New Techniques in Industrial Design Education

Jon Kolko [jkolko@scad.edu]
Professor, Industrial and Interaction Design
Savannah College of Art and Design
Savannah, Georgia, USA

Abstract

This paper presents three new techniques utilized in educating Industrial Design students, with a focus on collaboration, complex problem solving and user-centered contextual design. The first technique, in the form of a "total immersion" charrette, has proven to be an effective means of peer-learning, rapidly disseminating information from senior to lower level students. Additionally, this technique has been utilized to build both management and leadership skills, as well as introduce students to various "niche" aspects of Industrial Design. The second technique, large-scale product development and fabrication, has proven instrumental in developing interdisciplinary team building, as well as illustrating the precision and level of detail required to successfully fulfil real-world project expectations. Finally, the third technique demonstrates the importance of industry-sponsored design projects as a means for strategic and innovative product development.

Introduction

Industrial Design education has traditionally been defined by craft; while leading programs have evolved to include aspects of complex problem solving and business planning, much of the academic Industrial Design community continues to reference and embrace Bauhaus style studio courses centered around individual, hands-on product development.

While the industrialized world is shaped by dynamic change, design education seems reluctant to move beyond basic aesthetics and "form giving". Rather than focusing on business development and user-centered design process, emphasis in much of academia is placed on rendering, model making or styling, yet industry now demands Industrial Designers participate in strategic planning, innovative product development, and interdisciplinary collaboration.

Both qualitative and quantitative evaluation metrics are used to determine the value and success of the techniques, and recommendations are made for the

appropriate implementation of such techniques in other similar educational programs.

Traditional Industrial Design Education

Industrial Design is 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" [1]; since the industrial revolution, consumers have enjoyed the benefits of products that save time, accentuate our personalities and increase our physiological well being. However, much of the work of Industrial Designers has focused on form, function, and some sort of marriage between the two; design education commonly contains courses encouraging exploration of weight, structure, composition, size, shape and material. These courses have grown out of curriculum established by the Bauhaus and subsequently refined by the New Bauhaus; the classes reference both the content and structure of the preliminary courses and workshops of these unique schools.

The goal of the original Bauhaus was to "educate artists, painters, and sculptors of all levels, according to their capabilities, to become competent craftsmen or independent creative artists…" [5]. The curriculum focused on a three tiered method of education, and although it included aspects of drawing and painting and training in science and theory, the program initially focused primarily on aspects of craft training.

Industrial Design Education continues to build upon the principles developed by the Bauhaus; foundations programs at the Rhode Island School of Design (USA), Pratt Institute (USA), and the Savannah College of Art and Design (USA) all implicitly reference the preliminary course developed at the Bauhaus. Rowena Reed Kostellow's "Elements of Design" provides clarity into what has become the cornerstone for Pratt Institute's foundations program, focusing on line, plane, volume, value, texture and color. "This curriculum has become the foundation of most industrial design education programs, and also applies across the board to architecture, graphic design, and art. From the beginning and for over 50 years, Miss Reed taught three-dimensional design at Pratt" [6].

Time for a Change?

The *craft* of Industrial Design continues to demand a strong understanding of form, aesthetics and emotion, yet the *business* of Industrial Design has changed dramatically since the days of the Bauhaus. Time to market and product development cycles continue to diminish as advances in manufacturing increase speed of production. For example, Konica recently announced their new DiMAGE Z**3** Digital Camera less than six months after announcing their DiMAGE Z**2** [3], and this trend is visible throughout almost the entire consumer electronics segment. The outsourcing of design and manufacturing depends on cheaper labor in Pacific Rim countries, commoditizing many of the design skills that have traditionally been unique to those with a formal Industrial Design education. Even the field of furniture, the

origin of Industrial Design that has always upheld the notion of artisan craftsman, has felt the shift as Malaysian manufacturers sense the need to offer both cheap manufacturing and cheap design to compete with American products: At the recent Malaysian Timber Council, key speakers presented papers with names like *How Malaysia can Compete in the US Furniture Market* [4], indicating an internal awareness of this shift towards offshore design.

These issues, when examined alongside the political and cultural changes that have occurred with the coming of the information age, illustrate a strong confounding of Industrial Design in the professional world – the field has become much more complicated, and issues relating to product form and function are dwarfed by topics of internationalization, convergence and time to market. The professional world of product design has shifted dramatically, and demands new skills of graduating students of Industrial Design.

The Savannah College of Art and Design, in Savannah, Georgia, employs traditional Industrial Design teaching methodologies to teach traditional Industrial Design skills. Additionally, the program complements these more conventional methods of education, such as those employed by Bauhaus educators, with new techniques that attempt to target the specific and changing demands of industry.

Industrial Design "Total Immersion" Charrette

For the past three years, industrial designers at the Savannah College of Art and Design (SCAD) have participated in the annual Industrial Design Charrette. This three-day, moderated event brings together industrial design students from several colleges and universities to work on a project in a collaborative environment. The 2003 Charrette, moderated by Patricia Moore, encompassed experiential and contextual learning. Over three hundred and fifty students participated in this event, divided into 43 teams of approximately 8 students per team. The teams were mixed in terms of academic class standing and school of attendance (students from Georgia Tech and Auburn University also attended).

At the opening of the Industrial Design Charrette, students are given an opportunity statement, and instructed to immerse themselves in that domain. Previous subjects have involved emergency rescue and response, emotional reactions to language, and universal design in the home; all of these topics demand that the students delve outside of their traditional knowledge base, or "comfort zone", and research real people in their real context. Additionally, the opportunity statement is kept vague enough as to allow for and encourage diverse viewpoints as to potential solutions. Students quickly realize that the answer to the problem will not be found in their studio spaces, and within hours of receiving the target domain and opportunity statement, teams begin leaving the Industrial Design facility and entering the "real world" to uncover the nuances of the problem.

After collecting a substantial quantity of contextual data articulating problems and breakdowns relating to the target domain, students then retreat back to the studio to synthesize the often overwhelming quantities of data. Using whiteboards, post-it notes, and other visual organization tools, teams begin to address specific problems motivated by research, and begin the iterative nature of industrial design. Ultimately, time becomes the major obstacle, as teams race the clock to finish before the final presentations begin – not more than seventy-two hours after the event began.

The Charrette is structured in the form of a rapid product development cycle, integrating user centered research, rapid visualization sketching, the creation of physical forms, and the presentation of these materials to clients. These skills mimic those described above – relics from the "simpler" days of product design. Yet the true goal of this activity, both implicit in its structure and explicit in its direction, is the creation of relationships that encourage peer learning and cross over the rigid "class structure" of freshman, sophomores, juniors and seniors.

As illustrated in Peer Learning in Higher Education: Learning From & With Each Other, David Boud recognizes that "*…learning with and from each other* is a necessary and important aspect of all courses. The role it plays varies widely and the forms it takes are very diverse, but *without it students gain an impoverished education*" [8]. In the short timeframe provided for the Charrette, upper level students find themselves in a position where they must form relationships with their teammates that encourage the team to construct a unified vision of the design process. The professors, and even the moderator of the event, take on a *guide* role, as the upperclassman quickly become the driving and organizational factor.

Based on their experience in upper level studio classes, these more practiced students quickly acknowledge that simple brainstorming will not create a useful design solution; additionally, these students are often capable of providing more accurate time and material estimates. As lower level students struggle for direction, the upperclassman begin to articulate and describe the specific design process that must occur to successfully complete the assigned task; they realize that the opportunity statement must be restructured, that data must be collected, and that some form of immersive synthesis must occur before attempting to *build* anything.

Lower level students tend to be much more hesitant when thrust into this novel and intimidating environment, and these students often begin the project by observing quietly. Indeed, at the early stages of the Charrette, many lowerclassmen privately articulate that they feel "extraneous" or "in the way", and at this stage, the moderator and professors will be called upon to provide some form of guidance. Quickly, however, these students realize that their skills are not only needed, they are *required* – without them, there remains too many tasks to accomplish in order to successfully complete the Charrette on time. What begins as delegation of tasks based on level changes quickly to a master and apprentice model of co-*inquiry*.

A post-questionnaire (see table 1) confirmed the perceived validity of the charrette. 232 students, or nearly two-thirds of the total participants, responding to the question "*The charrette positively affected my understanding of the industrial design process*" yielded a mean response of **3.92** of 5 (5 being "strongly agree"); this number rises to **4.45** when examining only the 29 freshman questioned, and has a standard deviation between academic levels (freshman, sophomore, etc) of .32. The question "*I learned from my assigned team*", yielded a mean response of **4.33** of 5 (5 being "strongly agree"), with a standard deviation between academic levels of .22.

	All (n=232)	Freshman (n=29)	Sophomore (n=73)	Junior (n=54)	Senior (n=57)	Graduate (n=19)
The charrette positively affected my understanding of the industrial design process	3.92	4.45	3.96	3.83	3.8	3.53
The charrette positively affected my contextual user research abilities	3.65	3.76	3.73	3.59	3.59	3.47
The charrette positively affected my ability to work in teams	4.06	4.00	4.16	3.93	4.21	3.68
I contributed effectively within my assigned team	4.35	4.24	4.42	4.22	4.48	4.24
I learned from my assigned team	4.33	4.38	4.44	4.26	4.39	3.89

Table 1. Questionnaire results
[1 = strongly disagree, 5 = strongly agree]

Perhaps more interesting than the quantitative data are the qualitative responses gathered. When asked to describe the "most important educational aspect of the Charrette", a sophomore responded "Working with a team to solve a universal problem; learning the design process by example of upperclassman". A freshman explained that "learning where I have to go and what I am going to be learning by working with seniors" provided them with the most educational value, while an upperclassman described their role as "more of a teacher than a student, as most of the group wasn't as far [along in their curriculum], and that was new for me". These comments reflect the overall quality of the student response to the Charrette, and indicate both a respect of the peer learning process and a recognition of its value.

Large-scale Product Development & Fabrication

Assignments in industrial design education have traditionally focused on small, individual objects designed for mass production, such as a toaster or a flashlight. These items allow individuals to hone their abilities in form development, rapid visualization sketching, and even manufacturing and assembly specifications; the focus on individual skill building, however, is often at the expense of a larger, project-wide vision. Students completing this type of assignment rarely encounter logistical issues prevalent in the execution of a pre-defined project plan, and have no experience facing the challenges of

completing a project on-time and on-budget. This leaves them ill-prepared for the resource constraints facing professional design firms.

Justin Petro, an Experience Developer at the Industrial Design consultancy Design Edge in Austin, Texas, agrees: “The hardest lesson for young designers to learn is that time is indeed money. Young kids aren't used to our type of deadlines; they assume that they can continue to pull all-nighters to get the work done. What they fail to understand is that there is always more work, and more work equals more revenue. The skills most designers lack isn't necessarily tool skills, but the ability to judge how long it will take to *use* these tools. Time management is the most needed skill, yet the most difficult skill to find” [9].

Design theorists continue to debate the nature of the professional design problem, reflecting on the unique role of design in the business world. The term “wicked” has been applied to particularly complicated design problems, defining them as a “.. class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing” [10]. The problems facing designers in industry are becoming increasingly wicked, as multiple stakeholders demand excellence while imposing shorter development cycles and more rigid resource constraints.

The Industrial Design department at SCAD has, in the past five years, developed a number of large scale working prototypes; these include an Exo Spyder sports vehicle, a 21’ concept boat, an all-terrain vehicle, and a hang glider. While these projects appear diverse, they all share a common goal: to expose students to the precision, level of detail, amount of planning and rapid problem solving required to successfully complete a design under real-world constraints. These projects prepare students for the “wickedness” of the professional design world.

Perhaps the most daunting aspect of undertaking a large scale working prototype in a university setting is that of constraints; students quickly become aware that blue sky thinking will not create a pragmatic, functioning design. A normal class project lasting several weeks or months may impose basic constraints of size, shape, or function, but the professor often chooses to shield the students from some of the more menial issues of time, money and material access. These issues are faced daily by professionals, however, and are included in the scoping of the large scale fabrication projects; this gives students the ability to realize, first hand, the results of budgeting and how design decisions are often tempered by the realities of economic constraints.

A second major benefit realized through the large scale working prototype projects is the ability to quickly illustrate dependencies, and the results of these dependencies, throughout a project development lifecycle. Critical deliverables depend on multiple collaborators working in parallel, and there is a dramatic amount of holistic trust required of all students. When a project milestone slips, it negatively affects the results for the entire team; the “bell-curve” studio class grades are replaced by an expectation that all participants provide

excellent work and motivation. Nearly all participants become "project managers", in the sense that they must keep the project on track through individual efforts as well as peer motivation.

Perhaps the most important reason to introduce large scale working prototype projects into a university setting, however, is because the expectations of the project closely mimic the professional world: there simply is no room for failure. As Professor Tom Gattis explains, the momentum of the project becomes nearly unmanageable somewhere near the middle of the project's execution: "The pressure from the project at this point began to build. The college's marketing and admissions departments were publishing the project and beginning to anticipate the finished prototype … The students could not simply make a pretty model that looked as if it would go 50 miles per hour on the water; it actually had to perform at that level" [11].

Industry-Sponsored Design Initiatives

Uday Gajendar, in his paper Taking Care of Business: A Model for Raising Business Consciousness among Design Students [7], discusses some of the popular approaches towards merging issues of design and business and highlights many of the inadequacies of these approaches; he proposes a model of intersections between business and design, focusing on leadership, strategy, innovation and culture. The outcomes, if successful, include "realistic expectations of how blue-sky innovation meets 'brown ground' in daily practice" and a "broad understanding of the value of strategic thinking to design practice". This model has been realized through an ongoing, industry sponsored design initiative between the Savannah College of Art & Design and Proctor & Gamble.

During the winter of 2004, Procter and Gamble sponsored the project, "Universal Design in the Home" at the Savannah College of Art & Design. Students conducted original research and concept exploration, and presented to an industry leader in consumer marketing, product development, brand management and innovation. As part of Procter and Gamble's strategic focus on innovation, the Corporate Packaging R&D, and the Tide Brand Management groups visited Savannah to initiate a relationship with Industrial Design. The goals of this initiative were to

- Introduce students to state-of-the-art design practice and planning through close collaboration with Procter and Gamble professionals
- Foster a holistic and informed faculty through site visits and exchanges of product development methodology and practices
- Create relationships between industry practitioners and students

It was the stated intent of Procter and Gamble to establish a lasting partnership in the development of innovation practices that would extend beyond the boundaries of the class project. During the project Procter and Gamble made several presentations to students and faculty to demonstrate their business practice as it pertains to product development. Topics included "Developing

Ideas into Successful Products" by Sean Regan, Tide Marketing Manger, and "Corporate R&D as Strategy" by Alan Bates of corporate R&D.

As the first step in this endeavour, a special topics class, Universal Design in the Home: The Procter and Gamble Project, was planned and put into place on a fast track to correspond to Procter and Gamble's pace of doing business. Three teams of students were assigned the task of discovering overlooked patterns and activities involved in the laundry cycle at home with an emphasis on universal design issues and contextual research. During an intense session with Procter and Gamble early in the project, students presented their findings and produced a rapid-design body of concepts that expanded the vision of what can be done to improve people's lives and stimulate business initiatives. Using scenario development and role play, students built frameworks of understanding in which to innovate to target real, human problems in design.

Design activities included observational user research, personal interviews, site visits of commercial laundries, sketch development, experiential prototyping with a working washer-dryer ensemble, and video usability studies. Final presentations encompassed a range of solutions that included liquid packaging and metering devices, laundry handing hardware, accessibility controls, and entirely new concepts for detergent composition, spot removal and ironing. As a result of their performance, one of the teams was then invited to Procter and Gamble in Cincinnati during the month of June for a two-week internship devoted entirely to the development of their ideas.

This long term exercise with a recognized brand leader has provided students with a realistic view of how innovative, futuristic design ideas are whittled down through a pragmatic, bottom-line focused business development cycle. This allows students to develop a sensitivity for ownership, and an appreciation of what happens when an idea becomes bigger than its' respective owner.

Discussion

Bauhaus style design education has provided a substantial grounding to the field of Industrial Design, and has trained designers capable of producing beautiful and useful objects of everyday use. However, this education has stagnated while the business of design has not; the world of business has grown more and more complicated and the demands on product development teams have changed dramatically in the last century. This paper has presented three new techniques utilized in educating Industrial Design students, with a focus on collaboration, complex problem solving and user-centered contextual design. It is not the goal of this paper to argue for the *removal* of traditional craft and form oriented techniques within Industrial Design; instead, a program grounded in craft and fundamental design skills can easily be *supplemented* with these new techniques in an effort to shape designers capable of excelling in the professional world of Industrial Design.

Works Cited

1. Industrial Designers Society of America: Comprehensive Description of Industrial Design. IDSA. July 7th, 2004. http://www.idsa.org/webmodules/articles/anmviewer.asp?a=89&z=23

2. Bauhaus Archive: Museum of Design. July 7th, 2004. http://www.bauhaus.de/english/index.htm

3. Konica Minolta: DiMAGE Cameras. July 7th, 2004. http://konicaminolta.com/products/consumer/digital_camera/dimage/index.html

4. Cheng, Thean Lee. Malaysian Timber Council; Experts: Furniture makers need more polish. April 16th, 2004. http://www.mtc.com.my/coverage03.htm

5. Gropius, Walter. Program of the Staatliche Bauhaus in Weimar, translated by Wolfgang Jabs and Basil Gilbert, in Bauhaus: Weimar Dessau Berlin Chicago, 1962.

6. Viemeister, Tucker. The Elements of Design: Rowena Reed Kostellow and the Structure of Visual Relationships, a book by Gail Greet Hannah. IDSA National Education Conference, 2002.

7. Gajendar, Uday. Taking Care of Business: A Model for Raising Business Consciousness among Design Students. IDSA National Education Conference, 2003.

8. Boud, David. 'Introduction: Making the Move to Peer Learning'. In Boud, D., Cohen, Ruth & Sampson, Jane (Ed.). Peer Learning in Higher Education: Learning From & With Each Other. London: Kogan Page Ltd, 1–17. 2001.

9. Petro, Justin. Personal Interview. July 27th, 2004.

10. Buchanan, Richard. Wicked Problems in Design. In Margolin, Victor & Richard Buchanan. The Idea of Design. MIT Press, p14. 1995.

11. Gattis, Tom. The Large Scale Design Project: Beyond Traditional Education. IDSA National Education Conference, 2002.

Biographical Note

Jon Kolko is a Professor of Industrial and Interaction Design at the Savannah College of Art and Design, in Savannah, Georgia (USA). The Industrial Design Department at SCAD exists in order to develop highly motivated visionary students of design who create, articulate and communicate innovative solutions that enhance user experiences.

Contact Information

Jon Kolko
Professor, Industrial and Interaction Design

jkolko@scad.edu

Savannah College of Art and Design
3116 Montgomery Street
Savannah, Georgia, 31415
USA