

# Design Research in Undergraduate Design Education: Relevance and Implementation

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## **Abstract:**

This study sets out to answer the question: “What user-centered design research methods should be emphasized in education to improve employability and the practice of user-centered design research?” Design research has proven to be effective at increasing the likelihood of product success [4] [12] [1] and as a means of creating innovative and sustainable products to improve lives across various cultures. New approaches and attitudes within the field of user-centered design research continue to emerge as powerful tools for design research. However, questions and uncertainty remain regarding what to emphasize in education and the effectiveness of particular approaches. This study informs the design education community about relevancy and the perceived value of certain user-centered design research methods. The conclusions of this study are of high value to those desiring better prepared designers who are equipped to practice relevant user-centered design research.

## **Keywords:**

*Preparing students for real world design practice, Design Research, Design Research Methodologies, Design Education*

## **1. Introduction**

In the 1950s, Henry Dreyfuss encouraged studying people’s behaviors and attitudes as a first step in designing successful products. Since then, design research has continued to be a relevant part of design activity and surged in popularity over the last 15 years [4][1]. Today, questions have surfaced concerning the context of design research in undergraduate product design education, particularly with regard to integrating into today’s changing design curricula. Since academia serves as a primary source of innovative user-centered research methodologies [12], and designers are ever increasingly expected to cross over and conduct research [8] [5], it is imperative that designers be prepared to conduct credible and effective design research throughout their course work while in school. Currently, the majority of design programs in the United States expect students to experiment and innovate their own methods and approaches without equipping those students with fundamental knowledge about research [12]. Field research in industrial design has proven to be an effective activity. However, it is often little understood or misused by industrial design students, practitioners and educators. Comprehensive historical accounts of this subject are limited and offer little guidance in terms of relevance and implementation in design education [1].

**“A problem well stated is a problem half solved”  
– Charles Kettering, Inventor**

“If design is problem solving, then design research is problem seeking” [2]. Design research is a tool that the designer can employ to gain incredible insight and knowledge of the user [13]. Design research is a valuable resource of insight-generating methodologies that can make significant contributions during all stages of the design process, yielding very precise decision-making guidelines [14]. Obtaining and exploiting knowledge informs design processes on multiple levels in organization [7]. Pre-design research can clarify objectives and increase the likelihood of effective design [15]. As designers are expected to have greater flexibility in their working practices [5], the role of research allows (designers) to understand the deep emotional drivers of target constituencies, (resulting in) more power to ultimately satisfy them [6] by creating products that are useful, usable and desirable [9].

Despite the value and acceptance of design research within the design process, the term “design research” is a broad title that encompasses dozens of methodologies and techniques derived from anthropology, sociology, marketing and usability experts. To contribute to the design process, it becomes of utmost importance to be able to identify where a particular methodology has its origins, what type of data it can yield and how that data can be analyzed. It is of equal importance to the design community that these fundamentals of research are disseminated to undergraduate design students in a meaningful and intelligent way. Designers no longer fit neatly into categories such as product, furniture and graphics. Rather they are a mixture of artists, engineers, designers, entrepreneurs and anthropologists [5]. The question that this research is focused on answering is quite simply: “What do aspiring designers need to know about design research so that they can make a significant contribution to their field?”

If design research is pursued and carefully applied, designers will contribute to the growth of design as a disciplined field in its own right. Internally, this will boost designers’ confidence within their practice of design. Externally, this will boost the perceived relevance of the design field (from those outside the profession). Conversely, if design research is neglected entirely or poorly executed, the general public may not be able to fully appreciate the value of design and may not take the practice as seriously as they might the social sciences or other fields known for their rigorous research practices. In the same vein, designers can actually become a detriment to the profession, and even worse, to the people they claim to serve. This research is aimed at building a framework around what design research is and how it is applied in today’s design profession and then disseminating that knowledge to undergraduate designers.

## **2. Research Design**

### **2.1 Data Collection**

An extensive literature review was initiated to provide a background and setting in which the primary research could take place. The literature review was helpful in establishing a framework of stakeholders within the realm of design research.

The primary means of data collection was split into several phases. First, three groups of stakeholders were identified as having critical roles in design research practice, application and education. Participants were organized into one of the following groups based on their primary occupation: Researcher, Designer or Educator. Once identified, stakeholders were invited to participate in a semi-structured interview that was inspired by Gaver’s cultural probes and drew heavily from cognitive task analysis interviewing techniques. The semi-structured interviews explored the following five topics: Perspective, Definition, Purpose, Education and Future of Design Research. Each of the five topics had two to five probing questions aimed at exploiting each of the stakeholders’ experience with design research. The following diagram visually illustrates the semi-structured interview. Interviews were audio recorded and later transcribed for the purpose of analysis.

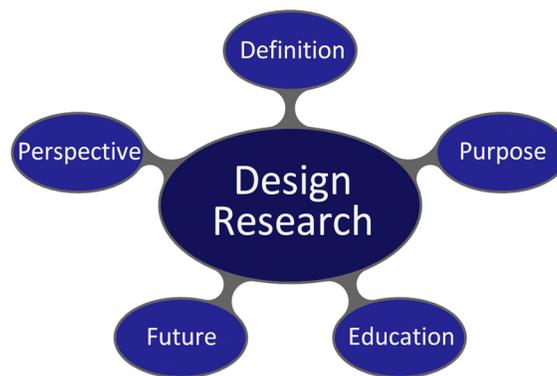


Figure 1. A visual representation of the semi-structured interview.

During one of the semi-structured interviews, one participant from the ‘Researcher’ group made the comment that “The world is for the young people – not the old people.” This participant suggested that students be counted as stakeholders and included in the research. The validity of this suggestion was complicated by the fact that students “know not what they know not” [8] Conducting the same semi-structured interview with students as equal stakeholders would prove fruitless as the interview’s primary aim is to extract experience from experts. The primary question for the student group was modified to: “How do undergraduate design students learn best?” This line of questioning reflected the overall research objectives while making use of the ‘expertise’ of the student learning experience.

Student participants were selected based on their active enrollment at The Ohio State University, within the Department of Design and in a course focused on design research. The methodology for answering this question was to ask 56 eligible students to respond to one journal question a week for seven weeks. Questions prompted students to respond to general and specific questions concerning design research and how they learn. A complete list of questions can be found in Figure 2. Questions were posed, distributed and collected via an established e-mail account. Student participant responses were then recorded and analyzed.

1. What experience have you had with research? Do you like it or not? Why?
2. What is your personality type (Meyer's-Briggs)? (All subjects used the same test.) Do you agree or disagree with what your profile says about you?
3. How do you learn best? Why? What is the worst learning mode for you? Why?
4. Why design? Did you have a choice between pursuing a degree in design and a degree in another discipline? What made the choice for you? Discuss your minor if you have one.
5. Think of a powerful learning experience from your recent past. What did you learn? Describe the experience of learning that lesson.
6. Think of a lesson you have learned in your design research class. Now, pretend you are a professor charged with teaching this lesson to a group of undergraduate designers. Write down your lesson plan or assignment you would use to teach your lesson to this group.
7. Identify (and describe) the most significant similarities and differences between research and design.

Figure 2. Questions asked to 'Student' stakeholder group.

## 2.2 Analysis

During the analysis phase of the research, data in the form of transcribed semi-structured interviews and student journal responses were analyzed. Dr. Liz Sanders, an internationally recognized expert in the field of design research, directed the analysis method of the qualitative semi-structured interview data collected. One of Dr. Sanders' methods of analysis consists of taking small pieces of data and grouping them to form information, which then yields knowledge concerning the given research question. This knowledge can then be further organized and shifted to gain understanding about the nature of the research question and ultimately form a framework of insights. Figure 3 describes this process and what one can expect from each phase of analysis.

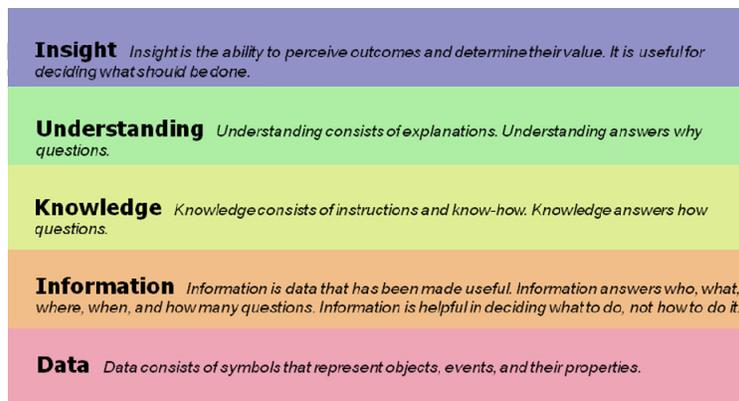


Figure 3. [11] Ackoff's Theory; 1989

Data collected from the three different professional groups of stakeholders was separated and grouped by topic to create 'maps' that drove the analysis and allowed for the communication of conclusions. The analysis process was photographed extensively for the purposes of recreating the 'maps' of the topics in a digital environment and for communicating the final presentation of the analysis of the research. Rutter describes "the communication of this data as important as its collection [9]."

The photographed data points and information clustered together were brought into a virtual 2D graphic space and turned into one digital document. The document consisted of different layers of data to allow the researchers to turn 'layers' on and off at will for the purpose of organizing the information clusters within and across groups and topics. This final step further exposed the researchers to the data set and served as the foundation for the insights gained, as indicated in the conclusion section of this paper. Johnson describes insight as more than the information on which it is based; she asserts that "Insight is understanding what others don't." She goes on to say that a coherent insight is one that can be simply explained, holds up under scrutiny and fits with other observations [3].

Analyzing the data collected from the series of questions asked of design students presented a unique challenge as the questions were both quantitative and qualitative in nature. For the quantitative questions (i.e. "What personality type are you?"; "How do you learn best?"), responses were tabulated and dropped into a spreadsheet to compare with national averages. For the more qualitative questions, student answers were analyzed with the same process and rigor as the semi-structured interviews.

### **3. Findings**

Relevant findings from the study were focused around the semi-structured interview topics. It was interesting to see where the different stakeholders seemed to agree with each other concerning the various topics surrounding design research. It was also interesting to see where there seemed to be a discrepancy between the opinions of the different stakeholders. It came as no surprise that each of the stakeholders became associated with design research through an extension of their history. This is to say that designers had a background in design, while researchers had a background in either sociology or anthropology. Educators, for the most part, had a background in design or a similar discipline, like architecture.

All participants said that they found that the practice of design research to be intrinsically valuable. One participant said "Design research serves as a catalyst to the design process and allows designers to focus their energy where it matters most." All participants said that they had used different design research methodologies in their professional practice or educational experience.

While there was no single definition that could satisfy the question of "What is design research?" for all participants, there were commonalities among the responses. The first commonality was the presence of multiple methods for understanding peoples' behaviors and perceptions. These multiple methods were then analyzed in light of each other so that one perspective could help to inform another perspective. This approach is known commonly as a 'triangulation of methods' that is purposed to reveal true insight into the research question. Other common responses to the definition of design research included the goal or purpose of design research, and then defined design research in the context of that goal or purpose. Many participants across all stakeholder groups also differentiated design research from market research by further citing the goals and purpose of design research and contrasting them to the goals of market research.

There were also dissimilarities among the responses centered on describing the purpose of design research. However, it is interesting to note that not one participant alluded to the idea of discovering an ultimate truth – which is the case for scientific research. There were overarching themes among the different answers about the

purpose of design research. These themes revealed that design research is about studying the perceptions of people with regard to their behaviors for the purpose of informing design decisions.

Patterns of answers emerged within groups of stakeholders in response to the question “How do you measure the success of design research?” The ‘Researcher’ group tended to answer the question with responses that brought focus into areas of ambiguity. The ‘Designer’ group tended to give multiple examples that focused on how design research aimed the design process in a new direction. The ‘Educator’ group tended to give answers pertaining to the success of different research methodologies having more impact than others on students’ designs.

One of the most conclusive patterns involved the question of “How is design research taught to undergraduate designers?” The clear pattern that emerged was that there was the complete lack of a pattern. Courses in design research across the U.S. – even at the same institutions – were taught differently, at different times, by different people with different backgrounds. When asked “What aspects of design research should be taught?”, the ‘Researcher’ group tended to focus on more of the methodologies that came from the social sciences (i.e. ethnography, and observation) while the ‘Designer’ group tended to focus more on a need for more rigor within the analysis and application stages of design research. Educators often commented about over-loaded curriculums, as well as a lack of available literature specifically created for design students to learn about design research.

One noticeable trend concerning the future of design research concerned generative tools. There was a general anticipation that these tools would become more common ways of leveraging the experiences, perceptions and creativity of people. This opinion seemed to be shared by nearly all participants within the study. Individual groups also expressed desires for where they would like to see growth in the future of design research. The ‘Designer’ group expressed a strong need to bridge the gap between research and the design process. The ‘Educator’ group also was interested in developing new methodologies that could use the inherent creativity of relevant stakeholders. The ‘Researcher’ group also recognized the sustainability of older, more traditional methodologies (i.e. focus groups and usability) and factored these methodologies into the future of design research, as well.

Findings related to when a course should emerge in a student’s career varied from the first day to the beginning of the fourth year. Reasons for an early introduction of design research methodologies were primarily to maximize the exposure and familiarity of using insights obtained through research in the design process. Reasons for introducing a design research course later in the student’s career were based on maturity and assumed that an older student would make a better student.

The study revealed that a single course in design research would not be sufficient to provide a working knowledge of relevant design research methodologies. Instead, nearly all participants suggested that design research methodologies should be incorporated into design curriculums to varying degrees. This incorporated research approach should be largely experiential, meaning that the students should be conducting and utilizing research within their design curriculum. One participant from the ‘Designer’ group summed up this concept with the statement of “(Design research) should be taught as design is taught, that is, when a student is introduced to

the conceptualization phase of design, generative research tools can be introduced at the same time to assist the creativity within the designer; the same goes for the prototyping phase and introducing evaluative research methodologies and finally introducing experiential research once a resolution has been found.”

Declarative knowledge concerning the history and origins of different research methodologies were agreed upon by most participants that they should be relegated to a course expressly focused on the topic of design research. Other themes such as rigorous analysis and documentation of data seemed to fit more into a course dedicated to design research. While opinions did differ on when such a course should be offered to undergraduate designers, the most consistent answer suggested that the course should be offered in the second half of the second year, or the first half of the third year. (This study assumed a four year, semester based program.) These findings are illustrated in Figure 4.

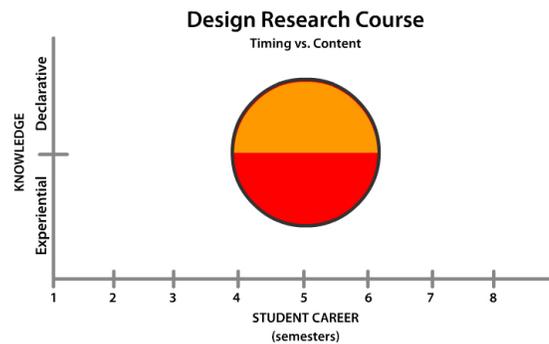


Figure 4. Design Research Course placement and content within an undergraduate design program.

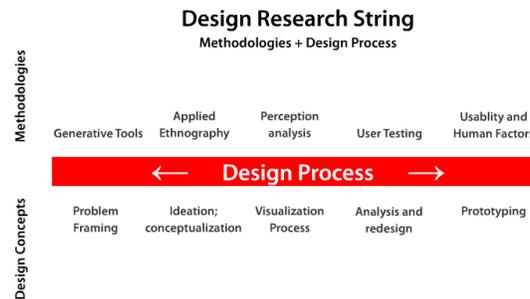


Figure 5. Opportunities for introducing different design research methodologies could be introduced through larger design concepts throughout a student’s career.

The approach of using the entire student’s career to introduce and utilize different research methodologies throughout the design process seemed to be reflective of practice and was therefore the most relevant approach to introducing these techniques to students. The use of a course to introduce and emphasize the rigor required for the analysis, documentation and communication within the research process should also coincide and bolster the incorporated research theme that already exists within the design programs’ currOf the different types of research, generative research and co-creation techniques showed the most promise for growth and future development. These methodologies include toolkits, Velcro molding, virtual toolkits and other participatory design techniques that allow non-designers to express their thoughts and opinions. Evaluative research methodologies such as

usability, ergonomics and ethnography are all established research techniques and will continue to provide valuable insights to researchers and designers alike.

Noteworthy findings from analyzing the student journal questions emerged after assigning high level patterns to all of the responses. There were multiple common themes. For instance, the vast majority of students did not seem to understand the difference between primary and secondary research (i.e. primary research is generated by a researcher within your study versus secondary research which is generated by another person outside of your study). Upon explanation of this difference, nearly all of the students said they understood and were able to apply that new knowledge quickly and appropriately.

When asked to self-report on their best learning method, the majority of the students (two-thirds of them) expressed a strong tendency to learn best in a learn-as-you-go, or kinetics, learning method. Less than three percent expressed that any type of reading served as their preferred learning mode.

While motivations for pursuing a degree in design were varied, common themes among students' responses included professional challenge, service to people and excitement that comes with creating something new.

Perhaps the most profound responses resulted from asking the students to describe and reflect on a powerful learning experience. Responses appeared varied and sporadic at first glance, but common themes showed up at high levels; these themes included Context, Culture and Motivation. and were apparent in nearly every response.

An unexpected outcome of the research came from one of the quantitative questions that asked the students to take a Meyers-Briggs Type Indicator (MBTI) test and to reflect on what the test said about them. The answers to this assignment revealed that the cross-section of sampled design students was grossly disproportionate to national averages. For example, the personality types ENFJ and INFJ are reflected nationally at 2.4 percent and 1.5 percent of the population respectively, representing just under four percent of the U.S. population. In this survey of design students, the same two personality types comprised nearly half of the sample set. Table 1 shows the difference between national averages and this study. To further differentiate the populations, the top three personality types in each table have been highlighted in yellow.

<u>ISTJ</u>	<u>ISTP</u>	<u>ESTP</u>	<u>ESTJ</u>	<u>ISTJ</u>	<u>ISTP</u>	<u>ESTP</u>	<u>ESTJ</u>
11.6%	5.4%	4.3%	8.7%	3.8%	0%	0%	0%
<u>ISFJ</u>	<u>ISFP</u>	<u>ESFP</u>	<u>ESFJ</u>	<u>ISFJ</u>	<u>ISFP</u>	<u>ESFP</u>	<u>ESFJ</u>
13.8%	8.8%	8.5%	12.3%	7.7%	0%	0%	3.8%
<u>INFJ</u>	<u>INFP</u>	<u>ENFP</u>	<u>ENFJ</u>	<u>INFJ</u>	<u>INFP</u>	<u>ENFP</u>	<u>ENFJ</u>
1.5%	4.3%	8.1%	2.4%	11.5%	5.7%	1.9%	32.7%
<u>INTJ</u>	<u>INTP</u>	<u>ENTP</u>	<u>ENTJ</u>	<u>INTJ</u>	<u>INTP</u>	<u>ENTP</u>	<u>ENTJ</u>
2.1%	3.3%	3.2%	1.8%	9.6%	3.8%	5.7%	13.5%
The 16 personality types National Average				The 16 personality types Design Student Sample Set			

Table 1. MBTI personality type U.S. population average vs. design student sample study.

While the number of students surveyed is still statistically insignificant, the outcomes and observed patterns from this research do bring to light areas for further investigation. If the perceived trend is, in fact, found to be valid, bigger questions could be explored like “What are the best practices for teaching these designer-driven personality types within the context of a design program?”

#### **4. Conclusions**

Trends that emerged from this research suggest several patterns which were triangulated with the student surveys and literature review when appropriate. The prominent findings are as follows:

- Currently, design research is taught inconsistently, even from year to year at the same institutions.
- Best practices for disseminating design research should be established and executed within a proper culture and context.
  - ‘Culture’ implies that the majority of faculty within a given design program believes in and includes design research elements within their instruction where appropriate.
  - ‘Context’ implies that research findings become realized within the design process and allow students to make personal conclusions as to the value of research.
- Design research should manifest itself in both a course that is focused on the topic as well as a theme of research incorporated into all courses. This theme should include different research methodologies throughout the design process (ideation through production) during the students’ college careers.
- Specifically, the theoretical design research course should be split equally into declarative knowledge (i.e. the history and evolution behind different methodologies) and experiential knowledge (i.e. practicing design research from research proposal through application). Such a course would coincide well with a design studio. The course should be taught early (i.e. in the first half of the students’ education) and lessons gleaned from the course should resurface to appropriate extents in each subsequent studio course.
- The future of design research lies in creating new methodologies to solicit unbiased responses from people for the purposes of understanding their perceptions, perspective and behaviors. Research methodologies focused on providing insight into the ideation phase of design show the most potential for growth in the coming years.

Designers have long been identified as having tremendous impact on society and therefore have the capacity to initiate social and cultural change through design. Papanek and Whiteley both write their books (*Design for the Real World*, 1985; *Design for Society*, 1994) in an attempt to change the way designers make decisions with the ultimate goal of changing the world through the practice of responsible design. The aim of this research is to answer the question “What do aspiring designers need to know about design research so that they can make a significant contribution to their field?” for the multifaceted purpose of improving the business, practice and calling of the design profession. The question is geared toward creating a stronger connection between designers and the people whom they serve. The relevance of the research aligns with its potential and desired result – that design research will empower designers to have direct and meaningful impact on the world, contributing significantly to the way people live and improving society as a whole.

The insights gained through this study are an essential and required step towards these ultimate and overarching goals. By understanding the current state of design research, how it is applied in the profession and how it has the potential to serve as a compass within the design process, design educators can elevate the base lexicon and working knowledge of design research among current and future generations of designers, thereby elevating the stage of the designed products of the future.

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