TEACH ONLY WHEN UNDERSTANDING: THE STRATEGIES OF TEACHING INDUSTRIAL DESIGN TO THE NET GENERATION

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Abstract: Industrial Design education has been defined by craft and well known for its 'immersed' and 'practice-based' learning environment. Most of Industrial Design schools continue to reference and embrace Bauhaus style studio courses centered on individual, hands-on product development. The design assignments have traditionally focused on researching, sketching, model making, and presentation. However, many industrial design teachers are now struggling with teaching current college design students, the so-called 'Net Generation', due to their preference and reliance on digital technology for learning. Since design education can never be accomplished solely by using digital technology, design educators are now facing major transformational change as digital technology alters how learning is enabled. This paper will explore and demonstrate how Industrial Design can be taught to the Net Generation with the understanding of their learning mode and characteristics making learning more relevant and effective. Specific examples of approaches integrated into a third year Industrial Design studio course will be illustrated.

Keywords: Teaching Strategy, Net Generation, Industrial Design Education

Introduction

Many current university students belong to the 'Net Generation (or Net Geners) '- a label used to describe today's young adults along with other terms including 'Digital Natives' (Prensky, 2001) and 'Generation Y' (McCrindle, 2006). This group of individuals, born between 1980 and 1994 (McCrindle, 2006), have been characterized by their familiarity with and reliance on information and communication technologies. They have " spent their entire lives surrounded by and using computers, digital music players, video games, cell phones, and all the other toys and tools of the digital age" (Prensky, 2001). A number of social psychologists have argued that the digital culture in which the Net Generation has grown up has influenced their preferences and skills in a number of key areas related to education. For example, the Net Geners are said to prefer receiving information quickly; expect immediate answers; have a low tolerance for lectures; prefer multi-tasking and non-linear access to information; prefer active rather than passive learning; rely heavily on communication technologies to access information and to carry out social and professional interactions (Frand, 2000; Prensky, 2001).

Industrial Design education has been defined by craft and well known for its 'immersed' and 'practice-based' learning environment (Kolko, 2000). Most of Industrial Design schools continue to reference and embrace Bauhaus style studio courses centered on individual, hands-on product development. The design assignments have traditionally focused on researching, sketching, model making, peer evaluation and presentation. The problems faced by current Industrial Design educators are students' little patience with the intensive and long design development process and their reliance on information and communication technologies as the major information resource.

The goal of this paper is not to change the nature of the Net Geners or the current design pedagogies, but to propose some teaching strategies that both accommodate the needs of the 'Digital Natives' and ensure that the learning of Industrial Design in design schools is relevant and effective.

The Traditional Industrial Design Education

According to IDSA (Industrial Designers Society of America), '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 (http://www.idsa.org/). Therefore, most Industrial Design curricula include courses related to problem solving, form development, human factors, designing for manufacturability, computer visualization,

and rapid prototyping. Design studio is often regarded as the most essential course for Industrial Design students due to its possibility for students to examine what they have learned from other core courses. It is often structured with activities including observational user research, personal interviews, concept ideation, sketch development, rendering, experiential prototyping with a working model, and usability studies.

These assignments allow students to hone their abilities in understanding their target users, generating relevant solution with great form development, and furthermore achieving user-centered design. The focus on individual skill building, however, is often at the expense of a semester long project. Students complain that these activities are 'time-consuming' and 'short of efficiency' and suggest that the instructors should tailor their teaching to match the skills, experiences and expectations of their 'Net Generation' students.

Characteristics of Net Generation

The term 'Net Generation' was coined by Tapscott in 1997. It is linked directly to the (Inter)net and the emerging digital technology of the 1990s with which this generation grew up. To date, more than 30 books have been written on the Net Generation, which report the results of several surveys and research describing their characteristics. Berk, the former Assistant Dean for Teaching at The Johns Hopkins University, synthesizes the survey research evidences from multiple sources and extends the work by the preceding authors in an effort to help faculty members in higher education understand the characteristics of the Net Generation and enhance the effectiveness of their teaching (Berk, 2009). Among the various sets of characteristics presented in the literature, 20 common denominator characteristics emerge that have a direct bearing on learning. The educational implications of the characteristics are shown below:

1. *Technology savvy*: Having grown up with the technology, the Net Geners are familiar with most forms of digital gadgetry. They have spent their entire lives surrounded by all of the toys and tools of the digital age. The technology affects everything they do and buy. They expect information to be at their fingertips. Their experience with the technology has enabled them to master complex tasks and make decisions rapidly.

2. *Relies on search engines for information*: About 89% of Net Generation begins searches for everything with search engines like Google. They have an "ease-of-use" mentality. Their high comfort level with the technology has fostered a false sense of ability, such that they routinely overestimate their skills at finding and evaluating online information.

3. *Interested in multimedia*: They are accustomed to entertainment, speed, and accessing music, videos, games, and information their own way. They prefer interactive media rather than passive TV. They have experience with massively multiuser games and participate in virtual worlds, which are immersive, animated, and 3D environments. Many will obtain their music, videos, ringtones, and software online. Leveraging these media in the classroom is critical to connecting with their culture.

4. *Creates Internet content*: They are not only avid users of the technology, with 90% using the Internet to assist with homework; they also contribute to its content. About 57% of them design and write Websites, post blogs with pictures and original artwork, and make videos for YouTube daily.

5. *Operates at "twitch speed"*: This generation grew up with the quick pay-off world of video games, MTV, the Internet, and ultra-fast speed of action films. They are used to the instantaneity of hypertext, downloaded music, iPhones in their pockets, a library of resources

on their laptops and IMing. They prefer random access, graphics-first, active, connected, fun, and fantasy activities. They have adapted to speed and even thrive on it. That translates into their" needs for speed" in everything they do by themselves and in their relationships.

6. *Learns by inductive discovery*: They prefer to learn by doing rather than being told what to do or reading text or manuals. They are kinesthetic, experiential, hands-on learners. They must be engaged, constantly connected with first-person learning, games, simulations, and role-playing.

7. *Learns by trial and error*: With their Nintendo mentality, they will jump right in and do what is necessary to solve a problem using trial and error, failing, starting over, and so on. They will seek help only if they can't come up with the answer.

8. *Multitasks on everything*: They can naturally do several tasks easily at the same time. The Net Generation can move quickly from one activity or medium to another, such as chatting with their friends on a cell phone while surfing the Net and watching TV. Mixing play and work is common. It's part of their lifestyle.

9. *Short attention span*: Again the Net Generation is used to speed in everything they do and touch. They must be actively engaged, doing some task, and having fun doing it, or boredom and impatience take over. They are used to immediate results and pay-offs for performance. That satisfies their needs for feedback and instant gratification.

10. *Communicates visually*: They are visually literate, comfortable in an image-rich rather than text-only environment. Many don't like to read books, especially textbooks. They perceive print as expensive, boring, and a waste of time. Instead, they prefer visuals, graphics, and images of any kind.

11. *Craves social face-to-face interaction*: Relationships are a high priority in the Net Generation's lives. Despite the hours that they spend in IMing and social media communications, they also gravitate toward activities that promote and reinforce in-person conversation, interaction, and collaboration.

12. *Emotionally open*: They express their feelings easily. They are open to meeting new people, sharing personal information, and digital storytelling online in blogs or other social media. They also want the opportunity to express their opinions and ideas in class or small group discussions and Q & A sessions.

13. *Embraces diversity and multiculturalism*: The Internet fosters diversity. The Net Generation's exposure and connection to the whole world through global communications have given 72% a tolerance, appreciation, and sensitivity for multiculturalism and 79% the ability to work with diverse people.

14. *Prefers teamwork and collaboration*: As stated above, the Net Generation has strong social tendencies and a need for interpersonal interaction, both online and face-to-face. They prefer to work in teams rather than alone. Collaboration enables their "collective intelligence" to emerge through the pooling of knowledge, research, arguments, and insights from diverse groups of people.

15. *Strives for lifestyle fit*: Net Gen students want flexibility in their lives. Many are non-traditional students who attend college part-time, work full- or part-time. Lifestyle fit is extremely important. They want their school to fit their lifestyle.

16. *Feels pressure to succeed*: They feel pressure from their Boomer parents to succeed at whatever goals they set. They are goal-oriented—setting college, career, and life goals. Being able to accomplish these goals and efficiently do what needs to be done is more important than accumulating a bunch of facts. They focus on short-term achievement and grades at the expense of critical thinking skills and deep learning.

17. *Constantly seeks feedback*: This characteristic is part of the 'Trophy Kid' mentality. The Net Geners want to be recognized for their efforts and achievements. Receiving regular and speedy feedback on their performance is important at school. They prefer objective methods of assessment and explicit guidelines on " How to Make As", which are inconsistent with most performance assessments.

18. *Thrives on instant gratification*: The speed with which the Net Generation operates in every aspect of their lives has provided them with instant gratification. Their lack of patience can create frustration and boredom.

19. *Responds quickly and expect rapid responses in return*: It's all about speed, efficiency, and "don't waste my time." Since the Net Generation operates at "twitch speed" and multitask as a way of life, they expect everyone else to respond quickly to all communications. They have zero tolerance for delays.

20. *Prefers typing to handwriting*: Taking notes in class the old fashioned way is not the Net Generation's way. They want to type notes, communications, and papers on their PC/Mac or iPhone. That is what they are used to doing. The advantages of Word far outweigh any alternative of verbal print communication.

Although not every Net Gen student shares the same personality and could be diverse in learning style and attitude, the major characteristics of the Net Generation are still being highly valued as the most effective guide for practices in higher education (Junco and Mastrodicasa, 2007).

Strategies for Teaching Industrial Design To The Net Generation

Take into consideration the nature of Industrial Design education and the characteristics of the Net Generation, eight strategies for teaching Industrial Design are formulated and examined in a third year design studio—usually the first design studio for Industrial Design college students to tackle real product design issues. These strategies are:

Strategy One: Incorporate digital technology into lectures, in-class and out-of class assignments, activities, demonstrations, and communications between teacher–student and peers. (*Tech Savvy*)

Strategy Two: Provide assignments that draw on the students' search engine skills, but give guidance and instruction on how to think critically about the information and on how to maximize the value of the search results. (*Relies on Search Engines*)

Strategy Three: Most Net Gen students are visually literate, the use of multimedia, such as graphics, images, videos, or music that are student favorites in the lectures, assignments, and even their reports will draw their attention and enhance their engagement. (*Visually Literate; Interested in Multimedia*)

Strategy Four: Provide a performance-oriented design studio; focus on the quality of their design and emphasize the ability of time management and responsibility at the same time. Students will engage and participate better in their learning when they are operating at their own pace. (*Pressure to Succeed; Lifestyle Fit; Operates at Twitch Speed*)

Strategy Five: Divide the class period into multiple sessions- such as the combination of short lectures, in-class exercise, group-discussion, class brainstorming and peer-evaluation. The Net Generation has short attention span and prefers multitask, the variety of class activities will keep students engaged in different way and ensure that learning is happening. (*Short Attention Span; Multitask; Prefers Teamwork; Embraces Diversity*)

Strategy Six: Provide hands-on, exploratory, and trial –and-error problem solving exercises, individually or in groups, to allow students test their own strategies and discover the solutions. The Net Generation likes to take control of their learning as an active learner. (*Experiential/ Kinesthetic; Trial and Error; Emotionally Open*)

Strategy Seven: Tap students' multiple intelligences and learning styles to give every student the chance to succeed; encourage students think critically and independently while providing fair and appropriate assessments of achievement. (*Pressure to Succeed; Lifestyle Fit*)

Strategy Eight: Provide regular and prompt constructive feedback- positive and negative, print, online, and face-to-face. The Net Generation seeks for instant feedback and gratification, and enjoys interacting with classmates or professors. (*Face-to-Face Interaction; Seek Feedback; Instant Gratification; Responds Quickly*)

Again, the goal of creating these strategies is to ensure that the learning of Industrial Design is relevant and effective with a special consideration of the needs of the Net Gen students. The first test of these strategies has been conducted within a third year design studio, and a post-questionnaire at the end of the semester gets the feedback from the enrolled students and validates the effectiveness of these strategies.

How These Strategies Work

By applying Strategy Five, the Basic Product Design Studio is structured in the form of multiple sessions with respective topics. Each session takes about 2-3 weeks and is comprised of four distinct phases, each of which requires its own set of design parameters and skill application. These phases are defined as: Observation, Analysis (Research Presentation), Application (Design Project), and Testing (User and Peer Evaluation) (Fig. 1).

Fig. 1. The process of learning Industrial Design.

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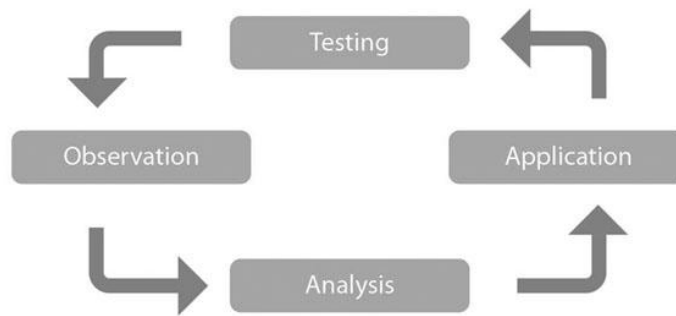
Prior to beginning any sessions, one lecture is introduced to the students and a class-discussion is followed to allow students the chance to interact with their peers and the faculty. The lecture is usually taken place in the form of PowerPoint presentation with multiple media such as graphics, images, and videos. During the Observation Phase students are required to research a specific topic assigned by the professor. They are encouraged to use different types of technology to observe design and present their findings in different types of techniques, such as drawing, photo-taking, videotaping, and so on. Students enjoy the way they take control of their learning style and pace in an open yet well-defined direction. (Strategy Two, Three, Four, and Seven)

The Analysis Phase requires students to bring the results developed from the previous phase to the class in any kinds of format and share their findings with other students. The live methods such as Q&A, in-class discussion, and brainstorming create a team atmosphere for learning where the professor is part of the team. The active and collaborative activities enable students to pool knowledge, debate, share opinions and create new insights. The immediate feedback is given from the professor during these activities to enhance the interactions between students and professor. (Strategy One, Two, Four, Seven, and Eight)

Following the Analysis Phase, the Application Phase challenges students to develop idea sketches, renderings, and physical models of their design in order to communicate their concepts. Prior to beginning this phase, a well-structured project handout and the design schedule are presented to the students as an agreement. The handout defines the game rules, such as the goal of this project, the basic requirements, the deliverables, and the grading criteria. Students are exposed to a hands-on learning environment and gain the ability to connect the function and the form in the product designed by them through physical mock up making. One-on-one meetings are taken place during the design development process for the students to get the instant feedback and guidance from the professor. (Strategy Four, Six, Seven and Eight)

During the Testing Phase students are required to test their design works, observe how users interact with these products, and document the process of operation to better understand how the form of an artifact influences the quality of design and user experience. Students are encouraged to photograph or videotape the process of testing and incorporate these media into their final presentations. In-class critique is taken place to provide prompt and interactive feedback to the presenters. (Strategy One, Three, Six, Seven, and Eight)

At the end of this semester, a questionnaire was conducted to students from three different third year design studios. The Design Studio C is the one adopting these new teaching strategies. Five simple questions with evaluation scales ranking from 1 (Strongly Disagree) to 5 (Strongly Agree) were provided to all of these fifty-two students. The following table shows the questions and the results of this questionnaire:

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

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	Students in Studio A (n=17)	Students in Studio B (n=18)	Students in Studio C (n=17)
This design studio positively affected my understanding of the industrial design process	4.2	4.10	4.55
This design studio positively affected my contextual user research abilities	3.76	3.59	3.93
This design studio positively affected my ability in form development	4.0	3.8	4.2
This design studio positively affected my ability to work in teams	3.9	3.2	4.6
This design studio positively affected my ability in both visual and verbal presentation	4.4	4.0	4.8

Design Studio adopting New Teaching Strategies to the Net Gen students

This post-questionnaire confirmed the perceived validity of these teaching strategies. The responses from students in Design Studio C yielded five mean responses either about or above 4 (4 being agree). It shows that students in Design Studio C, the one adopting these teaching strategies, have better learning experience and effectiveness and are well-equipped with fundamental design abilities.

Conclusion

Design education needs to prepare and equip future designers with the necessary and appropriate skills to support them professionally. This design studio does not just expose entry-level design students to the knowledge of Industrial Design, but also tries to create a "learner-centered" learning environment to ensure that learning is relevant and effective. Through this design studio, students sharpen their design skills and learn to take control of their own learning. The later ability to a design educator is more meaningful than the former one since "keep learning" is one of the best strategies to the success in the field of Industrial Design and the ever-changing digital era.

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