

## **Connecting Design Industry and Education in the Global Context: Its Dynamism and Efficacy**

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### **I. Introduction**

The world has been dramatically changing. The production facilities of Western European companies have been moved to Asia, East Europe, and Latin America, forcing a globally connected production and distribution system. Internet and network technologies now serve as the most powerful symbol of how the world of diverse cultures may grow and integrate harmoniously in an information sharing environment. These changes have driven a new socioeconomic system that realizes the unrestricted and connected creation, distribution, and application of information and knowledge. In this knowledge era, a departure from a more traditional discipline-oriented approach is required to create an interdisciplinary and holistic perspective that breaks down the boundaries between disciplines, industries, and countries. An interdisciplinary approach becomes a thread connecting the world.

In design practice, an interdisciplinary approach is considered a significantly important strategy and is integrated into the design research organization or system. For example, theme-oriented research centers are built around a unifying focus and incorporate an interdisciplinary environment including appropriate partnerships with academia and industry. From small to large-scale, interdisciplinary research is widely used to develop a greater understanding of a problem that is too complex to be dealt with using the knowledge of one discipline. One of the well-known interdisciplinary approaches is to mix and blur different disciplines including design, engineering, marketing and psychology.

In design education, interdisciplinary research and learning have been recognized as a way to challenge and reform education. The process of integrating interdisciplinary learning into educational practice is clearly mirrored in the field of design practice that encourages everyday thinking within authentic tasks in an attempt to situate learning. In order to achieve interdisciplinary design learning, the question should address not only ideas, but also the way ideas are structured in the curriculum: How can the design discipline extend the intellectual terrains and how does the design curriculum deal with such complex problems? What are available methods and processes in interdisciplinary and collaborative design work? What are the different types and levels of collaborative activity? How does the design concept and development process evolve in the context of global product development? What kinds of activities are associated with it?

The purposes of this study are (1) to develop new design curriculum for integrating multi-level interdisciplinary learning, which explore disciplinary and professional relations, (2) to identify and manage an effective product development process with diverse teams in geographically different locations, (3) to analyze the effectiveness of interdisciplinary learning, and (4) find appropriate strategies that break instructional and social barriers.

### **II. Interdisciplinary Learning in Design Education**

Interdisciplinary is defined as "a knowledge view and curriculum approach that consciously applies methodology and language from more than one discipline to examine a central theme, topic, issue, problem, or work" (Jacobs, 1989). In curriculum development, interdisciplinary learning may be used as a method or a strategic link to bring students a new awareness of the meaningful connections that exist among the disciplines. Therefore, interdisciplinary learning covers content, skills, critical thinking processes, and assessment through the exploration of connected disciplines.

As a highly accepted pedagogy, interdisciplinary learning can be categorized into three different approaches in design education based on Julie T. Klein's (1990) distinctions: multi-disciplinary, cross-disciplinary, and interdisciplinary approaches. First, multidisciplinary problem solving between design-related disciplines is the most popular pedagogy, such as graphic and industrial design. Using different knowledge and skills to solve one design problem provides more creative, appropriate and refined outcomes than a single discipline. Secondly, integrated design research and problem solving across multiple disciplines creates a common foundation for conceptualization, experimentation, and execution of new design thinking towards a deeper learning. More innovative ideas may be developed in this cross-disciplinary approach such as mechanical engineering and industrial design. Figure 1 illustrates the distinctions between multi- and cross-disciplinary partnerships. Third, interdisciplinary research that integrates industry and education enables partnership building as well as the facilitation of interdisciplinary approaches to questions that require multiple areas of expertise. By identifying the degrees of interactivity such as linear, border and cross-boundary, Klein (1990) discloses the ultimate degree of coordination is a transdisciplinary system that "facilitates the mutual enhancement of epistemologies" (p. 66). The degrees and levels of interdisciplinarity integrated in this study are described in Figure 2, which covers cross-boundary and interdisciplinary level of interactivity.

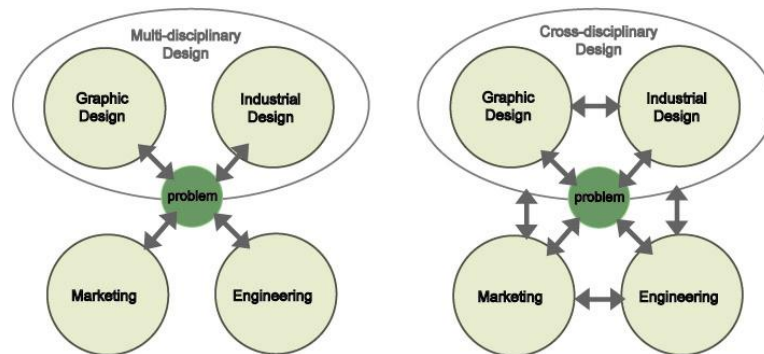


Figure 1. Distinctions between multidisciplinary and cross-disciplinary interactivity.

A good design curriculum becomes a blueprint for the student's learning in real time within the real-world context. The issue of real learning is a matter of motivation, participation, and organization of cognition and behavior. Therefore, it is our premise for this study that connecting industry and design education encourages students to produce real and authentic learning experiences that go beyond students' expectations and motivates them to develop interdisciplinary attitudes. Situating students in interactive and interdisciplinary environments allows them to construct their own knowledge. It offers the promise of realistic and motivated learning matched to the needs, desires, and learning styles of individual students. To build an interdisciplinary design curriculum, the following fundamental elements are discussed and developed in the planning phase.

- Design problem: the fundamental ground for interaction
- Degree of interactivity: select interactivity (multidisciplinary, cross-boundary, interdisciplinary, and transdisciplinary) for addressing broad issues and methods
- Objectives and relations between disciplines and professions: learning objectives and design criteria including qualitative and quantitative measurement of outcomes are specified in course syllabus
- Teamwork and communication management: schedule for continual feedback and physical/virtual communication methods planned before the project.

For the construction of interdisciplinary study, a 'design problem' provides the fundamental ground for interaction, and 'teamwork' becomes essential. Accomplishing a range of 'objectives' to address broad issues, explore disciplinary and professional relations, and find solutions that are beyond the scope of any one discipline should be understood clearly by all participants and considered when evaluating the learning outcomes.

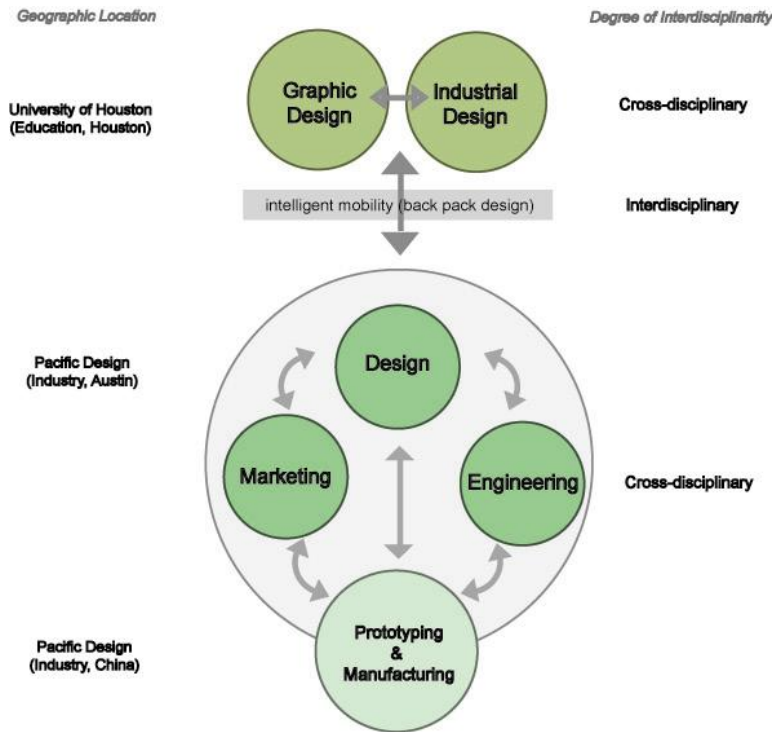


Figure 2. Multilevel interdisciplinarity designed for the case study.

### III. Case Study: Design and Implementation of an Interdisciplinary Design Project

#### 3.1. Design Initiatives

In order to address interdisciplinary design learning and its collaborative process, a project was planned at the University of Houston with a sponsored company, Pacific Design. After a year's incubation of the idea, an ambitious real-world project was introduced to the design studio in 2005: computer carrying case design under the theme of "Design in Houston and Made in China." The project offered a dynamic triad between the company and students from the Industrial Design and Graphic Communication Programs at the University of Houston. This relationship allowed the students to witness and participate in a design process from a multiplicity of viewpoints and methodologies. From the onset, the project was very appealing to the students as an opportunity to design for a successful and cutting-edge company. The product itself, a carrying case for mobile technologies such as laptop computers, smart phones and/or MP3 players, struck a cord with students that embrace mobile technology on a daily basis. This collaborative trio was elevated to a global platform with the incentive of the prototypes being made in China.

To address the real world design experience, two-levels of interdisciplinary learning were executed as explained in Figure 2: cross-disciplinary learning between industrial design and graphic design and interdisciplinary through industry and design education. The collaborative effort required strong teamwork to explore real-world product development, which covered the overall process, 'design A to Z' presented in Figure 3: design research, concept development, prototyping in remote factories, and building a brand identity. The interdisciplinary learning between industry and education included key members of the corporate management team from the disciplines of product design, marketing, engineering, and manufacturing. They all took part in the concept development, design reviews and feedback to the teams. The experts' opinions in three consecutive meetings (illustrated in Figure 3) became a significant driving force to create dynamic and authentic results by the students.

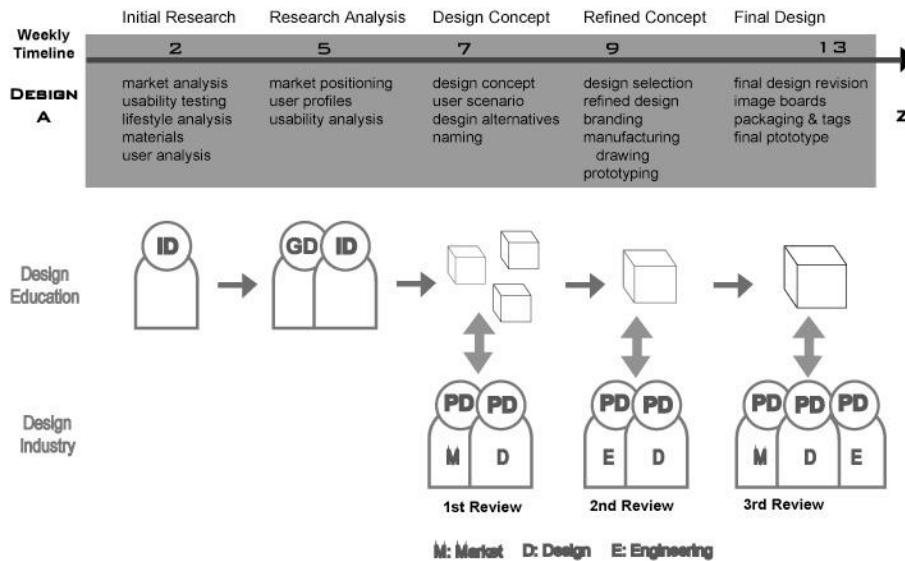


Figure 3. The thirteen-week interdisciplinary learning process.

This collaborative studio project addressed multi-level interdisciplinary learning with the following key learning objectives:

- To understand globalized manufacturing paradigms, design in X and made in Y, and their impacts on the product development process
- To provide students with critical skills that will enable them to work successfully with various team members in the design process
- To understand and execute human-centered design methods and branding strategies to meet the user's needs and to build product identities within the context of the company's product lines.

In addition to the learning objectives, Pacific Design established a clear set of project parameters for product development. For example, project themes focused on three potential technology categories: power, protection, and the human senses. Power was defined as the use of renewable energy sources such as solar or new battery technology. Protection was examined through carrying case construction and materials such as air bladder technology. The third category was framed around the human senses by addressing issues of how a product would be used in terms of touch, sight, sound, and scent—the most underutilized of all the senses in product development. Through a presentation of Pacific Design's methodologies and strategies used by designers and engineers within the company, students were able to compare corporate strategies to design methods used in the classroom.

### 3.2. Design Process and Outcomes

The class was divided into eleven teams that consisted of one industrial designer and two graphic designers. Each team challenged to work on many aspects of the new product development including: research, branding/identity/packaging, product design, manufacturing, and in-store/in-print merchandising and marketing in context of retail sales channels. Both industrial and graphic designers contributed to the concept as it evolved. Product branding was discussed early in the process, with the name serving as a way to encapsulate a product concept. While the industrial designers focused on the product development and manufacturing ideas, the graphic designers articulated team concepts through the use of descriptive text, branding, lifestyle images, and product illustrations. The final design requirements split the disciplines along traditional lines with the industrial designers responsible for the design of the product and the graphic designers for developing the product identity system and package/tag for the product.

Another significant challenge for this project was to deliver accurate fabrication specifications to the remote factories in China: materials, tools, processes, prototyping/sample development and manufacturing. Detailed and clear instructions, both visually and verbally, were the most critical aspect of this phase of new product development. The inclusion of a manufacturing/prototype expert early in the process insured clearer communication and eliminated surprises in the development process. The receipt of working prototypes delivered from China in the last week of the project was the critical moment when the effectiveness of authentic learning was validated for the students.

Many of the resulting product solutions were innovative and demonstrated real business potential and application. Examples of design outcomes are explained with two cases: *Duon* and *Swap*. For the professional woman, the sleek design of the *Duon* laptop case provides innovation, flexibility and security. Available in four unique colors and materials with four ways zippers, *Duon's* unique features include reversibility and expandability for the woman who seeks style, comfort, and convenience. The name *Duon* reinforces the bag's dual personality. The logotype implies an ability to flip inside out as illustrated in Figure 4. The typographic treatment of *Duon* reiterates the clean modern lines of the bag, yet maintains a feminine quality. The packaging is a translucent wrap to allow the viewer to see the bag and touch the fabrics. The vellum product tag provides swatches of fabric choices and color options.

*Swap* is a new type of laptop bag with customizable technology accessories that connect to the bag's frame and shock protection system. From observation, the team recognized that laptop users carry a large number of cables and accessories to be accessed frequently and easily. *Swap* allows the users to customize their storage and accessory features, and converts them to meet the users' changing needs. This clever design provides standing support, impact resistance and offers the ability to attach a variety of straps and/or accessory options to any of the corners. The name *Swap* encapsulates this unique feature of the bag. Designed in lowercase letters, the circular counterspace of the "a" and "p" restated the shape of the corner holes. An additional iconic symbol, used in conjunction with the logotype, reiterated the circular forms and flexibility. The *SWAP* bag is contemporary, playful, flexible and youthful. Figure 5 presents *Swap* identity and the prototype made in China, which was used for the usability testing.



Figure 4. *DUON* user scenario and prototype.



Figure 5. *SWAP* prototype for usability testing.

#### IV. The Effectiveness of Interdisciplinary Learning and Lessons Learned

##### 4.1. Interdisciplinary Learning Outcomes

Introducing an interdisciplinary element into a design curriculum encourages all knowledge communities involved to develop meaningful links among the fields. It pushes educators and students toward more powerful thinking and the ability to make comparisons that bridge disciplines and encourage the application of knowledge. The most effective aspect in this case study was to bridge the disciplines with the interdisciplinary learning process to engage and encourage high-order thinking skills. The integration of a multilevel interdisciplinary format within a design curriculum proved a highly effective means to help

students achieve professional behaviors and performances. At the end of the semester, in the course survey, students noted the important experiences learned from collaborative project as

- Learning about real-life product development & prototyping
- Learning how to communicate with others
- Provided an understanding of how other disciplines work and the value of responsibility, tolerance and patience in negotiating and sharing information with one another.
- Value of the exchange of ideas and feedback from the project stakeholders

Students learned valuable lessons on the meaning of deadlines and team effort. Presentations to Pacific Design were tightly scheduled, giving each group only 10 minutes to explain their material. This streamlined schedule encouraged efficiency, with information kept succinct. At least twice a week, the teams worked together in- and outside of studio. Each team developed their own dynamic to ensure success. The lessons learned through the collaboration more than outweighed the scheduling hurdles. Students quickly realized the challenges of group management. The key to a successful team was effective communication that fostered human relationships. Individuals and teams realized the development of connections to each other proved to be more powerful than individual creativity. Successful team building also shaped the design process and the ability to connect to the user in the final product solutions.

In summary, it was found that using interdisciplinary methodology with real-world problem-solving influenced students positively. Students found the content more exciting and relevant. In addition, this type of collaboration enabled professional and personal growth, and fostered the practice of communication skills, continuous learning, openness, tolerance, group responsibility, and trust. The experience of team management and group research provided insights into ways to enhance interdisciplinary team performance. As the semester progressed, groups improved their teamwork and professional articulation of concepts, form, and materials to Pacific Design. The combination of a real and global context in which diverse knowledge communities are included as partners narrows the gap between knowing and doing. The effectiveness of collaborative and authentic design learning was not limited to the students' achievements in this case study, but could be extended to their future work in the design industries where collaborative, communicative, and contextualized activities are strongly emphasized.

#### **4.2. Lessons Learned**

To enhance the team performance, individuals must be respected and empowered during the process. In order to empower team members, recognition of the different knowledge and working processes becomes the first step to effective team management. Cagan and Vogel (2002) introduced 'a concept of perceptual gaps' to provide "a foundation on which to understand how differently each discipline perceives a product" (p. 142). From their description, perceptual gaps are the differences in perspectives that "stem from discipline-specific thinking and prevent teams from developing an integrated interests-based conflict resolution process. These gaps make negotiation and collaboration strategies difficult" (p. 144). In our study, the teamwork was built slowly with the application of product branding, which included product naming, identity system and visual presentation boards. Integrating team members through the product naming was not our intention, but worked as a dynamic and efficient strategy to understand and link the perceptual gaps from the initial phase of the design process.

In our case, merging courses between the College of Architecture (Industrial Design) and the School of Art (Graphic Design) posed a challenge. Course schedules are not fully compatible. Classes in industrial design meet 4 times a week, while the graphics courses are twice a week. This caused students to work primarily within their disciplines. To overcome this institutional barrier, teams did meet outside of class, physically and virtually. The use of email to communicate, critique, and transport images was an imperative and efficient solution. The digital communication tool became also critical as teams prepared for reviews by Pacific Design to overcome the geographical barrier. Ideas, drawings and images were evolved up to the last minute, and frequent communication was essential to the success of quality design outcomes and presentation performance. However, usage of computer networking and communication channels among team members was underutilized, so the geographical limits were not fully overcome. The digital connection was achieved at the multi-disciplinary and linear level, not at the interdisciplinary

level. Total convergence for all stakeholders was not fully realized. Beyond the *WebCT* used within education context, incorporating the Computer Supported Cooperative Work (CSCW) system is strongly recommended for future collaborative learning to provide more interactive and dynamic learning experiences as presented in Figure 6.

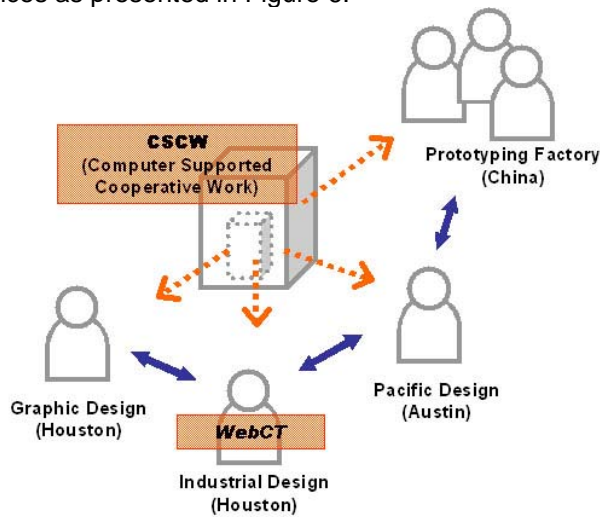


Figure 6. The communication model comparison between linear communication and CSCW for future collaboration.

## V. Summary

Design education faces the need to reform and restructure in order to mix and blur disciplines. The emerging paradigm, the knowledge era, has demanded designers possess a broad perspective to deal with complex problems based on more expanded and cross-boundary information and skills. Compared with discipline-oriented learning, interdisciplinary learning accomplishes a range of objectives that address broad issues, explore disciplinary and professional relations, and solves problems that are beyond the scope of any one discipline.

The interdisciplinary design learning investigated in this study was made possible by a dynamic triad between the company and two design programs at the university. Beyond the connection of industry and education, it showed how an interdisciplinary design curriculum could be developed to enhance the quality of education with its dynamism and efficacy. For the students and the faculty, the thirteen-week study provided highly intensive collaborative and authentic learning experiences in a global context. For the company, this interdisciplinary study enabled them to extend their vision of the future through the development of more innovative and meaningful products, services, and experiences. The company management team gained valuable insights regarding the impact of interdisciplinary learning and actionable concepts that can be utilized in their business.

Constructing interdisciplinary design learning and projects is challenging. It takes patience, flexibility, and significant time and effort. As a dominant trend in the knowledge era, it should be investigated further as a new pedagogy of connected learning.

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