INTERDISCIPLINARITY IN DESIGN EDUCATION
BENEFITS AND CHALLENGES

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INTRODUCTION

This paper examines benefits and challenges of interdisciplinary collaboration and it's role in university pedagogy. A variety of social, technological, and economic factors have been rapidly changing our world, and this has reshaped processes of new product development. Contemporary professional design practice is highly collaborative, it occurs across continents, and requires advanced knowledge of multiple disciplines. And if we are to train design students to be able to operate successfully in the profession, we need to give them the tools that they can use to respond to these shifting perspectives. Design education needs to prepare designers to be able to function fluently in interdisciplinary teams to tackle the challenges they will face in the future. In addition to providing them the knowledge and skills needed to operate as effective designers, we also need to train them to be able to work in cross-functional teams.

This situation however, is not unique to design. A variety of disciplines, including engineering, business, and the sciences are recognizing the value of interdisciplinarity. A significant amount of research has been emerging over the past decade on interdisciplinarity (Frodeman 2014, Repko 2011, Moran 2010, Weingart and Stehr 2010, Klein 1990), and this paper outlines some of the scholarship, especially as it relates to design education. Interdisciplinarity, multidisciplinarity and transdisciplinarity, though similar sounding and related terms, have distinct meanings, each important in different ways, and each relevant to design.

Design education, in most institutions, is structured around two main ideas—building knowledge in a variety of related subjects and the development of a range of visual and tactile representation skills. Components of knowledge include the history, theory and methodology of design, and the skills include sketching, rendering, model making, computer visualization, etc. These educational goals are typically achieved through lecture courses and project-based learning studios.

In addition, undergraduate beginning design students are often required to take two or more semesters of core studio-based courses with students from several art and design majors where they learn general design principles and processes. The pedagogical approach that is shared in this paper provides design majors with four semesters of discipline-specific design studios as well as design support courses that provide a firm grounding in discipline-specific design theory and practice before introducing them to interdisciplinary collaboration. It is critical to train students well in their own disciplines while requiring them to bring their disciplinary expertise together with students from other disciplines.

FUNDAMENTALS OF INTERDISCIPLINARITY

In broad terms, design is typically defined as the creative process of developing new goods and services (products, graphics, interior spaces, etc.) for the benefit of consumers and manufacturers. In addition to the creation of new goods, though, design can assist in the process of innovation because it represents a unique form of problem solving. "Design thinking" (Brown 2008, Buchanan 1992, Clark and Smith 2008), as this is often referred to, can help generate creative solutions to complex problems that involve multiple stakeholders. And one of the defining characteristics of design thinking is the ability to work in cross-functional teams. The challenges that design has to tackle are referred to by scholars like Rittel (1973) as "wicked problems". These are problems that are very difficult to formulate, they do not have right or wrong solutions, they do not have a logical end and they are often symptoms of other problems. Interdisciplinary, collaborative team work shows promise in taming such wicked problems because it advocates taking a systems view which can lead to more holistic solutions.

Cross-functional collaboration can take several forms, and each one of them represents different forms of engagements as well as levels of integration among disciplines. Multidisciplinarity, transdisciplinarity, and interdisciplinarity can be referred to as forms of knowing, acting, and thinking (Boradkar 2010). As renowned scholar on interdisciplinarity Julie Klein explains, these three terms “constitute a core vocabulary for understanding both the genus of *interdisciplinarity* and individual species within the general classification” (2009). Multidisciplinarity merely signifies the coming together of several disciplines to tackle a specific problem but transdisciplinarity refers to a deeper integration among disciplines. For instance, a multidisciplinary research project may be divided into smaller segments and distributed to various members of a team to tackle on their own. At the end, the results are combined into a comprehensive solution or report. However, in transdisciplinary projects, the problem is too complex to be apportioned and the disciplinary experts have to work together. In these situations, the integration among disciplines is intense, and the output of one discipline actively shapes and changes the output of another. Finally, interdisciplinarity serves as an umbrella term for transdisciplinary and multidisciplinary approaches. Of these three approaches, transdisciplinarity shows the most promise to be able to lead to truly innovative, integrated and transformative solutions to complex problems.

Jantsch (1972) too defines these terms similarly by outlining the nature of relationships among the participating disciplines. Multidisciplinarity is the lack of real co-operation between the disciplines. The problem at hand tends to be subdivided and different disciplines apply their expertise to it. He points out, “there is no understanding built amongst disciplines and disciplinary methods are never questioned. So, there may be a short term solution, but we do not learn anything from the experience”. Jantsch defines transdisciplinarity as, “the co-ordination of all disciplines and interdisciplines in the education/innovation system on the basis of generalized axiomatics (introduced from the purposive level down) and an emerging epistemological pattern”. In other words, this form of collaboration has the potential of generating new knowledge.

Max-Neef (2005) identifies several levels and actions involved in transdisciplinary projects. He refers to the bottom level “what exists” and that is empirical research, the second level is “what we are capable of doing”, which is purposive or pragmatic, the third level is “what we want to do?” and that is normative actions, and the fourth level or top level is “what we must do?” which includes values and ethics. Jantsch (1972) further explains that the notion of interdisciplinarity is a group of related disciplines defined by or from a higher level with a sense of purpose that includes two levels and multiple goals. Ken Friedman (2002) discusses conventional meanings of ‘design’ especially in post-industrial era, and generating an integrative nature of the discipline, where design professionals are working with far wider issues and often cross paths with multiple disciplines. He presents a ‘four domain’ model as taxonomy, composed of learning and leading, the human world, the artifact, and the environment. He suggests that such systematic thinking and domains provide a multidisciplinary perspective and eventually help designers succeed in a collaborative world. As scales of projects expand, boundaries between artifact, structure and process start to diminish, and demands at every level start increasing. Meeting such enormous challenges can be an extraordinary task for interdisciplinary collaborations where design is at the center. Friedman (2002) signifies where design comes from and how it should be altered to make it more suitable to today’s collaborative and interdisciplinary professional settings.

EXAMPLES OF INTERDISCIPLINARY COLLABORATION IN DESIGN EDUCATION

The following pages offer some examples of interdisciplinary collaborations conducted at The Design School at Arizona State University. In each case, there is a unique make up of teams, the length of collaboration varies, and the nature of the projects undertaken is different.

CLUSTER PROJECT

The Cluster Project takes place at the beginning of the spring semester each year. Recent topics have included “Water”, “Energy”, “Hot Future”, and “The Next 100 Years”. This week long charrette challenges multidisciplinary teams of third year undergraduate students from all design disciplines in the school to imagine solutions or opportunities around a particular topic. Proposals resulting from the charrette may include designs for communities, infrastructures, products and systems, and other economies or mechanisms for the built environment. Roughly 40 teams of approximately 7 students each are formed in advance of the start of the charrette. One faculty member is assigned to each team, and teams are encouraged to consult with other faculty and students during the week. Faculty members provide energy, focus, and management such as encouraging cooperation and responding to personal conflicts in the teams.

Proposals are presented in both poster and video form and juries evaluate them based on the following: A clear definition and communication of the proposal; reasonable feasibility of the proposal; originality (including new combinations of existing systems and ideas); visual quality and craft of the proposal; and demonstration of integrated disciplinary collaboration.

Figure 1. Large shared studio space offers many opportunities for collaboration.

INNOVATIONSPACE

InnovationSpace is a joint venture among the disciplines of Industrial Design, Visual Communication Design, Business and Engineering. The program is built on the premise that a nontraditional, transdisciplinary education provides the right kind of expertise and variation in thinking to handle the complex challenges of new product development. The effort requires teams of students from business, engineering, industrial design and visual communication design to work in educational settings where the boundaries are fluid and the knowledge is integrated. Here, they learn how to create sustainable product concepts that have anticipated—and met—the rigors of real-world challenges on multiple fronts. Students in InnovationSpace operate as teams in which traditional disciplinary roles often are mixed and matched.

The process of new product development that students follow in InnovationSpace is based on a model of innovation called Integrated Innovation (Boradkar and Duening 2009), which guides them through four specific questions:

- What is valuable to the user?
- What is possible through engineering?
- What is desirable to the corporation?
- What is good for society and the environment?

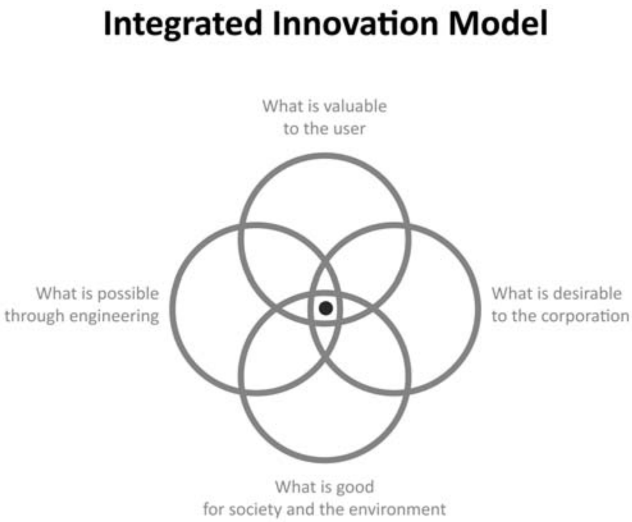

Figure 2. Integrated Innovation

It is critical to have interdisciplinary teams in order to address these four questions regarding user needs, engineering requirements, business concerns and issues of social and environmental sustainability.

In the early stages during the fuzzy front end of new product development, all students are required to drop their disciplinary affiliations as they conduct research in a designated problem area. In some cases, they do observations and interviews as a team. At other times, the students may work in pairs or individually to gather more detailed data in a specific area.

Figure 3. Student teams in InnovationSpace conducting research on a project dealing with design for emergency rescue workers.

As the project proceeds, the students dip into their disciplinary toolboxes to analyze their research into user needs, the market, potential technologies, and social and environmental issues. For example, the business students will perform SWOT (Strengths Weaknesses Opportunities and Threats) analyses. Engineers carry out technology benchmarking. As the information is compiled into one report, all students are required to understand the research and analysis tools used by their teammates. As a result, design students might use market mapping to critique products, while engineers help develop a list of the hierarchy of user needs. Such transdisciplinary learning creates a diversity that is tremendously beneficial to the class. Students and faculty contribute new resources, theoretical approaches, specialized methodologies and unique tools that advance the knowledge of the entire group. In the end, students understand the valuable lesson that other areas of expertise can improve the quality, depth and impact of their own work.

COLAB

The Design Co-Lab is a 10-day-long competition that takes place at the beginning of the fall semester with all 4th (final) year undergraduate students in school. Students from Architecture, Industrial Design, Interior Design, Landscape Architecture, and Visual Communication Design are organized into multidisciplinary teams mentored by faculty. This project asks students who plan to be designers of communities, buildings, spaces, products, and interactive systems to create design proposals, objects, places, spaces or experiences based on a specific topic. Guest speakers and additional mentors from outside the school help guide the teams as they tackle complex issues. A website serves as an information dissemination site as well as offers opportunities for students to connect with the administration team, outside mentors, and other resources.

Each team begins with a directed research and analysis activity, examining and documenting its own direct and indirect contact with the topic. For example, with a topic of “water” student teams might document their own water use in all forms for a 24-hour period of time. As personal and shared experiences are documented, students consider how they might re-imagine their behavior and relationship to topic. Based on their research and analysis each team is asked to design an experience, which encourages others to re-imagine their thinking and behavior about the topic. The projects can range in scale from that of infrastructure, to site and building design, to individual product or visual communication system design. Regardless of the scale, all aspects of the system lead to an examination of design strategies that enhance the experience of potential users. Each team produces a poster and a 5-minute “stand-alone” presentation (video, interactive pdf, Keynote, Powerpoint, Prezi, website, etc.) expanding on the information offered on the poster**.**

Figure 4. Professional mentors and reviewers meet with students throughout the project.

Each of these interdisciplinary, collaborative projects, have presented a variety of benefits as well as challenges from an educational perspective. Observing student teams working together in figuring out solutions, making tradeoffs and managing the outcomes of the project is rewarding. Such opportunities help build independence and leadership skills and can be extremely beneficial when students graduate and start working in the industry. Transdisciplinary projects serve as a microcosm of the work environment, and can therefore be beneficial from an employment perspective. However, managing cross-functional teams is by no means easy for faculty. It requires a broad as well as deep understanding of the content in a variety of disciplines. Very often, cross-functional groups require regular team-building exercises so that they may function seamlessly and without friction.

CONCLUSION

As the world grows to be more and more connected, complexities of design problems are expected to multiply significantly. Designers will be required to be familiar working in multidisciplinary and transdisciplinary teams and the dynamics of their working structures. It is equally significant to recognize separating factors among different types of disciplinarities and why they can succeed under specific circumstances. Several issues arise when disciplines collide and these problems should be tamed down through strategic planning, organization and maintenance. The discipline of design is living through phenomenal transformations and changing design pedagogy is one of the most foundational approaches by which we can create better opportunities and chances of success for future designers.

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