

## **2006-996: UNDERSTANDING "DESIGN THINKING" IN THE CONTEXT OF EDUCATION**

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# Understanding “Design Thinking” in the Context of Education

## Introduction

In 2005, Roger Martin (now the Dean of the University of Toronto’s Rotman School of Management) was quoted as saying, “In this turbulent, get-real economy, the advantage goes to those who can out imagine and out create their competitors”.<sup>1</sup> “Imagine” and “Create” are very artistic words for a School of management Dean. In the increasingly competitive global environment, both business and engineering have become more interested in gaining a broader understanding of the principles of creativity in their search for more meaningful innovation. One of the more recent terms to describe this interest in Innovation is the term “design thinking”.

Creativity and design thinking are thought of as “right-brain” activities. However, engineering education has traditionally focused on more left-brained activities. There is a growing consensus surrounding the need to develop and understand more right-brain thought processes to complement the strong use of traditional left-brain processes as we look for ways to differentiate ourselves in the growing global economy of outsourcing and computer automation.

This paper will discuss the main characteristics of design thinking, contrast it to the characteristics of design *thinkers*, and provide recommendations for classroom environments that promote design thinking and help students become more proficient at it.

## Difficulties of Creativity

When discussing issues dealing creativity, especially making judgments about who is creative and who isn’t, difficulties will necessarily arise. Creativity is a very broad topic. In addition, there are different directions that creativity can be applied – convergent and divergent.

Divergence can be defined by the ability to “generate many, or more complex or complicated, ideas from one idea or from simple ideas or triggers”.<sup>2</sup> Convergence is defined as “the ability to use logical and evaluative thinking to critique and narrow ideas to ones best suited for given situations, or set criteria.”<sup>3</sup>

For this paper, the word “Creative” is biased towards a more divergent process. It is the opinion of the author that art represents a reliance on a more divergent process, and engineering tradition represents reliance on a more focused or convergent process. Both processes can either be creative or destructive, depending on how they are used. The emergence of the term “design thinking” represents an attempt “to weave in and out of divergent and convergent thought patterns in arriving at an appropriate conclusion specific for a given situation.”<sup>4</sup>

## Design Thinking

Because of the combination of creative artistic roots and practical applications, the traditional “Design” disciplines are of particular interest when speaking about cross disciplinary creativity. These disciplines have a long history of balancing divergent creative/artistic principles everyday

activities and are thought to be the bridge disciplines between the visual arts and technology application.

The most familiar of these disciplines are Architecture/Interior Design, which deal with the buildings and environments we work and live in; Graphics/Communications/Interface Design which deals with the information we receive; and Industrial Design, which most often interacts with engineering in dealing with the mass produced products that we work with and use.

In reaction to the long tradition of focusing on convergent processes, recent business publications have stated that “The MFA is the new MBA”<sup>5</sup>. Additionally, Business Week magazine has highlighted the areas of design and innovation in their annual “Design Awards” issue with focuses on the work of Industrial Designers.

The idea that “right brained thinking” can be applied beyond the visual and studio arts is developed further in Daniel Pink’s new book “A Whole New Mind”<sup>6</sup>. In it, he points out the need to develop more right-brain thought and activities to compliment the traditional left-brain analytical activities that have created our current culture of affluence. Additionally, the growing contributions of Asia and the impact of Automation have influence as we move into the global economy.<sup>7</sup>

In the Educational arena, Stanford University is working to create the “d.school”. This is a product development program for multidisciplinary groups of students who will go on to be involved in a wide range of disciplines, not just design or art. The following is a quote from the web page for the d.school.

*“We believe having designers in the mix is key to success in multidisciplinary collaboration and critical to uncovering unexplored areas of innovation. Designers provide a methodology that all parties can embrace and a design environment conducive to innovation. In our experience, design thinking is the glue that holds these kinds of communities together and makes them successful.”<sup>8</sup>*

This statement describes the influence on education of the increasingly “messy”, large scale problems and projects that will typify projects in our modern society. It also marks the separation of the “process” used by applied artists/designers from their traditional “results”. Rather than just being applied to the traditional, art-based design disciplines, this process can be applied to the product development process, which includes aspects of business, engineering, and industrial design. This process is what is being defined as “design thinking”.

### **Characteristics of Design Thinking**

Design thinking is creative, but not all things that are creative can be said to use design thinking. While important, creativity is just one aspect of the design thinking process. Many different definitions of design thinking are emerging, but they appear to share four main characteristics:

1. Design Thinking uses the concepts of Creative Thinking
2. Design Thinking is Multidisciplinary

3. Design Thinking is User Centered/Context based
4. Design Thinking is Physical

## Creative Thinking

Creative thinking in and of itself is difficult to define. When thinking about creativity, many people think of the concept of “ex nihilo” (i.e. “something from nothing”). Creative people are thought to have the dynamic ability to create things spontaneously. Because the connections that they make are often startlingly new and unique, they are thought to “come out of nowhere.”

When asked about where he gets his ideas from, fantasy artist James C. Christiansen states:

*“I submit that the process of imagination is nothing more than the combining of cards in your card catalogue in new and unique ways. Nothing comes from nothing. Every original thought is based on information that we already have in our card catalogue. Whether by a methodical process or by sheer serendipity, all new ideas come from the combination of existing concepts put together in ways that no one has ever done before. That’s how imagination works.”<sup>9</sup>*

Four concepts that help to separate creative thinking from the idea of “ex nihilo” are: *flexibility, fluency, novelty, and definition*. **Flexibility** refers to the concept of that a creative person approaches a given problem from many different angles. All of their ideas are not based off of the same theme. The concept of **Fluency** refers to the need/ability to generate a large number of ideas to select a solution from. **Novelty** refers to the originality, uniqueness, or newness of the idea. Finally, **Definition or Elaboration** refers to the idea that a creative idea is not vague. It is specific enough that others can understand the idea, talk about it, elaborate on it, and explore it further.

These concepts of creative thinking form the core of design thinking. The complete definition of design thinking however, adds three more aspects that separate it from creativity alone.

## Multidisciplinary

Design Thinking differs from creative thinking in that it specifically takes advantage of a multidisciplinary, often team-based approach in order to force the issue of looking a problem from different points of view. It seeks to integrate these differing opinions into a wider, holistic solution to a given problem. Although the above described principles of creative thinking include the principle of approaching a given problem from many different angles, the single individual can only generate these angles based on their own experiences and biases. Even if they have experience in many different fields (representing a multidisciplinary individual) they bring those biases with them. In dealing with the increasingly complex problems posed in today’s world, it is through a team effort, with different points of view, that you are more likely to uncover real problems, or be pointed towards a solution that has meaningful impact for a broader audience. A multidisciplinary approach seeks, values, and expects input from experts and novices (because of their freshness) alike from various fields as they work to identify and solve a given problem. Team-based approaches illustrate one example of the multi-disciplinary aspect of design thinking.

## **User Centered**

Design is about making things for *other* people. These other people are called *users*. Donald Norman, in his book The Design of Everyday Things<sup>10</sup>, talks about the concept of “user centered design”. User centered approaches to problems are based on a deep understanding of context. Context can be defined as the environmental elements and circumstances that influence and define a person or a problem. The process of understanding context helps uncover the “real” problem. Often, a problem presents itself in one way on the surface, but after a deep look into the complete context, the phrase “what I really need is...” comes out.

Some of the things that can help to understand and define context are observed user behaviors, values, attitudes, and actions; market/brand awareness; acknowledgement of cultural differences; and a holistic view of the project/product life-span including use, production, point of sales, and end of life disposal. This deep awareness of context also includes other, perhaps more hidden “stakeholders” who are affected by the design, but not necessarily the final users.

## **Physical**

The physical aspect of design thinking takes many forms. Traditionally, designers and artists draw, sketch, and doodle. It is a natural talent. But the characteristic that can be applied to other disciplines and the design thinking process as a whole is the idea of making thoughts and solutions real as quickly as possible.

The physical nature of design thinking is best translated by the idea of mock-ups. Chapter six in the book “The Art of Innovation” is entitled “Prototyping is the Shorthand of Innovation” by the author, Tom Kelly<sup>11</sup>. Increasingly in product development teams, prototyping is a method borrowed from the discipline of industrial design for learning and evaluation. This often means building small models that represent an idea as far as you have it. For other disciplines, (writing for example) it means not waiting until you think you have it right before you write the first draft. Bringing clarity to a problem by forcing the current thoughts about the solution into reality by making prototypes allows one to identify weaknesses early, and to correct mistakes along the way.

## **Design Thinking vs. Design Thinkers**

It is important to make a distinction between the philosophy and practice of design thinking and the characteristics and aptitudes of people who are able to use these principles most effectively. These people can be called “design thinkers.” Many of the principles of design thinking can be learned and applied by many people. However, some people have specific attributes and aptitudes that allow them to use the principles of design thinking more effectively than others.

All people should be able to take advantage of adding the previous section’s skills to their personal toolbox. But because not all people have the same personal aptitudes, and talents, the results can differ significantly. The following section deals with skills which, if a person has them (or can learn them), will enhance the results of using design thinking.

The characteristics of a design thinker are:

1. High Tolerance for Ambiguity
2. Curiosity
3. Visual Thinker

Some may be tempted to place these skills in the section on design thinking. However, they are separated out here because they reflect more attributes of the individual, and less of a process to follow

When beginning a project, the real problem is not often explicitly stated. This ambiguity can be a stumbling block for people used to a more convergent process. They seek for a defined list of outcomes and deliverables up front that they can compare their effort to at each step. Design Thinkers have no problem dealing with this ambiguity, and start immediately working towards a final result. They can accept redefinition of the target (or outcomes and deliverables) along the way and not lose momentum. Design thinkers are good at “Suggesting something that MAY BE, and reaching out to explore it”<sup>12</sup>. This characteristic is an especially strong component of divergent creative processes.

Being curious, design thinkers take inspiration and input from a wide variety of sources and seek to learn new things. Design thinkers read and investigate issues outside of their individual spheres, and use this broad spectrum of knowledge to identify patterns, and extrapolate to solutions that don't yet exist. They can make analogies and transfer knowledge from one discipline to a new application in a new discipline.

Design thinkers are highly developed visually. Although this talent for visual thinking often manifests itself in terms of the ability to draw and doodle, it may also take the form of being able to mentally visualize the problem, or to “see themselves” in a given situation. Visual thinkers can often mentally rearrange their viewpoint in reference to their environment, or rearrange their environment in reference to their current view<sup>13</sup>. They often see and think in images rather than mental verbal descriptions.

### **Implications for the classroom**

Traditional assignments tend to be left brained. They are highly defined, with specific, steps and predefined correct answers that all students need to “arrive” at. They are worked step by step, with the whole being a collection of the completed steps. A set of math problems, for example, typifies assignments that design thinking is NOT geared to.

In reviewing and applying the previous discussion, assignments that use design thinking will require students to be Flexible, Fluent, Novel, and Defined. They should either have team members from different disciplines or require the students seek advice from several “mentors” who will be able to provide a different point of view. The project should force the students out of their own experience, and have to look at the world through the eyes of another. And lastly, they should have to represent their solutions physically from the earliest point possible.

In contrast to the example of a set of math problems, classroom assignments that can best take advantage of design thinking are longer term projects without a pre-set outcome. They should be classified as Projects rather than Assignments. Rather than focus on step-by step tasks, where the whole is the sum of completed tasks, structure projects backwards, where students have to spend time discovering the “whole” first (i.e. discover the problem first, and understand the contextual issues that are creating it), and then work on the necessary steps to solve it.

For example, rather than being asked to design a bridge with a specific set of physical requirements or constraints, students could be presented with the problem of getting across a river. They might look at the solution from the standpoint of a 70 year old pedestrian, a 45 year old motorist, a twelve year old bicyclist, and the 19 year old laborer who will participate in the construction. They might be required to understand city zoning ordinances and look at the environmental impact before beginning.

It is acknowledged that these type of projects can often be difficult to grade. During the project, attention must be paid to progress rather than just completion of steps. A student or group may work through the process several times before they arrive at an acceptable solution.

By structuring projects around topics and problems rather than specific solutions, students work towards defining (and defending) the problem that they identified and choose to solve. This allows ambiguity to creep in and forces the students to try and understand and deal with it.

## **Conclusion**

Design thinking seeks to combine the concepts of creative thinking, with the idea of real-world problems. By seeking to be closely connected to the context of the problem, and the people who will use them, design thinking, whether used by traditional applied arts designer or by an engineering/business based designer, often creates solutions that are more “compelling” or solutions that have a stronger emotional connection. This emotional connection often elicits the “gotta have it” response.

However, the relationship between creativity and design thinking can often confuse the definition of design thinking. Many people are creative in different ways. The FourSight group, associated with the International Center for Studies in Creativity, has identified four areas of where creativity can be applied - clarification, ideation, implementation, and development. Each of these areas are an important part of product development.<sup>14</sup> But creativity alone is not design thinking. Designers use creative thinking, but not all creative people use design thinking.

Working towards more creativity in the classroom, although noble, creates its own set of difficulties. It is often difficult to think up new problems for budding design teams, and grading often becomes more subjective. Similar to the study of the applied arts/design disciplines presents a model for creative activity separate from the results, perhaps a continued study of grading and criticism might result in a more defined way of the evaluation of these types of projects.

Not all problems lend themselves to the use of design thinking principles. Projects that are focused on maintaining, fine tuning, cost reducing, or quality control are less likely to be tackled by teams of design thinkers. But as the importance of creativity and design thinking are recognized, broader applications will be found.

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