team could not have been as successful without the Workshop Content</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>and your team could not have been as successful without your Team Facilitator</td>
<td>☑</td>
<td>☑</td>
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<td>☑</td>
</tr>
<tr>
<td>and your team could not have been as successful without the help of Mentors</td>
<td>☑</td>
<td>☑</td>
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</tr>
</tbody>
</table>

and your team would have been able to implement and execute your innovation if you had won one of the prizes
☒ ☑ ☑ ☑ ☑ ☑

and your team benefited from being in interdisciplinary teams.
☒ ☑ ☑ ☑ ☑ ☑

and your team found it valuable to have the input of a minor or student in your team?
☒ ☑ ☑ ☑ ☑ ☑

What do you think most influences your opinions regarding the questions in the grid above? *

Pretend to give your Team Facilitator feedback
This will actually not go back to them; it will just stay as data points for selecting Team Facilitators in the future.

They should do more of...

They should do less of...

They should do the same of...

Quick! Cat person or dog person? *

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Give your organizers feedback: IN TERMS OF LOGISTICS...
Your comments will be considered if there is a future iteration of the DesignShop.

You should do the more of...

You should do less of...

You should do the same of...

Give the organizers feedback: IN TERMS OF CONTENT...
Your comments will be considered if there is a future iteration of the DesignShop.

You should do more of...

You should do less of...

You should do the same of...

Reflect on your own performance
Tell us where you’re at after the DesignShop.

Rapid Prototyping
Including: cardboard, foam core, foam and hot wire cutter, hot glue, popsicle sticks, etc.
Excluding: 3D printing, laser cutting, and machining*

Sketching to visually communicate ideas
Using Post-it notes to succinctly capture and represent ideas.

Brainstorming in groups

Lego's and using them to express ideas

What was your most memorable learning experience at the DesignShop?

If you had to do it again, which of these would you keep the same and NOT change?

- Secretary Malone Keynote
- Intro to Design Thinking (Workshop)
- Visual Thinking & Sketching (Tutorial)
- Team Meetup/ Ice Breaker (Team Activity)
- User Observations (Workshop)

If you chose to change any, what would you change, and why?

Any last thoughts or comments to improve the DesignShop?

Would you like to stay in the loop and be involved in the DesignShop next year (if it were to occur)?

- Yes
- No
- Other