CO-DESIGN PROCESSES IN INDUSTRIAL DESIGN EDUCATION

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SUMMARY

Co-design is a process that allows designers to develop products with greater insight to user needs through the participation of users in the design process. During this process what users say, make, and do is investigated using common research methods in combination with newer generative and exploratory approaches created for this purpose. Co-design encompasses many design practices. Despite the prevalence of the co-design process, a lack of studies into the education of designers on co-design have been implemented, leaving a gap of information that needs to be filled in order for co-design to become integrated into design education and practice. The purpose of this project is to understand the current state of co-design education in the U.S. and to assimilate popular teaching techniques, by surveying teaching methods of co-design within Industrial Design programs at U.S. Universities with reputations as leaders in the field. This project also aims to design a learning aid for Industrial Design students derived from the findings of interviews, materials review, and literature. A snowball sampling was performed with schools leaders in co-design. Schools were contacted and given a survey, interviewed with selected participants and assessed on their materials and practices on co-design. Various qualitative data analysis was performed with the surveys, interviews and materials. The conclusion includes a composite of common methods for teaching co-design, which are assembled into a learning aid artifact. The artifact incorporates findings into a practical outcome. The significance of this project is to further research into teaching methods of co-design as well as providing a common framework for design educators to follow in higher level learning institutions.

CHAPTER 1

INTRODUCTION

Co-Design in University level Industrial Design Programs

Co-design is a process that allows designers to develop products with greater insight to user needs through the participation of users in design decisions during varied stages of the process. This leads to more relevant, better accepted, and justified designs. Different names are often applied to co-design because it encompasses many design methods. During this process what users say, make, and do is investigated using common research methods in combination with newer generative and exploratory approaches created for this purpose.

The origins of co-design as an advocated approach can be traced to the 1970s when user-centered design began to enter popularity and eventually brought attention to users' ability to bring new insight into design (Sanders & Stappers, 2008). Since the late 1990s influential researchers such as Sanders, Stappers, and Visser have been writing about the methods, tools, and benefits of co-design, adding to a growing body of research in the area. Co-design has even been assessed to show an increase in product value in empirical studies (Biemans, 1991; Gruner & Homburg, 2000; thesisSteen, Kuijt-Evers, & Klok, 2007).

From the state of papers published on the use of co-design it is clear that designers are learning and using co-design methods. However, few papers discuss practices in teaching co-design in Industrial Design. Moreover, no papers can be found which suggest the preferred or common methods of teaching co-design in industrial design. Despite the prevalence of the co-design process, a lack of studies into the education of Industrial Designers on co-design have been implemented, leaving a gap of information that needs to be filled in order for co-design to become integrated into design education and practices.

This project aims to answer how co-design is taught in undergraduate Industrial

Design programs with leading reputations in co-design within the United States. In order to answer this question answers to the following questions need to be discerned: which institutions have a leading reputation in co-design education, what is the possible content of co-design education, what methods are being used at institutions with leading reputations in co-design education, what content is being taught at institutions with leading reputations in co-design education, when is co-design being taught at institutions with leading reputations in co-design education, and what similarities exist in how co-design is taught at institutions with leading reputations in co-design education.

In order to answer these questions and assimilate popular teaching techniques, teaching methods in co-design within Industrial Design programs at U.S. Universities with reputations as leaders in the field were surveyed. Starting with two educators known to teach co-design processes, a snowball sampling was performed to determine up to 10 schools with reputations as leaders in the field of co-design. After a pilot study of surveys and interviews was performed, these schools were contacted and given a survey on co-design within their program. Seven schools were surveyed on co-design within their program. The survey was distributed by email after a phoned request. The survey was sent to the director or chair of each program. Interviews were developed based on a table of key tools and methods in co-design, derived from literature. The interviews were given over the phone to faculty recommended during the survey phase. Any available resources were requested (e.g. syllabus, student projects, list of materials used, etc.) from the interview participants for a material review. Teaching methods were defined through analysis of the interviews and materials.

This allowed for a collection of recommendations for teaching co-design as well as the design of a learning aid for students. This practical outcome incorporates findings from literature, interviews, and materials in to a transportable set of reference cards that are designed to be assembled into a co-design protocol. The significance of this project is to further research into teaching methods of co-design as well as providing an overview of standard practices to design educators along with a learning aid for students.

CHAPTER 2

DEFINITIONS

Co-Design, Collaborative Design, Participatory Design, and Co-Creation

Co-design has yet to be given a standard definition used by the disciplines and advocates of design. Often the terms collaborative design, participatory design, co-creation, and co-design are used interchangeably despite varied meanings and methods. For this project, co-design is defined as joint creation or the act of users making design decisions in conjunction with designers, particularly during the early stages of the design process.

There are different methods and terms that encompass co-design. All of these methods are part of a co-design process.

For example, contextual design is the act of creating requirements around information gathered about the user (Steen, Kuijt-Evers & Klok, 2007). Common tools of contextual design include workbooks, diaries or blogging, photo/video assignments, focus groups, observation, interviews, and surveys.

In user centered design, designers use second hand knowledge of the user, typically in the form of criteria created by a social scientist (Sanders, 2002). Common tools used to create the criteria for user centered design include focus groups, observation, interviews, and surveys. These methods are also part of a co-design process.

Human centered design uses information about and from the user in relation to design requirements to aid in iteration and evaluation of design (Steen, Kuijt-Evers & Klok, 2007). Common tools of human centered design include ergonomic testing, focus groups, observation, interviews, and surveys. These same methods are included in co-design processes.

Participatory design can be defined as mutual learning or users and designers sharing knowledge with each other in order to facilitate better designs and better user understanding (Steen, Kuijt-Evers & Klok, 2007). Common tools of participatory design

include workbooks, diaries or blogging, photo/video assignments, collage, brainstorming, cognitive mapping, story-boarding, acting out scenarios, simulation, site visits/product exposure, card sorting, and probes. These same methods are part of a co-design process.

Co-creation can be defined as guided user design where the user makes design decisions with the designer as an aid or soliciting user ideas to implement (Ramaswamy & Gouillart, 2010). Common tools include collage, brainstorming, cognitive mapping, story-boarding, acting out scenarios, simulation, site visits/product exposure, card sorting, user communities, social networking, model building, and Velcro modeling.

Co-design is joint creation, or the act of when users contributing design decisions in conjunction with the designer (Steen, Kuijt-Evers & Klok, 2007). Common tools of co-design include workbooks, diaries or blogging, photo/video assignments, collage, brainstorming, cognitive mapping, model building, Velcro modeling, story-boarding, acting out scenarios, focus groups, observation, interviews, surveys, simulation, site visits/product exposure, and card sorting.

These terminologies can be arranged in a continuum that begins with design decisions being the responsibility of the designer and ends with design decisions being made by users alone. In fig. 1 the terms are placed along this continuum to demonstrate the interrelationships they maintain with one another. The left can be seen as the common approach of designers creating a user from their experience (Lee, Bichard, & Coleman, 2008). Along the continuum different methods can be used to integrate users further into the design process. This continuum is used later to further clarify these design processes in conjunction with case studies. This is similar to Christina Lindsay's pyramid of user-based design methodologies, which expresses user involvement in terms of intensity from the bottom up (Lindsay, 2003). As well as Olsson's continuum of degrees of user involvement; however this continuum aims to demonstrate the way in which design methodologies overlap as well as align the terms with definitions from existing literature in a more detailed manner (Olsson, 2004).

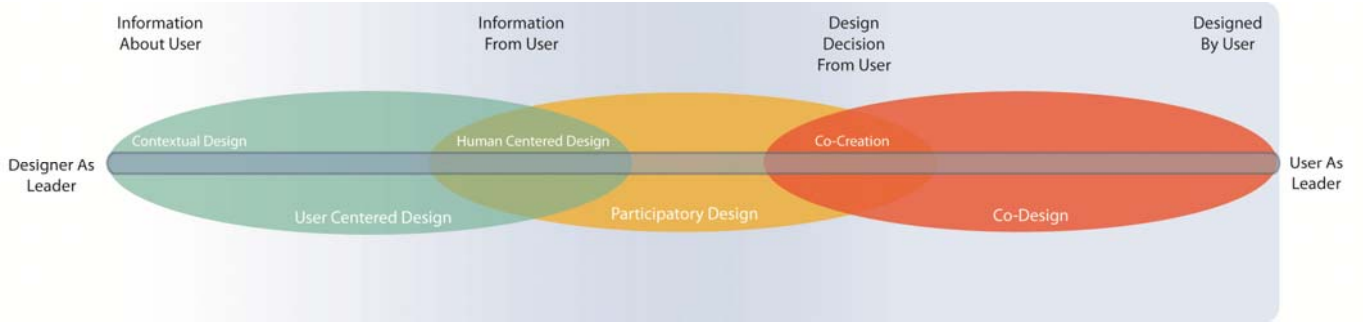

Figure 1: User Involvement Continuum

In this project co-design is intended to encompass all terms from the center to the right of this continuum. This represents multiple processes that allow the user to actively participate in the design process. As part of this project, the concept and definition of co-design in industrial design education will be further clarified after data analysis.

CHAPTER 3

LITERATURE

Previous practices in industrial design were mostly concerned with making the products given to designers look and function better. Industrial design as a field has stopped approaching design as the act of making objects and reinterpreted the responsibility of the designer to fulfill the needs of people (E. Sanders & Stappers, 2011). As the purpose of the designer changes, they must learn to incorporate the design thinking capabilities they have available to them in order to evolve with the times (Brown, 2009). One way that is seen as a means to discover and create needed solutions is co-design. Co-design is a process that allows for a particular type of participation from users as a product or service is designed.

Co-Design Process

Co-design is a design approach that incorporates those being designed for into the design process. While all methods of design research use information about users, co-design goes beyond simply basing design decisions on information from users and instead allows users to participate in design decisions. It is important to note that co-design requires designers to not only collect, analyze and interpreter data but to also integrate and expound upon the knowledge, insights and ideas of others who were previously seen as quiescent in the design process (E. Sanders & Stappers, 2008). In the co-design process users take on the role of “experts of their experience” (Visser, Stappers, Van der Lugt, & Sanders, 2005) within the design team. The consideration of participants as experts is integral to success of co-design; otherwise their input may be ignored or trivialized (Sanoff, 2007). In some situations they may be considered a full member of the design team while in others they may be a temporary participant, but they must function in an active role in order to fulfill the co-design process (E. Sanders & Stappers, 2008). There is a variety of tools and methods to aid designers in facilitating user

participation in co-design, which can be divided in to those which allow users to say, do, or make (E. Sanders, 2002). The approaches in which participants physically make things, constructive methods, in order to represent their ideas, thoughts, or feelings are the most specific to co-design and considered to provide stronger latent knowledge that is hard to access otherwise (Sanders, 2002; Sanders & Stappers, 2011). When performing co-design, tools can be used in a generative way that does not include the physical building of an object, but rather in a projective way in order to express information that is challenging to express through conventional communication (Hanington, 2007). The users chosen to participate are integral to the success of the co-design process. Lead users and financially attractive users are good choices, but it may be hazardous to choose users that are too technically advanced in the product area because their involvement may lead to products that do not align with the capabilities of the average consumer (Gruner & Homburg, 2000). The co-design process is a flexible approach that can be adjusted according to the results desired, participants involved, time available, stage of development, and any other changing factor in the design process (Ireland, 2003). This creates a challenge for students to incorporate existing tools and methods along with their own interpretations and approaches.

Co-Design as a Source of Value

Co-design has begun to be viewed as a process which adds value to designs. Co-design has been embraced by technology companies, such as Cisco and Red Hat, who have found it to drive sales and increase customer loyalty (Kambil, Friesen, & Sundaram, 1999). However, it is not relegated to the electronic realm. Companies such as Ikea, Nike, Lego, Nestle, GE Plastics, Muji, Proctor & Gamble, Shell, BMW and Nokia have begun to integrate co-design into product design and customer care (Kambil, et al., 1999; Prahalad & Ramaswamy, 2004; Ramaswamy & Gouillart, 2010; Hicks, 2010).

Co-design can allow companies to develop market insight while differentiating themselves in a field over run with options in order to gain efficiency in increasing their

customer base (Prahalad & Ramaswamy, 2004). One factor that contributes to the success of co-design is the ability of insights that emerge from a group to be greater and more powerful than those of individuals (Sanoff, 2007). Another is the ability to be informed by users' tactic and latent knowledge, which is often inaccessible otherwise (Sanders, 2002; Sanoff, 2007). Not only does co-design provide the political benefit of saying users are incorporated into the design process, but it can also provide input that saves money and time in development while often allowing designers to enact more creative products focused on future needs (Steen, Kuijt-Evers & Klok, 2007). Co-design can save time in development because concepts are often defined quickly within a workshop and then handed over to a design team to finish. These concepts are often more relevant than those provided by in house design teams alone (Hicks, 2010). Biemans found that innovation was increased in the Dutch medical equipment industry through co-design with the stakeholders (Biemans, 1991). In 2000, Gruner and Homburg found that as user interaction in the design process increased, so did the success of a new product. User interaction is particularly affective in the concept development stage as well as the prototyping stage (Gruner & Homburg, 2000).

Co-Design Tools and Methods

Co-design relies on the use of many tools and methods to incorporate users as participants in the design process. These tools have been assimilated from other types of design research or developed specifically for use in co-design by its proponents. Access to and an understanding of the tools available for performing co-design activities is a way to increase a student's ability to successfully use the co-design process. Eighteen tools have been identified as important and noteworthy in the field of co-design. It is important to note that while these tools can be used in the co-design process, not all are exclusively used in or inherently designed for co-design (see table 1). When using tools from other design processes, it is the way in which they are executed that makes them co-design tools. These tools and techniques involve a variety of aspects by which they could be

arranged; however, Liz Sanders' criteria of say, make, do allows us to delineate tools by the type of knowledge and involvement that is provided by the users, making it an ideal sorting methods for the purposes of this project (E. Sanders, 2002; E. Sanders & Stappers, 2011; E. B. N. Sanders & Dandavate, 1999). In figure 2 the eighteen co-design tools are sorted according to their status as a say, do, or make tool. These tools and methods can be used in combination to accent the different stages and decisions during the design process.

Table 1:Design Processes and their Tools

	Contextual Design	User Centered Design	Human Centered Design	Participatory Design	Co-creation	Co-Design
Methods /Tools	workbook diary photo/video assignment focus group observation interview survey	focus group observation interview survey	focus group observation interview survey	workbook diary photo/video assignment collage brainstorming cognitive mapping Story-boarding acting out scenario simulation site visit product exposure Card Sorting Probe	Collage brainstorming cognitive mapping model building Velcro modeling Story-boarding acting out scenario simulation site visits product exposure Card Sorting User community Social Networking	Workbook diary photo/video assignment collage brainstorming cognitive mapping model building Velcro modeling Story-boarding acting out scenarios focus group observation interview survey simulation site visit product exposure Card Sorting

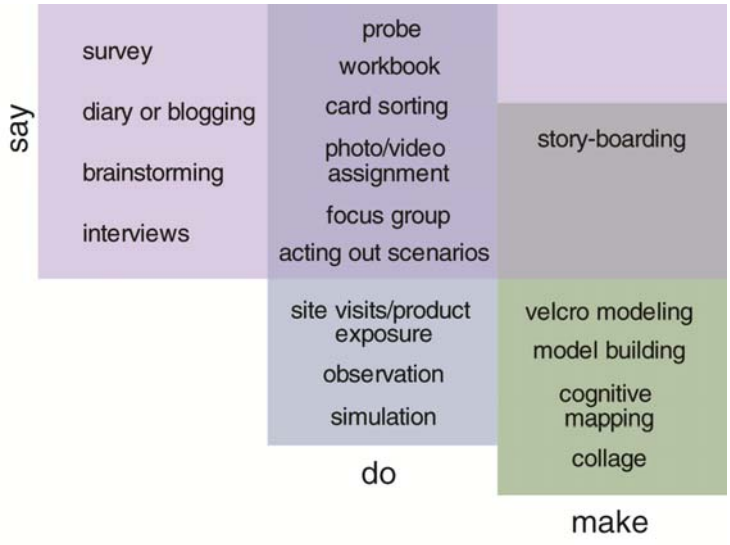

Figure 2: Say, Make, Do Tools

Say

"Say" techniques are those that allow participants to explicitly communicate what they think through verbal means (E. Sanders, 2002; E. B. N. Sanders & Dandavate, 1999).

Workbooks

Workbooks are booklets containing questions and small activities for participants to complete. They are often sent to participants in advance of face to face or group meetings in order to aid in the participants awareness of the issue being investigated. Workbooks are a way to create self-prospective within participants allowing them to be open to other tools used in co-design, but they can be useless when they are not allotted appropriate time to be absorbed (P. Stappers, Visser, & Van Der Lugt, 2007). Workbooks can also be a "do" technique where participants are given tasks, such as creating a story about one's self through personal photos (Gaver, Dune & Pacenti, 1999).

Diaries

Diaries or blogs are also often used prior to participant and designer interaction but may also be used as part of the ongoing process in co-design. Participants are typically asked to consider a specific action or interaction throughout their day and write about them. This allows investigators to have gain perspective not only on the participants thoughts during a meeting, but also giving an in depth look at a subject over time and in a personal context. Diaries and blogs from multiple participants can also provide varying views on similar situations allowing for a fuller understanding of user experience as well as revealing information that may be hard to garner otherwise (Westerlund, Sinnna, Mackay, & Sundblad, 2003). It is important that diaries are portable and easy to use to encourage participants to use them. By providing an overview, detailed instructions and examples it is easier to ensure the desired information is received

(Martin & Hanington, 2012).

Brainstorming

Brainstorming is a tool used in group sessions in which participants work together to answer a question or solve a problem. Most commonly, sticky notes are used to aid and depict the brainstorming session as it occurs because of the ease of sorting they provide. The use of sticky notes allows participants of all backgrounds to feel empowered and heard while constraining them enough to maintain a sense of comfort (Xie, et al., 2010). It is important to make participants feel comfortable enough to share their ideas freely. Brainstorming is best used in the conceptual stages of a design.

Interviews

Interviews are a technique used in many research processes including co-design. The way interviews are conducted can be altered to the desired type and amount of information desired. Interviews can include one on one guided conversations, surveys and other approaches to communication between researchers and participants. Closed formats can be applicable to the co-design process but are less relevant than an in-depth interview (E. Sanders & Stappers, 2011). Interviews can be used in conjunction with “do” and “make” techniques. For example, card sorting is often used during interviews.

Focus Groups

Focus groups are used in many types of design research, but they can also be used within the co-design process. Focus groups allow the views of multiple people to be garnered simultaneously, but the conclusions often represent the stronger opinion, as opposed to evenly representing differing views. The process of gathering ideas and opinions from multiple participants at once can lead to the discovering of information that would not have been garnered in a one on one interview. Wilson found focus groups to be a useful starting point to assess the views and capabilities of his participants before moving on to more interactive stages. In order for every participant to be of value during

a focus group it is necessary to maintain the importance of individuals' point of view as well as that of the group consensus (Wilson, 1995). It is also important to keep participants' needs in mind when running a focus group, for example younger participants will not stay interested or engaged for as long in group discussions (Xie, et al., 2010). Focus groups can also be the format in which other "do" and "make" techniques are used.

Do

"Do" techniques are those that allow participants to be observed in order to understand how they use and appear to experience things or tacit knowledge (Sanders, 2002; Sanders & Dandavate, 1999).

Photo and Video Assignments

Photo and video assignments ask participants to express their views visually or through a story. This is done prior to meeting with investigators or during sessions. When participants are asked to express themselves through photographs, they are often asked to annotate and/or sort them at a later time. Separating the tool into two actions allows participants to have a spontaneous reaction, yet allowing for deeper reflection and possible realizations at a later time (Westerlund, et al., 2003). Photo-sharing sites such as Flkr allow for photo tagging and comments over the internet. This allows for photo assignments to become group activities even when participants cannot be together at the same time (Somerville & Collins, 2008). Often disposable cameras are given to participants, which can be repackaged in order to integrate with other tools as well as allow for questions to be placed directly on the camera (Gaver, Dunne, Pacenti, 1999). Photo and video assignments are functioning as a "do" and "say" tool when participants are asked to annotate or talk about their pictures and videos.

Scenarios

Scenarios involve participants acting out possible solutions or situations to gain perspective on the reality of each. Often scenarios are acted out in conjunction with video

recording to allow reflection on the results. By acting out scenarios participants can understand the emotions and possibilities of a situation (Sanders, Brandt, & Binder, 2010). Scenarios can help participants express abstract concepts that would otherwise be beyond their ability to communicate otherwise (Sanders, 2010). One issue that can occur during this process is the generation of an unmanageable amount of ideas and concepts which have to be addressed using other methods (Brandt & Grunnet, 2000). Scenarios are useful when participants experience difficulty understanding how they are affected by products or situations. Scenarios are both a “do” and “say” techniques because almost as much of the results are produced verbally as are produced physically.

Observations

Observation has been a standard tool in design research (Bayazit, 2004). However, co-design uses it in conjunction with other tools. Often observation of participants takes place in advanced of other activities, allowing investigators to gain an understanding of the context and problems associated with the situation of interest (Wilson, 1995). This information is then used to aid in the design and choice of other tools for co-design, which in turn create richer and more meaningful results.

Card Sorting

Card sorting is when participants are given cards with images, words, or other depictions on them and asked to sort them into categories and/or priorities. Card sorting can be helpful for designing interfaces, tables of contents, or any other place where information must be structured (Martin & Hanington, 2012). It is best used with individuals or very small groups with thirty to one hundred cards (Martin & Hanington, 2012). Nielsen found that testing fifteen participants is optimal when using card sorting (Nielsen, 2004). However, if no consistencies begin to appear after ten participants, the cards themselves need to be reconsidered (Martin & Hanington, 2012). Often participants are asked to talk through their thinking as they sort, but just as an explanation of what

they are doing.

Site Visits

Site Visits are used in co-design to expose participants to solutions that already exists but may not previously be within their frame of reference. This exposure can lead to more ideas and inspiration from participants because it opens their views to more variety as well as creating awareness that the solutions they are most familiar with are not the only realistic possibilities (Wilson, 1995). This is considered a do technique because it is about the action of experience for the participant.

Cultural Probes

Cultural probes are a combination of "say" and "do" tools into a package that can be given to participants before perform other activities with designers. Often these kits include cameras, workbooks, and activities. The use of probes allows designers to develop an understanding of the participants' point of view and opinions. An advantage to using cultural probes is the ability to gather information over a longer period of time then is feasible through workshop techniques. Cultural probes allow for participatory workshops to be designed around the participants' context, which can provide for richer results. It is important that probes appear professional and well designed in order to maintain a sense of respect for the project from participants (Westerlund, et al., 2003). The aesthetic design and cohesion of a probe can be integral to its acceptance and consideration by participants. However, if a probe is too well finished it may increase the sense that a participant is working on official anonymous forms as opposed to feeling they are involved in a project that needs their personal involvement (Gaver, Dunne & Pacenti, 1999). In 2004 Harriss & Winstanley found that using unique methods for asking questions, such as tea cups to write on or maps of local areas to fill out, could encourage participants to give inspired answers and forget that they were research subjects (Harriss & Winstanley, 2004). Cultural probes can provide rich information if the participants feel

motivated to complete them. There is a risk with probes that they will be felt to be too much work and since the participant is on their own, they may fail to complete them or finish them without consideration in order to be done with the work (Harriss & Winstanley, 2004).

Make

"Make" techniques are those that allow participants to communicate their needs or desires through creation which aids in reaching latent knowledge (Sanders, 2002; Sanders & Dandavate, 1999).

Collaging

Collaging has been developed into different approaches to help participants express themselves visually without requiring artistic skills or insight. Participants are often asked to answer a question or express a situation through collage. The materials are provided by the investigators and range from magazine clippings and words to textured papers and participants previous photos. The materials provided need to be specific enough to provide the information sought while ambiguous enough to allow the participants to invent their own meaning (Martin & Hanington, 2012). This allows participants to get past verbal blocks and express deeper opinions or feelings (Sanders, 2000; Sanders & Dandavate, 1999). It is important to have participants explain their collage in order to clarify insights (Martin & Hanington, 2012).

Cognitive mapping

Cognitive mapping is a tool in which participants lay out connections between different ideas, needs, and/or processes. A common approach to this is to layout different images or phrases on a sheet and draw connection lines, which can be annotated, between interconnected areas. In order to encourage better results, it is wise to sensitize participants prior to a mapping session. This can be achieved through a cultural probe (Visser, Stappers, Van Der Lugt, & Sanders, 2005). The use of mapping can allow

investigators insight into the participants' experience of the issue at hand as well as the how the experience has been shaped (Sanders, 2000; Sanders & Dandavate, 1999). Through the visual alignment of many factors a complicated concept or problem can be more easily understood (Martin & Hanington 2012). It is integral to allow participants time to explain their map and its meaning, because it may be difficult to interpret appropriately otherwise (Martin & Hanington, 2012). The result is a map created by a participant that represents the context in which products exist within their lives (Visser, Stappers, Van Der Lugt, Sanders, 2005).

Model Building and Velcro Modeling

Model building and Velcro modeling are similar tools that allow participants to bring their ideas to life, while typically realistic designs are not achieved, the models allow designers to develop a path leading to a more focused and desirable product (Xie, et al., 2010). A Velcro modeling kit contains parts that easily attach using Velcro, which range from abstract and common shapes to pictures or stickers. Participants can assign their own meaning to simple parts in order to create a model without being overwhelmed, which allows investigators insight into elusive latent information (Hanington, 2007; Sanders & Dandavate, 1999; Stappers & Wisserm, 2007).

Model building usually takes place later in co-design sessions after participants have been familiarized with considering the issue at hand. Often basic craft supplies such as Legos, modeling clay, cardboard, found objects, and glue are used to create simple prototypes. These models allow a better grasp of how, when and where participants expect to use their artifact (Sanders, 2000; Westerlund, et al., 2003). However, low tech approaches to prototyping can focus work for some while distracting others, particularly when working with participants of varying backgrounds and ages (Taxen, 2004; Xie, et al., 2010). Velcro modeling simplifies the experience of creating a prototype, which can allow for a better acceptance by participants without limiting them (Hanington, 2007).

Storyboarding

Story boarding is a tool used to help participants understand the details that arise when interacting with a space, task, or object. Often a moderator or investigator will assist by drawing out visual depictions of steps or stages described by participants. By using a visual depiction which details each step participants can begin to understand the nuances of every action and the possible faults or advantages in each (Westerlund, et al., 2003). Whether the stories true or imagined they allow participants to empathize while creating ideas of future possibilities (Sanders & Stappers, 2011). Storyboarding can be adjusted to fit participants. For example, children may be able to express themselves better through a familiar format like a comic book that they participate in creating (Moraveji, Li, Ding, O'Kelley, & Woolf, 2007). While storyboarding is mainly a "do" technique, there are "say" aspects to the process. It is important to remember the "say" aspect of storyboarding, because in reviewing recordings later, comments that went unnoticed during the session may be found useful.

Simulation

Simulation is particular to the co-design process and is both a "make" and "do" technique. In simulations, participants act out the use of an artifact of their own design. This allows participants to reshape their desires and needs based on their own creation, which in turn allows them to see both advantages and drawbacks of their ideas without being criticized (Westerlund, et al., 2003). Props can be of use in simulation and do not need to be of high fidelity to generate valuable information (Martin & Hanington, 2012). Simulation could easily be used after Velcro modeling or model building to vet participant's concepts. This is a useful approach because it not only involves participants actively in the design process but also encourages them to reevaluate their opinions without hindering their confidence or willingness to engage.

Workshop Tool Kits

Workshop tool kits are the combination of materials necessary to use the tools

deemed appropriate for a work session with participants. These tool kits can cover “say”, “do”, and “make” techniques through physical components and guides. The design of a tool kit is particular to the desired outcomes of working with the participants, because of this it is important that the tool kit is designed with thorough consideration of the session’s goals (Sanders & Dandavate, 1999). Toolkits can be designed to be reused for a variety of sessions and should be made with consideration for storage and transit (Martin & Hanington, 2012).

Case Studies

In order to better understand the co-design process and how it differs from other design research involving users, case studies have been evaluated in relation to their location on the design process continuum (fig 3). Each case study has been assigned a number which is depicted on the continuum. Only case studies which involve user contact are discussed, because it is evident that co-design has not occurred when no direct contact is made with user participants.

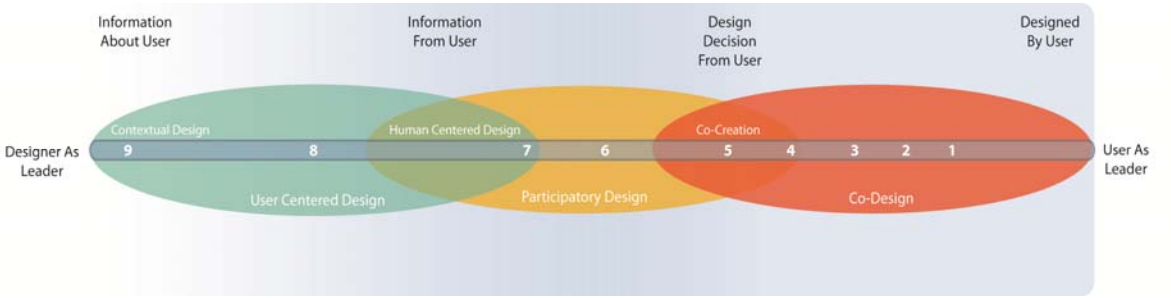

Figure 3: User Involvement Continuum with Case Studies

1. “Consumer co-design of apparel for mass customization”

This study focused on assessing the use of computer aided design (CAD) as a co-design technique. A mockup of a CAD program was created to allow participants to design their own work apparel and assess the processes. Participants were taken through each step with the aid of a designer, but the designer aided only in the use of the program and not in any decisions. The program allowed participants to pick a base for each

clothing item followed by details such as pocket type, cuff style, or collar. The participants were interviewed to assess their opinions of the process and what modifications they would like enacted. This study found that the despite the participants enjoyment of using the system, they were unsure if they would actually make a purchase after using such a system because of insecurities and apprehension about the quality of their design. It was discovered that individuals would feel more confident about designing their own work apparel if they were aided in the decision process by the designer (Ulrich, Anderson-Cornell, & Wu, 2003).

The results of this study suggest that even though the participants were given a structure to design within the designer was still need to create a sense of acceptability. Designers did play a role in design decisions before participants were involved, as opposed to creating blocks the participants' chose.

2. "Solution ownership in participative work redesign: The case of a crane control room"

This study focuses on five crane drivers as participants in the redesign of a crane cabin in which they worked (Wilson, 1995). In this 1995 study Wilson wanted to assess the outcomes of working with the crane controllers in an integrated manner when performing the redesign. A seven stage method was devised to perform this redesign. The steps were familiarization, site visits, design decision group "A", design decision group "B", simulation, product sourcing, and continued improvement. Each of these steps in the redesign involved the participation of the crane controllers. In order to be familiar with the actions and issues associated with the control room, video, photographic and direct observation of the drivers at work was first performed. To further understand the problem at hand as well as build trust amongst the participants one researcher was trained and spent time operating the crane. At his point a list of previous complaints, found ergonomic issues, and constraints were created to be used as guidelines within the next stages of the redesign. The operators were then taken to visit other work sites in order to

show them that alternative situations existed and open their minds to new possibilities before the workshops began. Due to their schedules participants could not all meet at the same time, subsequently they were divided into two groups for workshops. When group A met, they participated in group discussion, drawing exercises, brainstorming and other say processes. From this workshop a list of the operators' criteria and concerns was created which allowed for the researches to understand what issues were priorities in this redesign. When group B met they built metal mockups based off of Group A's criteria for the seat and control system. Although the results of the mock up were not what the researchers necessarily considered the best solution, it was deemed to be appropriate and to be the desired result for the operators. After the mockups were built the participants then experimented with simulations of different lighting setups within the crane room through the use of screens, blinds, and moveable lights. This allowed the possible solutions to be tested in the actual control room, producing true to life results. At this point the researchers worked with participants to source products that came closest to resembling the solutions designed with researchers, in order to encourage awareness of the pragmatism of implementing solutions. After this the crane operators were encouraged to continue thinking of ways to improve their work environment. When they were revisited later, it was found that they had begun to implement solutions of their own since the end of the project (Wilson, 1995).

Wilson's study reflects multiple lessons that need to be considered in the co-design process (Wilson, 1995). During the processes, approaches were changed to accommodate the participants. For example, after the first workshop with group A, paper mockups were deemed insufficient and the plan was adjusted for group B to create three-dimensional mockups using metal because of their prior metal working skills. It was also acknowledged that the participants were unlikely to have experience with the type of thinking exercises typically used in participatory design settings; therefore the approach to activities was revised to be more fitting to the participants’ context (Wilson, 1995).

3. “Co-design methods for designing with and for families”

This study focuses on the possible positive influence of integrated technology within home life through an extended deep investigation with three families (Westerlund, Lindqvist & Sundbald, 2003).

The investigation began by sending cultural probe kits to each family. The kits included integrated and matching materials to imply importance and respect for the participants and the project. The kits included workbooks with questions and tasks, pockets for the placement of artifacts, a diary which tended to be kept by the mother or father, disposable cameras repackaged with questions on them, a polaroid camera for younger children, a digital video camera for older children with instructions to explain your daily life to an alien, and a digital video camera for grandparents. These kits were to be used over a two week period. Once the cameras were returned, the photos were developed and sent back to participants for annotation. The cultural probes allowed for preparation before the workshops that followed (Westerlund, Lindqvist & Sundbald, 2003).

The workshops with the families were five hours long with lunch and took place on weekends. In the workshops drawings were provided of scenarios occurring in the probes. The whole group discussed the meanings of the drawings and then individuals were asked to describe a similar scenario where technology or products had proven problematic. This was followed by a group brainstorming session on solutions to the problem scenarios. Participants then built prototypes of their solutions from a low-tech materials kit. The prototypes were presented to the group and discussed (Westerlund, Lindqvist & Sundbald, 2003).

From the workshop prototypes, refined prototypes were created by the researchers and then installed in the family homes for six months. From this installment they hoped to gather further information on how to refine the concepts developed while working with families in a collaborative manner (Westerlund, Lindqvist & Sundbald, 2003).

This study is in the center of the co-design process section of the continuum. Designers used ethnographic studies to design their workshop activities with the users,

which assured participants views would be included and expounded. During the workshops participants ideas were elevated and then prototyped by themselves. The designers acted as guides through the process and then as vessels to refine the participants' ideas in ways participants could not. While the users did not make all and final design decisions, the concepts and prototypes were their ideas, only cultivated by the designers, making this study towards the middle on the co-design realm, as opposed to the extreme right.

4. "Connecting Generations: Developing Co-design Methods for older adults and Children"

This study focuses on older adults and children working together as co-design participants, in order to better define methods to interact with multigenerational groups working with technology based designs. The end goal of this study was twofold, to discover more about the process as well as create designs for a technology to bring generations closer together (Xie, et al., 2010).

Preliminary meetings took place to familiarize the participants with the process and information about the other generation with which they would be working. The older adult group used a round-robin discussion to address both subjects, while the children participated in a sticky note process to aggregate, display and address their questions and concerns (Xie, et al., 2010).

The first day of the workshop began with both age groups interacting. An introduction phase took place before the first activity began, which a sticky note activity was done in mixed groups of no more than five where they recorded ideas for technology to bring children and older adults together. After the sticky notes were put up and reviewed, the same groups were given a modeling kit to build a "computer of the future" based on their previous ideas (Xie, et al., 2010). At this point participants were given lunch before and other sticky note exercise about interacting and working with the other group. During this activity it was found that the different generations benefited from

different activities. The children were the most engaged with the model building, while the older adults felt they were wasting their time or being silly. The older adults found the sticky note exercises more productive, but the children appeared to become bored and distracted during these exercises (Xie, et al., 2010).

On the second day of the workshop the children and older adults met in separate locations. This was a last minute decision, which was made due to the interactions that took place during the first day. The groups each received regular updates on the other's ideas and progress. After a discussion took place on this disconnect of generations and the feelings of being burdensome, the researchers decided to teach the groups about blogs and have them be the focus of the second day. Each group performed a sketching sessions, the children drawing their own ideas and the older adults telling a researcher what to draw. During these sessions it was possible to find the similar ideas and designs that emerged from the separate groups (Xie, et al., 2010).

In this study the researchers used “say” and “make” tools, but managed to remain flexible in their approach in order to accommodate the participants. It is important to note that tools may not always be perfectly suited to the researchers’ purpose; however they can be adjusted to produce better results, such as having someone draw with direction from the participants if they feel uncomfortable drawing for themselves.

5. “Introducing Participatory Design in Museums”

This study focuses on a museum exhibit redesign in which high school students engaged in participatory design. The process involved three sets of workshops, one with the general public and two with the high school students alone (Taxen, 2004).

The first session with the general public was a sticky note sorting activity which took place after participants were shown the exhibit and told the goals and purpose. Participants were asked to use red and green sticky notes to record on three positive and three negative aspects of the exhibit. These were then sorted by the participants into groupings before they were divided into teams of five to explore solutions in discussion.

This information was used to determine that further participatory design would benefit the museum (Taxen 2004).

The museum had previously worked with a group of high school students who had prior knowledge of the exhibit. These students were chosen as participants for four two hour workshops to aid in the redesign. The students first went through the same sticky note process as the public group had performed except the students were also asked to discuss other museum experiences and how they applied to this exhibit. In the second session students were divided into groups to develop exhibition concepts without consideration for realistic implementation. Each group was also given an adult researcher to lead the group throughout the process. They were given a low tech building kit, which included materials like glue, tape, Legos, paper, clay and marbles, to create examples of their concepts. These were discussed and critiqued. In the following session, two of three groups returned to refine their concepts using scenarios. The scenarios were videotaped and then watched by everyone. A final session took place to receive feedback on the process. Participants felt they were empowered by having influenced the design process. They also expressed that the regular breaks provided prevented them from becoming bored or restless during the process, even though the goals for each session were too lofty. It was noticed that the adults tended to exert too much control over the direction of the students work and that the students tended to work with whatever material was closest to them. The process was considered a success by the practitioners who found it to require less cost and man hours than collecting the same information through observation (Taxen 2004).

In this case, participants were involved in creating their own design with the guidance and assistance of the designers, who were also the researchers.

6. “Capture It”

“Capture it” was a design investigation into facilitating communication between generations in the workplace. The project started with probe kits that were designed to be

playful and prevent the participants from feeling they were involved in a psychological study. The goal of the probes was to discern what activities take place throughout the work day and how the environment affected those activities. The probe kit was sent to twelve participants in three countries to complete over five days. The second tool used was a map on which participants were asked to make notes about their real and imaginary work place, which was completed during a conversation. The third tool used was an installation of lights on which participants tied fleeting ideas throughout their work day. The fourth tool used was a set of teacups that asked participants written questions. Group storyboarding was then performed after a review of the previous results. From the storyboarding eight key findings were discerned to six behaviors. From each behavior a design concept was created of which two were prototyped (Harriss & Winstanley, 2005).

7. Collaborative Design a Learner-Centered Library Planning Approach

This study focuses on the process of redesigning the San Jose State University library commons using a collaborative approach, which they also referred to as co-design. This process is interesting because it was run by librarians, as opposed to designers, using guidelines introduced by the Luleå University of Technology and revised by California Polytechnic State University researchers. The process used was focused on incorporating user input throughout the design process, but did not involve design decisions made by the users participating. During participatory activities run by California Polytechnic student, techniques used included interviews, focus groups, photo assignments, and observation. While social networking was found to work well for preliminary information during these activities, face to face interaction was found to be crucial to gathering valid in depth information. Site visits took place to evaluate existing library commons, but this was limited to the research team and did not include user participants (Somerville & Collins, 2008).

Case Study Summary

Each case study discussed in this project falls along the user involved end

of the design process continuum (figure 3). Study 1 is on the far end of the co-design spectrum where participants are making all the design decisions, but it does not reach the most extreme end because participants are merely assembling previously designed parts (Ulrich, Anderson-Cornell, & Wu, 2003). Study 2 is toward the middle of the co-design end of the continuum. Participants were closely guided in creating a new design for their work space, but they were allowed to make many decisions on their own after guidance on consideration from the researchers. It was said that researchers decided to only stop design choices and decisions if they would be harmful even if they went against the beliefs of the researchers as to the optimal decision. This made the researchers act as aids to the participants as opposed to the other way around, which places this study slightly right of the middle of the co-design realm (Wilson, 1995). Study 3 is between co-creation and the center of co-design on the process continuum. Multiple types of users were brought in to contribute original concepts as well as their vision of what these concepts could be physically in addition to functionally. While the designer/researchers aided in depicting the participants' ideas, their participation in the drawing of ideas and concepts would have influenced the results. The joint decisions made in this process put it on the edge of co-creation but closer to the middle of co-design. The ideas and prototypes created in this study were not final designs, but instead were to be used as the beginnings of designs to be refined; therefore this study would not fall on the right end of the continuum where users are the designer (Westerlund, Lindqvist & Sundbald, 2003). Study 4 is falls between co-creation and co-design because users contributed design decisions through brainstorming and model making. However, their decisions were not used as the absolute answer in design development, but instead as guides towards a final design (Xie, et al, 2010). Study 5 is in the co-creation section of the continuum. The fact that possible concepts were created by the users as well as use of generative tools by the participants demonstrates their involvement in designs decisions; therefore this processes is a form of co-design, but it falls on the end of co-creation because the research/designers were also making these decisions with the group, as opposed to

guiding them through the process. This form of co-design allows designers to maintain some control of outcomes while integrating user ideas and involvement into the design process (Taxen, 2004). Study 6 is considered participatory design according to the continuum in figure 3. The participants were providing rich information about their work lives and interactions, but there were never any design decisions made or considered by participants (Harriss & Winstanley, 2005). Study 7 is not considered co-design as defined within this project and is placed as user centered design on the process continuum. Student users were recruited and integrated into ethnographic research in order to gain a better understanding of their desires and needs; however, the participants were never involved in making any decisions about the design of the new commons. The level of user involvement in this project is in either the category of human centered design or participatory design, because information was gathered about users from users in order to influence design decisions (Somerville & Collins, 2008).

CHAPTER 4

INDUSTRIAL DESIGN EDUCATION

Industrial Design education and Co-design education practices are covered in this chapter.

Current Approaches to Industrial Design Education

From inception, industrial design education has aimed to train skilled craftsmen with the ability to create products that meet standards of form and function. The Bauhaus method, a tiered training approach that builds layers of knowledge and skills, has been the foundation for most programs in industrial design. This approach focuses on craft training through the principles of composition in combination with production skills (Kolko, 2005). Despite the prevalence of programs in which designers learn the most about form and function, a change in design education has started to focus on the user.

Industrial design is now viewed by many as a holistic process that involves many factors affecting the success of a product, such as user needs, specifications, details, manufacturing processes, and sales (Pugh 1991). Recently research has begun to be taught as a force to help determine the appropriate solutions for many of these issues in design, particularly user needs (Bayazit, 2004). Even though research and problem solving are being taught in leading programs, this change has yet to become universal within industrial design education as many still embrace hands-on development as the center of training new designers. This approach is maintained by many institutions even as the industry has changed to reflect a need for innovation in the process (Kolko, 2005; Strouse & Arnold, 2009). In order for design students to remain relevant in the changing market, they need to learn research skills, the ability to work creatively with those who may not necessarily be designers or creative people, and means of working collaboratively across disciplines (Weightman & McDonagh, 2006).

In institutions teaching design research there is almost no consistency in the way research is taught or even in which methods are taught (Strouse & Arnold, 2009). When

industrial design education does include research, it is typically evaluative. The most common approach is to develop a prototype and have it tested to assess its usability. The next being iterative design and testing, where designers make a prototype to test which is then refined and tested again (Buchanan, 2001). Other research methods are taught to aid in the formative stages, such as observation, personas or surveys. Students can be confused by when to use the research methods they are taught or how to use the research to define concepts or products (Hanington, 2007).

Current Approaches to Co-Design in Industrial Design Education

As with research methods, co-design is not taught across all industrial design institutions or in a consistent manner when it is taught. Co-design has begun to be considered an important frontier in design education and taught in industrial design programs, but the way in which it is being taught has not been written about nor have guidelines been created on how or what to teach in order to prepare students to perform the co-design process on their own (Strouse & Arnold, 2009). In order for a co-design to become a standard method in the toolbox of designers, it needs to be introduced during design education. New methods are better integrated and accepted if they are introduced during the training stages of a designers career (Bruseburg & McDonagh-Philip, 2002).

Co-design should not be taught in the same manner as other research methods (Hanington, 2007). Research methods borrowed from the social sciences follow well established protocols. Co-design processes can be copied from previous studies, but it is more important for students to understand the goals of co-design in order to devise a way to use existing tools or create their own. The concept of students learning how to design their research methods fits well with other elements of training design education (Hanington, 2007). Having students understand how to choose and devise tools may be crucial, because it may not be possible to teach all tools in methods within the co-design process (Weightman & McDonagh, 2004; Hanington, 2007).

Students can find themselves confused by how to use the co-design process, much

like they can with other research methods. While students are expected to use co-design processes to reach a better understanding of user needs in order to incorporate them into their concept, how to accomplish this can escape them (Hanington, 2007). This requires that students not only be taught the tools and processes of co-design, but the intentions behind the process and its ability to enrich or add value to products.

Relevant literature on co-design is focused on the Dutch institution Delft University of Technology. Their program teaches co-design within a research class and an elective class. The goal within these classes is to have almost all students understand the process, allow many to try the process, and have some students incorporate co-design into their personal design process. This is achieved by aiding students in changing their mindset about the roles within the design process and how they are not necessarily separate. Students are taught the positives and negatives of working with users, the roles involved, what insights can be garnered, and the tools and methods available to implement the process (Stappers & Sleewijk, 2007). At Delft they have found that students need hands on experience to grasp these concepts. This has led to students first receiving lectures before participating as users in the process and then as researchers (Stappers & Sleewijk, 2007; Stappers, Visser, & Lugt, 2007). This reflects Strouse & Arnolds finding that the majority design students self-reported themselves as kinetic learners, as well as Weightman & McDonagh's finding that students greatly benefit from a closer interaction with real situations (Strouse & Arnold, 2007, Weightman & McDonagh, 2004). Students may not be able to enact all co-design tools, and benefit from begining with the simpler methods such as collage or observation because of the organization requirements and inexperience in working with users, but it is important for students to expand their experience in order to decrease their limitations in understanding others (Weightman & McDonagh, 2004).

CHAPTER 5

FRAMEWORK

This chapter covers the context in which this investigation takes place. The goal of this research is to survey how co-design is being taught in institutions with leading reputations in co-design education in order to develop a recommended strategy for teaching co-design. Understanding the context in which the investigation takes place is paramount to designing an adequate research methodology.

Co-design Proliferation

Co-design is a developing alternative approach in design. As more professionals in industrial design use co-design, the need for students to be educated in the co-design process increases. Industrial design education can be considered to follow a less formal model than other areas of study, particularly when it is taught within a school of art. This informal model can lead to unclear requirements in education, particularly when a method or processes is new or developing such as co-design.

In order to ensure future students are able to perform co-design with others when they leave school, they need to have gained an education in the same process as others. To accomplish this, a standard needs to be developed for the education of industrial designers on co-design. To begin developing a standard it is integral to know what aspects of co-design are essential and how these aspects can be taught.

Literature can be used to derive the essential aspects of co-design. Much has been written about co-design and how to use it. Through thorough research of existing literature and studies, it is possible to create a list of tools and methods that can be taught when educating industrial design students on the co-design process. Defining the key aspects of co-design is necessary to find how co-design can be taught; otherwise it would be unclear which methods are being used specifically for co-design education.

Discerning Institutional Reputation

Co-design is being taught in industrial design institutions. Those who are considered leaders in teaching co-design will have focused on promoting it within their institution and educating students to become professionals who can enact the co-design process. Which institutions have leading reputations in co-design must be determined. Finding how, when and where co-design is being taught within these institutions will allow analysis to create a recommended teaching strategy. There is not literature available on the teaching of co-design. Therefore data needs to be collected in order to assimilate methods of teaching co-design. The methods of teaching co-design can be collected through qualitative methods, but first the subjects to collect data from must be identified. To discover how co-design can be taught those who teach it need to be involved, which is why professors at institutions with leading reputations in co-design are the ideal candidates as subjects.

In order to determine the institutions with leading reputations in co-design education, it is necessary to begin with the opinions of other institutions and advocates of co-design. Unlike general rankings of educational institutions and their programs, there are no independent bodies ranking the influence or teaching of co-design. All of the information that is needed to assess which schools are leaders in teaching co-design is not readily available without contacting those in the field, necessitating the opinions of other institutions. These opinions will be based off of experiences with the suggested institutions or their students, first or second hand knowledge of other programs dedication to co-design, placements of students after graduation, and publications or journal articles coming out of institutions. The opinion of other education professionals will reflect the general reputation an institution has throughout the field of industrial design.

Co-design Assessment

Different aspects on teaching co-design need to be assessed. Key aspects include what concepts, methods and processes are taught. Once the material being covered at each institution is understood, it is necessary to find what teaching style is used and where in each program is co-design being taught. In order to analyze these approaches and practices in co-design education, each programs alignment with literature on co-design, frequency of use within their curriculum, and the inclusion of key concepts needs to be considered. The repetition of teaching methods and content at institutions with leading reputations reflects best practices within the field. From this information, methods of teaching co-design can be assimilated into recommendations on how and what to cover in order to provide students with a comprehensive education in the co-design process.

Map

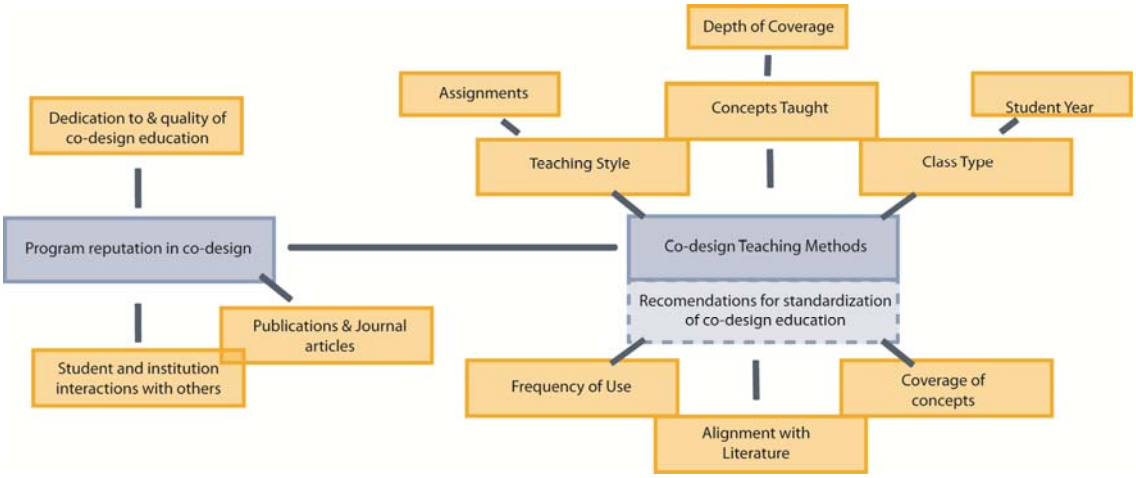

Figure 4: Theoretical Framework Map

Research Questions

This project aims to determine what methods are being used to teach co-design processes to undergraduate students at institutions with leading reputations in co-design

within the United States in order to create guidelines in teaching co-design.

Additionally this project aims to understand how co-design is taught in undergraduate Industrial Design programs with leading reputations in co-design within the United States.

As such, research questions include:

Which institutions have a leading reputation in co-design education?

What is the possible content of co-design education?

What methods are being used at institutions with leading reputations in co-design education?

What content is being taught at institutions with leading reputations in co-design education?

When is co-design being taught at institutions with leading reputations in co-design education?

What similarities exist in how co-design is taught at institutions with leading reputations in co-design education?

The next section describes the methodology used to answer the aforementioned questions.

CHAPTER 6

METHODOLOGY

In order to review the current state of co-design in industrial design education mixed qualitative methods will be used. Qualitative case study methods allow for information and insight to be gathered through ethnographic methods. Surveys, interviews, and ethnographic material reviews will be used in order to gather a sample of the teaching methods within institutions with leading reputations in co-design education. Qualitative methods will be used due to the objective nature of teaching approaches and practices.

The process will begin with a snowball sampling to determine participants. This will be followed by a survey and subsequent phone interview. The information from the surveys, interviews, and collected materials will be assessed as case studies using focused coding.

Participants

The project allows for up to ten institutions to be selected as participating institutions, in order to gather enough data for qualitative analysis without creating an unmanageable amount of data for the time available. It also allows for easier insurance of participation. The main selection criterion for participation is that the school be recognized as a leader in the area of co-design as considered by peer institutions. In order to determine schools that fit this criteria snowball sampling will be performed, which is a non-probability sampling method that uses participants as recruiters for other participants. Snowball sampling was chosen for participant selection because an academic institution's reputation within a specific area can be ambiguous and is not inherently quantifiable. This process will begin by contacting two known proponents of co-design as a valuable process via email, which will ask their opinion on the leading institutions for co-design education. These institutions will then contacted and asked for the same information until either ten institutions or no new schools are recommended.

The heads, chairs, or deans of the industrial design departments, schools, or colleges at the identified institutions will be selected as the survey participants because of their knowledge of their programs' overall goals and faculty interests as well as their lead role within institutions. Participants for the phone interviews will be determined through the survey process in order to access the faculty member or members at each institution who are most aware of co-design education practices within their program. The survey will ask specifically for recommendations on the faculty member who would be the best to contact for further information on co-design within the institution.

Pilot Study

A pilot study will be performed with the School of Industrial Design at Georgia Institute of Technology and Savannah College of Art and Design in order to test the survey and interview tools before performing the final study. The goal is to test the tools and review the materials to accommodate difficulties in implementation and deficiencies of information in responses.

Survey Methods

After the schools are selected as participants, the head, director, chair or dean of each industrial design department, school, or college will be contacted via email with a request to participate in an email survey on co-design. The e-mail will include an introduction to the project, a request to participate, an attached copy of the consent form, as well as the survey. Participants will be emailed a reminder one week, two weeks, and three weeks after the survey is first distributed if they have not yet responded. If the participants do not respond within three weeks, they will be contacted by phone and requested to participate. It was determined that due to the small sampling size that all candidate institutions will be contacted until they agree or decline to participate.

The survey (Appendix A) was designed to provide preliminary information on the depth of co-design education within each program as well as to determine who to contact for further information. Since the survey phrased questions in regards to user engaged

design, a definition is included at the beginning of the survey. User engaged design is defined as the act of involving users in design decisions or creatively in conjunction with designers, particularly during the early stages of the design process, which is synonymous with the definition of co-design within this project. Questions will be asked using the term user engaged design, which is defined as "the act of involving users in design decisions or creatively in conjunction with designers, particularly during the early stages of the design process" at the beginning of the survey. The survey is six questions long with five questions pertaining to the specifics within the participants' institution. The survey will be kept short in order to encourage responses from individuals that are known to have busy schedules. Questions are based on if, when, and what aspects of co-design are taught in the institutions as well as who teaches them. The surveys will be analyzed along with the interviews and collected materials using focused coding, the act of coding documents line by line while looking for specific information with the emphasis on co-design within each program.

Interview Methods

From the surveys performed, a contact from each school will be determined to be the faculty member with the greatest interest or expertise in co-design. These contacts will be emailed with a request to participate in a phone interview and a copy of the consent form. Reminder emails will be sent after one, two, and three weeks if no response is received. It was determined that due to the small sampling size that all interview candidates will be contacted until they agree or decline to participate. Respondents will be scheduled for a phone interview over email.

The interviews will be semistructured with a basic guide (Appendix B) and limited to one hour or less. Interviews will be recorded over the phone with a smartphone application and a laptop microphone as a backup in order to be reviewed for analysis. The interviews will focus on understanding what methods, tools and processes of co-design are taught along with how, where, and when they are taught. The interviews will begin

with questions on general research practices taught within the participants program. From there participants will be asked more specifically about methods that involved users in the design process. Details were requested on how long, when and where this type of user involvement was taught. The interview will then be directed towards what key concepts students were expected to understand about involving users in the design process when they finished their program of study. More detail will be sought in how these methods, tools, or processes were taught. Towards the end of the interviews participants will be asked about obstacles in teaching user engaged design to students, for example “Do students have trouble enacting the tools they are taught to interact with users?” The interviews will be analyzed using focused coding to assess which methods, tools, and processes are taught and how they are taught.

Interview responses to question areas in the interview guide will be compiled to create a chart of responses. After this, interviews will be read and annotated according to general topic areas. The line by line, or focused, coding will produce subject areas that multiple interview participants discus which were more specific than the general topic areas. These will be defined as sections and the relevant comments and information will be distilled into summaries of the interview participants’ views on each subject area.

Material Review

During the phone interviews participants will be requested to send copies of any relevant course documents, student projects, or other materials via email to aid in the review of the schools co-design education efforts. Participants will be emailed with a reminder to send materials one week after the interview process and each week thereafter.

These materials will be divided by school for review and interpretation along with materials collected off each institutions program website, which will include documents like program goals, curriculum requirements, and course descriptions. Focused coding will be conducted on each school. The materials will also be reviewed for a clearer understanding of the assignments used to teach co-design.

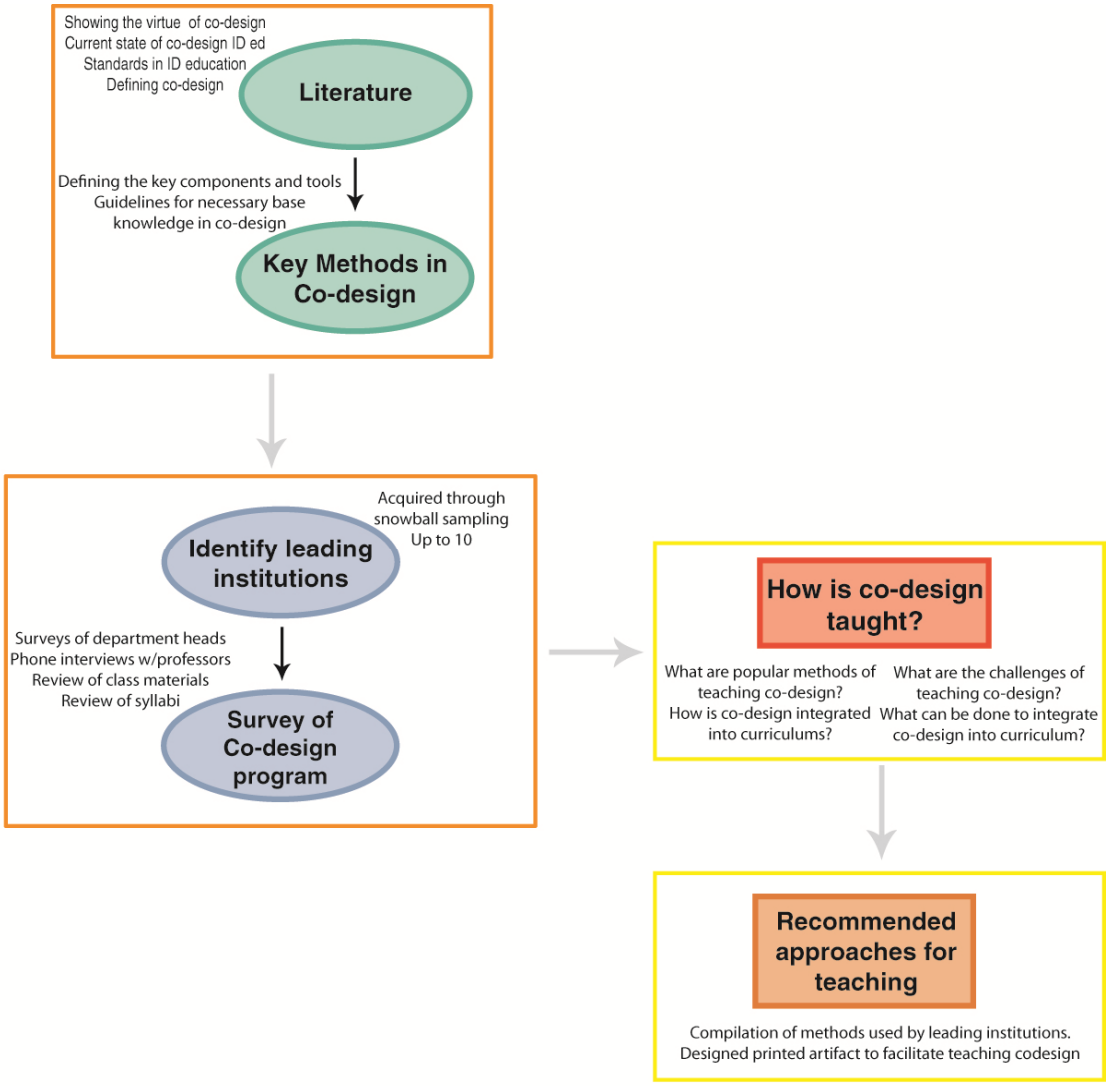

Figure 5: Action Map

Internal Review Board

This project was approved by the internal review board under exempt status. As such, all data collection tools will be designed and submitted to the board before approval, but subsequently further review will no longer required. Participants will all

receive consent forms (Appendix C) before participation. No participant information will be recorded in conjunction with answers to surveys or interview and all recordings will be labeled with acronyms. The acronyms used will represent the institution and the chronological order in which the interviews took place.

CHAPTER 7

RESULTS

The results of the pilot study, snowball sampling, survey, interviews, and material review are presented in this chapter.

Pilot Study

The pilot study showed that the surveys were unclear in some questions, too specific in others and repetitive in some areas. The term co-design was removed from the surveys because of the bias it created in respondents. Instead the term user engaged design was used along with a definition synonymous with co-design. One question asked what classes included co-design and another question asked if co-design was included in a specific class. These questions were found to be too similar and were combined into one question. An open ended question for any information the participant finds relevant was added, in order to allow for respondents to include thoughts that did not necessarily fit into more specific questions on the survey. The revised version of the survey was tested as well in the pilot. The revised survey resulted in longer answers with more useful and relevant information.

From the pilot interviews it was determined that there were too many specific questions on the interview guide and that a broader conversational approach would allow for better data to be collected. Answers from the pilot interviews were at times irrelevant to the topic as well as short with little useful information. The interview guide was altered to begin with broader areas while working down to the specific information desired with points to be considered topic areas, as opposed to specific questions. It was also noted that the interviewer needed to ask for more detail from participants to keep them engaged, while also steering the conversation back to relevant subject matter in order to provide pertinent data.

Snowball Sampling

A total of 7 institutions participated in this project. The snowball sampling began with two educators identified as leaders in the field. These educators identified other institutions (I1). I1 was contacted and identified institutions (I2, I3, I4, and a non-qualifying institution, referred to as NI1 (see figure 6). I2 was contacted and identified I1, I3, I5, I6, and I7. I3 contacted and identified I4 and NI1. I5 contacted and identified I2, NI1 and a second non-qualifying institution, referred to as NI2. I6 did not identify any other institutions. I7 was contacted and identified I2, I4, and an eighth institution that was never contacted due to time constraints. The figure below illustrates the recommendations from institution to institution.

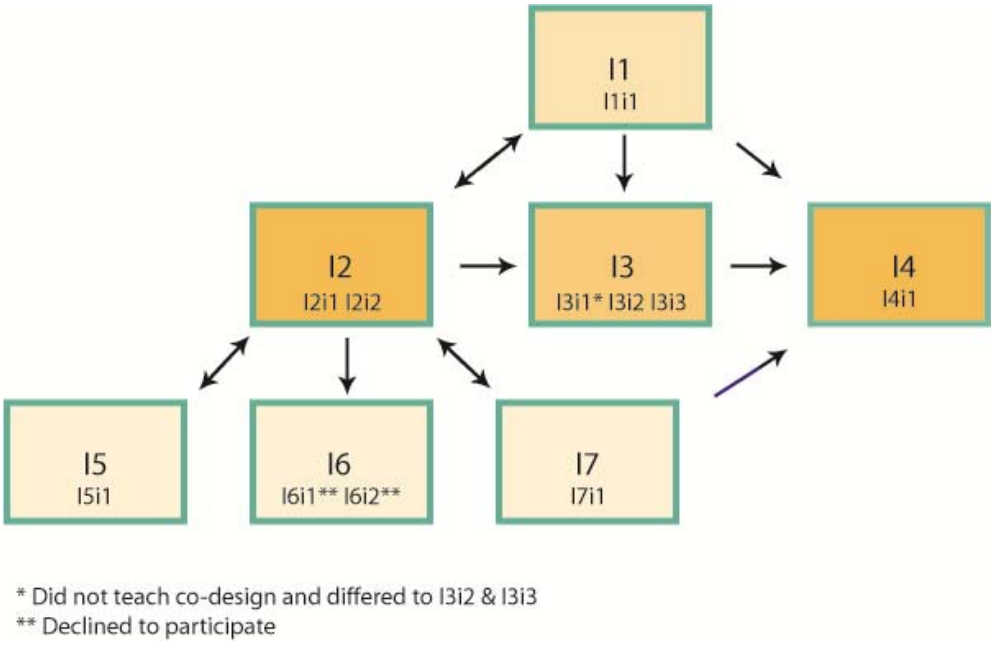

Figure 6:Map of Snowball Sampling

Survey

Seven institutions were contacted to take the survey. After innumerable request all seven institutions responded to the survey.

Teaching Research Methods

100% of institutions surveyed indicated that they teach design research methods, where 71% teach research methods in a standalone class. Two (I6 & I7) teach research methods within studio courses and electives.

In the survey user engaged design was given a definition at the beginning, which was synonymous with co-design. 100% of institutions surveyed teach user engaged design. 71% teach user engaged design within studios and elective courses. I1 and I7 have a standalone class where user engaged design is taught. 100% of institutions had more than one class where user engaged design is included.

Table 2: Survey Results

%	I1	I2	I3	I4	I5	I6	I7
Teach Design Research							
Teach User Engaged Design							
Teach Standalone Design Research Class							
Had more then 1 suggested Faculty Contact						*	
Teach Standalone User Engaged Design Class							

* After clarification via email

Faculty Contacts

The survey asked for any faculty contacts that would be best suited to consult for further information on user engaged design within their program. 86% of institutions identified at least one faculty member to contact. I6 identified a corporation to contact in addition to two faculty members were identified. 57% identified one faculty member. I4 identified two faculty to be contacted. I3 identified three faculty to be contacted. Overall, all institutions were able to recommend faculty members to participate in this project.

Interview Summaries

Of the seven institutions surveyed, six had faculty that participated in an interview. I1 had one faculty participant, referred to as I1i1. I2 had two participating faculty, referred to as I2i1 and I2i2. I3 had three participating faculty, referred to as I3i1, I3i2, and I3i3. I3i1 was interviewed first but differed to I3i2 and I3i3 on the subject matter as I3i1 was not involved in teaching co-design at I3. I4 had to recommended faculty participants, but only one agreed to participate, who is referred to as I4i1. I5 had one faculty member participate, referred to as I5i1. I6 had two recommended faculty participants, but both declined to be interviewed. I7 had one faculty participant, referred to as I7i1.

Institution 1-Interviews

One interview was conducted with a faculty member of I1, who will be referred to as I1i1. The interview was conducted over the phone and lasted twenty-eight minutes. During the interview one class was discussed, which was a quarter long design research class that focused on co-design methods. I1i1 had recently become full time faculty and had only taught design research classes until the current school year.

I1i1 clearly expressed that one quarter was not enough time to cover standard research methods and co-design and multiple times spoke of a lack of time to teach concepts. Due to time constraints I1i1 attempts for students to learn about the co-design process as a method, not just the tools that can be explained in class but the theory behind the design of co-design tools. I1i1 stated that hands-on and visual learning is important for design students multiple times and as such insists students participate in a real world experience after lectures filled with imagery. I1i1 does not currently use a textbook because there is not an appropriate text available. I1i1's class is made of 50-60 multidisciplinary students, with interior space, industrial design, and visual communication majors enrolled, which I1i1 finds to be advantageous for the varied view but too large to provide detailed contact with students as individuals. I1i1 spoke of

student mindset being a major factor in acceptance of co-design processes as valuable, which makes some students naturally attracted to the idea and others adverse to it. I1i1 also spoke of the importance of integrating co-design throughout the curriculum and the support of the entire faculty.

Institution 2-Interview

Two interviews were conducted with a faculty members of I2 (I2i1 and I2i2). I2i1 was conducted over the phone and lasted thirty-seven minutes. I2i1 teaches a class that can best be described as a human factors class, but it is more of a class about how people are related to design than the traditional definition of human factors.

I2i1's class has between 40-45 students from both industrial design and communication design, which I2i1 finds to be challenging due to both the number and the two majors being taught simultaneously. While I2i1's class does not directly cover co-design, it introduces the concepts that are the foundation for co-design work. Students conduct one large project that does not require co-design activities but could be executed using the co-design process. After I2i1's class in the sophomore year, students take their junior studio in which co-design methods are expounded upon. I2i1 considers sophomore unprepared to take on advanced methods like co-design processes, but finds that they are more open to them when introduce early in their academic career. While I2i1 finds that early emphasis on involving users in the design process prepares students for doing so, some students will never accept it as necessary because they are not wired to think that way. I2i1 then explained that I2 did not see very much opposition from students on the matter because of a cohesive faculty who make it clear that they believe that involving users is the ethical way to design. I2i1 uses The Universal Principals of Design as a textbook along with lectures, guest speakers, and in class activities to convey information to the students. I2i1's class has one half semester project in which students design a research protocol and perform it involving user participants. I2i1 finds students to be challenged in translating research to design, which I2i1 teaches as weaving findings into

actions. I2i1 also discussed students being overwhelmed by the research process, particularly the where, when, what, who , and how. I2i1 finds students tend to default to familiar and basic methods because of this. The interview ended with I2i1 expressing that companies often came seeking design research skills, like co-design, in students to hire.

I2i2 was conducted over the phone and lasted 20 minutes. I2i2 teaches a junior studio at I2, in which students practice the co-design process.

In I2i2's studio basic research is reviewed first and then co-design processes are introduced. In order to familiarize students with the process I2i2 shows many examples during lecture, which are followed up by students designing their own co-design tools with guidance from the instructor. The goal of student designed tools is to help them understand how to get participants to provide rich stories of personal experience in the context of products. The main challenge I2i2 faces with students learning the co-design process is the ability of students to understand when they are using a tool in a participatory way. In order to counteract this I2i2 tries to explain scenarios using the students' tools. I2i1 aims to shift students' view of goals from fixing a solution to answering a problem. I2i1 expressed multiple times that experiencing the co-design process, which requires lots of time to be done properly, is the only way to fully understand it and its value. At the end of the interview I2i2 expressed the belief that there is no co-design project that is exactly alike and therefore it is difficult to create a single set of instructions that will always work, particularly if one does not understand the essence of the co-design process.

Institution 3-Interview 1, 2 & 3

Three interviews were conducted with a faculty members (I3i1, I3i2 & I3i3). I3i1 was conducted over the phone and lasted seventeen minutes. After the purpose of the interview was explained I3i1 differed to a colleague, under the pretense that I3i1 did not teach co-design nor know about how it was taught at I3.

I3i2 was conducted over the phone and lasted thirty-two minutes. I3i2 teaches a

qualitative design research class at I3.

I3i2 began the interview by explaining that he subscribes to the IDEO philosophy of “go ask the world” because it allows designers to create products that resonate with the user. I3i2 uses class exercises, lectures, and collected readings to convey information to the students. I3i2’s students are taught that they are intermediaries or translators from information the user gives them to solutions that connect with users while fulfilling their needs. One challenge I3i2 faces when teaching students how to become this translator is the students desire to move to design too fast. In order to combat this, I3i2 makes students working in small exercises, which eventually build toward a larger project. I3i2 finds that some students really do not want to perform the processes engaging the user, but that they must do so if they want to work for a top tier firm. However, I3i2 also encounters students who are excited and enlightened when they discover co-design processes as well as those who later realize that these methods can help them when they are working on a difficult problem.

I3i3 was conducted over the phone and lasted forty-eight minutes. I3i3 teaches a junior studio where students employ co-design processes as well as a class on designing for the developing world that is co-design centric.

In I3i3’s studio students are given a quick introduction to ensure they understand basic research methods before they are introduced to co-design through the students designing their own tools to practice on real participants. I3i3 noted that it is important for students to understand the effect they can have on results through their behavior and phrasing. In this studio class, students are required to work with users during the early stages of concept development. Fewer students continue to work with users after concept development and almost none return to users with prototypes. I3i3 also mentioned that senior level students participate in co-design workshops.

In I3i3’s design for the developing world class students work remotely with participants from a village in the developing world over two semesters and visit the village in the summer to test prototypes and work in closer contact with the participants.

The class is multidisciplinary and includes undergraduate and graduate students. I3i3 says that students who take this class almost always adapt co-design in to their personal design process because they see the meaningful difference they can make after working in the developing world. Guest speakers are regular occurrences in this class because of the diverse nature of skills students need to be able to work in and with the developing world. For the same reason, the class is taught by multiple faculty with I3i3 as the lead instructor. Students use the IDEO design for the developing world toolkit as a textbook along with papers gathered by the involved faculty. The class performs many practice exercises in class with each other before working with participants. I3i3 says that many of the students in this class want to work for NGOs or firms working in the third world, which require the use of co-design methods to be successful. I3i3 finds the biggest challenge for students in the co-design process spurs from communication difficulties, particularly because most of their communication is taking place remotely in the developing world class. However, I3i3's students overcome this frustration when they see the final results of working with communities to improve their lives. I3i3 end the interview by discussing the way students are changed and enlightened by using the co-design process in the developing world.

Institution 4

One interview was conducted with a faculty (I4i1). I4i1 was conducted over the phone and lasted thirty-three minutes. I4i1 teaches a design research class at I4 as well as a sophomore studio.

I4i1's design research class is made of freshman from transportation design, product design, environmental design, graphic design, and entertainment design. I4i1 teaches the research class around a theme around which students get to pick their team projects. I4i1 finds it to be challenging to have the variety of majors in this class, but also believes it is good for the students' development to work in multidisciplinary teams. Students are required to work with users in the class, but while generative methods are

allowed they are not required. I4i1's students are taught co-design processes in class but not expected to use them until later in their academic career. I4i1 likes to teach processes n pieces and then assemble them in to a whole, which I4i1 likened to slowly learning a musical piece in parts before putting them together and playing at tempo. I4i1 expressed that it is more important for students to be able to use creative and critical thinking together in order to collect, evaluate and interpret information from users than it is for them to know the details of every tool and method. I4i1 also expressed that students in their freshman year have not developed a personal design process that would possibly make them averse to incorporating co-design or research methods, but that freshman are still young and often arrogant, thinking they do not need help or advice from anyone. I4i1 also finds that I4 provides plenty of support to co-design and other research methods, which makes it difficult for those who object to fit in. Some of I4i1's students find they have been introduced to a new and valuable process that opens their eyes to new possibilities. I4i1 uses readings, brief lectures, case studies and in class exercises to teach the design research students, but finds the hands on exercises to work best because students understand better through experience than being told. At the end of the interview I4i1 mentioned that a student's personality makes the difference in how involved they will become with research methods and working with users.

Institution 5

One interview was conducted with a faculty member (I5i1). I5i1 was conducted over the phone and lasted thirty minutes. I5i1 teaches design research methods at I5.

I5i1's class is made up of 55 graphic design and industrial design undergraduate seniors and graduate students. I5i1 made it very clear from the beginning of the interview that senior year was far too late to be introducing research methods. In I5i1's class students are taught about co-design but do not get a chance to practice a co-design project. I5i1 teaches students to integrate findings through a step system: 1.Make an observation, 2. Make an inference from your observation, 3. Find an insight in your

inference, 4. Develop a design requirement or principal from your insight. I5i1 believes that one semester is not enough time for students to learn and practice basic research as well as learn and practice more advanced methods like co-design. I5i1 uses personally gathered articles and the IDEO toolkit as readings in the design research class. I5i1 finds that having graphic design students who have been trained in a grid and typography focused program in class with the industrial design students keeps the class from covering as much information as it would with industrial designers alone. I5i1's industrial design students are enthusiastic to learn research methods like co-design, but they are held back from advancing because no other faculty in the program is able to assist and support them due to a lack of training and knowledge in the area. I5i1 finds students are nervous to talk to users and I5i1 encourages them to think of it as a conversation as they try to elicit stories from their participants. I5i1 tries to minimize lecture and focus on case studies and in class exercises, because it makes the class more exciting, which increases the likelihood of students absorbing and using the information they are learning. I5i1 tries to ensure students understand the process of gathering good information and insight from users over developing rigorous methods and tools.

Institution 7

One interview was conducted with a faculty member (I7i1). I7i1 was conducted over the phone and lasted thirty minutes. I7i1 teaches a sophomore studio course and an elective on design for disability.

I7i1 believes that the earlier students are introduced to the co-design process the more likely they are to integrate it into their life long design process. That is why I7i1 has sophomore design students begin working with users from the beginning of their studio course.

I7i1 also teaches an elective class in which 16 to 24 undergraduate and graduate design students are paired with a disabled student as a co-design partner. In order for students to realize they are biased with a singular world view, I7i1 has them participate in

ethnographic modeling, where they use outside means to disable themselves in a way similar to their partner. I7i1 finds that after these exercises students are completely willing to work with their co-design partner as an equal, not as a subject. I7i1 believes that other faculty's support of co-design has made it easier for I7i1 to go to extremes with students. During the semester I7i1 uses lecture, guest speakers, and exercises to teach students in addition to their projects. Students in this class do not tend to be averse to incorporating co-design partly because it is an elective and also because they develop empathy for their partners through ethnographic modeling. After I7i1's class students are often changes and cannot imagine working without user involvement, because see the end results of working with an extreme user makes the magnitude of influence apparent. I7i1 says the biggest challenge for students in performing the co-design process is developing a shared language with participants, but that this can be achieved with enough time and attention.

Interview Consistencies

Below are subjects that were discussed by multiple participants, followed by a summary of highlights and relevant information from each interview.

Co-design in Curriculum

Year Taught

Early vs. Late

The institutions interviewed varied on the program year that co-design was introduced. Figure 8 shows the location in the curriculum of each class that incorporates co-design processes. I5 introduces co-design during the first semester of the senior year. This was considered far too late by I5i1 to whom students had also expressed that they

wished they had been given this information and education earlier. I1 and I3 introduce co-design during the junior year. I1i1 considered the junior year to be less than optimal for introducing co-design. I1 has reformatted their curriculum so that in the future students will first encounter co-design in the beginning of their sophomore year. I1i1 participated in the curriculum redesign and believed the sophomore year would be a better time to introduce co-design. I2 and I7 introduce co-design during the sophomore year. I2 gives a cursory introduction during the sophomore year followed by a more robust involvement in the junior year. I2i1 expressed that the cursory introduction allows students to know about the process even though they might not be mature enough in their design capabilities to enact processes as complicated as co-design. I7i1 expressed that students should be introduced to co-design as soon as possible. I4 introduces co-design in the second semester of the freshman year and then recovers it in sophomore studios. I4i1 has seen students who have forgotten about the methods she taught them freshman year when she saw them again in their junior year, particularly if they had been in studios that did not require much research during development phases.

Students Set in their Process

Each institution had different experiences with students' willingness to change their design process. I1i1 found students had often defined their personal approach to the design process and were adverse to change. Students who had previously been told their process was good can be unwilling to accept additional steps or phases during design development. At I2 students are taught from the moment they enter the program that people are why design exists and that design is about the user. I2i1expressed that by teaching the importance of human centered design and making it a program wide philosophy, students know that they are expected to consider users throughout their design process. I3 makes co-design an option on projects and required within an elective. Since students who are learning about co-design have chosen to work in such a manner, they are prepared to adjust their process. I4i1 explained that when they first undertook

teaching her research class she introduced methods as to how to incorporate them into your design process, but found this to be erroneous because freshmen had yet to develop a personal design process. I5i1 finds that students have developed a personal process by their senior year and find it difficult to think of other people as a standard part of product development. I7 finds that the earlier co-design is taught the easier it is for it to become a standard tool for designers to consider.

Demographics

Major

Most of the participating institutions introduce or teach co-design in a multidisciplinary class. I1, I2, I4, I5, and I7 teach co-design with at least one other major than industrial design in the class. Three institutions, I1, I4 and I7, find this advantageous. Two institutions, I2 and I5, find it to have a negative effect. At I1 interior space, visual communication and industrial design are in a co-design class together. I1i1 finds the multidisciplinary group to lead to more interesting results because of their varied view points and input. I4 teaches design research, which covers co-design, to transportation, product design, environmental design, graphic design, and entertainment design majors in one class. I4i1 finds the multidisciplinary class to be more difficult to teach, but believes it is good for students to be exposed to the variety of views during the design process and that multidisciplinary groups yield more interesting results. I7 has an elective class that includes industrial design students as well as disabled students from a variety of majors. This provides the user participants for this class, which will be discussed later. I7i1 finds that it is important to expose students to differing or new views throughout their design education. I2 has industrial design and communication design students enrolled in their design research class, which covers co-design. I2i1 has found the communication design students to be less accepting of design research and co-design methods. The difficulty the communication design students have covering this material requires the class to be a compromise in how much and how detailed coverage is. I5

includes graphic design and industrial design students in one class that introduces design research, which touches on co-design. I5i1 finds the mixture of the class to have a negative effect on the class, particularly because the graphic design students have been taught in using a different philosophy which focuses on design principles and not consideration for their audience. The discrepancy between industrial design students training and graphic designers' training prevents the class from cover as many techniques in as much depth as would be possible with only industrial design students.

Age

Two participants discussed the age of their students. I3i2 expressed that older students with work experience were more accepting of guidance and new techniques than students who had only worked in academia. I4i1 found that younger students were cockier than older students and far less likely to accept advice or input from others.

Class Size

Class size was mentioned in four interviews. I1i1, I2i1, and I5i1 described their classes as larger than ideal. I7i1 felt their class size was optimal. I1 teaches co-design in a class of 50-60 students. I1i1 did not see this as detrimental to the class, but did express that this prevented them from ensuring everyone understood the details of the process and required them to lean on the students who were impassioned as team leaders. I2 has 40-45 students in their class first class that introduces research and along with it co-design. I2i1 also did not find this to be detrimental, but did express that the number of students made it difficult to cover all the information as well as one would like. I5 has around 55 students in its research class that also covers co-design. I5i1 expressed that it was too big and unwieldy, preventing the level of coverage that would be optimal. In I7's elective class which is purely co-design, there are 16-24 students. I7i1 described good individual relationships with the students and an ability to get into the details with everyone.

Amount of Time

Time Allotted

The amount of time in which co-design is taught was varied by institution. I1 covers co-design in one quarter and then incorporates it in following studios. I2 gives cursory coverage to co-design methods through guest speakers during the sophomore year and then incorporates it throughout a studio in the junior year. I3 covers co-design over three semesters in an elective. I4 has a semester long design research class, which provides for time to discuss co-design without practice. I5 covers basic research including co-design in one semester and incorporates processes in later studios. I7 has an elective on co-design that last one semester and includes co-design processes in studio classes.

Time Needed

Despite varied lengths of time allotted for teaching co-design, most of those who lacked a dedicated semester felt there is not enough time available to adequately teach the co-design process. I1 has a dedicated class, but it only last a quarter, as opposed to a semester which was considered insufficient for covering all co-design tools and concepts. The institution has decided to move to semesters instead of quarters starting in the Fall of 2012. I1i1 was involved in the planning of the new curriculum in which one semester will be allotted for basic research and co-design will be addressed in a standalone course. I1i1 expects that having an entire semester available will aid in overcoming many of the obstacles faced in teaching co-design, particularly in training students in the use of tools before they begin real world practice. I2i2 teaches co-design during studio classes. I2i2 explained that it was hard to make enough time for the co-design processes to be fully grasped by students because it requires a period of “gestation” to adapt to co-design as part of the design process. I3i3 did not express any issue with time in the 3 semester co-design focused course, but did find that in studio courses students do not typically have

time to return to users after the conceptual stages of the design process. I4i1 found students can be taught about the co-design process within a semester long design research class, but also expressed that there is not enough time to practice the methods of co-design, which is integral to understanding the methods. I4i1 expressed that students need time to learn processes at a significantly slower pace than they will perform them in future classes or professionally. I5i1 is not able to incorporate co-design as considered optimal within a semester long research class. I5i1 believes that more time is needed to allow students to practice co-design processes in order for it to be integrated into other courses in the curriculum. I7 did not express any problems with teaching co-design in a standalone semester long course, but did mention that it is key for students to be allotted time to absorb co-design concepts before practicing them.

Universal Support

Interviews with every institution revealed that universal faculty support is considered a key factor in the success of student acceptance and continued use of co-design. I1i1 expressed that most students need to have the concepts of involving users in the design process reinforced by other faculty throughout their academic career in order to believe that it is a useful or necessary step in the design process. I1i1 feels that it is detrimental for students to be told by other faculty that they do not need to perform as much research as is involved in co-design. I2i1 believes that the reason the students at I2 students are actively willing to learn and integrate co-design processes into their personal design process is because the faculty at I2 are cohesive and dedicated to viewing user involvement as integral to the design process. I3i3 expressed that the design for the developing world class is successful because other faculty are highly invested in making the class work, which translates in to a willingness to help through co-teaching, providing resources, and contributing their skills. I4i1 has seen that students in other departments where the faculty do not encourage research or co-design processes the students tend to forget what they learned freshman year by their junior year. I5i5 believes that students at

I5 do not have the resources through other faculty to have an adequate education on design research or co-design to meet expectations in the professional world. I5i1 expressed that the students receive no education on co-design outside of the design research class, not because the other faculty oppose it but because they do not know enough to teach about it. I7i1 believes that the design for disability class would not be able to go to as far as it does without the support of the rest of the faculty. The other faculty at I7 include co-design processes as part of their design curriculum, because of this they are easily able to accept and support any unorthodox or extreme methods I7i1 has students exercise.

Teaching Methods

Co-teaching

Two institutions, I3 and I4, use co-teaching in their classes covering co-design processes. I3i3 finds that using multiple faculty to teach the course allows them to rely on one another's strengths and resources. It was also expressed that having a main teacher who dictates the course plan is part of making the co-teaching successful. I4i1 finds it useful to have more than one teacher in a class in order to lean on each other's strengths.

Structure

Basic Research Before Co-Design

Five of the institutions, I1, I2, I3, I4, and I5, interviewed explicitly teach basic design research before co-design processes are taught. I1 provides students with a base knowledge of evaluative research, in the same class, before students begin to learn the generative methods of co-design. I2 teaches students traditional design research methods in its own class where co-design methods are addressed in a cursory way before they are taught about the co-design process in studio classes the following year. In I3's qualitative research class there is mention of co-design methods. In I3's elective, which centers on co-design, students are taught basic research methods before they begin learning about

the co-design process. The studios at I3 which include co-design processes come after the qualitative research class in the curriculum. I4 teaches co-design in a general design research class. Within this class students first learn about basic research and then about co-design before beginning projects. I5 also teaches about co-design in a general design research class. Within this class students are taught about and practice basic research before they receive lectures on co-design processes.

Piecemeal Approach

Five of the of the interview participants, I1i1, I2i2, I3i2, I4i1, I5i1, expressed that they taught co-design processes in a compartmentalized way. I1i1 explained that students were taught many approaches very quickly and then thrown in to practice them. I2i2 believes that introducing methods on step at a time over half a semester in order to build towards the ability to complete the entire process in the later half is optimal. I3i2 separates concepts and methods into pieces by creating individual exercises for each. The exercises are then used later to create a larger project. I4i1 relates teaching research processes, such as co-design, to teaching music, where each piece is learned individually and slowly before they are combined together and sped up to make the complete process. I5 teaches a method, then shows a case study of that method and follows it with an exercise of that method. This is repeated for each method or tool of a process students are taught.

Cobbled Reference Material

Five of the interview participants, I1i1, I2i2, I3i3, I4i1, and I5i1, used gathered resources to use as reference material. I1i1 used collected papers, some they had written and others, as the main source to communicate information outside of lectures. I1i1 does this because they have found no book that covers the information they want to convey. I2i2 pulls from their personal collection of journal articles and papers to communicate information outside of lectures and desk talks. I3i3 uses the IDEO “Social Impact Workbook and Toolkit” as the class text book along with collected journal articles and

conference papers for I3's developing world class. I4 uses a personal collection of readings and case studies to communicate information outside of class. I5 uses an IDEO toolkit along with relevant contemporary articles to communicate information to students outside of class.

Fewer Lectures

Five of the interview participants spoke about adapting the role of lectures in their class. I1i1 believes that design students learn best by doing and seeing, because of this I1i1 tries to minimize lectures and include as many photos as possible as opposed to text or bullet points. I2i2 tries to use less lectures and uses pictures to create the narrative in the ones given. I3i3 incorporates lectures as a minimal part of their classes and involves hands on practice to teach students. I4i1 gives brief lectures in order to maximize time for students to experience methods and tools because I4i1 believes students understand better through experience than being told. I5i1 minimizes lectures given to increase the time available for practice. In the future I5i1 intends to prerecord short lectures on each method for students to watch before class, which will allow for the class periods to be dedicated solely to the presentation of case studies and practice.

Case Studies

Five of the interview participants, I1i1, I2i2, I3i3, I4i1, and I5i1, used case studies as part of their approach to teaching the co-design process. I1i1 focuses on using pictures of case studies to tell the story of the co-design process and the use of its tools. I2i2 relies on case studies and examples to demonstrate what can be accomplished using co-design as well as what the process entails. I3i3 shows students case studies of previous work to prepare students to use the co-design process while also exposing them to the developing world with which they will be working. I4i1 uses case studies of their previous work to demonstrate the methods used in the co-design process and its value. I5i1 uses personal case studies to explain the co-design process and methods to students, but I5i1 is limited to show the students these case studies in class because they cannot be distributed due to

contracts surrounding the work being examined.

Guest Speakers

Three of the interview participants, I2i1, I3i3, and I7, considered guest speakers to be an important part of teaching about co-design. I2i1 uses guest speakers to help in teaching about specialized methods and issues. I3i3 has guest speakers come to speak with the students on aspects that are important to the success of the course but may not be I3i3's area of expertise, such as cultural issues students might encounter while working with different people in developing countries. I7i1 invites and host guest speakers in order to ensure the involvement of the local disabled community as well as expose the students to new views.

Too Much To Cover

Interview participants expressed that it is not realistic to cover all the tools of co-design in different ways. I1i1 says there are infinite co-design methods and it would not be realistic to cover every tool. The tools taught by I1i1 are those that have been documented in recent years. Of those I1i1's students do not exercise every tool, but are shown them in class and then further exposed to them through their classmates projects and presentations, as each team uses different tools and methods. I5i1 expressed that co-design tools and methods cannot be covered in entirety as a small part of one class, that it would be more likely if it was spread throughout the curriculum.

Understanding Process Over Learning All Tools

Four interview participants, I1i1, I2i2, I4i1, and I5i1, expressed that it is better for students to understand the process over learning all the tools. I1i1 believes that students cannot be taught all of the methods; therefore they need to understand how the co-design process works and how it produces different results through integrating a specific style of research tool. I2i2 finds that it is more important for students to understand the process over tools, because they can create their own tools if they fully understand the details and

goals of the process. I4i1 aims for students to understand the process of uniting creative and critical thinking over telling them the details of each tool and method. I5i1 wants students to learn to develop good insight over great data collection and detailed tools.

Learning to Make it their Own

I2i2 and I3i3 expressed that students learn more by making the co-design process their own. I2i2 finds students understand the process better when they design their own tools. I3i3 requires students to create their own tools after they have been taught the co-design process, in order for them to fully understand the goals of the tools.

In class Exercises

Six interview participants, I1i1, I2i1, I3i2, I4i1, I5i1, and I7i1, spoke about the impact of class exercises. I1i1 believes that design students learn by doing. As such I1i1 has students perform in class exercises to practice tools and methods before they work with participants outside of class, which gives them assistance in sorting out any challenges they encounter. I2i1 uses immersive activities followed by reflection discussions to ensure students developed an understating of methods. I3i2 has students conduct incremental in class exercises to build on the previous exercise and to encourage students to learn from one another while the instructor guides them along. I4i1 has students perform exercises in class because I4i1 finds design students learn best by doing and activities help excite the students. I5i1 tries to make as much time for in class exercises as possible by minimizing lectures because it makes the students more excited about the information. I7i1 uses ethnographic modeling exercises in class to help students generate empathy for their co-design partners.

Real World Practice

Eight interview participants I1i1, I2i1, I2i2, I3i2, I3i3, I4i1, I5i1, and I7i1, expressed the use of real world projects or practice when teaching students a new process. I1i1 believes students learn best when they are enacting what they have been

told. I2i1 has students work on a project that revolves around the redesign of an existing issue on campus, where they have to work with people outside of their class. I2i2 believes that students cannot truly understand and value the co-design process until they have experienced a real world co-design process. I3i2 has students do real world research in order to familiarize them with the process. I3i3 centers the design for the developing world class on a real world project, which I3i3 believes to have a great impact on students. I4i1 requires students to do real world practice outside of class to reinforce class lectures and activities. I5i1 requires that students do at least 3 real world interactions to practice their skills. I7i1's class is based on real world issues and working to solve them.

"Changing" Students

Three of the interview participants, I1i1, I3i3, I7i1, expressed that students often seemed to change once they had experienced the co-design process in a real world situation. I1i1 finds that students often become passionate about the use of co-design processes after completing their project working in the real world. I1i1 sees students changed to a new designer through using the process. I3i3 finds that students who experience a real and complete co-design process become designers who cannot imagine a process which does not involve users. I7i1's students are changed after working with those who need interventions. Students find it unimaginable to work without some sort of co-design after completing I7i1's course.

Retrospective Understanding of Value

Four of the interview participants, I1i1, I2i2, I3i3, and I4i1, discussed students seeing the value of co-design only after completing a co-design process. I1i1's students are often surprised with how well the co-design process works after they complete and present their semester long co-design project. I2i2 believes that students cannot truly see the value of co-design until they have completed the process, but sometimes students will realize it after they complete a pilot study, as opposed to an entire project. I3i3 finds that

after the completion of a co-design process, student's frustrations are often overcome by seeing the value that was added through co-design. I4i1 sees students realize mid-semester that the work they have been doing has real value.

Assignments

Team Work

Six of the interview participants, I1i1, I2i2, I3i2, I3i3, I4i1, and I5i1, discussed the importance of using teams on projects. I1i1 finds teams to work best, particularly because of I1i1's class size. I1i1 depends on the team member with the most passion for working with people to lead the group, especially when dealing with participants. Using teams also allows everyone to present their process in detail from which the rest of the class to learn. I2i2 finds that having students work in teams makes the large class more manageable. I3i2 uses teams in order for students to learn from one another as well as prepare them for working in the real world. I3i3 believes that students need to work in teams to handle the entire co-design process. I4i1 finds that by using teams students are able to experience the whole process because they have enough man power. I5i1 finds having students work in teams to be a good way to force them to have better content, work, and analysis because they must answer to their team mates.

Seeking Stories

Four of the interview participants, I2i1, I2i2, I4i1, and I5i1, discussed teaching students to seek stories. I2i1 expressed that students need to look for the story in their research in order to weave it into design actions. I2i2 believes that students need seek rich information through personal stories elicited by make tools. I4i1 finds story methods to be more advanced than others, which sometimes makes them harderfor students to grasp early in their education. I5i1 teaches students it is key to retrieve stories from participants instead of answers.

Hands On Learning

Four of the interview participants, I1i1, I2i2, I3i3, and I4i1, discussed design students learning from hands on work. I1i1 believes it is best to throw design students into hands on practice in order for them to learn the co-design process quickly. I2i2 finds students learn the process best through hands on creation of tools and enactment. I3i3 believes design students cannot learn the co-design process without hands on experience of designing their own tools and using then in real situations after practice with classmates. I4i1's students learn best through action and practice. I4i1 finds it is more valuable to the students when they discover things through hands on interaction then if they are just told the answer.

Writing Reflections

Three of the interview participants, I2i2, I3i3, and I7i1, require students to write reflective essays. I2i2 has students write a reflection essay because it helps students review the value of what they have experienced and learned. I3i3 finds that writing about the experience helps students see the true value of the co-design process. I7i1 has students write a book chapter about their project, which allows them to reflect and understand what they have done while also sharing it with the design community.

Participants

Finding Users

Student Sought

Three interview participants, I2i1, I3i3, and I5i1 commented on students finding participants. I2i1's students often struggle with where and how to find participants. I3i3 has found students tend to mainly do convenience sampling, such as talking to the shop manager about power tools, as opposed to seeking other participants. I5i1 believes finding good participants to be one of the greater challenges of the process.

Existing Relationships Providing Pool

Three of the interview participants, I1i1, I3i3, and I7i1, provide participant pools for their students' co-design projects. I1i1 provides participant groups for students through existing relationships with users who have facilities that are optimal for participation. I3i3 has developed relationships over the past five years to facilitate in recruiting participant groups. I3i3 has also developed ties in the developing world to ease the transition for students to working in the developing world. I7i1 has been successful in building relationships with a local community of participants. I7i1 believes it is key to have a relationship that benefits both parties and requires respect and consideration for the participants.

Extreme Users

Three of the interviewed participants, I3i3, I5i1, and I7i1, spoke of the virtue of using extreme users. I3i1 finds that using extreme users in the developing world allows students to see the amount of difference the co-design process can make. I5i1 believes that extreme users produce better results and that inspiring people yield inspiring results. I7i1 finds that using extreme users makes the value of the co-design process more obvious to the students because the results show greater change.

Challenges

Student Attitudes

Four of the interview participants, I1i1, I2i2, I3i2, and I4i1, spoke about students' attitudes towards the co-design process. I1i1's Industrial design students are more accepting of co-design methods than other majors, but some are still too set in their personal design process by their junior year to integrate co-design after the influence of other faculty earlier in their education. I2i1 believes that fewer students at I2 are opposed to integrating users in the design process because it is considered an integral part of the program by the entire faculty, but also makes note that some students will never accept it

because of their personalities. I3i2 has a hard time convincing some students of the value of the co-design process, but says the same students often come back to co-design methods later when they become stuck on a problem they cannot solve alone. I4i1 finds that freshman have not yet developed a personal process and therefore are not set in it, but their youth often makes them arrogant, believing that they do not need input from anyone else.

Exciting Students

Five of the interviewed participants, I1i1, I3i3, I4i1, I5i1, and I7i1 felt that exciting students about the process had an important impact. I1i1 finds that if students can be excited about the co-design process and its results, they are more likely to include it in the future. I3i3 sees students excited when they discover they can truly impact people's lives through co-design. This excitement leads to a desire to do it more. I4i1 tries to create a synergy between creative and critical thinking in order to overcome "boring" projects. For example, producing three-dimensional representations of information can excite students about understanding the information. I5i1 believes it is more important to excite students about discovering information and finding insights then it is too instill a sense of rigor in their process. I7i1 finds students to be excited by the possibilities of co-designing after brief discussions with their disabled partner. This excitement leads to a greater willingness to try methods.

Encouraging Branching Out

Three of the interview participants, I2i1, I3i3 and I4i1, discussed students leaving their comfort zone. I2i1 finds that students default to comfortable and familiar methods; when given choice students typically do not use innovative approaches because they are frightened of them. I3i3 finds that typically students will work with participants they know unless they are instructed because it is easier. I4i1 sees only the most ambitious students embrace methods and adapt them to their needs or create their own tools.

Teaching Integration

Five of the interview participants, I2i1, I3i2, I4i1, I5i1, and I7i1 discussed teaching students to integrate findings into design. I2i1 tells students to think of integrating findings as weaving a story into design actions. I3i2 encourages students to imagine themselves as translators from what participants say and do into design decisions. I4i1 finds the key to design integration is using intuition in combination with critical and creative thinking to interpret information while looking for nuance. A shorter version of this being “use, understand, and interpret” information. I5i1 teaches a method of moving from observation to inference to insight to design requirements and reminds students to find the inspirations in their data. I7i1 noted that it is important to always go back to the participant but to also know when to back away.

Communicating with Users

Two of the interview participants, I2i1 and I5i1, expressed that students often feared communicating with people outside of their common circles. I2i1 finds that students fear of working with strangers often steams from being overwhelmed by the details of interacting with participants (i.e. where do I find them, when do I contact them, how do I talk to them, what if they say no). I5i1’s students are often nervous to talk to people. I5i1’s solution is to tell students to think of it as a normal conversation and then require students to work with three different participants after which they typically feel more comfortable.

Six of the interview participants, I1i1, I2i1, I3i3, I4i1, I5i1, and I7i1, mentioned how students are taught to communicate with users. I1i1 has the student who is most comfortable talking with participants take control in each team because there is not enough time to ensure that all students are capable of talking to the participants. I2i1 has a guest speaker from the psychology depart come and speak to students about how to work and communicate with participants. I3i3’s students have many difficulties with communication because they are working with individuals of different cultures that are

remote for two out of three semesters. Students are told they will have to accept these difficulties and are taught about the cultures they are working with to help ease any disconnects. I4i1 tries to teach students to engage the user without using leading questions or disregarding nuanced information. I5i1 teaches students that self-awareness is crucial when working with participants. I7i1 tells students that it is crucial to spend time developing a shared language with users in order to fully understand each other.

Lack of Support

Two of the interview participants, I1i1 and I5i1, discussed the negative results of a lack of support from other faculty. I1i1 has seen efforts with students undermined through a lack of support of other faculty and the curriculum. When students are told they do not need as much research as is involved with co-design, they can disregard its value. Furthermore when the curriculum does not reinforce the use of co-design, it can fall to the wayside and fails to be integrated into students' future work. I5i1 finds that when faculty who lack the capacity to provide support to students through their own knowledge of the process, students fail to learn the process well enough to use in their professional career.

Table 3: Interview Result Topics

%	I1	I2	I3	I4	I5	I7
In Class Exercises						
Real World Practice						
Use Teams						
Need more then a section within basic research						
Find Faculty Support Crucial						
Use Cobbled Resources						
Should be taught before junior year					*	
Basic Research Covered 1st						
Teach in Pieces Before Assembly						
Use Case Studies						
Students difficulties communicating w/user						
Minmize Lectures						
Prefer students learn process over tools						
Have some obstinate students						
Feel Co-design "Changes" students						
Prefer class be Multidisciplinary						
Use extreme users						
Better results when students try new tools						
Co-Teach						
Students recruited for co-design skills						

Positive Response | Negative Response | No Expressed Opinion

*Should be taught earlier in academic career interpreted as before junior year

Continued Use

Overcoming Biases

Opening Students Eyes

Five of the interview participants, I2i2, I3i3, I4i1, I5i1, and I7i1, discussed how students rethought their world view after learning about co-design processes. I2i2 finds that students open their eyes to a new point of view, where they solve problems instead of fix solutions, after they experience the co-design process. I3i3 has students who feel their eyes have been opened to the biases and blind spots they can have when designing for others. I4i1 has some students who eyes are opened to new avenues of thought after they learn about the possibilities. I5i1 finds students' eyes are opened to another world view after they learn of the possibilities of design research, including co-design processes. I5i1 has even had students that changed their focus to research after this revelation. I7i1 finds that after experiencing part of another person's world, students realize they had a singular view and try to find ways to open their eyes to others point of view.

Meaningful Work makes a Meaningful Experience

Two of the interview participants, I3i3 and I7i1, expressed that meaningful work leads to meaningful experiences for students. I3i3 finds that if the project is of a critical and meaningful nature students can see the strong impact they can have and they change the way they look at their work. The experience often creates a student who cannot imagine working without the co-design process. I7i1 sees students become passionate about the co-design process when they create a meaningful product that can change the life of their co-design partner. After this, students typically view co-design as an integral part of their process.

Professional World

Desired

Four of the interview participants, I2i1, I2i2, I3i3, and I5i1 mentioned companies desiring recruits to have co-design capabilities. I2i1 says companies that include co-design in their culture have expressed the need for students to know how to integrate users into the design process. I2i2 has been contacted by a top tier corporation that desires a manual to aid their designers in the co-design process. I3i3 finds that designers that work with NGOs or in the developing world cannot work without co-design abilities. I5i1 finds that employers are seeking students that either have strong skills in the execution side of design or in the process side, which includes knowledge of the co-design process.

Workplace Dependent

Two interview participants, I2i1 and I3i2, mentioned that students continued use of methods is highly dependent on their future workplace. I2i1 says students' future use of co-design methods is affected by where they work. However, companies come to I2 to recruit students that have been trained in incorporating users into their design process. I3i2 finds that top tier consulting firms like IDEO, Sonic Rim, and Frog expect their designers to have the ability to use the co-design process and expect them to use it during their employ.

Material Review

Not all interview participants followed through with sending materials. Materials were received from I1i1, I2i1, I2i2, I3i3, and I7i1. The materials received from each institution were not of a consistent type except for the curriculum overviews. The curriculum overviews allowed the percentage of course work in which co-design was taught to be discerned as well as the location of co-design within the curriculum. Due to the diverse and inconsistent nature of the materials collected it was not a valid choice to compare the schools through the material review. Instead a summary of important information from each set of documents was created.

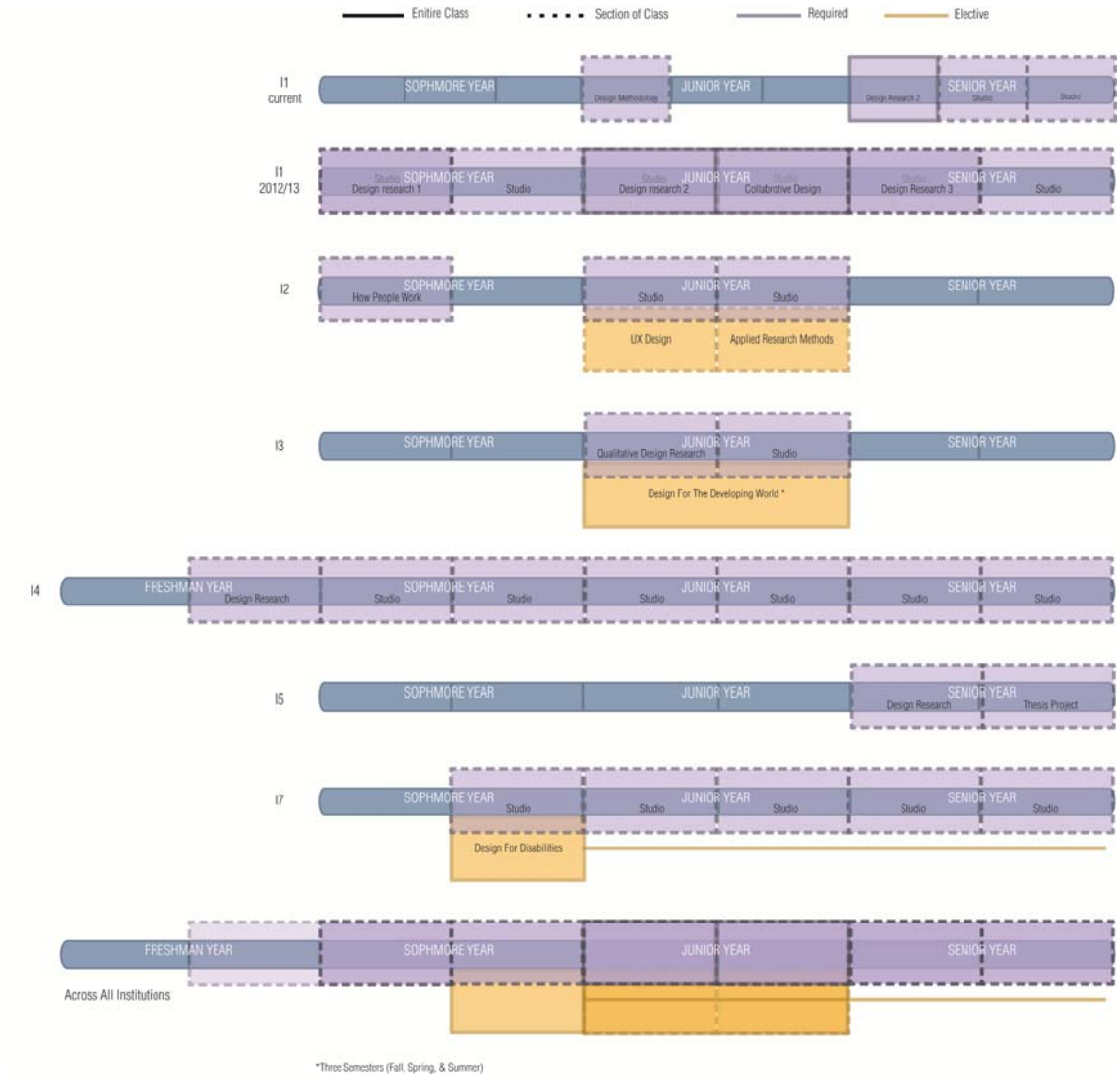

Figure 7: Where Co-design is taught in the curriculum

I1 Materials

The materials collected from I1 included a description of the program goals and how the curriculum fulfills them, a curriculum guide, a syllabus from I1i1's co-design centered class, and two student projects from the same course.

Program Goals and Curriculum Guide

The document containing the program goals of I1's Industrial Design undergraduate program was found publicly available on their website. It describes six overall goals in the education of undergraduate industrial design students. Two of these

are relevant to co-design. The third program goal of “practice” ends by stating students will “lead work productively as team members able to adapt to the evolving role of Design.” This statement can be considered to include co-design because it is part of the growing field of design research, which is currently becoming a crucial new aspect of designers’ capabilities. The sixth program goal of “role” states “Students acquire the ability to recognize the role of the Designer as the expert practitioner and/or catalyst for collective creativity.” This goal can be related closely to the goals of co-design in practice. The role of the designer in co-design processes is often to guide, lead, or direct participants creativity towards ideas around their design development. These two goals reflect that I1’s intentions are in line with encouraging the use and growth of co-design within its industrial design program.

The curriculum guide aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. The 2012/2013 curriculum was used because it was decided to be the ideal circumstance and distribution by I1i1. I1 has 2 required courses worth 6 institutional hours that are dedicated to co-design processes, which is 4.6% of the 131 required hours. I1 has 9 required courses worth 27 institutional hours that include co-design in the course, which is 20.6% of the 131 hours required to graduate.

I1 Syllabus 1

A syllabus was included in materials sent by I1i1, which is referred to as I1s1. I1s1 is from the second design research class students take at I1 which has a focus on co-design. The course objective is described as “bridging the gap between research and design”. Learning outcomes for the course related to co-design included “learn how to conduct participatory design workshops with key stakeholders in their area of focus” and “experience first-hand the connection between design research and design opportunities” amongst six others that could be considered to refer to general research issues. The class format was described as hands on and team based. The class periods were described to

include lecture, demonstration, in class assignments, feedback, discussion and field work. The course grade was comprised of 20% for one individual project and 80% for one large group project. It also included a required textbook, which was a behavioral research guide written for psychology, sociology and anthropology audience.

There were 23 class periods noted on the syllabus. 7 class periods were designated for lecture, which is less than 30% of the classes. 3 class periods were designated for student presentations, 2 at the end and one in the middle. 4 classes were designated as workdays, one of which was specified for pilot studies. 3 class periods were designated for groups to share and compare experiences with classmates. 2 class periods were designated for the introduction to the class and to the semester long projects.

I1 Projects

Two projects were received (I1p1 and I1p2). I1p1 is semester long project for the co-design class taught by I1i1. In I1p1 students were asked to use new design research methods to join the gap between research and design. The participant group was provided by I1i1. Three methods were used to interact with the participants: observation, an interview, and a focus group.

18 hours of observation were performed, divided amongst the group members. The students performed a line by line analysis from their observation notes. From these notes the students identified design opportunities, which they then developed.

An interview was performed after the observation. In the interview the students used a card sorting technique to discover further insight into their previous observations. The students transcribed their interview and performed a line by line analysis to identify design opportunities, which they developed concepts around.

The students then took sketches of their concepts to a focus group with participants. In the focus group participants annotated and discussed the concepts. During this process the students were able to identify the viable concepts.

The students then further developed the identified concepts, which they included

in their final presentation.

I1p2 is semester long project for the co-design class taught by I1i1. In I1p2 students were asked to use new design research methods to join the gap between research and design. The participant group was provided by I1i1. Three methods were stated to be used in the project: observation, card sorting, and sticky note annotation.

Each group member performed an observation of their participants using an observation worksheet. The students performed a line by line analysis from their observation worksheets. From these notes the students identified design opportunities, which they then developed.

After the initial observation and analysis, the students returned with a plan for systematic observation. The students performed a line by line analysis on their new observation worksheets to identify design opportunities, which they developed concepts around.

The card sorting activities and sticky note annotation were not discussed or documented after the research plan within the student's documentation. It is unclear if this section is merely missing from the file received or if the students did not complete these actions as planned.

I2 Materials

Materials were provided from I2 by I2i1 and I2i2. I2i1 provided a syllabus, a project write up, and an assignment sheet. I2i2 provided the introductory lecture presentation given to I2i2's students on co-design processes as well as a syllabus. A curriculum overview and a write up on program goals were collected from I2's website.

Program goals and Curriculum Overview

The program goals and curriculum overview was publicly available on I2's website. The program goals began with a description of the programs view of industrial designers as those who shape products to "serve people in answer to their individual and collective needs and desires." The program goals described aspects of students the

curriculum is intended to nurture, such as an “emphasis on human observation, modeling, and testing” and “helping them better understand the complexities of the world and the people who live…”.

The curriculum overview aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. I2 has 3 required courses worth 27 institutional credits that include co-design in the course, which is 7.5% of the 360 credits required to graduate. I2 has 2 elective courses worth 18 institutional credits that include co-design in the course, which is 5% of the 360 institutional credits required to graduate.

I2 Syllabi

Two syllabi were received (I2s1 & I2s2). I2s1 covers the introductory design research class taught by I2i1. The course overview states that products should “take the attributes and natures of people into account” and students will be exposed to “utilizing the perspectives of human centricity.” The course is described as centering on five themes. One of the themes, “How designers research and understand people” could apply to co-design processes. Of seven course objectives listed, two could apply to co-design processes: “to collect information through basic research” and “to apply principals and research findings to the creation and evaluation of your own design.” I2s1 then describes the course structure, rules and expectations. In the assignment section, it is noted that there will be one large project and the remaining grades will be comprised of short exercises often performed in class. The remainder of I2s1 covers general institution policy.

I2s2 was sent by I2i2 and covers I2i2’s class in which students practice co-design processes. The course description states that the course will explore research methods of all types. The course goal is listed as “understand the process that the designer employs to understand the ‘say, do, make’ responses of the user to develop appropriate solutions.” I2s2 also states that students will look at participatory methods among other qualitative

research methods. The stated intent is geared toward the front end of the design process and that students determine their own research tools to gather, analyze, interpret and visualize information from people. I2s2 further elaborates that students will be required to create their own research tools and methods.

I2 Project Description and Assignment Write-up

I2i1 also sent a project description and an accompanying assignment write-up, which will be referred to as I2p1 and I2a1.

I2p1 describes the large project in I2i1's introductory research class. I2p1 is performed in interdisciplinary teams of 3. The project is divided into six phases, each on which contains research steps that could be related to co-design. Phase 1 is identifying a design opportunity, which requires students to find a product or system that is in need of redesign. While not explicitly required, students are suggested to observe people to discovering what is dissatisfying them. Phase 2 is plan development, which requires students to develop a thorough plan of action or research protocol. Phase 3 is conducting research, which requires students to interact with at least 6 participants. Phase 4 is documenting findings, which suggest video or audio recording, drawing, and notes. Phase 5 is proposing a redesign based on research findings. Phase 6 is communicating the project on a poster, which specifies that a story be conveyed. I2p1 is allots six weeks to the project with 3 meetings with the professor scheduled into class periods.

An assignment sheet was included in materials sent by I2i1. I2a1 describes the research protocol mentioned in phase two of I2p1. I2a1 describes a research protocol as a documents that lays out the who, what, where, why, when, and how of a research plan. The first requirement described is an introduction to the research and the questions asked. The second set of requirements includes: a detailed description of planned activities, how many participants will be included along with their demographics and how they will be recruited, what will be asked of participants, how the research will be documented, the role of each team member, the length of each research session, results analysis, and a

time frame. The third set of requirements is a write up of materials needed. It is also stated that the protocol should be a concise document.

I2 Lecture Presentation

I2i2 also included a PowerPoint presentation used when introducing co-design methods, which is referred to as I2l1. The presentation is sixteen slides long. 5 slides are dedicated to the concept of co-design. 3 of these pages refer to Liz Sanders work, 1 with text and 2 with diagrams. The other introductory pages contain a 1 diagram slide and 1 text slide. The first two slides place the context of co-design. The next three slides cover the concept of people centered design and the say, make, do philosophy of user research. The remaining slides cover two case studies. The first case study is covered over 7 slides, 1 of which contains bullet points and 6 of which contain pictures. The second case study is covered over 4 slides, which are all made up of pictures.

I3 Materials

The materials collected from I3 included a syllabus, a course outline, a course flier, study guide, a curriculum overview and a write up on program goals.

I3 Curriculum Overview and Program Goals

The curriculum overview and program goals were found publicly available through I3's website. The program goals only contained one relevant statement, "[Industrial Design teaches] a clear understanding of how to identify, evaluate, and respond to the physical and psychological needs of users." Otherwise the program goals speak of being an interdisciplinary program and preparing students to be professional product designers.

The curriculum overview aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. I3 has 2 required courses worth 8 institutional hours that include co-design in the course, which is 6.7% of the 120 institutional hours required to graduate. I2 has 2 elective courses worth 6

institutional credits that are centered on co-design in the course, which is 5% of the 120 institutional hours required to graduate.

I3 Syllabus and Course Outline

I3i3 provided a course syllabus and course outline for I3i3's developing world class, which will be referred to as I3s1 and I3co1. The course description in I3s1 explains that teams will partner with a village that they will work with directly. I3s1 states that the course will be multidisciplinary as will the teams. The course objectives in I3s1 include: understanding Human-Centered design principles and the use of the HCD IDEO toolkit. The course structure is described as in class activities unless there is a guest speaker. I3s1 lists 14 course competencies. Of the fourteen, 4 were directly related to the co-design process: research method development, prototype analysis with the community, ongoing communication with the community leaders for feedback, and ongoing communication with the community for monitoring and evaluation. I3co1 lays out a tentative 16 week schedule, which includes a class for research and actionable insights, and a class for understanding the user. The remainder of I3co1 contains student rules and resources.

I3 Course Flier

I3i3 also shared a flier distributed to promote I3i3's developing world class, referred to as I3f1. The relevant statements on I3f1 were "You will communicate directly with the village to understand problems, culture, and resources" as well as "Class exercises will reinforce concepts to help you successfully complete your project." I3f1 also encourages students from many majors to join the class.

I3 Study guide

A study guide was included in the materials sent by I3i3, which will be referred to as I3sg1. I3sg1 asked students to watch a video on working in the developing world and then answer the questions. No relevant information was discernible from the study guide other than students were requested to participate in a priming activity.

I4 Materials

The materials collected from I4 included a curriculum overview and a write up on program goals.

I4 Curriculum Overview and Program Goals

A curriculum overview and write up on program goals were found publicly available on I4's website. The program overview discussed the view of Industrial Designers professionally and preparing students to meet those needs. The program goals state "[consumers are] seeking an emotional connection with objects that surround them" and that the curriculum includes human-centered design methodologies.

The curriculum overview aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. I4 has 7 required courses worth 21 institutional hours that include co-design in the course, which is 14.6% of the 144 institutional hours required to graduate

I5 Materials

The only material collected from I5 was a curriculum overview which aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. I5 has 2 required courses worth 7 institutional hours that include co-design in the course, which is 5.2% of the 134 institutional hours required to graduate.

I7 Materials

The materials collected from I7 included a curriculum overview and a write up on program goals.

I7 Curriculum Overview and Program Goals

The curriculum overview and program goals were found publicly available

through I7's website. The program goals did not contain any statements relevant to co-design processes.

The curriculum guide aided in the definition of course locations in the program as well as the percentage of the program in which co-design is taught. I7 has 6 required courses worth 24 institutional hours that include co-design in the course, which is 19.7% of the 122 institutional hours required to graduate. I2 has 1 elective courses worth 3 institutional credits that are centered on co-design in the course, which is 2.5% of the 122 institutional hours required to graduate.

CHAPTER 8

Discussion

The results of this project cover the prevalence of co-design in Industrial Design education, curriculum considerations, and teaching methods.

Prevalence

The methodology of this project allotted for up to ten institutions to be identified as leaders in undergraduate Industrial Design co-design education. The snowball sampling produced only eight institutions, including the institution identified but not contacted due to the timing of the recommendation. The lack of institutions being recommended could represent multiple scenarios.

Data shows that there are few institutions placing emphasis on co-design in Industrial Design education. It is assumed that practitioners of co-design education are familiar with others' efforts. If co-design were being widely taught in Industrial design education then the limit of ten institutions would have been reached.

It is possible that institutions of Industrial Design education are unaware of the efforts made by others in the field. It has been assumed that practitioners of co-design education would be familiar with others with the same goals, but it is possible that this was an inaccurate assumption; however the snowball sampling did result in multiple referrals to the same institutions, which would support the theory that those in the field are familiar with one another.

In order to develop a certain understanding of the prevalence of co-design in undergraduate Industrial Design institutions in the United States, a survey of all Industrial Design programs would need to be performed.

Course Considerations

Faculty and Programs

The need for support from faculty throughout the curriculum appears to be a

critical aspect of teaching co-design. Every institution had at least one interview participant who expressed the importance of faculty support. In order for students to integrate co-design into their repertoire of design capabilities, access to faculty who support the co-design process and know enough about co-design process to guide students must be provided at all stages of their academic training. This can be achieved by an increase in awareness by faculty through colleagues, professional practice, or continued education, like seminars or conferences.

Co-design Introduction

Despite the variance between participating institutions, patterns in opinions on the optimal time to introduce co-design existed. It was made clear that the senior year was too late to introduce the co-design process, but it was also expressed to be overwhelming for students in the freshman and sophomore year. Those who introduced juniors to the co-design process found them capable of performing it, but sometimes begrudgingly because they did not find the concept appealing. A pattern was found in the interviews that students exposed to the concept of co-design at the beginning of their design education were more likely to embrace it as part of their personal process. This leads to the recommendation that students be given a basic introduction to co-design as early as their freshman year and optimally before the end of their sophomore year. The interviews also suggest that a full introduction to the co-design process id optimal during the junior year because the students are further developed in their capabilities.

Co-design is currently taught in both standalone classes that focus solely on the co-design process and within classes that cover other material. Those who teach co-design within a design research methods class do not feel there is enough time to fully cover the co-design process. Those who had a semester long elective course dedicated to the co-design process felt their students were able to learn, understand, and embrace the process. While only one participant had a required course dedicated to co-design, they had the same issue as other required courses, students who were unaccepting of the

process. For this reason, it is recommended that co-design be given a basic introduction in a required course covering other material and fully taught in an elective centered on the co-design process.

If students are given an early basic introduction to co-design in a required course, they would be aware of its use and given time to grow accustomed to the concept. While this will not eliminate obstinate students, it will relegate them to a brief introduction on the topic. If a co-design centered elective was then available at a higher level, students who had developed further interest would be able to learn and practice the process in a focused way.

Multidisciplinary Classes

Those who teach co-design and general design research methods to a multidisciplinary class had more difficulty with majors outside of industrial design. The issues that occur appear to stem from a difference in philosophy on design. Majors that are taught in a classic Bauhaus manner without any influence of human centered design or other user based principals have a hard time understanding or accepting the importance of research of any type including co-design. However, participants also expressed the value of a multidisciplinary class despite the challenges it presents. If co-design processes were given only a basic introduction in the required multidisciplinary classes, there may be less challenges of acceptance but would still give students a level of exposure that would allow some to develop further interest.

Class Size

The class size at which co-design at most institutions was taught varied, but required classes were consistently larger than elective courses. Classes that reached 40-60 were affected by the class size through a lack of time for individual attention and requiring concepts to be taught at a slower rate. This issue could also be resolved by only giving a basic introduction to co-design in a required course and giving full coverage to

the topic in an elective course. Electives are smaller in size because no student has to take the course and the size can be limited.

Teaching Methods

Co-teaching & Guest Speakers

Interview participants used both guest speakers and co-teaching to supplement their own knowledge. While it is not necessary to use these techniques it may be advisable, particularly when the instructor has access to individuals with expertise on skills necessary to complete the co-design process that they are lacking. The participants found benefit from co-teachers and guest speakers when teaching students about interacting with users, especially when the participants are outside of student's typical interaction group.

Concept Over Details

The co-design process can be achieved using many different tools. While 18 different tools were identified as standard to the co-design process in the literature review of this project, they can be used in many different ways, as addressed by multiple interview participants. Interview participants expressed that if students understood the purpose of the co-design processes, the theory behind it, and the basics of execution they can be adept at the process without knowing about all tools thoroughly. Interview participants also expressed that the co-design process is different for every project, necessitating an understanding of the general process in order to create new tools when needed.

After the interview process was completed and analyzed, the need for students to be taught about each co-design tool in detail was reevaluated. If students had access to reference material on existing co-design tools, it would be possible for them to use them in practice after being taught the co-design process as a concept. This is not to say that students do not need to be taught or practice the tools of co-design, but instead that

students can learn in detail about some tools and have the ability to create their own tools or use others through reference. Therefore it is recommended that students first be taught the theory and objectives of the co-design process before tools and that a reference on the tools of co-design would aid students in their process.

In Class

Interview participants used a variety of methods for teaching in class. Three methods that were used in consistent manners were in class exercises, case studies, and lectures.

In class exercises were considered to be valuable learning tools by interview participants. Design students were described as hands on learners that understood information better when it was enacted than when given information as literature or verbally. In class exercises were also expressed to aid in insuring students are ready to enact skills outside of the classroom. Therefore it is recommended that in class exercises be integrated into the teaching of co-design.

Case studies were used by most of the interview participants, who considered them to be compelling to students while also providing explanation on the use of the co-design process. Students were seen as seeing the capabilities of the co-design process through case studies.

Lectures were considered necessary but undesirable by the interview participants. Lectures were seen as boring to the students, while being the only way to convey necessary information, particularly because of a lack of a textbook centered on the co-design process. It was also expressed that when teaching design students, lectures were better understood with the inclusion of many pictures. This leads to the recommendation that lectures be minimized when possible in favor of case studies or class exercises.

Teaching in Parts

Most interview participants expressed that they taught in pieces that assembled

into a whole. Their students are taught stages one at a time to ensure the student does not jump to the next stage before they have completed the first. This approach yields a full understanding of each phase while working towards a complete process.

Projects

Projects are used for students to practice skills throughout industrial design curriculums. Interview participants did not vary from this practice in teaching co-design. The main difference between student projects in co-design and other industrial design studio projects is the requirement for students to interact with an individual outside their class. Interview participants shared common traits in the projects they assigned such as using teams, using participants outside of the department, having students design their own tools, and using extreme users.

It was considered necessary for students to experience a real world co-design process in order to fully understand the co-design process and its value by multiple interview participants. The more connected students' projects were to an effect on the real world the more interview participants saw a change in the student and their design process. The co-design process cannot be adequately taught without students involving real participants, preferably participants with a different world view than that of the students.

Interview participants found that students tasked with finding their own participants often defaulted to using those that were most convenient as opposed to participants that would be the most useful. It was also noted by three participants that extreme users produced the most successful outcomes. From the outcomes noted by interview participants, it is advisable that instructors provide students with participants for their first full co-design project if possible.

Teams were used in most co-design projects discussed by the interview participants. Factors in this decision included the need to adapt to team work, mixing the strengths of students, manpower to complete the project, and encouraging higher quality

work. Interview participants found that one advantage to using teams with mixed capabilities is that typically there is a student who is better at communicating with users and may help others overcome their fear of doing so. Using teams allows students to experience and finish a full co-design process.

While not all interview participants discussed students designing their own tools to perform the co-design process, those who did were adamant. They felt that by designing their own tools, students became more familiar with the process and its goals. It was found to be a useful teaching point to assist students in refining their tool to meet the needs of their project as well as the goals of the co-design process. Having a student design their own tool may be reserved for an in depth class on co-design but it might be considered as requirement in that class.

Integrating Findings

Story telling was an analogy used repeatedly to express how students were taught to integrate findings. Integration was described as the weaving of a story into a design. The other approach was to tell students to gather information, use intuition to gather insights and inferences to create design criteria. Using both a metaphorical explanation and a direct technical explanation in combination may be optimal to ensure that all students understand how to integrate findings from the co-design process.

CHAPTER 9

Project Outcome

The results of this study have produced insights to better design a co-design methodology. These interview findings can be integrated into a learning aid to help students understand the co-design process. For this purpose, a tool was designed which allows the creation of a personalized map of the co-design process. The beginning requirements were that the tool provide students reference to the tools of co-design while allowing them to visualize the stages in the co-design process and build the details to create a full picture of each stage.

The learning aid was designed to overcome common obstacles for students in the co-design processes after they have been taught the theory behind and the purpose of the process. By guiding students through each step of creating a co-design protocol it aids students in managing all the decisions that must be made to complete the co-design process without being overwhelmed.

Result Integration

Through the literature review, interviews, and material review performed for this thesis, results developed that can be integrated into a learning aid for students learning the co-design process. The approach of working in stages, the key tools, the flexibility of co-design, the tendency of design students to be visual learners, and the need for practice can all be integrated into the learning aid.

Interview participants spoke of teaching students in stages. It was expressed that students needed to carefully consider each part of research before moving on to another or the next stage. One example used was that students often try to move directly from observation into integration. Another was the tendency of students to choose participants without analyzing how the participant would affect their outcome. This was integrated by incorporating a system based on the steps of research. These steps were arranged as

choosing an insight goal, choosing a time within the design process, choosing participants, choosing tools, planning materials, choosing a setting, identify data collection methods, and analysis and integration.

The eighteen key tools and methods of the co-design process, which were found during the literature review, were integrated into the tool. These tools and processes were distilled into a brief description and key tips in order to give students a basic overview of tools from which to choose. The literature also aided in creating the pieces for the other steps.

Interview participants and literature referred to the flexibility of co-design. Co-design was found to have stages that vary or repeat and tools are created or modified for different projects. Therefore the learning aid needed to be flexible allowing for tools to be created or changed and stages to be reordered.

Design students were said to be hands on and visual learners by interview participants. This supported the concept of having students physically build their process in to a visual depiction of a co-design protocol.

The learning aid will prepare students to practice a real world project by helping them incorporate the details required. The visual depiction of the process aims to simplify the details in order to prevent students from being overwhelmed.

Existing Learning Aids

In order to begin designing, common learning aids were reviewed in order to be familiar with existing possibilities (figure 9). Learning aids reviewed included process posters, card games, quiz cards, puzzles, reference pamphlets, and cheat sheets. The use of an answer wheel was considered, because it allowed for any aspect to be chosen and other factors to line up (figure 10). The answer wheel did not allow for any customization or the space for the information needed. After investigation, no existing aid was assessed to fulfill the goals defined above.

Figure 8: Learning Aids

Figure 9: Answer Wheels

Early Concepts

Early concepts began based off the idea of building the co-design process. Different shapes were addressed as possibilities for depicting the building of decisions into a full process.

The first layouts considered were literal building blocks, a pie that emphasized the importance of steps, a puzzle where each step had its own shape, and a line of connecting cards. Building blocks lacked the flexibility and portability desired. The concept of a pie allowed for an emphasis on important phases, but it did not accommodate customization or the amount of information that needed to be included. The fit in puzzle was reminiscent of toddler puzzles, which made it inappropriate for the audience. This layout was also lacking in adaptability to custom protocols. Connecting cards to build a linear process only lacked the dimensionality desired. Therefore elements of this idea were incorporated into subsequent ideation..

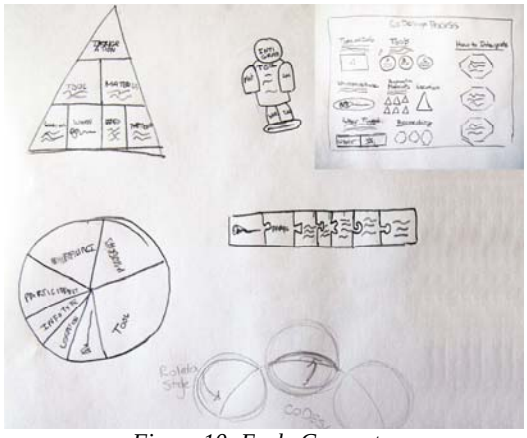

Figure 10: Early Concepts

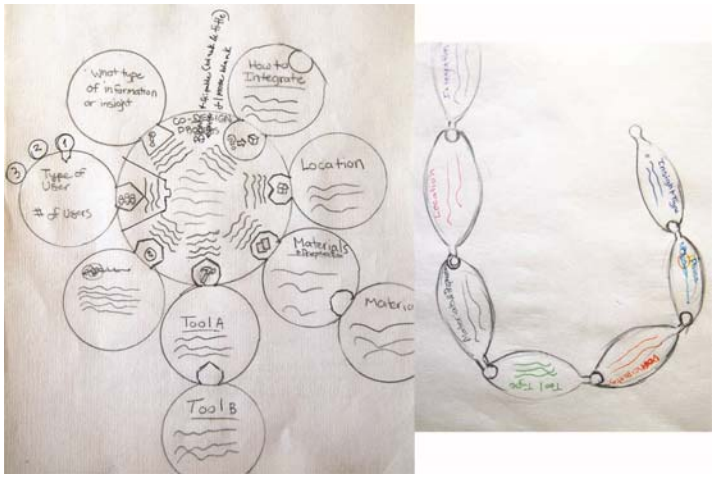

Figure 11: Filtered Concepts

From these concepts two were identified to move forward. One depicted the process as linear through linking pieces with the possibility of off chutes arising, which was a combination of two previous ideas. This design was chosen to prototype because it allowed for customization and flexibility in elements. After a paper prototype was created, the linking linear design was determined to be too confusing and unwieldy, particularly since it did not provide a guide for the process. The second was a circular representation with slices representing the stages and detail pieces which connected to their respective pie piece. This was built on the previous ideas of a puzzle and that of a pie. This concept was chosen to investigate further because it allowed for customization, flexibility and full process coverage. The circular representation was chosen because reminiscent of many depictions of design processes. The details of the process were

added through bubbles with topic specific connectors. The growth of the map through the addition of bubbles was logical and enticing, but became cumbersome despite its connection to the thought process of creating a co-design protocol. Also the variety of connection points would unnecessarily increase the cost of production and the shape was not conducive to portability.

Each of these concepts was built as a paper prototype using cardboard and cardstock in the shape of each piece with basic labeling included (fig 13 & 14). After simulating use with these paper prototypes it was found that in some cases the types of stages repeat themselves and that a linear arrangement would best depict the co-design process. Neither the linking linear design nor the circular disk with bubbles accommodated all aspects needed, but elements of both could be combined to accomplish all the goals of the learning aid.

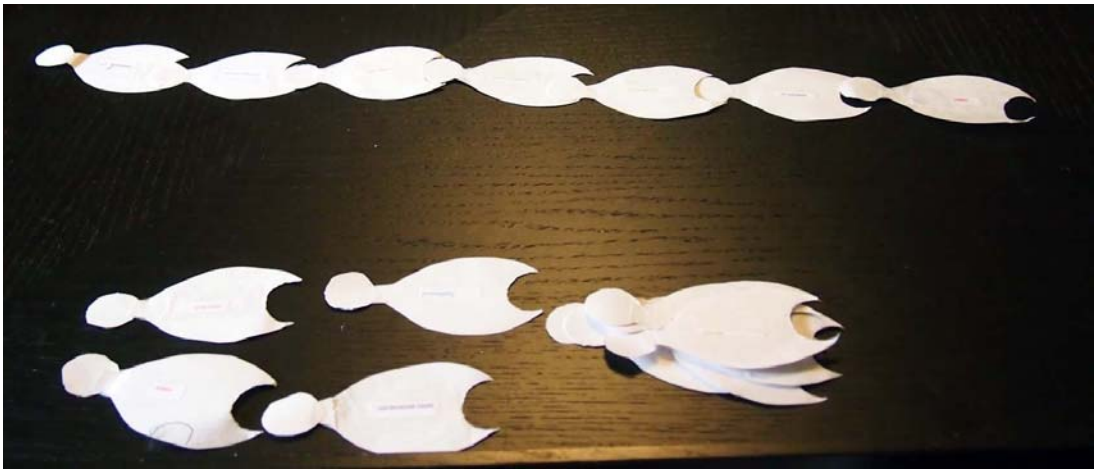

Figure 12: Chain Concept

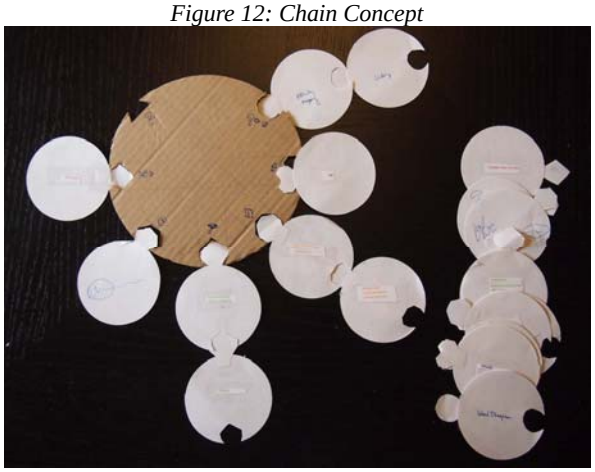

Figure 13: Pie Puzzle Concept

These factors lead to the following requirements for the next iteration: The shape should be such that only one die would be required for all add on pieces in order to make production cheaper and storage simpler. The main title piece or stage guide should be linear and allow for the reordering and addition of stages, because the co-design process often happens with the repetition of stages. Users must be able to add their own tools and methods, because designing tools specific to your research is a key aspect of co-design.

First Iteration

The next iteration was designed with one title piece which also contained the stages. The piece could be flipped from one printed side to a blank side which would allow users to customize their stage ordering. A prototype was made of acrylic to allowing testing of use and layout (fig 15). While this prototype was made in acrylic to allow for quick testing of graphic styles, the intended medium was thick card stock or card board which would allow the title piece to be scored and fold into a piece almost the same shape as the detail building pieces. This would allow the tool to be stored like a deck of cards. Each detail piece was made from one shape, including the smaller pieces, which could be made using the same die if shifted halfway down the piece. The pieces would be different colors to represent their stages. The backside of each piece would be left blank to allow users to create their own details.

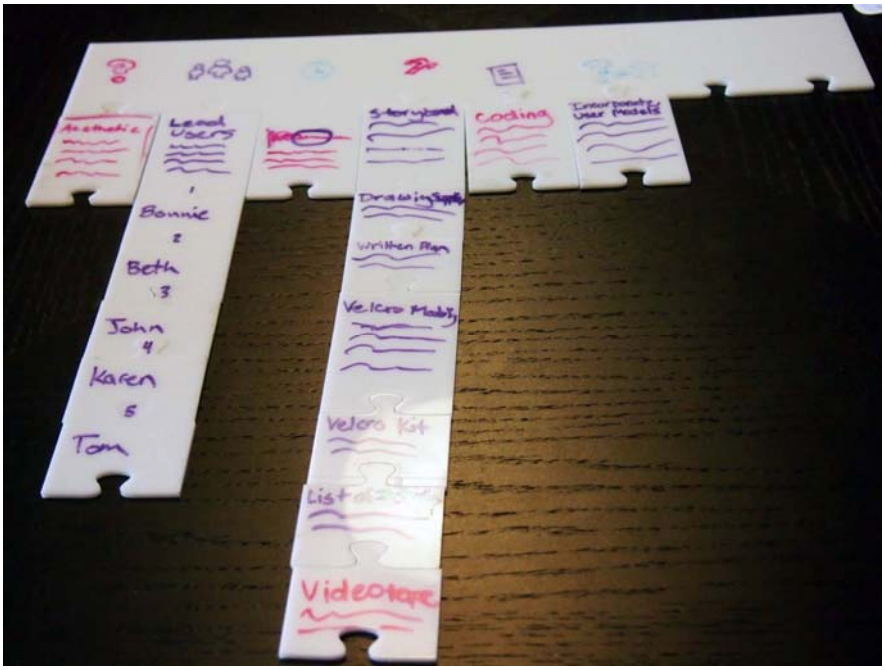

Figure 14: First Prototype

Material Choice

Once the concept was decided upon, material choice began. A materials that was foldable for the title piece and worked with dry erase markers was needed. After exploring the possibilities of coated cardstock and coated cardboard, a third option was discovered, Yupo synthetic paper. Yupo paper was preferable to coated cardstock and cardboard because it works better with dry erase markers, which would allow students to write their own notes, comments, or ideas on the pieces as they work. The Yupo paper is tear resistant, water resistant, and made from recyclable materials. The durability of Yupo paper far surpassed other options, which was another deciding factor.

Graphic Iterations

The graphic aesthetic of this learning aid was deemed to be of great importance. Without an informative aesthetic the elements of this learning aid could become overwhelming and defeat the intended purpose of use. The pieces needed to be easy to recognize from one another as well as cohesive to portray the process as a whole. A mood board (figure 16) was created to derive the aesthetic for the learning aid in order to ensure

that the graphic elements would be cohesive. It was created considering the expected user group, designers. The photos chosen for inspiration came from current issues of design related magazines, in order to incorporate styling that is currently familiar to designers.

After the mood board was created, several variations of the graphic styling were created in addition to variations on the piece shape. A color palette was selected to be in line with current graphic design trends, which involve intense bold colors and stark contrast (figure 17). The color pallet was explored in different iterations. The same shapes were also laser cut in order to test the durability of the shape as well as functionality (figure 18). The previous shape was used to create a mockup of the print sheet in order to get quotes from printers (figure 19).

Figure 15: Moodboard

After the connection shape was chosen, a more detailed mockup was created (figure 20). Once the second mockup was created the layout was reassessed and decided to be lacking in graphic communication of information. Once fully assembled, the pallet appeared less professional than expected because it too closely resembled children's

educational aids.

The layout of steps on the front of the learning title piece was decided by the common order of steps in the co-design process. The backside of the title piece has space for students to write in their own steps in case they want to reorder or repeat steps once they become more comfortable with the process. Each piece contained multiple levels of information including phase, title, description and tips. Typography was used to create a visual hierarchy to each piece, which allowed for quicker identification.

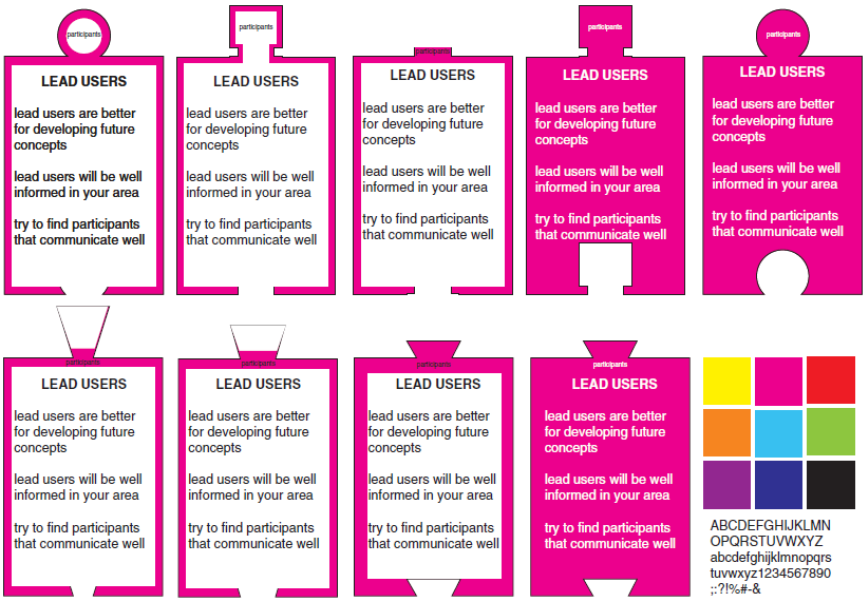

Figure 16: 1st Graphics

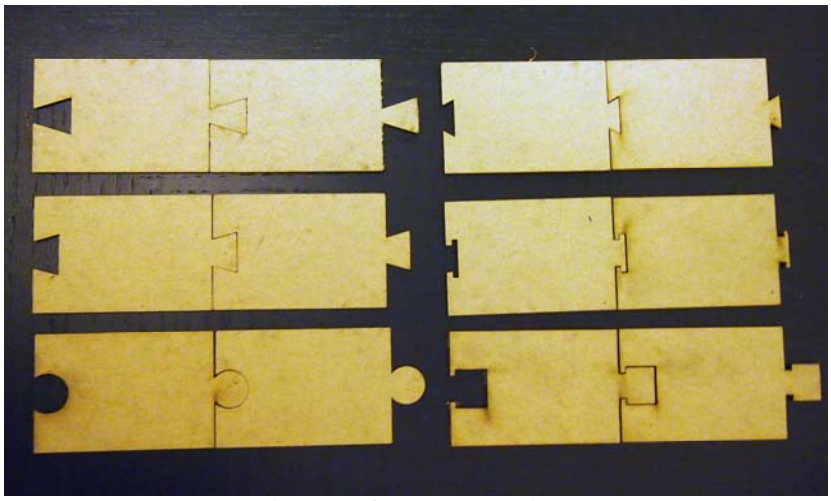

Figure 17: Connector Test Pieces

Figure 18: First Layout

Figure 19: Second Layout

A new layout and color pallet was designed. Most colors used were close to those of the mood board but muted to maintain professional aesthetic (figure 21). The new layout included more graphic cues to the information contained on the card. The front now includes a picture and a description of a tool or action, while the back contains space for customization of the method along with tips.

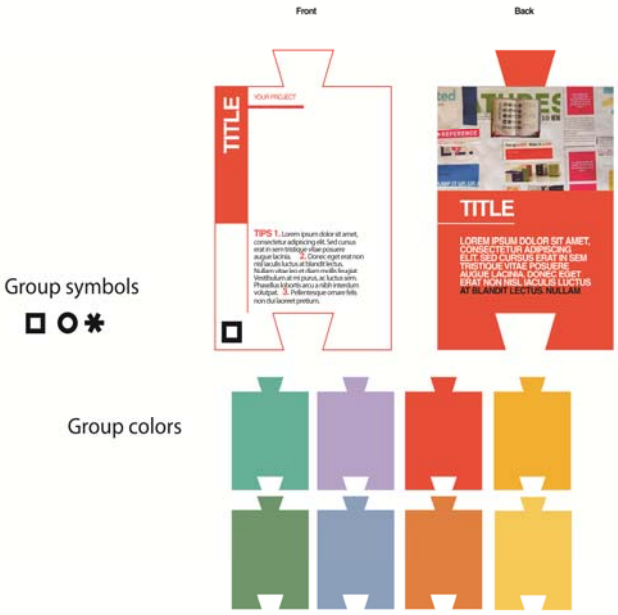

Figure 20: Third Layout

Prototyping

A prototype was created using graphics printed on adhesive vinyl, which was applied to polyethylene sheet. These materials were chosen to emulate the Yupo paper. The parts were cut out using a laser cutter. The prototype will allow for testing and refinement.

Figure 21: Final Prototype 1

Figure 22: Final Prototype 2

Figure 23: Final Prototype 3

CHAPTER 10

Conclusions

Co-design is being integrated in professional Industrial Design practice, but there have been very few previous investigations in the education of Industrial Designers in co-design processes, which needs to occur if co-design is to become integrated into design education. It was hypothesized that standard practices would exist amongst educators at institutions with leading reputations in co-design education.

Survey Findings

The survey used in this project accomplished three goals that were originally set for it. The survey served as a screening tool to ensure that participating institutions fit the requirements for the interview process and it provided preliminary information on institutions before the interviews. The survey also allowed for the identification of interview participants.

Interview Findings

Through the analysis of interviews with the identified educators, the similarities or standards in practice were identified and distilled in to recommendations for other Industrial Design educators. The analysis of interviews provided the most information on the methods used for teaching co-design. Recommendations were formed based on the prevalence of use and the consideration of the intensity of support.

It was found that in order to facilitate student's education on co-design processes, all faculty members need to support students in learning the co-design process through attitude and knowledge. This may be the most challenging recommendation garnered, because changing the views and educating educators are both difficult tasks.

The interview analysis lead to the conclusion that co-design is best introduced briefly as a part of a required freshman or sophomore course in conjunction with the offering of a higher level elective that covers co-design in depth. This recommendation is

a matter of aligning the curriculum of Industrial Design programs with the goal of including co-design as part of students training.

Findings on the structure of co-design courses include using co-teachers or guest speakers to augment instructors' expertise, which requires educators to develop and use contacts with varied capabilities. As well as teaching co-design as a concept in stages more than a collection of tools. Findings also suggest using technical and metaphorical explanations for the integration of information is optimal. This can be accomplished by instructors through a restructuring of their approach to co-design processes. Another recommendation derived from the interviews is that lectures be minimized while in class exercises and case studies are maximized. This will require instructors to rethink the structure of their class time.

Findings on assignments in co-design centered courses included involving instructor provided real world participants in students' projects. This recommendation again requires an effort from the instructor to seek contacts. While real world projects are often used in Industrial Design education, it is uniquely imperative to co-design, because the co-design process does not work unless real problems and real people are involved.

The two simplest findings to implement are the use teams for co-design projects and student designing their own tools, because these do not require as much effort on the part of the instructor.

It is hoped that these recommendations can serve as a beginning guidelines for teaching co-design to Industrial Design undergraduate students. Previously there was no reference on methods found helpful by educators of co-design. Now instructors or educators can develop an understanding of current practices used in the education of Industrial Design students on the co-design process.

Learning Aid Development and Production

The learning aid developed from the literature review and interview findings is designed to be useable by students with a basic knowledge of the co-design process.

Integration of Industrial Design students as co-design participants during the refinement of the learning aid is planned. It is hoped that the learning aid will be further vetted and then produce. Production of the learning aid would allow students throughout Industrial Design programs to use it as a guide when design protocols.

Limitations

The snowball sampling used to identify leading institutions in co-design education succeeded in identifying institutions. However it did not identify as many institutions as desired, it required more time than expected, and it did not aid in clarifying the prevalence of co-design in Industrial Design education. The number of institutions identified may be a failure in the method, or it may be representative of the current state. The time required for the snowball sampling is dependent on the speed of respondents, which is at best difficult to predict. The failure to clarify prevalence is due a poor choice in method. In the future snowball sampling will be allotted more time and will not be used to clarify trends.

While common methods of co-design education were identified, the use of a material review did little to aid in this identification. Although this phase was unsuccessful in creating any quantifiable results, it did assist in creating a clearer qualitative view of the class structures and expectations at the institutions that participated in the material review. The material review may have been more useful if a systematic way to ensure the submission of comparable materials was used as well as a way to further encourage the submission of any materials.

Future Work

While recommendations for the teaching of co-design were discernible from the interviews performed, they need to be further vetted through testing. The recommendations would be best tested against alternate teaching scenarios. This could be best executed by an instructor in Industrial Design education. Future work may also include a survey of all Industrial Design programs within the United States to determine

the prevalence of co-design, which was not answered through this project.

The learning aid will be further developed. It is hoped that it will be finished using co-design methods with educators and students before being put into production.

APPENDIX A

Survey

Dear _____,

Attached is the consent form for the survey we have previously discussed. Below are the survey questions. Please take your time to review the consent form and answer the survey questions at your leisure.

Thank you,

Chauncey Saurus

Master of Industrial Design Candidate

Georgia Institute of Technology

Cmyshkin3@gatech.edu

770-356-1140

Please answer the below questions and return via email to Cmyshkin3@gatech.edu.

In this survey user engaged design is defined as the act of involving users in design decisions or creatively in conjunction with designers, particularly during the early stages of the design process.

1. Do you teach research methods in your undergraduate program? If so, what are the key components students are expected to understand?

2. Do you teach methods of user engaged design in your undergraduate program?

In what class/classes are they taught?

Is there a class that has a section focused on user engaged design processes?

Are user engaged design processes practiced or taught in studios?

3. What are the key concepts, tools or methods students are expected to understand about involving users in the design process?

4. Are there any faculty members that would be best to contact for further information on user engaged design within your program?

5. Are there other factors or issues you feel are relevant to your program and user engaged design?

6. What other institutions would you consider leaders in co-design education?

APPENDIX B

Interview Guide

Have you had a chance to read over the consent form? (If not, go over consent form)

Do you mind if I record our conversation?

Describe purpose of project and intent of interview

Do you teach ethnographic research methods in your program? Which methods? Explain further?

Of those methods I'm very interested in the ones that involve users in the design of products; can you tell me more about those?

What are the specific tools students learn to facilitate involving users in designing?

In what class/classes are they taught? Are students expected to use or learn these in studio?

Is there a class that has a section focused on involving the user in designing?

What are the key concepts students are expected to understand about involving users in design?

What methods do you use to teach the processes & tools associated with involving users in designing?

Can you explain further? Elaborate on specific tools?

Do students read about the tools? Do students practice? Do they use the tools with users?

Do students continue to use these processes?

Have you found any aids to be useful in teaching user involvement?

Do students have trouble understanding? Do students have trouble enacting? How do you overcome this?

Do you receive push back from others on the participation of users in designing?

What other challenges do you face when teaching user engaged design processes?

APPENDIX C

Consent Form

CONSENT DOCUMENT FOR ENROLLING ADULT PARTICIPANTS IN A RESEARCH STUDY

Georgia Institute of Technology
Project Title:
The state of Co-Design Education in Industrial Design at Higher Level Learning Institutions in the United States

Investigators: Chauncey Myshkin, Claudia Rebola

Protocol and Consent Title: 9/7/2011 Co-Design Interview Consent v1

You are being asked to be a volunteer in a research study.

Purpose:
The purpose of this study is to understand the current state of co-design education in U.S. undergraduate programs. The goal is to assess teaching methods of co-design by using phone interviews, surveys and document collection.

Exclusion/Inclusion Criteria:
Participants in this study must be either a student or faculty member in an industrial design program.

Procedures:
If you decide to be in this study, your part will involve participating in an interview over the phone as well as sharing resources from previous classes. The interview should take less than one hour. The sharing of resources would be over email. You are free to end the interview at any time.

Risks or Discomforts:
The risks involved are no greater than those involved in daily activities such as making a phone call.

Compensation to You:
- There is no compensation for participation.

Confidentiality:
- Your privacy will be protected to the extent allowed by law. To protect your privacy no identifiable information will be recorded or linked to your survey answers. Your name and any other fact that might point to you will not appear when results of this study are presented or published. No link will be maintained that could connect your identity with your responses. To make sure that this research is being carried out in the proper way, the Georgia Institute of

Technology IRB may review study records. The Office of Human Research Protections and/or the Food and Drug Administration may also look over study records during required reviews.

Participant Rights:

- Your participation in this study is voluntary. You do not have to be in this study if you don't want to be.
- You have the right to change your mind and leave the study at any time without giving any reason and without penalty.
- If you decide not to finish the study, you have the right to withdraw any data collected about you. If you choose to withdraw your answers will be shredded.
- Any new information that may make you change your mind about being in this study will be given to you.

Questions about the Study:

If you have any questions about the study, you may contact Dr. Claudia Rebola at telephone (919) 389-2302 or crw@gatech.edu

Questions about Your Rights as a Research Participant:

If you have any questions about your rights as a research participant, you may contact

Ms. Melanie Clark, Georgia Institute of Technology
Office of Research Compliance, at (404) 894-6942.
or
Ms. Kelly Winn, Georgia Institute of Technology
Office of Research Compliance, at (404) 385- 2175.

If you choose to participate in this interview it means that you have read -- or have had read to you -- the information contained in this letter and would like to be a volunteer in this research study.

Thank you,

Chauncey Myshkin
&
Claudia Rebola

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