

# Design Research: The Application in Professional Design Practice and Teaching in Design Education

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## Abstract

Design research has become important in both design education and design practice. For design education, its role is in the identification of problems as well as the understanding of user behavior; for design practice, design research is used to identify new markets and assist in the development of novel products. The latter is referred to as ‘research through design’ and is used principally for the creation of artifacts rather than the building of theory (Findeli, A., Frayling, C.). Although there are many articles and publications about design research, little empirical data are available. The aim of this paper is to better understand the benefits of the application and teaching of design research in two sectors, practice and education. This paper presents the connection between the teaching of design research and its application in practice. Interviews were conducted to examine specific differences between the two groups. Design practitioners and faculty members were interviewed for this study.

**Keywords:** *Design Research, Design Process, Problem solving*

## 1 Introduction

Design is considered a problem-solving process. As such, it most often occurs by the identification of a problem, the brainstorming and exploration of ideas, and terminating in the testing of the ideas to reach an effective solution (Ulrich, 2011). Bruce Archer defined design research as a ‘systematic inquiry whose goal is knowledge of, or in, the embodiment of configuration, composition, structure, purpose, value, and meaning in man-made things and systems’ (Archer, 1995). This definition exemplifies how design research is a systematic and analytical process. However, the process of design is still imbued with a certain mystery and often emphasizes the role of ‘intuition’ and ‘creativity,’ which is widely regarded the essential element in design thinking (Cross, 2001). Dorst also agrees with Cross that design is closely related to creativity, which leads to the realization of new ideas as well as improved problem solving (Dorst, 2003).

However, design research is also an analytical process. One view of design is that through this scientific and systematic process, knowledge is applicable in practical tasks (Willem, R. A., 1990) that can be beneficial to companies who must solve practical problems. On the other hand, Schön proposed design as ‘an epistemology of practice implicit in the artistic, intuitive process,’ suggesting that design problems are not well-formed (1992). His viewpoint is rather similar to the view that creativity plays an important contribution to solving design problems. This is consistent with the notion that creativity is a mysterious inspiration that occurs in a sudden moment (Isaken & Merckock, 1993).

Today, there are an increasing number of firms that use design research that have proven to be effective in revealing insights and solutions to design problems. A design company, IDEO, has been leading the market for the past decade proving that conventional research methods which focus on economic values tend to block revolutionary ideas. Similarly, there is an increasing number of universities that teach design research. However, there is a disconnect of understanding design research between the two sectors. In this paper, researcher hypothesized that research methods between education and practice is different. Furthermore, explored common research methods that were taught and applied across two sectors.

## 2 Design Research in Education

Generally, there is less of an output or result that can quantify or explicitly identify the value(s) of design research in design education. This study explores how design research is taught across top research based schools in the US.

Specifically, we ask: What is the purpose of design research, and how is it taught in your institute? And how does learning design research affect problem solving abilities for students? As Buchanan states, to solve a particular individual design problem, it is essential to gather whatever information or understanding may be relevant in its solution (2001). In principle, design education teaches students how to find such information and how to organize those aspects that are essential in the design process. By looking at the methods that are taught in design education as well as those applied in design practices, we can begin to identify how the design research affects the design process. This allows us to understand the consequences of teaching and learning design research more clearly. This paper builds from the idea that evidence should be supported as a means to exemplify the importance of teaching design research in design education.

We hope that this research will provide empirical evidence of the value of design research at each stage of the design process and to encourage the use of design research tools for any new product, service or system, particularly in the early phase of the design process.

## 3 Literature and Theory

Herbert Simon, economist and Nobel laureate, stated that to design is to “*devise courses of action aimed at changing existing situations into preferred ones*” (1982). For its part, the International Council of Societies of Industrial Design (ICSID) defines design “*...as a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange.*” (<http://www.icsid.org/about/about/articles31>). The Industrial Designers Society of America (IDSA) defines industrial design as the “*professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer.*” (<http://www.idsa.org/what-is-industrial-design>).

In sum, industrial design can be defined as the production of a physical solution that optimizes the function, value, and the appearance of a product or system for the benefit of the

user. As a result, it is not unusual to perceive industrial design as a domain consisting of knowledge from many areas such as marketing and engineering in order to deliver a working tangible solution. Moreover, industrial design has even adopted and adapted research techniques such as market research from marketing and included human factors discipline (Arnold, 2005). Since the 1970s, design research has flourished (Sanders, 2008), but as research on industrial design as an element of innovation, it is still relatively immature. (Candi & Gemser, 2010).

When a certain task is given to an industrial designer, it is not unusual to expect that there be an ability to understand various problems that occur in areas that may not necessarily relate to industrial design. For instance, when asked to design a car, designers would have to understand the basic needs of the future driver. But there would also be a need to have some knowledge about mechanical engineering, aero dynamics, and other related technologies. Understandably, the designer must be able to see the so-called bigger picture. A comprehensive knowledge in several background areas will allow designers to understand better problems that arise in these different areas. In contrast, a solid foundation of design knowledge anchored in broad research traditions gives each industrial design practitioner access to the cumulative results of many other minds and the overall experience of a far larger field (Friedman, 2003). Thus, research methods, which can add time to a design project, may not be always been seen as suitable for design practice. Design research is a holistic process that tries to uncover the deeper meaning of people's psychological and physical behavior, and there are many new methods emerging in the industry that try to uncover people's decision-making in product usage. However, developing a comprehensive background through practice takes many years.

It was not until the late 1970s that company managers began to realize that, apart from marketing, the design of products and services had a significant impact on sales (Sanders, 2008). Suddenly, there was an influx of management theory covering the subject of design, how design should be managed, how design could be used as a strategic tool, how design could be part of an overall company identity, and so on. Since then, there has been a strong emphasis upon the rationalization of design activity. Design was no longer a form of applied art but a structured process with logical stages, and needed be managed as such (Design Council, 2007; Van Koten, 2009).

Design research is often used because of three distinct advantages that it brings to industrial design practice. These are:

- a) A reduction of market risk, which can reduce the cost of doing business;
- b) An understanding of the potential user, which can foster future markets (Adams, 2005); and
- c) Getting the design right by exhaustively investigating the product's functional requirements.

Both design practice and design education make use of design research. However, design research is used differently across these contexts. In design practice, design research is a way of increasing market share. In design education, design research enhances knowledge and helps students understand the deeper meaning of users. In other words, design research in design practice is geared to solving immediate problems. This maybe because the "*Design research field emerged from practitioners developing ways of working to help them cope with the problems they faced.*" (Dorst, 2008).

However, there is another viewpoint of how design research should be approached. Colins states "*Design research is not aimed simply at refining practice. It should also address theoretical questions and issues if it is to be effective.*" (2004). Colins viewpoint addresses what design education is aiming to do. Irrespective of how design research is defined or how it is applied in these two different sectors, design research is actively used. Thus, the use of design

research should not be limited for immediate outcomes but also able to address long term applicable knowledge.

Lastly, Almquist states the various ways design research is defined: *“Design research has no single definition. It is an interdisciplinary form of inquiry categorized in multiple ways, including: research with a focus on theory, practice, and/or production, as design epistemology, design praxiology, and design phenomenology, and humanities-based design studies”* (2010).

This paper focuses on the application of design research in order to analyze the benefits of its use. The research investigated two specific groups for the application of design research: design practitioners in professional practice and faculty members in design education. Interviews were conducted to examine specific differences between the two groups.

#### **4 Methods and Data Collection**

Semi-structured interviews were conducted to gather the opinions and experiences from practitioners and educators. Jones states that *‘in order to understand other persons’ constructions of reality, we would do well to ask them...in a way that they can tell us in their terms’* (1985). It is also useful and as Punch puts it as *‘good way of accessing people’s perceptions, meaning, definitions of situations and constructions of reality’* (1998).

A total of eight interviews were conducted in both aforementioned groups. For design education, faculty members from top design schools in the US. were recruited. The schools ranged from research-based schools and art-based schools. The design school rankings were based on the Design Intelligence report from 2013 and 2014. The faculty members were full time assistant and associate professors who either had experience teaching design research or who are currently teaching design research. The interviews took place via Skype or phone for approximately 1 hour to 1 hour and a half.

A similar process was used to interview design professionals. The design professionals ranged from designers working in mid-sized design consultancies to those employed by major IT companies in the US. The experience of professionals ranged from three years to 20 years or more. The education background of the interviewees was mostly from design, or with some level of design education. A few had backgrounds in anthropology psychology and communication.

#### **5 Result**

The hypothesis was that research methods and process is different and various between design education and practice. Specifically, in the practice sector, the predicted outcome was that design research methods will differ between design consultancies and IT companies. In the education sector, teaching research methods findings would vary between research-based universities and art-based colleges. However, there were some common ground between design practices and design education in which that all taught and applied qualitative methods in design education.

In practices, the success of design research was based on the market sales, whereas the failure of design research was effected on several factors both internal and external. Internal factors were decisions made by people outside design teams, or when design research was used for strengthening the hypothesis, or design ideas. External factors were decisions made by clients organizations that did not favor the result from the design research team. Some other factors were launching products that were either too early or too late for the market.

Design consultancies chose research methods based on time, budget and research question. Common research methods were observation, interview and focus groups in real life settings. In IT companies, design research is commonly understood as user experience or human factor

research. Research methods are applied depending on four areas; updating existing products, launching innovative products, hardware and software. The most critical information for all four areas are capturing and understanding human behavior by observing physical and emotional conditions. These data are shared across multiple teams and accumulated throughout.

In education, interview, questionnaire and observations were the most common research methods taught. To give structure and boundary for observation, ethnographic observation skills such as AEIOU (Actors, environments, interactions, objects and users) or A4 (Atmosphere, actors, activities, artifacts) (Rothstein, P. 2003) were used to identify the context. Research based universities teach research methods as an independent course both in undergraduate and graduate level. Some of the research based universities offer upto three design research courses in the graduate level. On the other hand, art based colleges teach design research to enhance the traditional design education such as form, function and color studies.

**Table 1: Research methods preference between design education and design practice**

	Design Education		Design Practice	
Definition of Design Research	Research University	Art-based Colledge	Design Consultancy	IT company
	To discover user behavior and collect evidence to support design and verify design solution	N/A	Commonly used as user research, also referred as research or market research	Human factors, user experience research
Importance of Design Research	Very important for Master degree or higher education important for undergraduate but not as much as graduate level	Important but design research is taught to support traditional education of Form Color. define functional requirement study	Mostly used	Very important
Research Methods	Observations Interviews Surveys Encourages to use various methods	Task analysis Mind maps	Depends on research question and client  Time and budget	Depends on question but physical, emotional, social understandings of human behavior
Qualifications	Design research enhances creativity and problem solving		Prefered psychology and antropology backgrounds	

Most design consultancies and design education prefer qualitative research. Qualitative research methods can be applicable to understand the meaning and experiences that underlines human behaviour. This is a context where exploring a problem when little is known, and need the ‘inside’ perspective, or a sensible topic that requires emotional depth, or rich narrative data

is needed and numbers can not deliver is meaning. Furthermore, if a researcher wants to capture ‘live experience’ from the perspective of those who live and create meaning from it, the inside point of view can be captured by observing or interviewing human subjects (Padgett, 2008). However, the methodological choices between quantitative and qualitative should be decided based on the research question. Specifically, cases in the evaluation design process, when problems have boundaries, design practices use quantitative methods. In this case, numbers in statistical data can provide sound and credible support.

Design researchers that have psychology, anthropology, marketing background advise design students that lack quantitative research methods. Moreover, IT companies traditionally favor quantitative methods prefer design researchers who are capable in both qualitative and quantitative methods. Statistical analysis were one of the qualifications that were preferred, but not taught in design education.

**Table 2. Applications of research methods between design consultancy and IT company**

	Design Practice	
	Consultancy	IT company
Innovative product	Qualitative	Qualitative/Quantitative
Existing product	Qualitative	Quantitative
software	Qualitative, some quantitative	Qualitative, Quantitative
hardware	Qualitative	Qualitative, Quantitative
Failure of design research	Decision making in organization When design research was used merly to support hypothesis	When products are launched too early or too late

**Table 3. Teachings of research method between research-based university and art-based college**

	Design Education	
	Research-based University	Art-based College
Undergraduate	Introduce methods that can be address the understandings of the user. SAY/DO/MAKE model  Research methods are taught so students can use appropriate methods across in each design processes. E.g) Exploratory, generative and evaluative research phase.	Inbedded as studio course  Design research is used in the exploratory phase to support design factors such as form, function. But main object is to make tangible, intangible artifacts
Graduate	Independent course, work with community based clients	Inbedded as a studio course or depends on students projects
Importance	Very important	Important

## 7 Conclusion

Although the purpose of design education and design practice differ, sharing design research applications, methods and process can enlighten both sectors. While it is understandable that design practice is proprietary, the contribution to revealing what design researchers challenge and solve can meaningfully build design as a unique domain. Design is no longer a domain where a lone genius creates biographical design (Krippendorff, 1995). Designers are faced with problems that require interdisciplinary knowledge where teamwork,

collaboration is needed. The creative ideas can be generated with affectively communicating. Design research can articulate knowledge that resides in both sectors in different form. Challenges that design practice face today can be helped by training sufficient future design researchers in education. However, the lack of communication and disconnect between two sectors are not being addressed at present. We hope feasible discussion can be addressed between two sectors that can enhance the effectiveness of design research.

The limitation of this paper is the small the small sample size. Thus, this study could be considered a pilot study for future studies in design research between design education and practice.

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