# REDESIGNING THEDESIGNEXCHANGE METHOD PAGE TO ASSIST NOVICE DESIGNERS IN EMBEDDING DESIGN METHODS INTO PRACTICE

**Varna Vasudevan**
Mechanical Engineering
University of California, Berkeley


*Advised By:*
**Prof. Alice Agogino and Danielle Poreh**
Mechanical Engineering
Berkeley Institute of Design
University of California, Berkeley

## ABSTRACT

The growth of the field of human-centered design, both in academia and industry, has led to a large increase in the quantity of documented design methods used as procedures to properly execute actions within the design process. This ever-growing collection of over 300 distinct design methods was disorganized and dispersed across different industries and resources, thus motivating the creation of theDesignExchange which consolidated and organized these design methods into a central online repository. Despite the benefits of the integration and collection of methods onto theDesignExchange database, usability studies showed that users, particularly novice designers felt overwhelmed by the sheer quantity of methods available to choose from. The selection and use of appropriate design methods for a specific project context has been linked to more successful project outcomes, thus emphasizing the importance of student access to design methods. In order to understand the needs of designers and educators embedding theDesignExchange into their projects and curriculum, this paper introduces an additional usability study involving design educators. Educator interviews were conducted in order to understand the current design education ecosystem and assess the value of theDesignExchange in the classroom. The findings illustrate that theDesignExchange has valuable content for both user bases, but suggested that the current organization and information architecture of the method page created major issues with usability and navigability of the online platform. Educators described how the direction provided by structured curriculum and educator experience in the classroom helps guide students towards method selection during individual and team project work. To solve this need, the *Method Coach* feature on theDesignExchange is in development. Early stage designs will be presented in this paper.

## INTRODUCTION

Design methods are used to help designers perform actions within the design process that lead to a desired goal or outcome in their design process. There is a significant correlation of the usage of design methods applied in the proper manner and success outcomes to design projects, resulting in the increasing popularity of design methods as a significant tool in design education [1]. However, "the curriculum of many design courses currently use textbooks and static web-based repositories to teach design [methods]..., thereby limiting the breadth and diversity of method selection for students to apply in practice" [1]. Educators are actively trying to bridge these gaps by teaching design methods in an exploratory, activity-based manner using interactive and dynamic resources for content.

### *Berkeley Design Ecosystem*

Human-centered design theory and skills are actively being embedded into the core curricula of many classes and even have stand-alone courses at UC Berkeley. These courses focus on hands-on skill development and exploration of core actions of the design process, using project-based learning as a medium to focus on interdisciplinary prototyping and teamwork across the entire design process from Research and Ideation to Prototyping and User Testing [2]. This dynamic, flexible, and interdisciplinary nature of the Berkeley Design Ecosystem is fostered at the Jacobs Institute of Design, which offers courses in three levels: 1. Design Foundation courses that incorporate interdisciplinary thinking and an overall introduction to design thinking; 2. Design Skills courses that focus on specific skills and crafts; and 3. Advanced Design courses that combine the hard skills and foundational methodology content into a culminating project that spans the entire design process. These classes incorporate design methods and skills into the core of their design curriculum, actively guiding students to use "Research" methods such as 1:1 interviewing and card sorting and "Build" methods such as laser cutting and 3D printing. Many of the course syllabi focus on goals and actions of the design process, and are organized into clusters of methods, similar to the 5 buckets (Research, Analyze, Ideate, Build, Communicate) on theDesignExchange. Some courses, such as ME 110, Introduction to Product Development, and ME 292C, Human-Centered Design Methods, currently use the content on tDX to support their teaching. The increasing interest in design thinking and innovative problem-solving can be visualized by the number of design course offerings at Berkeley - the Jacobs Institute sponsors 15-20 courses every semester, and a total of 176 courses are included in the interdisciplinary Human-Centered Design Course Thread. Due the increased interest and growth of the design community, the Berkeley Certificate in Design Innovation offered by the Jacobs Institute has increased in popularity.

### *theDesignExchange Online Platform*

As the field of human-centered design continues to grow, more and more design methods will be developed and put into practice. As highlighted by Roschuni, "with over 300 distinct design thinking methods, and more developed every year, there is a need to clearly categorize and organize these methods and develop a standardized way of communicating about them" [3]. An online platform, theDesignExchange, currently serves as a central repository and resource for classifying and organizing these design methods, using ontology developed from literature reviews and a series of workshops to help categorize and classify this large volume of method content [3]. TheDesignExchange supports the design community through the entire life-cycle of the conceptual design process—from observation through synthesis and analysis to realization and evaluation – through a library of versatile and extensive tools. The tDX platform consists of three main sections: methods, collections, and case studies. The

methods page includes best practices, instructions for use, resources, and tools to help designers seamlessly embed design thinking into their work. Collections are currently used by educators as a tool to help group methods into modules. The case studies on the platform provide contextual examples of design methods in practice to inspire and empower the design community to creatively embed methods in practice.

TheDesignExchange uses the ontology and classification defined by the Roschuni Process Map in **Figure 1**, where methods were collected by conducting a literature review of design case studies, drawing on publications, online collections, books, and industry toolkits to compile the list of methods [3]. These methods were grouped into five key groups, or buckets - Research, Analyze, Ideate, Build, Communicate. From here, these hundreds of methods were categorized into schemes developed through a series of workshops with design practitioners and experts. Themes were developed to help classify methods within each bucket, and separate sub-categories were developed under each team. Buckets, themes, and sub-categories were used to develop a hierarchical system of tagging methods by important factors such as context of use, purpose, and other factors vital in selecting the best method to be used in a specific project context. There is an important tie between method selection and context, as discussed by Poreh that "when given the task to select a design method to apply to certain project, students tend to exhibit contextually-aware method selection mindsets" [1]. In this exploratory research, evidence suggests that by providing students using tDX with a tool or coach to help select methods that best fit their needed contextual application, the students can better find a method that matches the needs of the sociotechnical context, industry domain, user base, and motivation of the problem they are intending to solve [1]. By understanding the existing organization of the methods on theDesignExchange as well as the importance of context in method selection, we were able to conduct focused research studies to inform iterative changes of the method organization with a focus on fostering a more critical method selection mindset in novice designers.
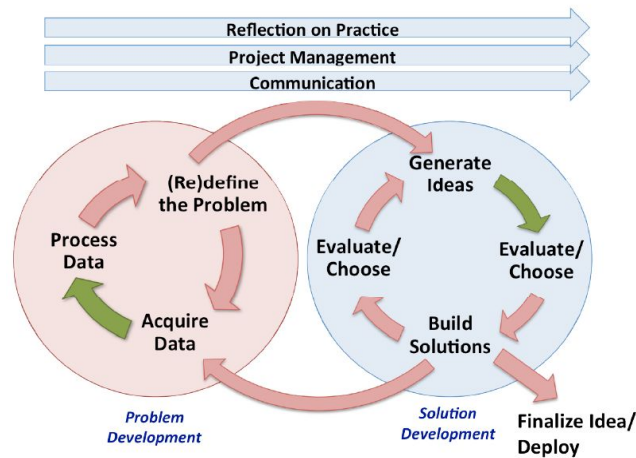


*Figure 1: Roschuni Process Map [3]*

***Usability Testing***

The popularity of HCD or Design Thinking has resulted in an increased interest in embedding design methodology into traditional curriculum, and theDesignExchange helps bridge design and education as a knowledge platform. An initial think aloud study was conducted with 13 undergraduate students to understand how tDX could be better suited to assist novice design students with embedding design

thinking into their work. This study specifically focused on frustrations that the students felt with the user flow, content presentation, and the user interface of theDesignExchange. A researcher in the study asked the participants to talk out loud while completing two tasks: 1. Find assigned reading and share with a team member, and 2. Pretend you're new to the site and searching for a method that would help you with a design project. The following quotes and insights show that students in general appreciated the wealth and depth of content offered on theDesignExchange, but had significant difficulty navigating and searching through the  quantity of methods on tDX:

- *"On a scale of -3 to 3, I'd give it a … "0. It's **3 for content** in that it's all there, but the poor rating comes from **not being able to choose very easily**. Even if you knew some of these things well it's **hard to tell what would be best for what you're doing** so you might end up using something you've already learned **instead of finding something new**."*
- **Everybody who did not use the search bar used the filter** to find methods (9/13 people) and preferred the existing filtering system over random browsing. The students still had to scroll through the leftover options, in order to "*see if any pop out*", and tended to look at images and titles as well as skim through descriptions. The participants still felt it was overwhelming to scroll, and at least 7 people asked for more specific filters.
- Every student, either during the study itself or in the follow up interview, expressed that they felt overwhelmed or experienced a similar sentiment at some point while browsing: theDesignExchange provides a "wealth of information" but is overwhelming in magnitude of content

We learned that when a user on the platform has a particular method in mind, they are able to intuitively use the search functionality embedded into the web application and find their desired method without issue. However, when a user is looking for a new method to apply that fits with their project context, goals, and desired actions, this task is incredibly challenging. The pain points extracted from the insights of this usability study showed a key need to present the site content in a clear manner, perhaps using a hierarchical method organization or sorting functions to improve content navigability. In addition, the balance between the variety and breadth of options seemed vital- the participants liked having a volume of method options but felt overwhelmed when selecting methods to put into practice. Lastly, the students suggested that they could be guided to methods more pertinent to their needs as well as to methods they may not have noticed before. These insights helped us inform our platform changes to suit the needs of novice designers. We additionally wanted to understand the perspective of another key stakeholder, educators working to embed design into their classrooms and curriculum. By understanding the needs of these two personas, we can focus on developing theDesignExchange into an accessible knowledge platform to help support the rapid growth of the design community and design-focused courses.

### *Motivation*

To continue building on the previous findings, 1:1 interviews were conducted with educators teaching design courses at Berkeley. More specifically, the goal was to gain insights into the value,

usability, and user experience of the online platform from this new perspective. The initial research questions aimed to be addressed by these interviews in this paper are as follows:

*Q: How do current design educators seek and develop resources for their courses?*

*Q: How can theDesignExchange fit into their classrooms and existing curriculum?*

*Q: What aspects of theDesignExchange are most engaging for educators?*

*Q: Where do educators see value in theDesignExchange?*

This paper will be divided into two chapters. The first chapter will discuss the Educator Interviews and the second will cover the Method Reorganization project that resulted from insights gathered during Educator Interviews.

# CH. 1 EDUCATOR INTERVIEWS

In order to understand the role of theDesignExchange (tDX) in the classroom, two researchers conducted in-person interviews with design educators at UC Berkeley. The goal of these ethnographies was to better understand the current landscape of design thinking education, with tDX as a portal that aims to support the design process by providing educators and students with a versatile library of tools. By understanding how educators currently seek resources, develop coursework, and structure design courses through these interviews, we hoped to understand how to suit the functionality and services of theDesignExchange to be of most value to these educators. theDesignExchange was presented to educators who had with minimal prior knowledge and experience with the platform before the interview, thus allowing us to clearly understand their initial reactions and discuss the factors they look for when trusting the content of a knowledge platform with a fresh perspective.

## 1 INTERVIEW STRUCTURE

### 1.1 Acquiring Educators to Interview

The two researchers reached out via email to twenty-two educators within Design, Engineering, Business, and New Media departments at UC Berkeley. The researchers were able to conduct only seven interviews with educators due to the quick timeframe of the research project as well as difficulty in establishing communication channels with instructors. Each interview had a duration of 30-45 minutes each, and followed a semi-structured interview template. The two researchers individually interviewed educators and captured audio recordings of each session to transcribe post-interview.

### 1.2 Interview Template

The interviews started broad before discussing specifics about the current tDX platform. The researchers began each session with a general discussion regarding the educator's background in design and teaching. The second portion of the interview consisted of semi-structured critiques on the usability and architecture of the landing page, methods page, case studies page, and collections tool.

 Each interview began with the researchers providing the educators with a brief introduction to theDesignExchange, providing a quick summary of the history of tDX including background information on the leadership and student team, initial motivation for the research effort, as well as overall mission and intent for the platform. The researchers also asked the educators to introduce themselves, their interests, and relevant experience with design education to obtain initial insight into individual's emotional attachment and passion towards the field of design thinking and teaching as a whole. The researchers asked the following questions that concentrated on a **general inquiry into current pedagogy**:

*Q: What makes you interested in design, and how did you begin teaching design?*
*Q: What type of human-centered or design thinking design course do you teach? What is the*
*level of the students and typical class size?*
*Q: What disciplines do the students in this class come from?*

*Q: What textbook or online resources do you use? Why?*

The second section of the interviews consisted of a semi-structured critique of theDesignExchange web offering. The researcher introduced and **walked through specific pages on theDesignExchange online platform with each educator**:

*Q: [Landing Page] What are some of your initial thoughts regarding the landing page? What is most appealing about this platform?*

*Q: [Methods Page] Currently you can filter by stage of design, as well as subcategories or tags. How do you typically find methods that are relevant to your class?*

*Q: [Methods Page] What features could be added to the methods navigation and selection feature?*

*Q: [Case Studies Page] Our case studies are currently focused on development engineering, and in the future we hope to expand this to include student-written case studies. The goal is that students can publish their work and other students can read about past projects.Might you consider using this feature in your classroom? Was there anything surprising or unexpected about this product?*

*Q: How do you structure (or provide structure for) your class, and create a syllabus?*

*Q: How do you currently share design methods with your class?*

*Q: [Collections Page] This feature allows instructors to bundle methods and case studies to share to the class. How would you organize the collections for your class?*

*Q: [Collections Page] What features could be added to the collections tool?*

*Q: Might you consider using tDX instead of a textbook? If so, why? If not, what would need to be added or modified?*

## 2 DATA SYNTHESIS

Each researcher transcribed the voice recordings captured from the interviews, and highlighted key quotes and insights. A summary of the backgrounds of the seven educators who were interviewed are outlined in **Figure 2**.

| Professor | Type | Class | Goals | Notes | Readings |
|---|---|---|---|---|---|
| Lauren Ruiz | Industry Teacher | Fundamentals of DT, Reimagining Mobility, Undergrad, 30-40 | Methods, Thought Process | 1st time teaching intro/general class, teaching soft + hard skills | Has a database of readings from colleagues/designers, assigns Burce Hanington's book for intro reading at the beginning |
| Purin P. | Industry Teacher | Visual Communication and Skethcing, Undergrad, about 36 students | Hard Skills about Sketching | | Recommended NOT requires |
| James Pierce | Industry Teacher | Discovering Design, UX Intro | Methods, Thought Process | | no textbook, gives various resources/readings |
| Emily Au | phD in Product Designer, Researcher in Shanghai, Taught Product Design Courses Before, both Industry and Professor | Design Methodology (previously Sara Beckman's Class), 45 students | Learning methods, utilizing methods | Reflection after each class to see what info students find useful | No textbooks, gives various resources/readings |
| Ken Sandy | Industry Teacher | Project Management, 80 students | appreciate and interest in PM role | | |
| Jill Miller | Design Teacher | Critical practices (Jacobs and Stanford d. School) | art for social impact and activism | focus on build and research methods | |
| Grace O'Connell | PhD Bioengineering Design/ME Teacher | ME C178/BIOE C137: Designing for the Human Body | | | no textbook, pulls from various resources |

*Figure 2: Overview of Educators Interviewed*

Three researchers participated in two analysis sessions to synthesize key themes and painpoints from the ethnographic research, specifically focusing on different features of theDesignExchange platform: methods filtering, method content, collections, and case studies. Each of the two researchers that conducted educator interviews brought in strips of paper that encompassed the top ten quotes from each educator interviewed, resulting in a pool of 70 top quotes that were analyzed and organized. The team used the method of *affinity diagramming* where similar observations were clustered and compiled into themes and categories as seen in **Annex A**. These quotes were compiled in a flexible, organized manner and color-coded by educator using the online platform Trello as seen in **Annex B.** The themes developed through the affinity diagramming workshop were used as the titles of the cards in Trello, including "General Insights", "Readings" (tDX as a textbook), "Filtering Methods", "Method Content", "Case Studies", and "Collections." In addition, the researchers used the *persona* method to craft two types of educator personas, as well as define the persona of a novice design student based off of the synthesis from the think-aloud study.

# 3 RESULTS

## 3.1 General Insights

*Educator Personas*

After reviewing the summaries of the educator experiences and credentials as outlined in **Figure 1**, we realized that the background of the educator greatly influences their perspective and critique of theDesignExchange. We identified two personas of educators beginning to emerge in the field of design education - 1. an *Industry Educator*, who might have previously worked as a professional designer in industry before reentering the world of academia, and 2. an *Academic Professor*, who views design through the lens of academia and university-level innovation. For the Industry Educator, tDX is a supplementary tool in their classroom as these instructors play the role of an expert when presenting design methodology through the lens of previous and personal industry experience. On the other hand, the Academic Professor persona allows theDesignExchange to assume the role of a design methodology

expert since the professor is also a novice looking to embed human-centered design into their existing curriculum. It is this second persona that would most benefit from guidance and coaching from tDX to help with method selection and navigation.

*Method Complexity and Access*

Another general takeaway from initial research synthesis included a new perspective on the categorization of existing methods on tDX. From both usability studies, think-aloud study with students and ethnographic interviews with educators, we were able to see how the diverse collection of design methodology content on the platform was being utilized by these different user bases. There are over 50 methods for a novice designer to choose from for each stage of the design process as outlined on tDX (Research, Analyze, Ideate, Build, Communicate) in addition to the hundreds of methods available on the platform in total. As seen via the pool metaphor depicted in **Figure 3**, we noticed two *depths* of methods in terms of complexity. An initial, shallower depth of methods, termed *Basic HCD Methods*, were usually the most popular, least complex, and most well-known methods. This set seemed to be an ideal selection of methods for novice designers and students, as well as professors looking to incorporate HCD into their classrooms. A second, deeper level of *Advanced Methods* seemed to be more unique, more complex, and more specifically tailored to projects within certain specific contexts. These methods tended to be a useful addition to the design toolbox of more proficient designers and students, as well as industry teachers who were experts in their field and were already comfortable with the set of *Basic HCD Methods*.
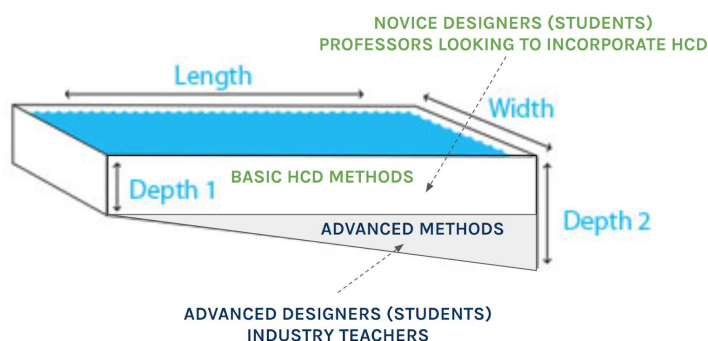


*Figure 3: Pool Metaphor for Method Organization*

## 3.2 Key Insights

Six key themes were extracted from the clustering of educator interview responses during the affinity mapping workshop. In order to provide substantial evidence to the claims and synthesis of this ethnographic research effort, direct quotes and links to user research studies were associated with each major insight.

**(1) Method Filtering** should guide *industry teachers* based on goals and objectives

- *"**Design is getting watered down into a forced 5-step process**, rinse and repeat; but it's not truly that way, a **lot of looping and more ambiguity**"* -Lauren Ruiz

- People need **guidance identifying the right methods** to achieve their current goals
- Want to **highlight most popular or recommended methods** on landing page or top of methods page to have an easy starting point
- (on IDEO's Design Kit's format) *"I teach brainstorming all the time and I'm like 'Okay, I need to fit this in two minutes, let's make sure I have everything.' I might see something else that might be cool and throw it in there. So the **adjacent methods is kind of nice** and how it's **color-coded** and you can scroll, which is lacking right now."* -James Pierce

(2) **Method Content** is strong, but not a replacement; tDX is a secondary or supplemental education tool

- Want to feel a **sense of trust**; vetting or secondary opinion on content
- Like **related methods** to find methods with similar names and discover new methods
- tDX methods can **supplement course material**, but can not **replace current readings**

**(3) Resources** are especially helpful to professors who are new to design thinking

- Content is useful as both a **general resource** to gain interest in a method and a resource to **show real examples of tools** (software, videos, templates) students can be using
- Want tDX to **create more original content**: templates for methods (ex: AEIOU) and instructable videos (ex: for build methods)
- *"I like using multiple resources because it teaches students to search and find out other things. A **method is a blob with many different sides to it,** and you can kind of squeeze it and it shoots out over there, and the [stuff] that hit the wall is yet another version of the method; and that's how I tend to approach teaching methods."* -James Pierce

**(4) Case Studies** can be a more effective learning tool if organized by project type, not the stage.

- Would like case studies to be **organized based on nature/type of problem or case study**, not the stages in the design process (ex: service design, physical design, digital design, web dev, etc.)
- **Linked methods** (that were used in the case study) should be more obvious
- Students want to see more case studies since they already **walk through example projects** in class that are relevant to their work

**(5) Collections** either need to be a novel experience for educators, or should be removed.

- *"Currently feels like **an empty box** or a **pinterest board**. Hey students, here's a **mixtape** that I've curated for you, go check it out."* -Purin P.

- *"With the current collections, I would rather just **link methods in an email**."* -Jill Miller
- *"As a new teacher at Berkeley, I am **wondering what are other people teaching?** Are we pulling from the same design methods? It's useful to see **what methods did students learn in a previous class** to not be redundant."* -Lauren Ruiz
- *"I want to have a bit more here than just my assigned methods, to **create an experience** for students: read this , do this exercise or external reading, and look at my course notes or other **material that is important to me**."* -Ken Sandy

**(6) theDesignExchange** supports teaching soft skills and process, not hard skills.

- At Jacobs Institute of Design students do not have specific prerequisite skills, so teaching methodology is a combination of soft and craft/hard skills
- Likes skills matrix, currently using survey to gauge student skills/familiarity/experience
- tDX focused on soft skills, early stage design

## 3.3 Motivation for New Projects

After gaining insight into both the usability and value proposition of tDX for different stakeholders, both educators through ethnographic interviews and students with the think-aloud study, the team focused on actionable deliverables that could address various painpoints highlighted in Section 3.2 above. The priority of future projects for the larger theDesignExchange team were extracted from these key insights. During the usability studies, we received feedback that the messaging regarding the value, motivation, and storyline of theDesignExchange was confusing for first-time users, informing the need for a landing page redesign. The majority of painpoints extracted from the user research regarding usability and navigability of the online platform were in relation to issues with the current organization and information architecture of the method page. The feedback on the overwhelming quantity of methods on display and the complex search filters motivated a project to help guide both novice designers and educators in navigating the large quantity of methods on theDesignExchange.

# CH. 2 METHOD REORGANIZATION

## 1 MOTIVATION

### 1.1 Current Categorization Scheme

The methods are currently organized in theDesignExchange in five key buckets with guidance from the Roschuni Process Map in **Figure 1**. To address the need for more intuitive navigability of methods, we chose to go back to the original process framework as a way to filter methods. This process map highlights key *goals and actions* that a designer masters during the design cycle, in turn addressing the need for more guidance for users in identifying and filtering the right methods to embed into their design process to achieve their goals. During the talk-aloud usability study, students felt the need to be actively navigated through theDesignExchange due to the overwhelming nature of the current method filtration and search system. Educators expressed similar frustrations, and identified that students in the classroom also seek direction in selecting the right method for their specific project stage and needs.

Each of the five buckets (Research, Analyze, Ideate, Build, Communicate) help a designer achieve a certain *goal* or outcome:
- **"Research"** includes methods to support the goal of acquiring meaningful data to drive design decisions
- **"Analyze"** includes methods to support the goal of synthesizing and drawing insights from collected data
- **"Ideate"** includes methods to support the goal of generating new ideas for products, services, etc.
- **"Build"** includes methods to support the goal of turning concepts and ideas into reality
- **"Communicate"** includes methods to support the goal of sharing insights and design ideas

In addition, each of the five buckets described in the Roschuni Process Map are associated with one or more *actions* described in **Figure 1** as described below [3]:
- **"Research"** combines *Acquire Data* and aspects of *Evaluate/Choose* to include methods in which human-centered design research (on users, stakeholders, market, etc.) informs design decisions.
- **"Analyze"** combines *Process Data*, *(Re)define the Problem*, and aspects of *Evaluate/Choose* to include methods that help organize, synthesize and interpret collected information to inform design decisions.
- **"Ideate"** parallels *Generate Ideas* and includes methods that help generate new ideas, concepts, business models, etc.
- **"Build"** combines *Build Solutions* and *Finalize Idea/Deploy* to include methods that help turn concepts and ideas into reality.
- **"Communicate"** parallels *Communication* and includes methods that help communicate insights or design ideas.

Each method associated with one or more buckets is associated with a set of tags that help a user filter and select methods. **Figure 4** depicts an example categorization scheme for "Storyboards," a

method under the *Build* bucket of methods. For the Build methods, there exists 8 categories, or themes, of tags (Stage of Prototype, Fidelity, Offering Type, etc.) and numerous subtags within each category (Mockup, Operational, Production under the Stage of Prototype Category) [3].

| Description | "*Storyboards*, derived from the cinematographic tradition, represent how a design concept may be used by a customer through a series of drawings or pictures put together in a narrative sequence. It shows every touchpoint the customer may have with the design during the experience." | | |
|---|---|---|---|
| **Stage of process** | Mockup | **Prototyping format** | Abstract |
| **Fidelity** | Low | **Aspect** | Role or context |
| **Offering format** | Either | **Scope** | Horizontal |
| **Product or service** | Either | **Purpose** | Experiment, Explore, Persuade |

| | |
|---|---|
| **Stage of prototype** | Mock-up, operational, production |
| **Fidelity** | High, medium, low |
| **Offering Type** | Product, service, either |
| **Produces** | Digital offering, physical offering, either |
| **Format** | Abstract, virtual, tangible |
| **Aspect** | Role/context, appearance, implementation, behaviour |
| **Scope** | Vertical slice, horizontal slice, full scope |
| **Purpose** | Experiment, validate, explore, persuade, demonstrate |

*Figure 4: Current Categorization Scheme for Storyboards Method [3]*

## 1.2 New Categorization Scheme

From our insights extracted from the educators interviews, we learned that designers seek guidance when trying to find the right method to embed into their work. In the classroom, an educator can serve as a coach, helping students align their project needs and context to a specific set of methods. The current categorization scheme of theDesignExchange forces the user to sift through the tags and take on the role of the coach themselves, thus assuming responsibility on the novice designer to understand and manipulate the tags to best suit their needs. By using the Roschuni Process Map and the categorization scheme around the 5 method buckets as well as correlated actions and goals, we can shift the responsibility of the role of the expert from the novice designer to theDesignExchange. By transforming the online platform to act as an extension of the expertise of the educator, we can more actively assist a user with their method selection on the website. In order to guide novice designers' method selection, we started by taking a deeper look into the structure and foundation given by the Roschuni Process Map and began to reorganize the presentation of tags and their associated methods to help develop a *Method Coach* functionality on theDesignExchange.

### *Action-Bucket Pairs*
We began by clearly outlining each action associated with a bucket, and isolated each *action-bucket pair* (e.g. Bucket: Research, Action: Acquire Data). This resulted in nine pairs of buckets and actions as seen in the second and third columns of the table in **Annex C**. We further reorganized these pairings into a more chronological order, using the circular flow of the design process from the Roschuni Process Map, starting with Problem Development then continuing onto Solution Development. This new perspective of how actions correlate with the buckets in a process resulted in a lot of clarity of many painpoints with the current categorization. By creating a chronological order, we noticed that the five

buckets seemed to be too prescriptive of a process. For example, methods in the "Research" bucket were involved in multiple stages of the design process, both during the initial exploratory user research stage with the action of *Acquire Data* action as well as later in the process for the *Evaluate/Choose* action during the ideation and prototype-testing stage. Through this reframing activity, we realized that the association of actions and buckets significantly helped in grouping sets of methods to achieve certain goals in a more intuitive and transparent manner.

Educators mentioned that their most effective method of coaching students is by answering questions that seek direction and advice during the design process. This inspired a FAQ (Frequently Asked Question) format on theDesignExchange to help address the core ideas and goals associated with each action-bucket pairing. We developed questions that encapsulated the core goals, needs, and stage of each action-bucket pairing and maintained the perspective of a novice designer asking these questions to a coach or guide in search of method recommendations as seen in **Annex C: Section 1**. This use of questions written in the first-person point-of-view helps reinforce the focus of tDX on developing novice designer's individual problem-solving mindset, and encourages careful selection of appropriate methods for use. From our educator interviews, we heard that educators did not want a resource like tDX to prescribe a specific linear design process, and instead wanted to present a more cyclical, iterative process such as the Roschuni Process Map. Our use of an FAQ-style method coach suggests a general flow or sequence of thoughts, but does not seek to impose a particular design flow.

### *Key Tags*

For each of the FAQ questions developed, we reviewed the action-bucket pairings and associated goals in order to identify existing tags, or themes, and sub-tags that would be the most important for a novice designer to consider when narrowing down a method selection search at a high-level. For each of the nine questions, we identified three categories of tags that were the most relevant for a novice designer to consider. For each of these three categories of tags, we identified 3-5 sub-tags for students to further filter their method selection. Many of these decisions were based off method selection choices described in syllabi and curricula for many of the design courses taught in the Jacobs Institute of Design Innovation. This structure of question, category, and subtag is depicted in **Annex C: Section 2**, with columns describing the title of of each category as displayed on the current filtering functionality on theDesignExchange (e.g. Tag 1: Type of Data Collected) as well as the subtags associated with each method from the existing database (e.g. Drop-Down Tag 1: Qualitative, Quantitative, Mixed Methods). This new Method Coach reorganization uses the existing backend database on theDesignExchange, building off of the previous work of developing and linking categories and tags with each of the 300 methods on the platform.

### *Mad-Lib User Flow*

To create an intuitive user flow for a designer trying to filter methods through this new Method Coach, we presented the action-bucket pairs as a series of questions, similar to a FAQ page. To answer each of the nine the questions, the categories and sub-tags were presented in mad-lib, or "fill-in-the-blank" style (e.g. I am trying to collect ____ data and conduct ____ user research in order to ____) as seen in **Annex C: Section 3**. Each of the nine mad-lib sentences are interactive, with the sub-tag options displayed as a drop-down menu. Novice designers can select the correct input for each of the blanks to help answer their questions with clear guidance on critical factors to consider during method selection. This format of questions and answers in the Method Coach parallels the student and educator interactions as described in the ethnographic research. This interactive medium of a

mad-lib-style Method Coach can help guide the novice designers ask the right questions and think about the most prevalent tags or classifications when converging to a set of a few methods to put into practice. As the user manipulates the tags in the blank sections of the mad-lib, the set of methods displayed on the website dynamically change to reflect the modifications in filtering and selection immediately. In this manner, tDX can act as a more active coach in the method selection process.

*Redesign*

To visualize these changes on the main method page, a team of UI designers developed mockups (**Annex E**) of the Method Coach as an additional section on the current method page documented in **Annex D.** The research team is currently working with a web development team to implement the horizontal split-screen concept depicted in **Annex E: Section 1.** The tags use the existing backend database and display the content in a new visual and intuitive layout, thus continuing and building off of previous work in strategically categorizing and labeling methods with groups of buckets and tags. With further work, the team would love to launch the method coach live on the method page and work on iterations to the user interface and implementation supported by further usability testing and user research.

# CONCLUSION AND FUTURE RESEARCH

Both novice designers and educators looking to embed HCD methodology into their projects and classrooms seek guidance and coaching to help with method selection. Think-aloud studies with students and ethnographic interviews with educators showed many pain points with the current tDX online platform, specifically focusing on method selection as a crucial and overwhelming moment in the user flow when navigating the web application. The current categorization scheme of the hundreds of methods on theDesignExchange forces the user to sift through the tags and take on the role of the coach themselves, thus assuming responsibility on the novice designer to understand and manipulate the tags to best suit their needs. We identified actions and goals that designers seek to accomplish throughout the design process in order to develop and design a Method Coach that uses questions, tags, and a fill-in-the-blank style user flow to foster more thoughtful consideration and selection of methods to put into practice. By using the Roschuni Process Map and reorganizing the categorization scheme around the five method buckets as well as correlated actions and goals, we shifted the responsibility of the role of the expert from the novice designer to theDesignExchange. Using a new Method Coach interface as a dynamic and intuitive guide, we were able to make theDesignExchange play a more active role in fostering meaningful and critical method selection mindsets.

User testing through A/B testing, usability tests, and in-person interviews can help validate and reexamine design decisions relevant to the Method Coach project. Further research questions to continue exploring include:

- *Is the format of the questions intuitive or limiting, and can we crowdsource or collect questions that users tend to have in mind?*
- *Is the format of the mad-libs helpful, and do users want access to the larger set of tags and buckets currently on the search functionality of tDX platform?*
- *Were the tags selected for the Method Coach the most crucial for a novice designer, and were the insights obtained from literature reviews, educator interviews, and talk-aloud studies applicable and universal?*

Some of the initial user research questions, specifically focusing on the user interface architecture, can be initially tested during workshops and courses that use tDX content, including upcoming executive education workshops as well as a summer and fall design course. These initial insights can help validate our initial hypotheses regarding the mindsets and needs of students and educators. Future research into educator needs can expand outside of the realm of design education as well. Thinking into the future, we would like to help anyone who is looking to embed HCD into their coursework, regardless of course subject.

## ACKNOWLEDGMENT

# REFERENCES

[1] Poreh, D., Kim, E., Vasudevan, V., and Agogino, A. 2018., "Using 'Why and How' to Tap Into Novice Designers' Method Selection Mindset ". DETC/CIE 2018

[2] Dym, C.L., Agogino, A.M., Eris, O., Frey, D.D. and Leifer, L.J., 2005. Engineering design thinking, teaching, and learning. Journal of Engineering Education, 94(1), pp.103-120.

[3] Roschuni C, Kramer J, Agogino A. Design Talking: How Design Practitioners Talk About Design Research Methods. ASME. International Design Engineering Technical Conferences and Computers and Information in Engineering Conference

# ANNEX A

# RAW AFFINITY MAPPING NOTES ON WHITEBOARD
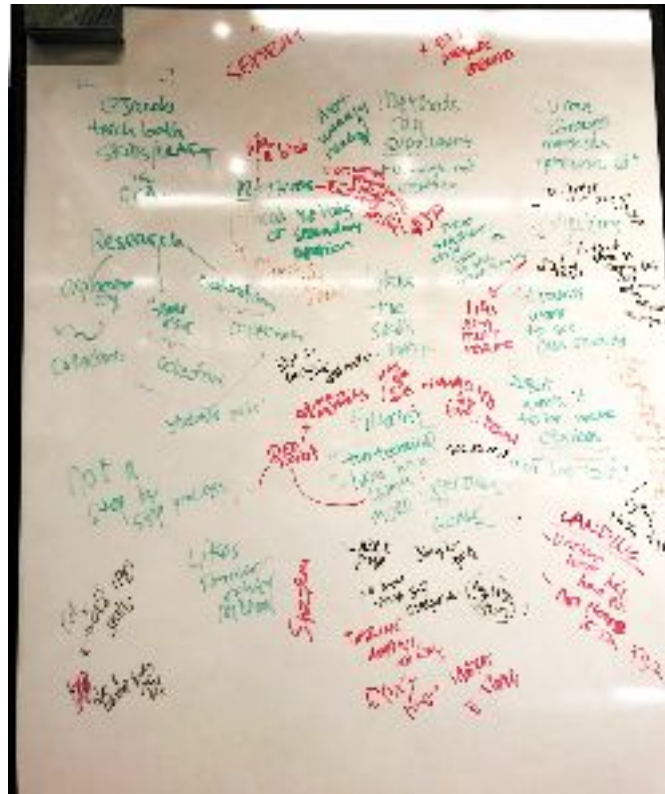
# ANNEX B

# AFFINITY MAPPING NOTES ORGANIZED ON TRELLO

**ANNEX C**

**METHOD COACH REORGANIZATION SCHEME**

| "Process" Order | Bucket | Action/Goal | Question | Tag 1 | Drop-Down Tag 1 | Tag 2 | Drop-Down Tag 2 | Tag 3 | Drop-Down Tag 3 | Example Mad-Lib | Default? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Research | Acquire Data | How do I begin to understand my users' mindsets? | Type of Data Collected | Qualitative, Quantitative, Mixed Methods | Researcher Location | Present, Remote, Absent | Purpose | Explorative, Draw on Previous Work, Co-Design | I am trying to collect ____ data and conduct ____ user research in order to ____. | I am trying to collect qualitative data and conduct in-person (present) user research in order to explore new spaces. |
| 2 | Analyze | Process Data | How do I make sense of the data collected? | Inputs | Quantitative Data, Text/Quotes, Observations/Images | Outputs | Charts, Flowcharts, Network Diagrams, Timeline/Trends | Purpose | Identify Current Beliefs, Search for Nuggets | I have collected ____ and want to process this data into ____ in order to ____. | I have collected observations/images and want to process this data into flowcharts in order to identify current beliefs. |
| 3 | Analyze | Re(define) the Problem | How can I frame the problem that I am trying to solve? | Inputs | Insights, Themes | Outputs | Themes, Perspective Shifts | Purpose | Shift Perspectives, Identify Current Beliefs | I have extracted ____ and want to ____ in order to ____. | I have extracted insights and want to find themes in order to shift perspectives. |
| 4 | Ideate | Generate Ideas | How do I come up with lots of ideas? | Activity Type | Drawing, Building, Writing, Talking | Participants | Individual, Core Team, Relevant Stakeholders, Users (Co-Design) | Purpose | Prepare Mindset, Diverge, Build on Ideas | I want to develop new ideas by ____ with ____ in order to ____. | I want to develop new ideas by writing with my core team in order to diverge ideas. |
| 5 | Analyze (and Some Ideate) | Evaluate/Choose (Converging) | How do I narrow down and pick a few ideas to pursue? | Inputs | Concepts, Themes, Quantitative Data | Outputs | Rankings, Charts | Purpose | Bring in New Data, Scope for Ideation, Judge Relevancy, Converge (in Ideation Purpose) | I have ____ that I want to organize into ____ in order to ____. | I have concepts that I want to organize into rankings in order to converge ideas. |
| 6 | Build | Build Solutions | How do I turn my idea(s) into reality? | Product or Service | Product, Service, Either | Offering Format | Digital, Physical, Either | Purpose | Explore, Validate, Demonstrate | I am trying to prototype a ____ that is a ____ offering in order to ____ a concept. | I am trying to prototype a product that is a digital offering in order to explore a concept. |
| 7 | Research | Evaluate/Choose(Testing) | How can I test and see how users interact with my prototype? | Type of Data Collected | Qualitative, Quantitative, Mixed Methods | Researcher Location | Present, Remote, Absent | Purpose | Evaluate Viability, Evaluate Business Desirability, Evaluate Desirability, Evaluate Implementation | I am trying to collect ____ and conduct ____ user testing in order to ____. | I am trying to collect qualitative data and conduct remote user testing in order to evaluate viability. |
| 8 | Build | Finalize Idea/Deploy | How do I create a more refined prototype? | Stage of Process | Operational, Operational Prototype, Production, Mock-Up | Offering Format | Digital, Physical, Either | Purpose | Persuade, Demonstrate, Validate | I am building a ____ for a ____ offering in order to ____ the final concept. | I am building a mock-up for a digital offering in order to demonstrate the final concept. |
| 9 | Communicate | Communication | How do I communicate my work throughout my design process? | Audience | Core Team, Full Team, Users, Mass | Medium | Conversation, Document, Experience, Presentation | Purpose | Inform, Facilitate Discussions, Build Empathy, Plan, Inspire | I want to communicate my design process to ____ using a ____ in order to ____. | I want to communicate my design process to my full team using a presentation in order to facilitate discussions. |

## Section 1: Bucket and Action Pairs

| "Process" Order | Bucket | Action/Goal | Question |
|---|---|---|---|
| 1 | Research | Acquire Data | How do I begin to understand my users' mindsets? |
| 2 | Analyze | Process Data | How do I make sense of the data collected? |
| 3 | Analyze | Re(define) the Problem | How can I frame the problem that I am trying to solve? |
| 4 | Ideate | Generate Ideas | How do I come up with lots of ideas? |
| 5 | Analyze (and Some Ideate) | Evaluate/Choose (Converging) | How do I narrow down and pick a few ideas to pursue? |
| 6 | Build | Build Solutions | How do I turn my idea(s) into reality? |
| 7 | Research | Evaluate/Choose(Testing) | How can I test and see how users interact with my prototype? |
| 8 | Build | Finalize Idea/Deploy | How do I create a more refined prototype? |
| 9 | Communicate | Communication | How do I communicate my work throughout my design process? |

## Section 2: Tag System

| Tag 1 | Drop-Down Tag 1 | Tag 2 | Drop-Down Tag 2 | Tag 3 | Drop-Down Tag 3 |
|---|---|---|---|---|---|
| Type of Data Collected | Qualitative, Quantitative, Mixed Methods | Researcher Location | Present, Remote, Absent | Purpose | Explorative, Draw on Previous Work, Co-Design |
| Inputs | Quantitative Data, Text/Quotes, Observations/Images | Outputs | Charts, Flowcharts, Network Diagrams, Timeline/Trends | Purpose | Identify Current Beliefs, Search for Nuggets |
| Inputs | Insights, Themes | Outputs | Themes, Perspective Shifts | Purpose | Shift Perspectives, Identify Current Beliefs, |
| Activity Type | Drawing, Building, Writing, Talking | Participants | Individual, Core Team, Relevant Stakeholders, Users (Co-Design) | Purpose | Prepare Mindset, Diverge, Build on Ideas |
| Inputs | Concepts, Themes, Quantitative Data | Outputs | Rankings, Charts, | Purpose | Bring in New Data, Scope for Ideation, Judge Relevancy, Converge (In Ideation: Purpose) |
| Product or Service | Product, Service, Either | Offering Format | Digital, Physical, Either | Purpose | Explore, Validate, Demonstrate |
| Type of Data Collected | Qualitative, Quantitative, Mixed Methods | Researcher Location | Present, Remote, Absent | Purpose | Evaluate Viability, Evaluate Business Desirability, Evaluate Desirability, Evaluate Implementation |
| Stage of Process | Operational, Operational Prototype, Production, Mock-Up | Offering Format | Digital, Physical, Either | Purpose | Persuade, Demonstrate, Validate |
| Audience | Core Team, Full Team, Users, Mass | Medium | Conversation, Document, Experience, Presentation | Purpose | Inform, Facilitate Discussions, Build Empathy, Plan, Inspire |

## Section 3: Mad-Lib

| Example Mad-Lib | Default? |
|---|---|
| I am trying to collect ____ data and conduct ____ user research in order to ____. | I am trying to collect *qualitative* data and conduct *in-person (present)* user research in order to *explore new spaces*. |
| I have collected ____ and want to process this data into ____ in order to ____. | I have collected *observations/images* and want to process this data into *flowcharts* in order to *identify current beliefs*. |
| I have extracted ____ and want to ____ in order to ____. | I have extracted *insights* and want to *find themes* in order to *shift perspectives*. |
| I want to develop new ideas by ____ with ____ in order to ____. | I want to develop new ideas by *writing* with *my core team* in order to *diverge ideas*. |
| I have ____ that I want to organize into ____ in order to ____. | I have *concepts* that I want to organize into *rankings* in order to *converge ideas*. |
| I am trying to prototype a ____ that is a ____ offering in order to ____ a concept. | I am trying to prototype a *product* that is a *digital* offering in order to *explore* a concept. |
| I am trying to collect ____ and conduct ____ user testing in order to ____. | I am trying to collect *qualitative data* and conduct *remote* user testing in order to *evaluate viability*. |
| I am building a ____ for a ____ offering in order to ____ the final concept. | I am building a *mock-up* for a *digital* offering in order to *demonstrate* the final concept. |
| I want to communicate my design process to ____ using a ____ in order to ____. | I want to communicate my design process to *my full team* using a *presentation* in order to *facilitate discussions*. |

# ANNEX D

# CURRENT THEDESIGNEXCHANGE METHOD PAGE

# ANNEX E

# METHOD PAGE REDESIGN MOCKUPS

## Section 1: Horizontal Split-Screen
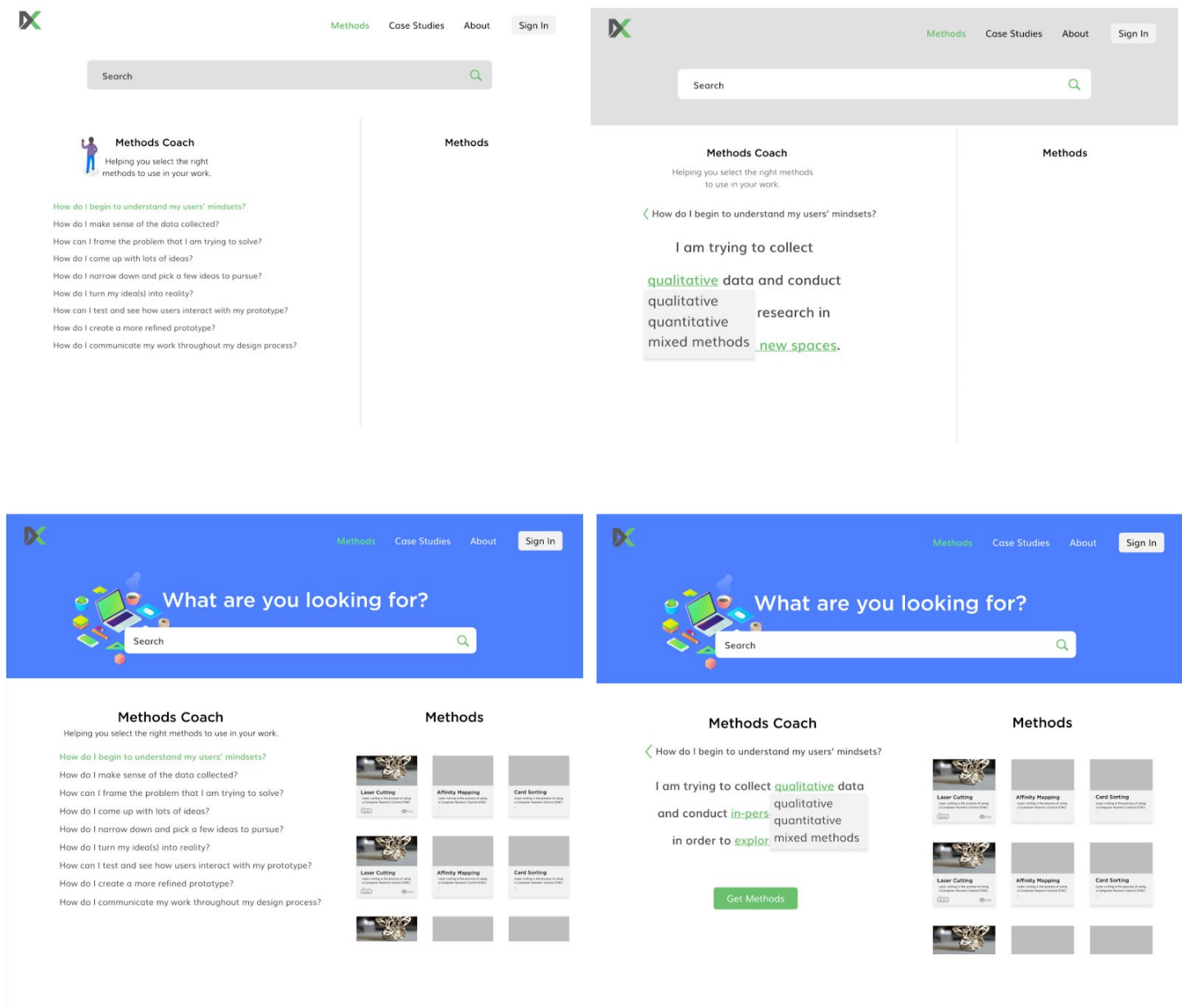
# Section 2: Vertical Split-Screen