An Investigation of Strategies for Discovering Design Methods in an Online Repository

by

Carmen J. Castaños
S.B. Civil Engineering
Massachusetts Institute of Technology, 2014

Submitted to the
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in Partial Fulfillment of the Requirements for the Degree of

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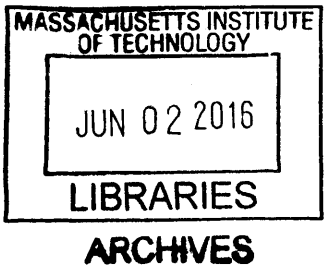

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ABSTRACT

This thesis investigates strategies for finding design methods using *theDesignExchange*, specifically during ideation. *theDesignExchange* is an online repository of over 300 design methods. While aimed at practitioners, the site has the potential to be a valuable tool in the classroom. However, students often have difficulty selecting an appropriate method for their work. This thesis poses two research questions. First, does featuring specific design methods on a page change students' familiarity and confidence with those methods over simply presenting them in no particular order? Second, what draws a student to select a particular design method on a page? Findings reveal that highlighting specific design methods on *theDesignExchange* does not impact the number of methods students recognize and feel confident with. The findings also reveal that students are more likely to browse, rather than search, for design methods on the repository, and that they are attracted to methods primarily because of the method's view counts and titles. Students perceived *theDesignExchange* as useful for finding new methods, specifically during ideation after exhausting methods they already knew. This second study provided user feedback for the site, validating and directing future site development.

Thesis Supervisor: Maria C. Yang
Tile: Associate Professor of Mechanical Engineering

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Chapter 1

Introduction & Background

1.1 *theDesignExchange*

'Design Thinking' describes the diverse, multidisciplinary skills needed in a range of professions to successfully design. However, each discipline has developed its own methods and skills [1, 2]. *theDesignExchange* is a comprehensive online repository of over 300 design thinking methods for a range of disciplines. *theDesignExchange* aims to organize and develop an ontology, facilitate multidisciplinary communication about design methods, and develop a community of profession designers, practitioners, educators and students [3, 4]. Finding an appropriate method to apply to a particular design problem can be challenging, especially for students or for those less experienced in design [5]. However, students are interested in becoming a part of a professional community of designers, building their expertise in design methods and documenting and sharing their work to get guidance from others [6]. The typical design course only has a limited amount of time to teach students design methods and skills and provide feedback – an interactive repository such as *theDesignExchange* presents an opportunity to expose students to a larger range of design methods beyond the classroom. Previous educational work on *theDesignExchange,* pairing traditional, formal design education with an online educational model, highlights the need to further develop *theDesignExchange* site content to facilitate the ability of students to think beyond their experience to engage in design with their class teams and within the larger design community [7]. Limited work has been done to study how students and others with limited design experience interact with *theDesignExchange*.

This work addresses this shortcoming by asking two research questions –

- First, does featuring specific design methods on a page change students' familiarity and confidence with those methods over simply presenting them in no particular order? This is done by experimenting with different layouts of the ideation methods page of *theDesignExchange* as readings for a capstone design course in order to investigate the effect on user recognition, confidence with or familiarity with design methods. The experimental hypothesis is that students given a reading with a 'featured method' section to provided guidance as they looked for methods would have higher familiarly and confidence with those featured methods than students given a unmodified version of *theDesignExchange* as a reading.
- Second, what draws a student to select a particular design method? This work details a descriptive 'talk aloud' or 'think aloud' study of students using *theDesignExchange* to better understand how they use the site and how future site development can best serve their needs. It is expected that students will be able to successfully navigate the site but that the current site does not fully address all their needs.

Chapter 2

Related Work

2.1 Design of Readings from *theDesignExchange*

Fundamentally, navigating through design methods and selecting one is about making a choice. Making a good choice is difficult and requires effort. To make a decision, one needs to determine goals and their importance, look at the options and evaluate how they match to one's goals, and make a choice. Even with a small number of options, this process is a lot of work and, as the number of possibilities increases, the effort required to make a good decision increases as well [8]. People find it appealing to have more options to choose from, but too much choice can have negative consequences for decision makers' motivation and decisiveness. Large choice sets can increase the chances that someone looking for something would find a good match for their needs [9]. However, They can be overwhelming and can result in choice overload, where people experience lower willingness to choose any option because more options result in more frustration and difficulty [10]. On top of maximizing utility and minimizing effort, people also desire to minimize negative emotional effects and maximize their ability to justify their decisions [11]. This leads to situations where it may be better to accept voluntary constraints on the number of choices simply to make the process of choosing less burdensome [12].

The motivation and willingness to make a decision is also related to a person's subjective knowledge. Subjective knowledge is how much one thinks they know about a subject whereas actual knowledge is the actual number of facts you know [13]. For example, two students with the same level of *actual* knowledge about a design method can have different levels of *subjective*

knowledge about that same method. Subjectively, a student would know less than a professional designer but they would know more than someone in a different field. People with high levels of subjective knowledge feel choice overload when presented with a large choice set, while those with lower subjective knowledge are more motivated to make a choice when presented with more options. However, non-informative information nullifies this effect [14].

2.2 Talk Aloud Study

2.2.1 Motivation and Background for Talk Aloud Study

75% of usability problems can be found from talk aloud studies with four participants, the recommended number [15]. For this study, the research team recruited eleven participants with a variety of design experiment from both the undergraduate and graduate. These participants were recruited in order to capture a wide range of experience levels.

Think aloud studies are generally directed, where participants are given a specific task to perform, which influences the part of the text that the participant will comment on. This focus may limit the overall number of comments and issues discovered, but is appropriate given the scope of the study and the current stage of development of *theDesignExchange* [16, 17].

A talk aloud study was done to find the most pressing problems on *theDesignExchange* and to investigate how students interact with the site. In the study presented here, the researcher gave neutral acknowledgments of participants' comments. When asking for clarification, the researcher strived to not influence participants' responses and to only ask for clarification when the interruption was justified, for good experimental technique [18].

2.2.2 Analysis of Talk Aloud Study

To test common group behavior, it is desirable to encode responses at an aggregate level. This allows data to be generalized at the expense of granular analysis of unique user's approaches to solving problems [17]. Analyzing trends in qualitative data, such as that generated by a talk aloud study, can highlight priorities and provide focus for further analysis and future work [19].

Additionally, the talk aloud study was done to better understand how users read through the methods presented in *theDesignExchange* and generally interact with the site content. Reading through pages of results is a two-stage process, where results are skimmed in stage one and in stage two, a limited number of result snippets are read and a click decision is made [20]. A clear and useful visual hierarchy triggers a different visual search strategy and effectively gives the user greater control over their visual navigator [21]. Position bias also plays a role in what options are picked. User clicks are influenced by result's relevance but are also influenced by the quality of the result set and the order in which the results are listed. Users are less likely to examine results at the bottom of a list [22]. However, other studies alternatively say in addition from starting at the top, users skip to the bottom and browse up a little before skipping to the next page of results, if there is one [23]. Attractive result summaries affect perceived relevance, where attraction is measured by the number of matching, bolded query terms in titles and abstracts, a feature not currently available on *theDesignExchange* [23]. In addition, users almost always see the option right after an option that they have already clicked [24].

Chapter 3

Methodology

3.1 Reading Design and Survey

Two groups were shown the same content from *theDesignExchange* but the content was laid out in different formats to determine if that influenced students' recall of methods later on. One format was the current unsorted site layout (referred to as 'unmodified') that presents methods written without any obvious order, and the other had a 'featured methods' ('modified') section at the top that highlights four specific design methods. It was expected that the students who had the modified version of the site would have better recall of the featured methods. The reading assignment was to look through the 'Ideate' portion, modified or unmodified, of *theDesignExchange* in preparation for class lecture. This was measured by comparing results of a pre- and post-surveys given before and after the readings.

Participants of the surveys were product design students in an upper level, multidisciplinary course, ME110 *Introduction to Product Development*, taught at the University of California, Berkeley in Spring 2016. The students came mostly from a mechanical engineering background, but various other fields of engineering, computer science, business, humanities and social sciences were represented. This class was chosen as the study environment because of the variety of backgrounds represented and the relatively advanced level of the undergraduate students. Students were hoped to have had enough experience in design to feel comfortable with the material presented in *theDesignExchange* but also new enough to the field to be open and comfortable trying new methods.

Prior to being shown *theDesignExchange* and structured ideation methods in class, the students were asked to fill out a survey on design methods for ideation as an assignment. The survey was created using SurveyMonkey[1]. The students were first asked for their name, email address and major in order to assignment credit and for the research team to have a better understanding of the background of the class. The students were presented with a list of ideation methods from *theDesignExchange* and asked which ones they were familiar with or have used before. In order to encourage honest answers, the research team made sure to use language that made it clear that they were not expected to be familiar with any of the methods presented, and that the number of methods they indicated having knowledge of had no effect on their grade in the course.

If the students were familiar with or had used any methods, they were asked follow up questions only about those they had selected. This was done to streamline the survey process and to avoid possible selection mistakes. Students were asked when they first learned about the method(s) they selected. They could choose between school, work/internship, online, a book, word of mouth or other, and were given space to specify more details if needed. Of the method(s) indicated, students were asked what level of familiarity they had with them and if they had ever used them. If they had used them, they were asked the context of use – through school, work/internship, independent project, or in a combination of project types.

Finally, of the methods they were familiar with, the students were asked what their level of confidence was for applying it in future use in various domains. The students were asked to rate their confidence on a fully labeled, five-point scale. For example, instead of needing to translate their levels of confidence to numbers, students were asked specifically where they were from 'not at all confident' to 'extremely confidant'. Fully labeled scales result in more reliable data [25]. When asked about their confidence and familiarity with methods, students were only given five options from 'not at all' to 'extremely'. Surveys with five to seven points to choose from are more reliable than surveys with either more or less options [26]. Too few options, and there is not enough granularity to pick an accurate answer; too many, the differences between options becomes difficult to parse. The questions were written in a way that intentionally minimizes

[1] https://www.surveymonkey.com/

students feeling that they are expected to know methods in *theDesignExchange*. A copy of the survey is provided in Appendix A.

Space was provided throughout for comments on the survey content, design methods and practices, or the course itself. In this manner, students' comments could easily reach the research team. If a student had more detailed comments or questions, they could email the research team at a provided email address. The survey took between one and ten minutes for each student, depending on the number of methods they were familiar with.

Students were also assigned a reading from *theDesignExchange*. One half of the class had an unmodified version of the ideation section of *theDesignExchange* as their reading assignment, that is, the site in its current form. A screenshot of this section is shown in Figure 1. The second half viewed a *modified* version of the ideation page with a 'featured methods' section, with four highlighted methods at the top to provide guidance in their reading (Figure 2). The methods highlighted were selected at random and crosschecked with the original ideation page to not repeat featured methods. In both versions, the same thirty-one methods were presented.

The students were split by listing them alphabetically by last name and alternating which reading group each was in. This was done to quickly and effectively split students without clustering those with similar last names, which may indicate similar ethnicities or backgrounds in the same reading group.

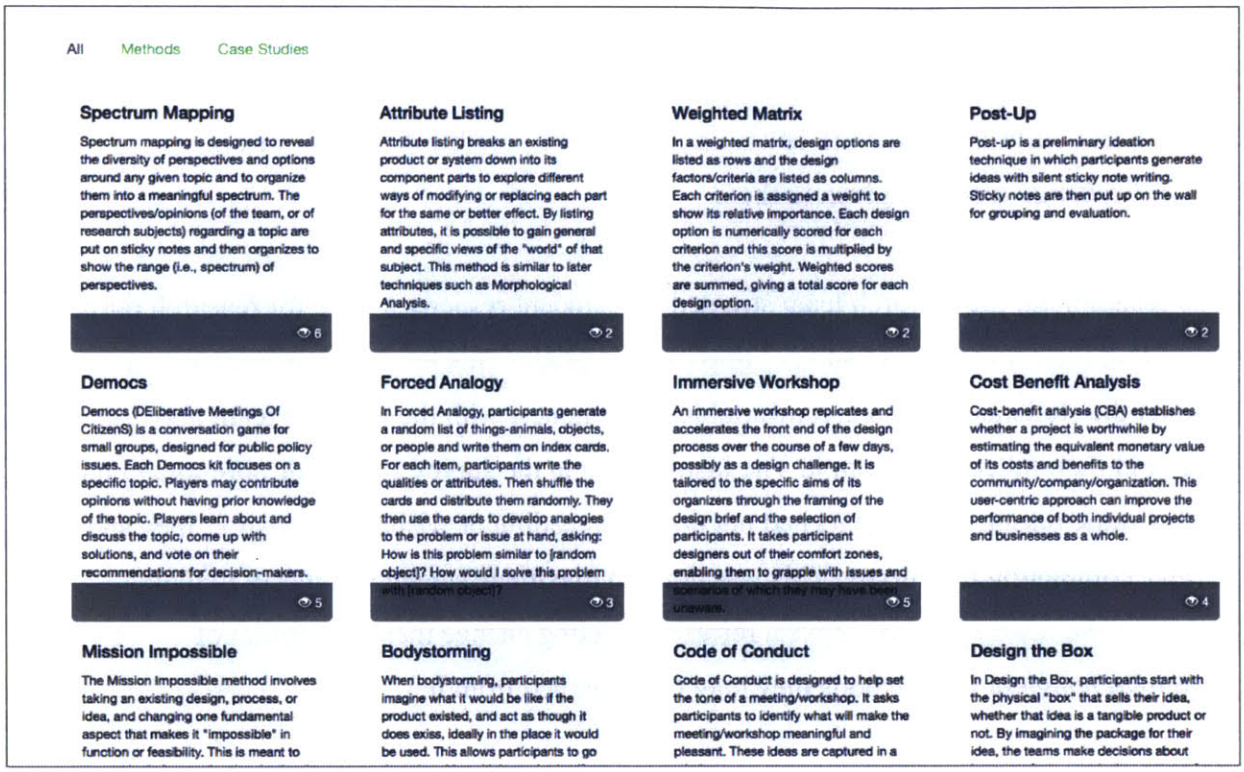

Figure 1 - Unmodified reading from *theDesignExchange*

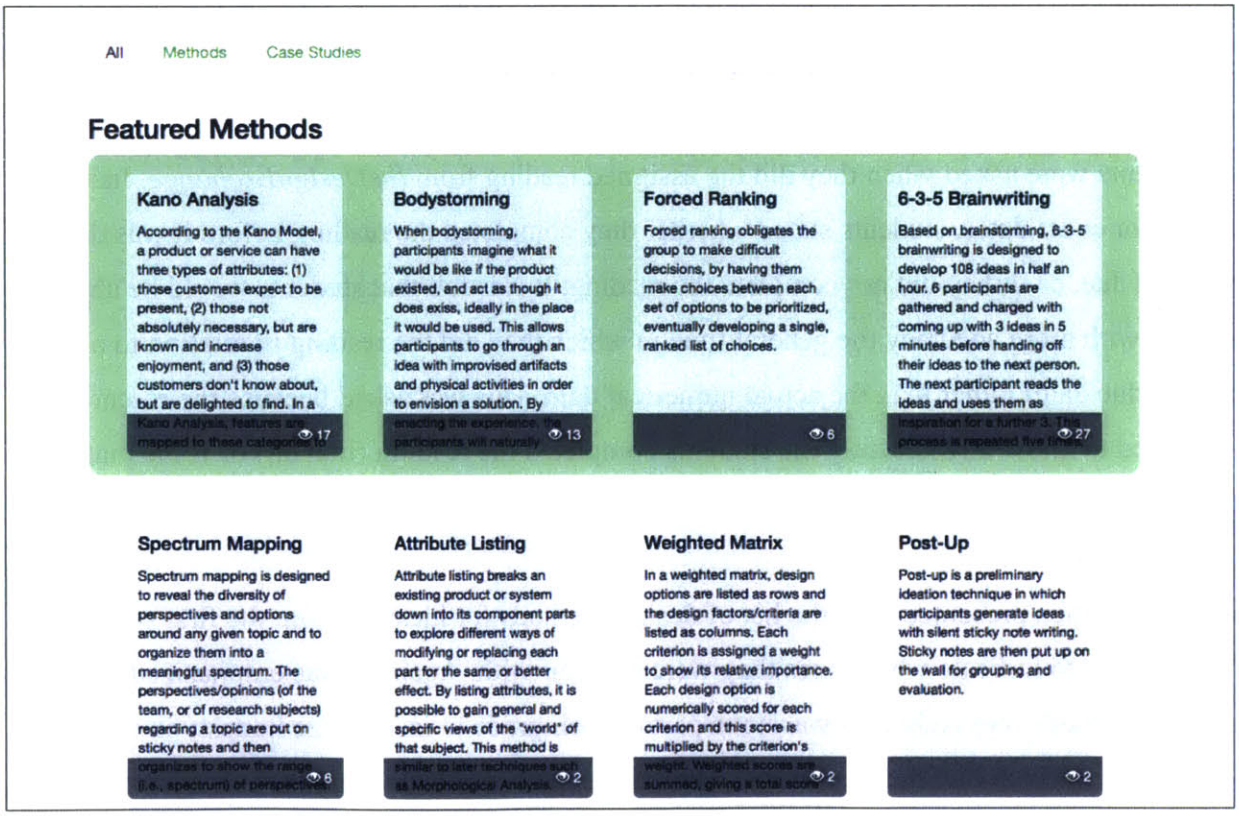

Figure 2 - Modified version of *theDesignExchange* with featured methods

Two weeks after the ideation course readings were due, students were given a follow up survey as a subsequent class assignment to better understand the possible differences from *theDesignExchange* readings given to them.

For this assignment, the research team stressed that student responses were for research purposes only, and that their responses would not impact their grade. This level of openness was chosen in order to let the students feel more comfortable being honest with the research team about their readings and their takeaways from it. The instructions in the survey also made sure to emphasize that, if for some reason the students had not done the reading or wished to revisit it, they should do so *after* completing the survey. This was done to maximize students' honesty in their responses on the reading and not have a refresher reading change their perception of *theDesignExchange* or the methods they may have learned from it.

Similar to the first assigned survey, students were asked to list their name, email and major to provide credit for finishing the assignment and for later verification to restrict analysis only to those who had completed both surveys *and* their class reading.

First, students were asked when they did the assigned reading from *theDesignExchange*. Instead of asking for exact dates, students stated whether they completed the reading before it was due, after it was due, or if they did not complete the reading. It was felt that students would be able to remember with more accuracy the general time in which they did the reading in relation to a set event (the due date) rather than the actual numerical date. This was asked because the research team wanted to know how recently the students completed the reading (if at all) or if the material the students remembered was only from class lecture or assignments.

Students were then presented with the list of design methods for ideation from the first survey and were asked to indicate which ones they were familiar with. Again, it was emphasized that the number of methods they indicated was not a part of their grade to incentivize honesty in the survey answers. Much like the first survey, students were then asked where they first learned about the indicated methods although students could select *theDesignExchange* as the resource

from which they learned about the method. They were then asked what their level of familiarity was by asking if they were familiar but have never used the method or if they have used the method before in a project setting. They were asked what their level of confidence was for the methods they selected if they were to use them in future contexts. Students were asked about applying the methods to a project to prompt visualization of concretely using the methods, not just feelings towards them in general. Finally, students were given the space to provide feedback on the survey content, methods, *theDesignExchange* page itself, or the class in general. A copy of this survey is provided in Appendix B.

3.2 Talk Aloud Study

The researcher in this study observed and interviewed both undergraduate and graduate students as they searched or browsed for design methods using *theDesignExchange* in its unmodified state. A 'talk aloud' or 'think aloud' protocol study was done to understand the strategies they used and to identify future areas of improvement that will enable them to access and learn methods better from the site.

Students were recruited by emailing past class lists for 2.009 *Product Engineering Process*, 2.739 *Product Design and Development*, 2.00 *Introduction to Design*, 2.00b *Toy Design* and DPD *Discover Product Design* at MIT. These classes were selected because it was expected that students enrolled in them had at least some level of familiarity with design methods, but, since they are students, are still open to learning. Students were also able to reflect on their time in the design classes they have taken and how *theDesignExchange* could possibly fit into that experience. Students were given the incentive of a $10 Amazon gift card for their participation in the study, which took between twenty and thirty minutes each.

Individual students completed the study in an office on a MacBook Pro using the Google Chrome web browser. The MacBook Pro was selected after a pilot study using a Microsoft Surface proved confusing to participants unfamiliar with tablet computers. The Chrome web browser was selected because of its popularity [27]. The study was done in a newly created account on the laptop. The websites for the practice activities (the New York Times website and Amazon.com) as well as *theDesignExchange* were bookmarked in the upper left hand corner for ease of access

during the study, and to minimize any confusion typing in the URL. In between students, the browser history was erased to protect participant privacy and to ensure that subsequent participants could not use stored URL suggestions to navigate. Students were provided the option between navigating the site using a track pad or a mouse, whichever they were more comfortable with.

The activities on the screen were video recorded and the student walkthroughs were audio recorded. The practice sessions and the questions at the end were not recorded, except through notes taken by the researcher. During the actual talk aloud study, the researcher aimed to be minimally involved, providing affirmation of the students' comments and following up on statements that merited further explanation, attempting to be as neutral as possible [18].

Students were first given a brief introduction to *theDesignExchange*, the study, and the practice exercises. For practice narrating their thoughts and feeling comfortable with someone watching them on the computer, students were asked to talk aloud as they found an article to read on the New York Times website and pretended to purchase a book to read for pleasure on Amazon.com. Amazon.com was selected as a practice site since pilot testing indicated that students are more likely to use the search box to find what they are looking for on it, while the New York Times website was selected since students tended to browse the day's headlines and pages of interest to find an article to read. Together, the practice exercises encompassed the search and browse techniques that were expected to be used on *theDesignExchange*. These sites were picked because their content and layout are expected to be familiar to students. Between students, the order of the practice exercises was switched to avoid priming all students in the same way to have most recently searched or browsed.

Students then were observed as they searched and/or browsed for design methods on *theDesignExchange* website. Students were told to imagine that they were looking for a method to use in a product design class. In pilot testing, this proved to be helpful – otherwise students were not sure where to even begin or what to look for. As they looked through *theDesignExchange*, the students were asked to describe how they went about the process of finding a method and responded to the site content and design. The students were left to describe

their process as they saw fit, with a few questions and prompts from the researcher as needed – for example if a student made a series of clicks through the site with no explanation [18].

As students went through the exercise, with their permission, they were recorded using Adobe Captivate. The program only records activity on the screen, not the students themselves. Audio was recorded using the built in microphone of the computer. This method was chosen for two reasons: 1) increased privacy due to the fact that only voices and actions on the screen were recorded, and 2) the fact that no extra video equipment was needed. Both reduced the complexity of setting up the study, and without visible reminders of being recorded, students could feel more at ease participating naturally.

After the computer activity, the students were asked for basic demographic information and interviewed to gather deeper understanding of their search/navigation process. All students were asked about their year in school, major, previous design experience both in school and in internships or jobs. Students were then asked follow up questions about their experience using *theDesignExchange*. In particular, each student was asked about their frustrations using the site, what their favorite things about the site were, and what features that they would like to see implemented that would make method searching, browsing or selection easier. Lastly, students were asked to reflect back on their design experience in the class they were recruited from. They were asked if they thought *theDesignExchange* would have been useful to their project, what stage of the process it would have been useful for and what information about their chosen method they thought they would need to tell their teammates to get them to use the method as a group. We asked these questions to spur discussion about what was particularly important to students when they looked for a method to use and how to best address their needs in future work for *theDesignExchange*.

Chapter 4

Results

4.1 Page Layouts and Method Recognition and Confidence

Before analysis, the pre- and post-survey assignments were examined to ensure validity by checking for:

- Completeness – did the student fill in all or most of the questions? In order to be considered complete, students had to fill in all their demographic information and fill in information about at least one design method.
- Range of responses – did the student mindlessly give the same answer to every question? Were all the methods selected or all the same levels or familiarity and confidence recorded? Only those that gave the same answer to every question were filtered out.
- Time spent on completely the survey – did the student speed through the survey questions, or did they take more time to answer the questions? Most responses were at least a minute long; those that were only a few seconds were eliminated. This was checked by comparing the start and end times of the survey provided by SurveyMonkey for each response.

In addition, the survey responses were filtered to include only students who did *both* surveys *and* completed their reading from *theDesignExchange*. 88 surveys were submitted for the pre-survey and 86 for the post-survey. After filtering according to the criteria above, final analysis was done on 49 students who successfully completed both surveys and *theDesignExchange* reading.

Of the valid responses, this work went through both surveys and made note of all the methods that students indicated some level of familiarity with. Since the levels of familiarity and confidence selected were qualitative and not quantitative, the first step of the analysis was to convert the data into numerical scores. For each method, a note was made of their level of confidence, translating it to something quantitative. 'Not at all confident' is one point, 'slightly confident' two points, 'somewhat confident' three points, 'very confident' is four points, and 'extremely confident' five points, as showing in Table 1. In this way, we are able to get a quantitative idea of where student's confidence was with methods and how that changed between surveys.

Table 1 - Confidence Level Scoring Rubric

Confidence Level in Survey	Quantitative Confidence Score
Not at all confident	1
Slightly confident	2
Somewhat confident	3
Very confident	4
Extremely confident	5

To translate the familiarity levels into quantitative scores, a similar process was done (Table 2). Because the students were only asked if they had used a method or not, the scale is binary. Methods students were familiar with but never used were given the score of one and if the method had been used in any context, it was given a two.

Table 2 - Familiarity Level Scoring Rubric

Familiarity Level in Survey	Quantitative Familiarity Score
Familiar with this but have ***never*** used it	1
Familiar with this and used ***only*** in a school exercise or project	2
Familiar with this and used ***only*** in an internship related project	2
Familiar with this and used ***only*** in an	2

independent project	
Familiar with this and used in a combination of project types	2

The original hypothesis was that students who were given the modified reading of *theDesignExchange* would have higher levels of confidence about the methods that were featured in green at the top of the 'Ideate' method page. By providing some level of guidance to the students, it was anticipated that they would pay attention to those methods in particular, and would be more confident using them in the future.

4.1.1 Method Recognition and Confidence for Both Readings

The average number of methods that each student marked as recognized statistically increased between the pre- and post-test for both readings. The Student *t*-test *p*-values were less than .05 between the surveys. Note that the survey did not include methods that were explicitly mentioned in the course as part of a lecture on structured ideation methods. In the post-survey, students indicated that many of the methods they marked they first learned about from *theDesignExchange*.

In tandem, the average confidence in a method indicated by students was statistically higher (Student *t*-test, *p*-value < .05) for the post-survey than the pre-survey, indicating that if a method was recognized by students, students overall had a higher level of confidence for it. However, the average confidence of students *overall* was not statistically different (Student *t*-test, *p*-value > .05) despite an increase in exposure to design methods from coursework and *theDesignExchange*.

The data suggests that students' familiarity with methods rose even though their overall confidence about methods did not, but of the methods they *did* select, there are higher levels of confidence. This may be because students are familiar with *more* methods, but the increase in confidence of a few does not compensate for the low confidence overall. Detailed result charts are included in Figures 3 and 4.

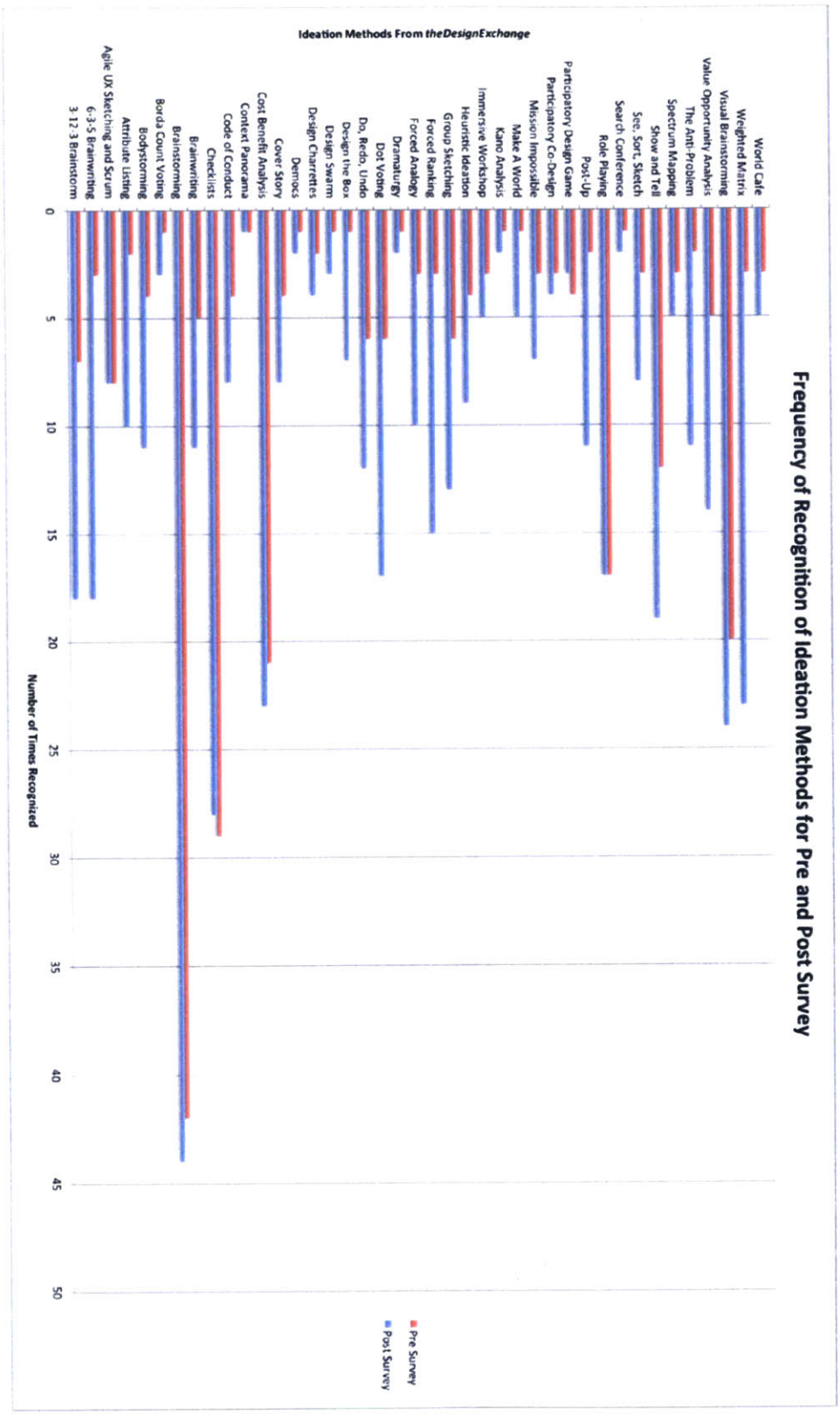

Figure 3 - Frequency of method recognition for pre- and post- survey for both readings

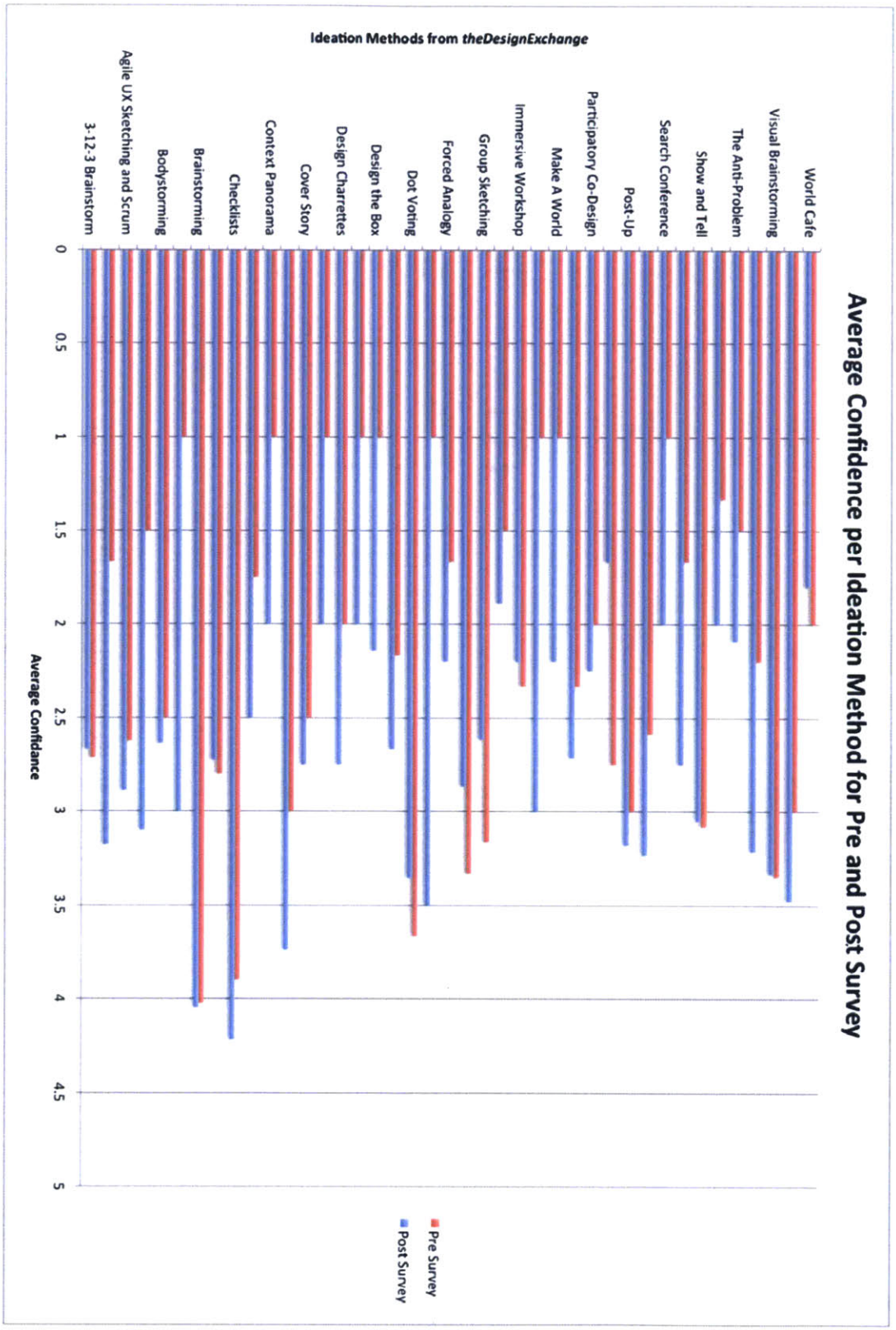

Figure 4 - Average confidence per method for pre- and post- survey for both readings

The three methods student were most familiar with in the pre-survey were 'Brainstorming', 'Checklists', and 'Cost Benefit Analysis', in that order. The three methods that students were most familiar with in the post-survey were 'Brainstorming', 'Checklists', and 'Visual Brainstorming', also in that order. In both surveys, each method was familiar to at least one student. In the pre-survey, only one student was familiar with each of the following nine methods – 'Borda Count Voting', 'Context Panorama', 'DEMOCS', 'Design Swarm', 'Design the Box', 'Dramaturgy', 'Kano Analysis', 'Make a World', and 'Search Conference'. In the post-survey, only one student was familiar with 'Context Panorama'.

4.1.2 Method Recognition and Confidence Divided by Reading Group

The analysis of methods that were highlighted in the modified version of *theDesignExchange* when divided by reading group was contrary to the original hypothesis. Students has the same statistical confidence (Student t-test, p-value > .05) about the highlighted methods no matter which version of *theDesignExchange* readings were done, which can be seen in Figure 5. The number of times the students recognized each highlighted method, seen in Figure 6, was not statistically different (Student t-test, p-value > .05). Students indicated that they had used a highlighted method in some form (school, work, internship or independent project) with the same statistical frequency (Student t-test, p-value > .05). This surprising result provided additional motivation to do the 'talk aloud' study to better understand how students look at methods at a more detailed level.

Students across all methods, not just those highlighted in the featured interface, divided by readings had the same average number of methods recognized (Student t-test, p-value > .05). This, coupled with the same levels of confidence across reading groups for all methods (Student t-test, p-value > .05) and the results from the highlighted methods discussed previously, suggests that the use of the method may be more important to confidence than reading exposure to it.

Figure 5 - Average confidence for featured methods split by reading group

Figure 6 - Frequency featured methods were recognized by students in each reading group

4.1.3 Comments about Readings from *theDesignExchange*

Some students used the provided comment areas to detail where they had learned methods that were not covered in the categories that were given in both the pre-survey and the post-survey. Students have heard of methods in more formal ways, such as through talks hosted at school or in the military and others noted that many of the methods could be recognized from everyday life – one student cheekily responded "my mother taught me about checklists" and another said they learned about brainstorming from "life".

The post-survey additionally included comments about the readings provided from *theDesignExchange*. Students who had the modified version with featured methods commented "Not very helpful. Seemed really cheezy [sic]", "There were a lot of methods presented, almost an overwhelming number. I know people use all different types, but maybe identifying the main ones" and "it had a lot of methods that I did not (and still do not) recognize well". The comments from students with the original version of *theDesignExchange* expressed similar sentiments, such as "there were so many I wasn't sure which one [sic] applied to me", "there were too many to keep in mind, so I mainly held on to the ones that were either so common sense, or those that were so crazy I thought 'I really want to try this idea because I never did or will do this method anytime soon'" and "there were a lot to go through and quite a few seemed inapplicable or just kind of strange". Some students noted the breadth of the methods available in a more positive way – "good ideas to help generate a large quantity of ideas quickly", and "I appreciated the thoroughness of the content". One student suggested "I thought how the information was presented was slightly off-putting. Rather than a presentation of a large array of methods, I would suggest grouping them into larger categories".

4.2 Design Method Search Strategies and User Response to *theDesignExchange*

Eleven students participated in a recorded talk aloud study over the course of two weeks at MIT. Of the students that participated, two were second year graduate students, three were freshmen and six were seniors, as seen in Figure 7. The two graduate students were in the MIT *Leaders of*

Global Operations program, an Engineering/MBA dual degree program. The undergraduates were all mechanical engineering majors except one, who was a computer science and electrical engineering major. The breakdown of majors can be seen in Figure 8. Only four of the students had design experience in the workforce – two in product design related internships, one in a start up, and one in a full time consulting job. The number of design classes taken by the students varied widely from one to seven courses. The classes ranged from those that the students were directly recruited from past years of the freshman, sophomore, senior and graduate level design and manufacturing courses and programs. Six of the students had also participated in other design related classes from other departments such as architecture, the MIT Media Lab, D-Lab (Development Lab), Engineering Systems, and GEL (Gordon Engineering Leadership Program). None of the students were familiar with *theDesignExchange* beyond the information provided in the recruitment email prior to participating in this study.

Figure 7 - Talk aloud participants by year in school

Figure 8 - Talk aloud participants by major

To analyze the results of the talk aloud study, the recordings and the notes taken during the process were combined and tagged. Of particular note were the strategies that students used to look for methods, particularly if they browsed or used the search function, and what they noticed first about the methods page as they attempted to select a method. Suggestions for improvement, what was liked about the site, and any other observations were also recorded.

Throughout the process, this study hoped to gain a greater understand of what students' needs are to make *theDesignExchange* a useful tool for them to use in coursework and beyond. While *theDesignExchange* was created with practitioners in mind, it has rich potential as a way for students to build on their own design education.

The students began their study on the 'Popular Methods' page, seen in Figure 9. The first thing seven of the students noted upon arriving at the page was the view count, the number of time the individual method page had been opened, as shown in Figure 10. The remaining four students who did not initially note this feature eventually mentioned it in the course of navigating the site. One student noted that when first looking at the page, if one does not read the titles or descriptions, the views are the only feature that differentiates the methods. Another student commented that the view counts were "really valuable". Many of the students expressed an interest in sorting by number of views. When describing their search strategy, five students

explicitly used the view counts by looking for methods that seemed the most popular and looking closer at the titles and descriptions of those, though some students abandoned this browsing method when they realized the number of views were all close to each other. The initial explanation of the importance of view counts to students was that they were using it as a proxy to measure popularity or ratings of methods.

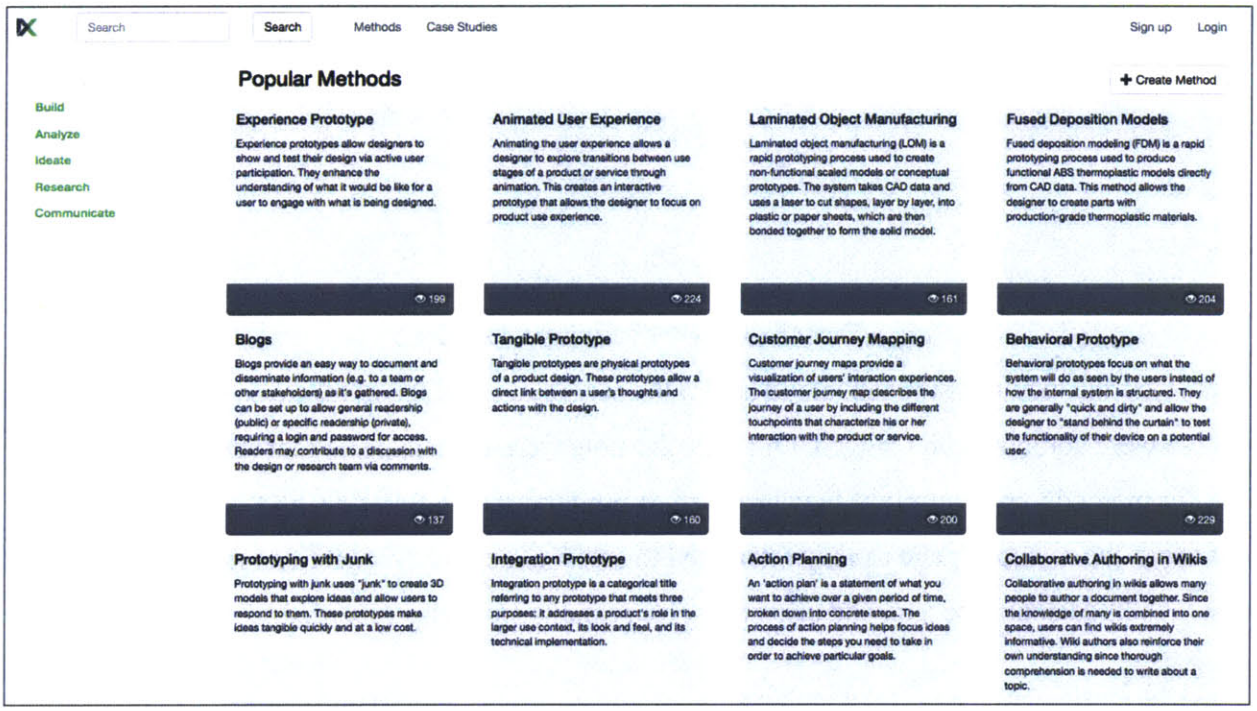

Figure 9 - Screenshot of popular methods page

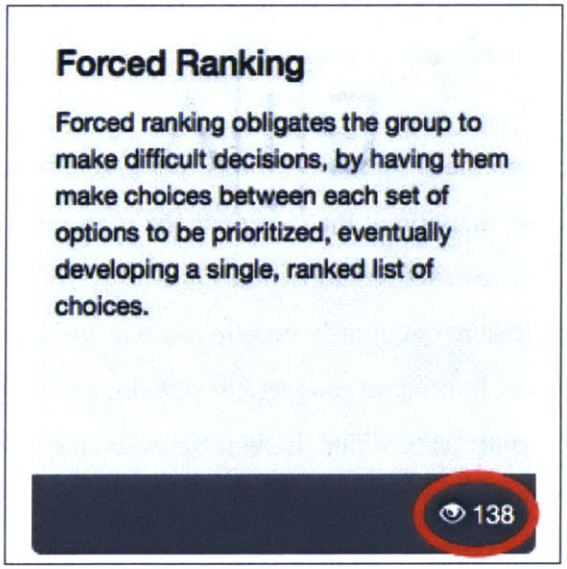

Figure 10 - Detail of view counts on method thumbnails

The feeling of being overwhelmed was another common first impression of the methods landing page, where there were 31 methods presented. One student audibly groaned when the method page opened before clarifying that it was a lot of text that he did not want to read. While this reaction was the most extreme, eight of the students initially mentioned either the amount of text, an unclear starting point, or feelings of being overwhelmed. 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. At the same time, the number of methods presented surprised many students – one student said she did not realize that that many design methods even existed. Five students explicitly said they liked how many methods there were and described the site as "wealth of information". One student described this dichotomy succinctly as the number of methods being "great but overwhelming". Of the students that participated, six scrolled to the bottom of the 'Ideate' methods page, the other five only made it a fraction of the way through.

4.2.1 Method Finding Strategies

The approaches of finding methods can broadly be split between students who used searched and those who browsed. Those who used searched used the search box in the upper left hand corner of the website. Students who instead perused the methods on the page in order to select a method for the study could be categorized as browsing.

Out of study participants, only one student used the search box during the talk aloud. One additional student used the search box in the interview portion of the study. It is thought that students tended to browse because the information presented to them was largely new, even to relatively experienced students, and therefore wanted to explore the offerings of the site.

Students had a variety of ways to look for methods using the browsing strategy. As previously mentioned, many students initially noticed the view counts on the methods and many indicated a desire to sort by them or used them to look for the most popular methods. Because this is not an implemented feature, students had to use other strategies to browse. The browsing strategies used varied from student to student but several were common between them. Most students focused on

the titles of the methods and ignored the descriptions, some did not even realize the text was the same between the category page and the method page and one student was disappointed by the method he selected because he chose based on the title and ignored the description. When students focused on the title, some students picked methods based on its familiarity. Two students selected methods that they were very familiar with, 'Brainstorming' and 'SWOT Analysis', in order to be able to understand how information was provided by *theDesignExchange,* in addition to using it as a frame of reference for looking at further methods. When students picked methods that they were not very familiar with based on title, students selected ones that seemed similar to those that they already knew or ones that they recognized from elsewhere. For example, one student selected 'Empathy Map' and explained that she had never heard what it was but that it intrigued her because she recognized the word empathy and thought it might mean a method focused more on users' feelings. Multiple students picked 'Mission Impossible' and when asked about why, one student responded, "I like Tom Cruise, I liked the movie and thought it sounded cool", a sentiment repeated by the other students who looked at the same method. Another student giggled before picking 'Quick and Dirty Prototyping' and said she picked it because it was a term she had heard outside of school but was curious to see how it fit into the design process.

The three freshmen that participated in the study took closer looks at methods with titles that they said they recognized explicitly from *outside* of design, whether it was the movie 'Mission: Impossible'[2] or 'Heuristic Ideation' because they recognized the word "heuristic" from an algorithms class. While some of the other participants also did this, the freshmen were the only group that all had the same strategy at some point to use words in the titles from life outside of design. All of the students at some point took closer looks at methods that were not exactly ones that they had used before in design classes, but that they thought were similar based on the titles. One student expressed it nicely by saying things that were "unfamiliar but remind me of something I'm familiar with catch my eye". Interestingly, many students looked at 'Post Up' in detail or took note of it during the study because they thought, based on the name, that it was voting on concepts with post it notes, which falls under the 'Dot Voting' method. This method is taught and used under the guidance of instructors in several of the product design classes at MIT.

[2] Paramount Pictures, 1996

Only one student would open methods of interest in new tabs to keep track of what she had already looked at. Others expressed confusion once they had a decided on a method they would want to use, asking if they needed to click something to indicate that they had chosen it. As he was browsing, one student expressed interest in a "cart" or a place where he could keep methods he was interested in so when he ultimately selected one, he would only have to choose between the ones he had already earmarked as potentially useful or interesting.

Due to the nature of the study, the researcher prompted all the students to reflect on a design group experience they had in the concept generation stage and guided the students to look primarily in the 'Ideate' category of *theDesignExchange* site. Most students remained on the 'Ideate' page but a few explored the other categories as well by browsing through them. Many students started on the 'Popular Methods' page and were confused if they were popular methods within a *category* or if they were popular for *all* methods. The student that used the search function at one point in the study also navigated to other categories through the search box but was confused if she was searching within the 'Ideate' page or if she was searching through *theDesignExchange* site as a whole.

Of the students that browsed at some point during the study, all of them mentioned wanting a way to sort through the methods. Sorting by view count has been previously mentioned, but many of the students looked for an inherent order in the methods listed, such as by view count or alphabetization, and were disappointed when they could not find one. A common desire was to have a ranking system for methods that could be sorted in order to filter out methods not suitable for their task. For many students, when they entered a specific method's page, seeing the characteristics section came as a relief. For methods that fit under multiple categories, the characteristics are listed under each category they are pertinent too. For example, as seen in Figure 11, the characteristics for 'Forced Ranking' are sorted under 'Communicate', 'Analyze' and 'Ideate'. One student commented that the associated characteristics were useful to see how methods differed but others commented, that, while they thought the characteristics could be helpful, they were not sure what they meant. Several students, when realizing that it was possible to click on a characteristic to display methods sharing that characteristic, were happy to have an

implicit sorting or grouping function. Students had comments about how to further improve this function, such as by being able to filter by multiple characteristics or having a better idea of tracking how they have journeyed through the site so they could retrace their steps if needed. Largely their comments were positive and one student directly said she wished she could have used this feature at the beginning of the talk aloud process. Many students liked the feature but wished that they could access it without having to find a method that had the characteristic they wanted first.

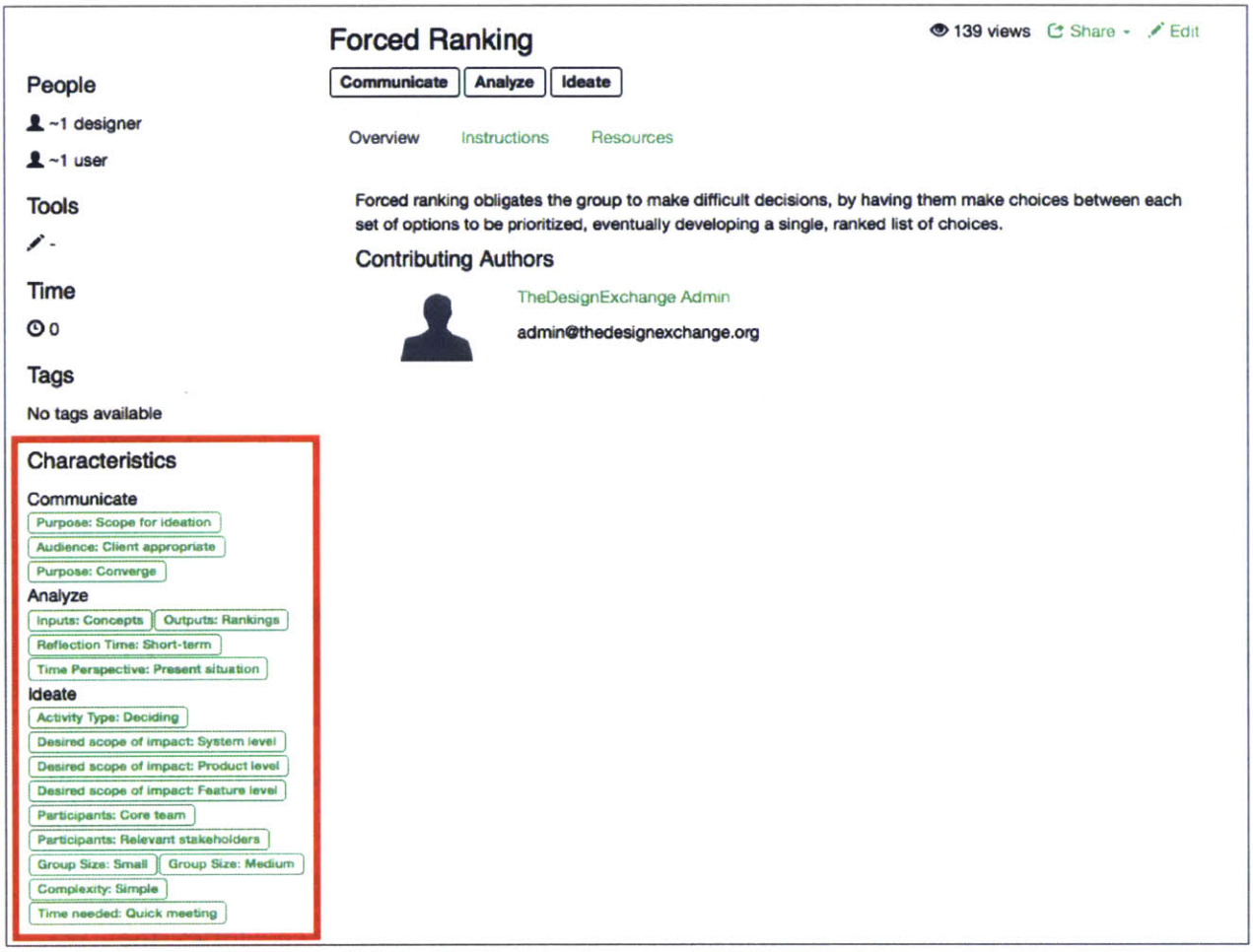

Figure 11 - Characteristics detail on method pages

A similar feature many students mentioned liking was the listing of the people, tools and time needed as shown in Figure 12. Some students realized that this was boilerplate by noticing incongruences between method descriptions and the contents of this page detail. But for many

students, they were looking exactly for this information when they were browsing the 'Ideate' page and wanted it to be easier information to find.

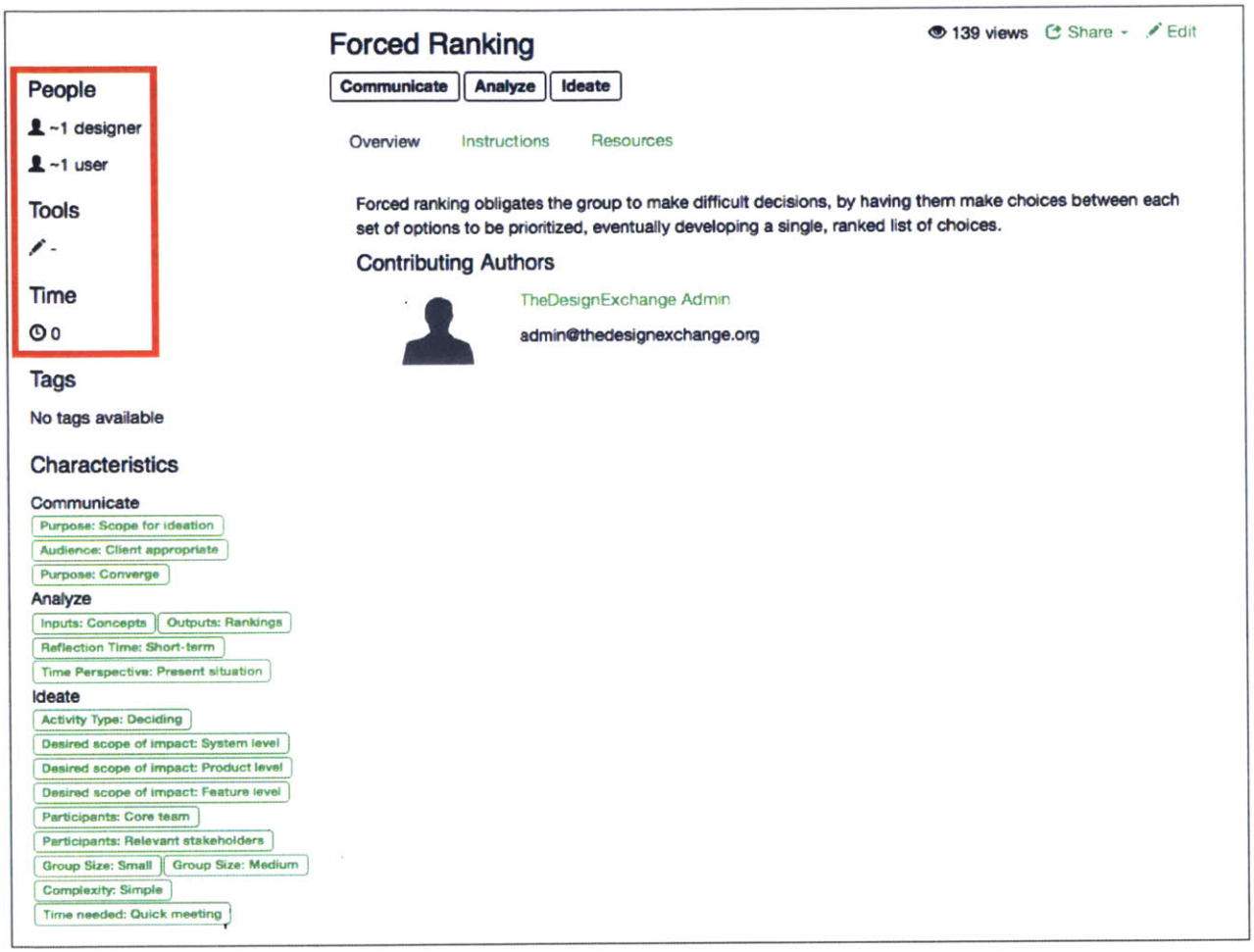

Figure 12 - Detail of people, tools and time needed for each method's page

Students generally mentioned liking the layout of the individual method pages. Most students investigated the instructions and resources tabs, as seen in Figures 13 and 14, and asked when they would be finished, as these tabs were in development at the time of the study. Of the students who looked at the resource tab, most said they would like the links to be clickable instead of needing to copy and paste. When asked why they liked the instruction tab, students responded that if they were to use the method, they would want to at least check for more detail on how to implement it beyond the description provided on the method page. When asked about the resources tab, students responded that they added credibility and validity to the method. One student said she would not explicitly use them except if she needed to know the background of a method for documentation. Several students, when explaining their ideas on a method's validity

and credibility, mentioned they would want to see which companies or groups have created or used these methods. One student with a management background said including use statistics by a company could create controversy, for example ethical disagreements with company policy. While this is a valid concern, the mission of *theDesignExchange* is to be a repository of design methods and not to make comments on corporate policy.

Figure 13 - Detail of incomplete instruction tab for method page

Figure 14 - Detail of incomplete resource tab for method page

The final interview question did not pertain to students' searching or browsing approach. Rather, this question asked students whether they believed *theDesignExchange* could have been useful at particular points in a previous design course. Students all generally agreed that *theDesignExchange* had the potential to be helpful in their classes, especially if underspecified content was filled out. All of the students said that *theDesignExchange* could be helpful during the ideation phase of their project, which is not surprising given the way the talk through task

was framed. However, several of the students elaborated further, saying it would have been helpful when they got stuck during ideation. In particular, 2.009 *Product Engineering Processes* students had a homework assignment where they had to think of at least twenty ideas and the students pointed to this assignment in particular as one where they could have used *theDesignExchange* as a resource. One student who had taken the capstone senior design course said most of her peers "didn't know what they didn't know" and that *theDesignExchange* could fill the gaps beyond the methods they already knew, and would initially try and exhaust, for their assignments. Interestingly, the students from DPD (*Discover Product Design*, a freshmen pre-orientation program focused on design), who are among the least experienced participants in design, echoed these sentiments, saying that even though most freshmen do not know about design, they would want to try using brainstorming techniques they know from high school or everyday life, and, when realizing the limitations of that, they would turn to *theDesignExchange* as a resource. One student said that it seemed like *theDesignExchange* could be an easily accessible source for students beyond textbook and lecture content for class projects.

4.2.2 Other Suggestions for Improvements to *theDesignExchange*

One student suggested having a downloadable single slide PowerPoint or PDF of the design method to facilitate sharing between team members. One student expressed interest in a tutorial on how to use the site, suggesting challenges in site usability, though the student conceded that many people would be uninterested in using a tutorial for a website. Another student suggested including a general design timeline allowing for easy visualization of where selected methods are in the design process. Many students indicated a desire for more visual content but were not able to articulate further on what would be helpful to visually differentiate between methods. Many students wanted to see what others thought of the methods through a ranking system but many also mentioned wanting to see what methods were used by past students in the design classes that they had taken as a way to guide their own class experience.

Chapter 5

Discussion

5.1 Survey Results Discussion

The original experiment set out to investigate if changing the layout of *theDesignExchange* to avoid large choice sets would make the process of learning methods easier for students. This was done by providing the students two sets of readings from *theDesignExchange* – one unmodified and one providing "featured methods". The familiarity and confidence of students on design methods they recognized were collected in surveys given before and after the reading.

The initial analysis comparing the results of the pre- and post-test were not surprising. The average number of methods not explicitly mentioned in lecture that each student marked as recognized statistically increased between the surveys, and the average confidence per method also increased. In the post-survey, students indicated that they first learned about many methods from *theDesignExchange*. However, the average confidence levels per student did not rise between surveys despite the increase in exposure to methods. In the comment section of the post survey, students indicated a desire for more time to use design methods. This suggest that while *theDesignExchange* is a useful tool to increase exposure to design methods, the site in its current form does not provide enough information to make students confident in the methods they have read about. Without trying the methods for themselves, students are less likely to feel confident in their knowledge of design methods. The increase in confidence for each method is possibly a result of a combination of using methods in the classroom, for assignments, and using *theDesignExchange* as a validating resource. This use of *theDesignExchange* will be covered in more detail in the discussion of the talk aloud study.

The analysis of the survey when students were split by their reading group were not what was expected from the experimental hypothesis – that students who were given the modified reading had statistically higher levels of confidence and familiarity with featured methods. Upon further reflection, this is likely the result of a combination of the reading assignment for class and the computer-based nature of *theDesignExchange*. While the survey analysis only concentrated on students who did their reading from *theDesignExchange,* interpretations of what reading constitutes, especially for an assignment, can vary widely. Different typologies of reading change the way that people read – in particular for this body of work, when reading is done for the purpose of discussion, details are generally skipped over to focus on the main points [28]. The digital format of the reading is another factor – in a study of undergraduate students in particular, participants preferred print reading over electronic for learning purposes but factors like cost, accessibility, complexity, and importance of the reading to the course affected actual reading behavior [29]. Overall, paper based reading is preferred over computer based reading, with physical aspects such as eyestrain cited as top problems. However, online reading is preferred for ease of access to resources [30]. Given that the reading was done for a course and done digitally, it is likely that the students who indicated that they read *theDesignExchange* only skimmed it for main points and may have paid less attention and retained less than if it had been a traditional reading on paper.

This and the commentary provided by students suggests that, while the featured methods were not effective in increasing students' confidence about them, some other form of hierarchy or guidance needs to be provided for students to be able to gain confidence in design methods online beyond just exposure to new methods. This information will need to be mindful of the limitations of reading digitally, particularly a for classroom discussion. In addition, these survey results prompted a follow-up talk aloud study in order to observe students using *theDesignExchange* in a more controlled environment.

5.2 Talk Aloud Results Discussion

The initial overwhelmed reactions to *theDesignExchange* highlight a key need in presenting site content, for instance, with hierarchical method organization and sorting functions. In the absence of obvious ways to sort methods, students used view counts as a proxy for ratings and popularity, assuming the most viewed methods were more used or of better quality. Implementing students' intuition to provide ways to sort methods would help streamline the browsing process. Students also expressed a desire to know what methods professionals and previous students in their design classes used in order to provide direction and guidance in method selection.

Given the prompt to look for a method to use in a past design course, all but one of the students browsed through the methods instead of using the search feature. When considering the comments from students about "not knowing what they didn't know", this is perhaps not surprising, namely that students wished to learn about numerous novel methods rather than searching for reinforcement of previously known ones. This browsing behavior, in addition to the overwhelmed feeling voiced by many of the students, indicates a need to balance between the variety and breadth of options, which students liked, without overwhelming them.

When browsing, in addition to view counts, many students skimmed for information that would help them see if a method was even applicable to his or her project team. These students were often pleasantly surprised once they selected a method and found the characteristics and the details of what was needed in terms of time, people and tools in the sidebars of each method page, and wanted these featured earlier in the method browsing process. Some students expressed confusion about what the characteristics meant and tried to hover over them to look for explanation – this feature is in development and students' attempts to get more information in this way validates the development direction for this functionality. In addition, students who browsed focused their search on method titles and often ignored the details of the descriptions, picking methods that were familiar to them but not methods they knew well. By placing the relevant information more prominently, students could potentially be guided to both methods more pertinent to their needs as well as methods they may not have noticed before.

Most of the students clicked over to the instructions and resources tabs of the specific method pages (c.f. Figures 13 and 14). For instructions, the reasoning is straightforward – students were simply looking for more information on how to use a method in order to make a more informed decision. For resources, students expressed that they would use them for citations or verification of the validity of the method. To reinforce method credibility, students desired to see prominent research groups and companies that have successfully integrated these methods into their product design process. While most of the methods students selected had these fields underspecified, the 'Personas' method, as seen in Figures 15 and 16, has been fully fleshed out and illustrates what information *theDesignExchange* could possibly provide to users moving forward.

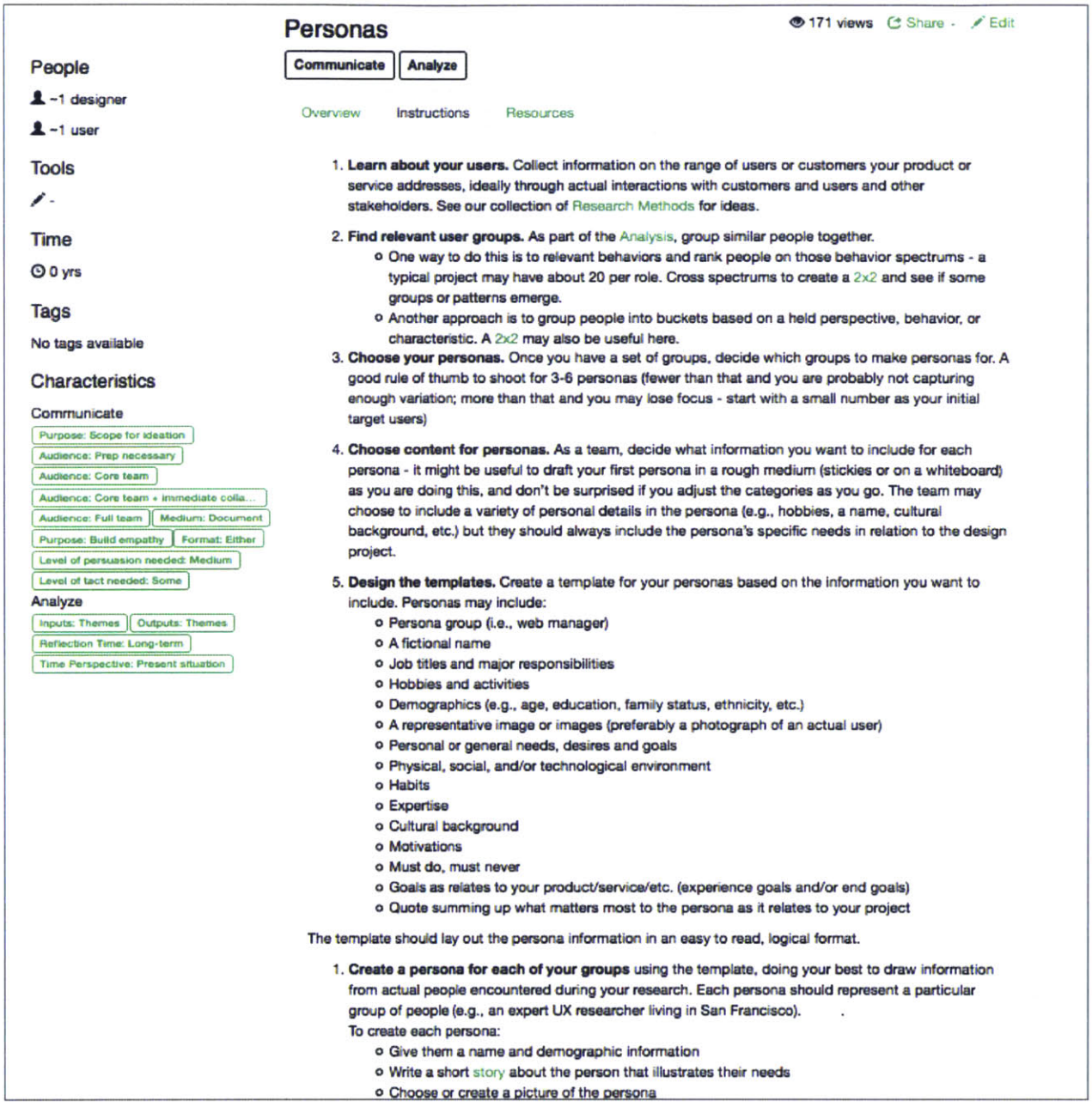

Figure 15 - Instructions for Personas

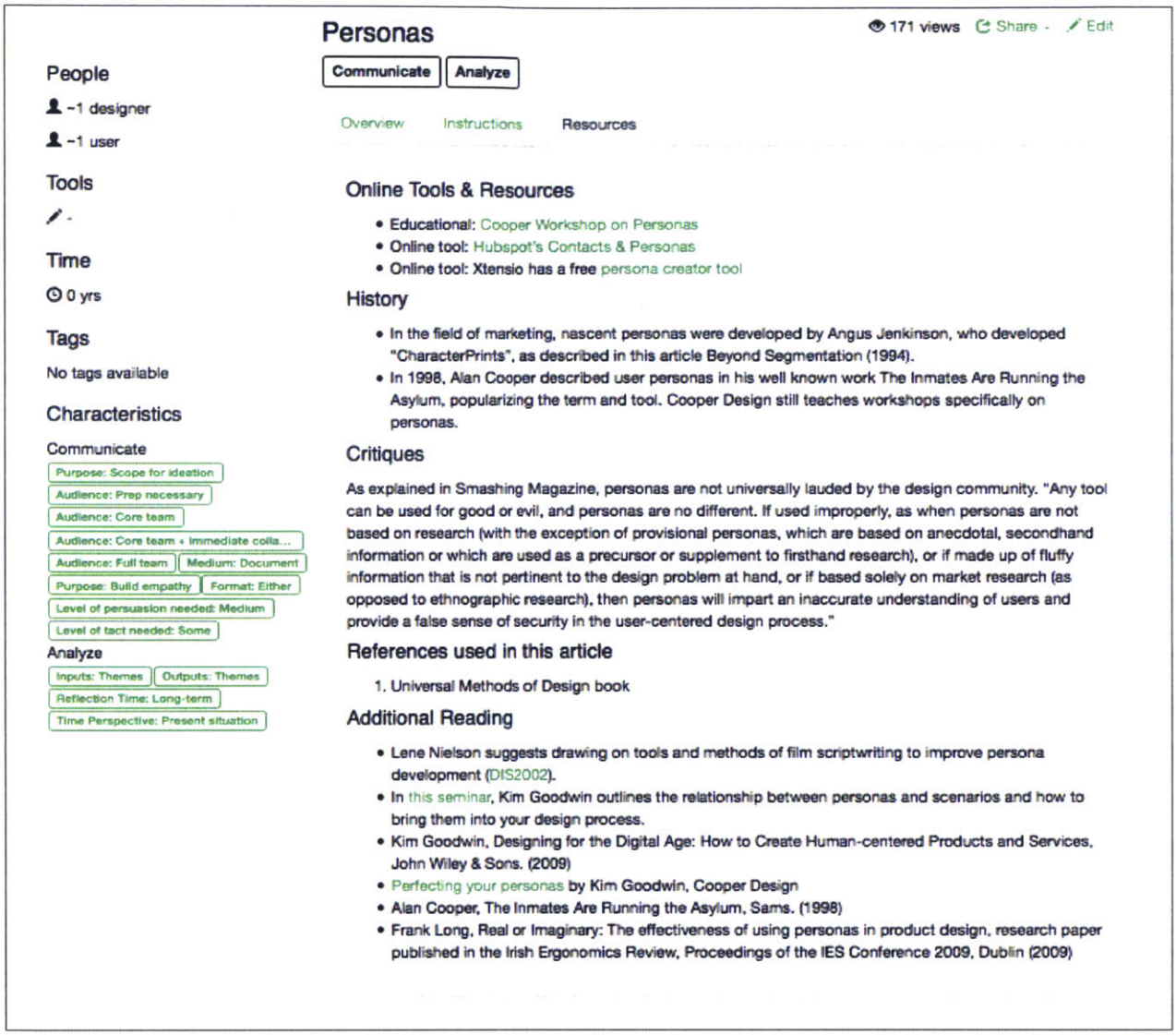

Figure 16 - Resources for Personas

All the students interviewed said that they could see *theDesignExchange* being a useful companion to their project work, specifically in the ideation phase. This is not surprising since the study prompt had the students concentrate on ideation in particular, but what was interesting was that students thought *theDesignExchange* would be useful once they had tried to ideate on their own and needed help to go beyond what they have already done. This illustrates that, while students do not think of *theDesignExchange* as their primary learning source for design methods, it could be a valuable resource for them to build on the knowledge they have already gained in the classroom.

5.3 Future Work

A significant amount of analysis can still be done using the data generated from both the survey and the 'talk aloud' study. In the survey portion of this work, students were asked about where they first learned about each design method. So far, this data has not been analyzed, but it would be interesting to do so comparing confidence and familiarity with methods based on where they are learned. In addition, it may be interesting to revisit the analysis of familiarity and try to gain a better understanding of various familiarity levels depending how often, and in what context, the recognized design methods are used.

In addition to the talk aloud study, it would be interesting to look more closely at the time it took students to select a method, and to see if their level of design experience had a quantifiable effect on their experience using *theDesignExchange*. The existing data could also be analyzed at a more granular level, possibly revealing insights into how students use *theDesignExchange*, and what features are needed to make the site more useful to them.

Further talk aloud studies could also be done with additional groups of students. While the current study was limited to individual students, most of the design work in the classroom is done in groups. The group dynamic was minimally addressed in the follow up interview by asking students what information would they need from *theDesignExchange* to share with their group in order to promote group interest. It would be interesting to take this a step further and investigate design method decision-making in a realistic group setting using *theDesignExchange* as a method resource.

Many of the suggested features from the students from the talk aloud study are already in the process of being implemented, and additional methods are currently being fleshed out in the same manner as the previously discussed 'Personas' page. Because of the iterative nature of web development and the surrounding community of users, it would be beneficial to repeat these studies to explore user interaction with existing site content and to investigate future development areas.

Additionally, more work integrating *theDesignExchange* into the classroom is being planned for a course at the University of California, Berkeley. The course is currently planning to use the site as a resource for students' independent projects. This would provide the motivation to further develop the site and the possibility of more testing and input from students on site content and layout.

Chapter 6 - Appendices

Sample Documents from Experiments

Appendix A –Design Methods Pre-survey

I-7 Concept Generation Methods Survey

1. Introduction

This assignment is to assess your familiarity with design methods for concept generation, where they are discovered, if you have ever used them and confidence with each. You are not expected to be familiar with any design methods and the number of methods you are familiar with does not impact your grade.

If you have any problems with this assignment, please email thedesignexchange@mit.edu

I-7 Concept Generation Methods Survey

2. Engineering and design background

1. Please enter your name and email below

Name

Email Address

2. What is your major?

- [ ] Mechanical Engineering
- [ ] Industrial Engineering & Operations Research
- [ ] School of Information
- [ ] Haas School of Business
- [ ] Chemistry & Chemical Engineering
- [ ] Civil & Environmental Engineering
- [ ] Electrical Engineering & Computer Science
- [ ] Bioengineering
- [ ] Nuclear Engineering
- [ ] Materials Science
- [ ] Letters & Sciences
- [ ] Biology
- [ ] College of Environmental Design
- [ ] College of Natural Resources
- [ ] Other (please specify)

I-7 Concept Generation Methods Survey

3. Overall familiarity with design methods and tools

3. Below is a list of product and engineering design methods. You are not expected to be familiar with them. Which of these have are you familiar with or have used before?

- [ ] 3-12-3 Brainstorm
- [ ] 6-3-5 Brainwriting
- [ ] Agile UX Sketching and Scrum
- [ ] Attribute Listing
- [ ] Bodystorming
- [ ] Borda Count Voting
- [ ] Brainstorming

- [ ] Brainwriting
- [ ] Checklists
- [ ] Code of Conduct
- [ ] Context Panorama
- [ ] Cost Benefit Analysis
- [ ] Cover Story
- [ ] Democs (DEliberative Meetings Of CitizeS)
- [ ] Design Charrettes
- [ ] Design Swarm
- [ ] Design the Box
- [ ] Do, Redo, Undo
- [ ] Dot Voting
- [ ] Dramaturgy
- [ ] Forced Analogy
- [ ] Forced Ranking
- [ ] Group Sketching
- [ ] Heuristic Ideation
- [ ] Immersive Workshop
- [ ] Kano Analysis
- [ ] Make A World
- [ ] Mission Impossible
- [ ] Participatory Co-Design
- [ ] Participatory Design Game
- [ ] Post-Up
- [ ] Role Playing
- [ ] Search Conference
- [ ] See, Sort, Sketch
- [ ] Show and Tell
- [ ] Spectrum Mapping
- [ ] The Anti-Problem
- [ ] Value Opportunity Analysis

3

- [ ] Visual Brainstorming
- [ ] Weighted Matrix (Pugh Matrix)
- [ ] World Cafe
- [ ] Other (please specify)

I-7 Concept Generation Methods Survey

4.

4. How did you *first* learn about the design methods you are familiar with?

	Through school	Through work or an internship	Online (please indicate site below)	From a book (please indicate title and/or author below)	Word of mouth (Specify details below)	Other (please specify)
3-12-3 Brainstorm	○	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○	○
Attribute Listing	○	○	○	○	○	○
Bodystorming	○	○	○	○	○	○
Borda Count Voting	○	○	○	○	○	○
Brainstorming	○	○	○	○	○	○
Brainwriting	○	○	○	○	○	○
Checklists	○	○	○	○	○	○
Code of Conduct	○	○	○	○	○	○
Context Panorama	○	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○	○
Cover Story	○	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○	○
Design Charrettes	○	○	○	○	○	○
Design Swarm	○	○	○	○	○	○
Design the Box	○	○	○	○	○	○

4

	Through school	Through work or an internship	Online (please indicate site below)	From a book (please indicate title and/or author below)	Word of mouth (Specify details below)	Other (please specify)
Do, Redo, Undo	○	○	○	○	○	○
Dot Voting	○	○	○	○	○	○
Dramaturgy	○	○	○	○	○	○
Forced Analogy	○	○	○	○	○	○
Forced Ranking	○	○	○	○	○	○
Group Sketching	○	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○	○
Immersive Workshop	○	○	○	○	○	○
Kano Analysis	○	○	○	○	○	○
Make A World	○	○	○	○	○	○
Mission Impossible	○	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○	○
Participatory Design Game	○	○	○	○	○	○
Post-Up	○	○	○	○	○	○
Role Playing	○	○	○	○	○	○
Search Conference	○	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○	○
Show and Tell	○	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○	○
The Anti-Problem	○	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○	○
World Cafe	○	○	○	○	○	○
Other (please specify)	○	○	○	○	○	○

Other (please specify)

5

I-7 Concept Generation Methods Survey

5.

5. To understand the application of design methods you are familiar with, please indicate whether you are only familiar with a design method or in what context you have used it in.

	Familiar with this but have ***never*** used it	Familiar with this and used ***only*** in a school exercise or project	Familiar with this and used ***only*** in an internship related project	Familiar with this and used ***only*** in an independent project	Familiar with this and used in a combination of project types
3-12-3 Brainstorm	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○
Attribute Listing	○	○	○	○	○
Bodystorming	○	○	○	○	○
Borda Count Voting	○	○	○	○	○
Brainstorming	○	○	○	○	○
Brainwriting	○	○	○	○	○
Checklists	○	○	○	○	○
Code of Conduct	○	○	○	○	○
Context Panorama	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○
Cover Story	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○
Design Charrettes	○	○	○	○	○
Design Swarm	○	○	○	○	○
Design the Box	○	○	○	○	○
Do, Redo, Undo	○	○	○	○	○
Dot Voting	○	○	○	○	○
Dramaturgy	○	○	○	○	○
Forced Analogy	○	○	○	○	○
Forced Ranking	○	○	○	○	○

6

	Familiar with this but have ***never*** used it	Familiar with this and used ***only*** in a school exercise or project	Familiar with this and used ***only*** in an internship related project	Familiar with this and used ***only*** in an independent project	Familiar with this and used in a combination of project types
Group Sketching	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○
Immersive Workshop	○	○	○	○	○
Kano Analysis	○	○	○	○	○
Make A World	○	○	○	○	○
Mission Impossible	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○
Participatory Design Game	○	○	○	○	○
Post-Up	○	○	○	○	○
Role Playing	○	○	○	○	○
Search Conference	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○
Show and Tell	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○
The Anti-Problem	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○
World Cafe	○	○	○	○	○
Other (please specify)	○	○	○	○	○

Comments

I-7 Concept Generation Methods Survey

6.

6. Of the methods you are familiar with, what is your level of confidence to use it for *afuture* school,

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work/internship or independent project?

	Not at all confident	Slightly confident	Somewhat confident	Very confident	Extremely confident
3-12-3 Brainstorm	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○
Attribute Listing	○	○	○	○	○
Bodystorming	○	○	○	○	○
Borda Count Voting	○	○	○	○	○
Brainstorming	○	○	○	○	○
Brainwriting	○	○	○	○	○
Checklists	○	○	○	○	○
Code of Conduct	○	○	○	○	○
Context Panorama	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○
Cover Story	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○
Design Charrettes	○	○	○	○	○
Design Swarm	○	○	○	○	○
Design the Box	○	○	○	○	○
Do, Redo, Undo	○	○	○	○	○
Dot Voting	○	○	○	○	○
Dramaturgy	○	○	○	○	○
Forced Analogy	○	○	○	○	○
Forced Ranking	○	○	○	○	○
Group Sketching	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○
Immersive Workshop	○	○	○	○	○
Kano Analysis	○	○	○	○	○
Make A World	○	○	○	○	○
Mission Impossible	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○

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	Not at all confident	Slightly confident	Somewhat confident	Very confident	Extremely confident
Participatory Design Game	○	○	○	○	○
Post-Up	○	○	○	○	○
Role Playing	○	○	○	○	○
Search Conference	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○
Show and Tell	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○
The Anti-Problem	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○
World Cafe	○	○	○	○	○
Other (please specify)	○	○	○	○	○

Other (please specify)

7. Please add any other comments you have on either design methods and practice, or on this assignment itself:

I-7 Concept Generation Methods Survey

7. Assignment successfully submitted

Thank you for your responses. If you have any questions or comments about the assignment, please contact thedesignexchange@mit.edu

Appendix B –Design Methods for Ideation Post-Survey

1. Introduction

This assignment is a follow up to assignment I-7 to assess the effectiveness of your structured design methods readings from theDesignExchange. You are not expected to be familiar with any design methods and the number of methods you are familiar with does not impact your grade.

If you would like to revisit the reading, please do so AFTER completing the survey

If you have any problems with this assignment, please email thedesignexchange@mit.edu

2. Engineering and design background

1. Please enter your name and email below

Name

Email Address

2. What is your major?

- [ ] Mechanical Engineering
- [ ] Industrial Engineering & Operations Research
- [ ] School of Information
- [ ] Haas School of Business
- [ ] Chemistry & Chemical Engineering
- [ ] Civil & Environmental Engineering
- [ ] Electrical Engineering & Computer Science
- [ ] Bioengineering
- [ ] Nuclear Engineering
- [ ] Materials Science
- [ ] Letters & Sciences
- [ ] Biology
- [ ] College of Environmental Design
- [ ] College of Natural Resources
- [ ] Other (please specify)

3. Assignment Background

3. When did you do the assigned structured methods reading from theDesignExchange? (Due on 3/1). *Please be honest - your answer will be used for research purposes and has no effect on your grade.*If you would like to revisit the reading, please do so after taking this survey.

- ◯ Reading was completed **before** the due date 3/1
- ◯ Reading was completed **after** the due date 3/1
- ◯ Reading has **not** been completed
- ◯ Other (please specify)

4. Please include any comments you may have about the reading assignment on structured ideation methods

4. Overall familiarity with design methods and tools

5. Below is a list of product and engineering design methods. You are not expected to be familiar with them. Which of these have are you familiar with or have used before?

- [ ] 3-12-3 Brainstorm
- [ ] 6-3-5 Brainwriting
- [ ] Agile UX Sketching and Scrum
- [ ] Attribute Listing
- [ ] Bodystorming
- [ ] Borda Count Voting
- [ ] Brainstorming
- [ ] Brainwriting
- [ ] Checklists
- [ ] Code of Conduct
- [ ] Context Panorama
- [ ] Cost Benefit Analysis
- [ ] Cover Story
- [ ] Democs (DEliberative Meetings Of CitizeS)
- [ ] Design Charrettes
- [ ] Design Swarm
- [ ] Design the Box
- [ ] Do, Redo, Undo
- [ ] Dot Voting
- [ ] Dramaturgy
- [ ] Forced Analogy
- [ ] Forced Ranking
- [ ] Group Sketching
- [ ] Heuristic Ideation
- [ ] Immersive Workshop
- [ ] Kano Analysis

- [ ] Make A World
- [ ] Mission Impossible
- [ ] Participatory Co-Design
- [ ] Participatory Design Game
- [ ] Post-Up
- [ ] Role Playing
- [ ] Search Conference
- [ ] See, Sort, Sketch
- [ ] Show and Tell
- [ ] Spectrum Mapping
- [ ] The Anti-Problem
- [ ] Value Opportunity Analysis
- [ ] Visual Brainstorming
- [ ] Weighted Matrix (Pugh Matrix)
- [ ] World Cafe
- [ ] Other (please specify)

5. Learning Design Methods

6. How did you *first* learn about the design methods you are familiar with?

	From theDesignExchange readings	Through school	Through work or an internship	Other website (please indicate site below)	From a book (please indicate title and/or author below)	Word of mouth (Specify details below)	Other (please specify)
3-12-3 Brainstorm	○	○	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○	○	○
Attribute Listing	○	○	○	○	○	○	○
Bodystorming	○	○	○	○	○	○	○
Borda Count Voting	○	○	○	○	○	○	○
Brainstorming	○	○	○	○	○	○	○
Brainwriting	○	○	○	○	○	○	○
Checklists	○	○	○	○	○	○	○
Code of Conduct	○	○	○	○	○	○	○
Context Panorama	○	○	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○	○	○
Cover Story	○	○	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○	○	○
Design Charrettes	○	○	○	○	○	○	○
Design Swarm	○	○	○	○	○	○	○
Design the Box	○	○	○	○	○	○	○
Do, Redo, Undo	○	○	○	○	○	○	○
Dot Voting	○	○	○	○	○	○	○
Dramaturgy	○	○	○	○	○	○	○
Forced Analogy	○	○	○	○	○	○	○
Forced Ranking	○	○	○	○	○	○	○
Group Sketching	○	○	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○	○	○

	From theDesignExchange readings	Through school	Through work or an internship	Other website (please indicate site below)	From a book (please indicate title and/or author below)	Word of mouth (Specify details below)	Other (please specify)
Immersive Workshop	○	○	○	○	○	○	○
Kano Analysis	○	○	○	○	○	○	○
Make A World	○	○	○	○	○	○	○
Mission Impossible	○	○	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○	○	○
Participatory Design Game	○	○	○	○	○	○	○
Post-Up	○	○	○	○	○	○	○
Role Playing	○	○	○	○	○	○	○
Search Conference	○	○	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○	○	○
Show and Tell	○	○	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○	○	○
The Anti-Problem	○	○	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○	○	○
World Cafe	○	○	○	○	○	○	○
Other (please specify)	○	○	○	○	○	○	○

Other (please specify)

6. Familiarity of Design Methods

7. To understand the application of design methods you are familiar with, please indicate whether you are only familiar with a design method or in what context you have used it in.

	Familiar with this but have ***never*** used it	Familiar with this and used ***only*** in a school exercise or project	Familiar with this and used ***only*** in an internship related project	Familiar with this and used ***only*** in an independent project	Familiar with this and used in a combination of project types
3-12-3 Brainstorm	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○
Attribute Listing	○	○	○	○	○
Bodystorming	○	○	○	○	○
Borda Count Voting	○	○	○	○	○
Brainstorming	○	○	○	○	○
Brainwriting	○	○	○	○	○
Checklists	○	○	○	○	○
Code of Conduct	○	○	○	○	○
Context Panorama	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○
Cover Story	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○
Design Charrettes	○	○	○	○	○
Design Swarm	○	○	○	○	○
Design the Box	○	○	○	○	○
Do, Redo, Undo	○	○	○	○	○
Dot Voting	○	○	○	○	○
Dramaturgy	○	○	○	○	○
Forced Analogy	○	○	○	○	○
Forced Ranking	○	○	○	○	○
Group Sketching	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○

	Familiar with this but have ***never*** used it	Familiar with this and used ***only*** in a school exercise or project	Familiar with this and used ***only*** in an internship related project	Familiar with this and used ***only*** in an independent project	Familiar with this and used in a combination of project types
Immersive Workshop	○	○	○	○	○
Kano Analysis	○	○	○	○	○
Make A World	○	○	○	○	○
Mission Impossible	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○
Participatory Design Game	○	○	○	○	○
Post-Up	○	○	○	○	○
Role Playing	○	○	○	○	○
Search Conference	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○
Show and Tell	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○
The Anti-Problem	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○
World Cafe	○	○	○	○	○
Other (please specify)	○	○	○	○	○

Comments

7. Confidence with Design Methods

8. Of the methods you are familiar with, what is your level of confidence to use it for *afuture* school, work/internship or independent project?

	Not at all confident	Slightly confident	Somewhat confident	Very confident	Extremely confident
3-12-3 Brainstorm	○	○	○	○	○
6-3-5 Brainwriting	○	○	○	○	○
Agile UX Sketching and Scrum	○	○	○	○	○
Attribute Listing	○	○	○	○	○
Bodystorming	○	○	○	○	○
Borda Count Voting	○	○	○	○	○
Brainstorming	○	○	○	○	○
Brainwriting	○	○	○	○	○
Checklists	○	○	○	○	○
Code of Conduct	○	○	○	○	○
Context Panorama	○	○	○	○	○
Cost Benefit Analysis	○	○	○	○	○
Cover Story	○	○	○	○	○
Democs (DEliberative Meetings Of CitizeS)	○	○	○	○	○
Design Charrettes	○	○	○	○	○
Design Swarm	○	○	○	○	○
Design the Box	○	○	○	○	○
Do, Redo, Undo	○	○	○	○	○
Dot Voting	○	○	○	○	○
Dramaturgy	○	○	○	○	○
Forced Analogy	○	○	○	○	○
Forced Ranking	○	○	○	○	○
Group Sketching	○	○	○	○	○
Heuristic Ideation	○	○	○	○	○
Immersive Workshop	○	○	○	○	○

	Not at all confident	Slightly confident	Somewhat confident	Very confident	Extremely confident
Kano Analysis	○	○	○	○	○
Make A World	○	○	○	○	○
Mission Impossible	○	○	○	○	○
Participatory Co-Design	○	○	○	○	○
Participatory Design Game	○	○	○	○	○
Post-Up	○	○	○	○	○
Role Playing	○	○	○	○	○
Search Conference	○	○	○	○	○
See, Sort, Sketch	○	○	○	○	○
Show and Tell	○	○	○	○	○
Spectrum Mapping	○	○	○	○	○
The Anti-Problem	○	○	○	○	○
Value Opportunity Analysis	○	○	○	○	○
Visual Brainstorming	○	○	○	○	○
Weighted Matrix (Pugh Matrix)	○	○	○	○	○
World Cafe	○	○	○	○	○
Other (please specify)	○	○	○	○	○

Other (please specify)

9. Please add any other comments you have on either design methods and practice, or on this assignment itself:

8. Assignment successfully submitted

Thank you for your responses. If you have any questions or comments about the assignment, please contact thedesignexchange@mit.edu

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