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Robin Vande Zande
Kent State University

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K-12 Design Education, Creativity, and The Corporate World

Robin VANDE ZANDE*
Kent State University

Abstract: *Creativity has been described by a number of researchers as a 21st Century Skill and a way for students to succeed as learners, workers, and citizens. The corporate sector has had tremendous impact on what happens in American education for years and continues to do so. Teachers should understand that it is often beneficial to speak the language of business and cite corporate authors to offer validation for what they teach as being essential for creative skills. An effective way for teachers to teach creativity in the context of business is through design education, a natural integrator of various subject areas.*

Keywords: *K-12 Design Education, Creativity*

* Corresponding author: Kent State University | USA | e-mail: rvandeza@kent.edu

In effect, because technology has made simple tasks easier, more emphasis is being placed on a workforce that is proficient in higher order skills, which have been identified as The 21st Century Skills. A great deal of research has been conducted to define the skills that the American workforce will need as learners, workers, and citizens. Many top corporate leaders support the 21st century skills, as being the skills for today's students to be successful in a world that is quickly changing (Khadaroo and Clabaugh 2009). Many countries use have national, state, and district standardized tests to assess learning. However, quality learning measured by the standardized test system is only one aspect for measuring academic outcomes (Wagner 2008). Education accountability should exceed the boundaries of what is possible to test through standardized tests and should consider the skills listed for the 21st century workforce as being equally important. This is a position paper that views the skills of innovation and creativity and what those mean to people in American business as a predictor of future success. Content knowledge is important but the application of skills in real-world examples is the ultimate goal. Design education has an essential role to play in this arena. The ideas stated here could very likely be applied to design education in many countries.

Three sources that identified the 21st century skills were selected for this writing. The sources include: *Tough Choices or Tough Times: The report by the new Commission on the Skills for the American Workplace* (National Center on Education and the Economy (U.S.) 2007), created by 19 individuals who did two years of research in the United States and 13 other countries; *The Framework for 21st Century Learning*, a compilation of research conducted by The Partnership for 21st Century Skills from education, business, and industry publications in the last two decades (Partnership for 21st Century Skills 2008); and *The Global Achievement Gap* (Wagner 2008), written by Tony Wagner, co-director of the Change Leadership Group at Harvard and senior advisor to the education program of the Bill & Melinda Gates Foundation. These sources approached the topic from different perspectives. However, a basic skill that all three sources listed as essential was the ability to be innovative and creative.

Reviewing the backgrounds of these three sources reveals that their missions stem from the belief that improving the performance of the K-12 education system in the United States is necessary to be competitive in our rapidly changing world. *The New Commission on the Skills for the American Workplace* is a national coalition of business leaders, education leaders, and political leaders. The committee was initiated as a result of their belief that the quality of the American workforce has declined in the past 40 years, which has put the US economy in a "perilous position", said Marc Tucker, president of the National Center for Education and the Economy (Brodie 2009). Their report details recommendations for education reforms.

The Partnership for 21st Century Skills was formed in 2002 through the efforts of the U.S. Department of Education, AOL Time Warner Foundation, Apple Computer, Inc., Cable in the Classroom, Cisco Systems, Inc., Dell Computer Corporation, Microsoft Corporation, and the National Education Association. Their mission is to "serve as a catalyst to position 21st century skills at the center of the U.S. K-12 education by building collaborative partnerships among education, business, community and government leaders" (<http://www.21stcenturyskills.org>).

Tony Wagner interviewed business leaders from high-tech, retail businesses, and basic manufacturing operations about the skills they want new employees to possess. The interviews were followed by conversations with nonprofit, philanthropic, and education leaders. Wagner explains that business leaders have been the primary

advocates for education reform. He continues to say that educators and business representatives seldom talk and have little common ground, if any at all. It is time that educators more fully understand the impact that the corporate world has on American education, what is being proposed by the corporate world as being advantageous skills for employment, and how to develop ways to work together. Design education is positioned to meaningfully contribute in this endeavor. An area to start is in the training of students in the 21st century skills, particularly in innovation and creativity.

Design Education

Researchers of K-12 design education in the United States discuss design education as falling into four broad categories: *objects*, *communication*, *environments*, and *experience* (Vande Zande 2010). The design of *objects* may be referred to as industrial or product design. It includes the design of tools, furnishings, transportation, and fashion, among others. The design of *environments* is comprised of building and landscape architecture, community planning, interior design, and recreational spaces. *Communication* design encompasses graphic design and information architecture that would consist of publications, packaging, computer graphics, video, film, and advertising. *Experience* design may be referred to as interactive or event design. It includes designing occasions in which the user interacts in a situation or plans an event, such as festivals, theme parks, parties, computer and video games, strategic plans, and interactive websites (Margolin and Buchanan 1995).

The definition of creativity includes the concept of uniqueness as a result of a use of new materials, a new use of old materials, new ideas, new combinations of common ideas, and/or new style or revision of a past style. However, in the most innovative designs there is a unique solution that creatively satisfies a problem. Design combines two ways of thinking: a mix of creativity and analytical reasoning (Dorst and Cross 2001). The creative part of designing is not just the introduction of something new, but how that leads to a result that is unexpected and valuable (Gero 1996). A designers' primary strategy involves looking for solutions. Designers typically take a great deal of time before coming to a solution because they must explore what already exists, look at hidden topics and possibilities, then work through many concepts that go beyond the first idea. They try out different perspectives to get an idea of the challenges and limitations.

On one level design is a profession with particular skill sets and theories that are taught, but on another, basic designing is an innate ability. We make decisions about what to wear, how to personalize our living spaces, or fashion our appearance through the style of our clothing. These basic design decisions identify who we are to ourselves and to others. This suggests that design may be defined as the human capacity to shape our environment in ways that serve our needs and give meaning to our lives (Heskett 2003). The capacity to shape our world has gotten to the point that few aspects of our planet are left pristine. Life is nearly entirely conditioned by designed outcomes (Heskett 2003). Consider our landscape, for example. In most residential and commercial places, the lawns are mowed, weeds are pulled, bushes and plants are selected for color and texture then are pruned and shaped, and sidewalks are edged, all to create a particular effect. This example demonstrates that even nature is designed to serve our needs, reflect cultural values, and give meaning to our lives. In most American communities it has become a cultural expectation that lawns are cut. In some places laws are enacted that restrict the height of grasses and collection of

weeds. Why? It may be that by mowing the grass and pulling weeds reduces habitation for insects and animals, protecting us from their unwanted intrusion into our environments. However, lawn mowers are noisy, may be dangerous, and give off emissions. Insects and animals are destroyed and the lawns are rarely used for anything. Whether you agree with this practice or not, it illustrates that personal choice in designing permeates our lives, through shaping our lawns, to the selection of our clothing and accessories, and to arranging our living and work spaces.

To go beyond our innate proclivity to design requires that we teach students a basic conceptual understanding and skill sets. The optimal approach is to teach design in K-12 education as an interdisciplinary endeavor. The characteristics of design have a multidisciplinary nature and are to be found somewhere at the intersection of technology, art, and science (Findeli 1997). As Richard Kimbell writes about the teaching of design and STEM (science, technology, engineering, and math) subjects, “(Design) really is the integrator, the sense-maker, the interest-provider that transforms arid and failed models of learning and brings them to life” (Kimbell 2011, 7-8). Most often subject content in schools is taught in segmented and separate classes, which does not replicate many life experiences. Every day we need to apply knowledge from a variety of sources to resolve problems, manage relationships, and establish a quality life. Integrated design lessons help students connect their learning experiences, to produce a more holistic approach to learning. The aesthetic aspects or stylistic concerns should be taught in the art program with the functional aspects taught by the STEM teachers. History, economics, psychology, kinesthetics, music, writing and reading are areas that may be covered when researching aspects of a design problem. The interdisciplinary model of making connections between or among fields of study creates relevance and context, and assists students in understanding relationships among concepts (Jensen 1998).

K-12 students in a design study first learn the design process of problem solving and design thinking. They then work with the compositional tools that designers and artists commonly use, the elements of art and principles of design, as a way to create the style or aesthetic qualities of a product (Shadrin 1992). They become proficient at creating drawings or models used to communicate ideas to others and for translating ideas into dimensional objects (Todd, Todd, and McCrory David L. 1996). They study the basic skills and concepts used in technologies, materials, and differing philosophies that have impact on the approach a designer uses to create a result.

The Design Process and Design Thinking

Many designers and engineers use a tool called the design process. The process follows a planned sequence of analytical, synthetic, and evaluative steps, until the final solution is found (Lawson 1997). Creativity is infused throughout the process, which starts with defining the goals and objectives of the challenge and designing a plan to structure and direct problem solving. Problems that allow for creative solutions tend to be ambiguous and include conflicting assumptions and information that may lead to different solutions (Reiter-Palmon et al. 1997). Problem formation and reformation are an integral part of creative design. Once the problem is defined it is necessary to build a knowledge base by researching its various components. Researching takes the form of reading resources, observing participants, and/or role-playing. Designers then draw on their personal experiential base, applying abstract thinking and imagination through

brainstorming to generate a variety of possible solutions. The design process offers a viable structure for students to use in problem solving.

Tim Brown, CEO of IDEO, one of the top design firms in the world, is a promoter of the concept of 'design thinking'. Creativity is thought of at IDEO as a methodology that is human-centered, powered by a drive to understand what people want and need through observation, interviewing, and soliciting feedback throughout the design process. The shift from the emphasis only on the output to design thinking, where the emphasis is also on the act or the process, has been the catalyst for change at IDEO (Brown 2009). The designers involve community participants in generating possible solutions. They have anthropologists, psychologists, sociologists and designers out in the field, because IDEO (and most design firms) believe that the collaborative practice with more people looking at a problem, and more people thinking creatively, means that a better idea is more likely to happen. It is essential for the designers to understand the cultural context to include multiple perspectives through the use of teamwork.

A year-long ethnographic study was conducted by Sutton and Hargadon (Sutton and Hargadon 1996) of the design firm IDEO. The purpose of the study was to understand how the firm could consistently maintain high levels of creativity for so many years. They concluded that the use of brainstorming created a culture that inspired innovative design concepts. Design thinking is used to stimulate creative thinking in order to produce a solution using empathy, visual thinking, storytelling, and multifunctional teaming. These processes start with 'empathy', which incorporates caring for the customer (Patnaik and Mortensen 2009). Visual thinking, or comprehending through images, is an alternative method to verbal thinking, comprehending through words. Storytelling provides a vision for a solution through a factual or fictional narrative. The use of multifunctional collaborative teams is critical because of the complexity of design problems.

Transferred to the classroom, the design process and design thinking in a supportive climate is essential. Students are given a structure to work through a problem, are encouraged to be playful and think of wild thoughts without having to have THE right answer, and use empathy to consider varying perspectives. The students should work on their design projects while remaining open to unexpected ideas and new possibilities, working with a team where everyone contributes and builds on each other's thinking. As students become more capable of these skills, they are preparing for 21st century society and workforce.

21st Century Skill: Innovation and Creativity

The *Commission on the Skills for the American Workplace* predicts that the kind of leadership needed for this century requires "a deep vein of creativity...people who can imagine how to use things that have never been available before, create ingenious marketing, write books, build furniture, make movies, imagine new kinds of software" (National Center on Education and the Economy (U.S.) 2007). Generating fresh solutions to problems is part of the intellectual capital that gives a company its competitive edge. *The Partnership for 21st Century Skills* (Partnership for 21st Century Skills 2008) includes within this category, thinking creatively, working creatively with others, and implementing innovations. Thinking creatively starts with idea generation techniques, trying radical and incremental concepts, and evaluating and refining ideas. In working with others, it is important to learn how to communicate effectively and to

be open and responsive to diverse perspectives. It is advised that students learn how to understand limitations to adopting new ideas but to view failure as a learning opportunity and understand to act on innovative ideas as a possible contribution.

Tony Wagner (Wagner 2008) explains that the heavy emphasis on standardized tests in a narrow band of subject areas has caused American public schools to cut back significantly on contributing to this country's capacity for creativity, imagination, and innovation. However, business leaders nearly always mention creativity and innovation as one of the skills that matter most. The neurobiologist, Robert Sternberg (Sternberg, 1996) identified creativity as an attitude toward life. Creativity is about coming up with an unusual idea, persuading other people that the idea is good and there is a willingness to take a risk. Corporate creativity is characterized as the ability to perceive the world with a different vantage point, to find patterns, to connect seemingly unrelated phenomena, and to recognize solutions (Naiman 2009). People should think in disciplined ways but also have a lively imagination. Curious people look at root components and do not accept things at face value.

It is beneficial to speak the language of business and to cite corporate authors as a way to offer validation for what we teach as being essential for 21st century skills. An important skill to teach is creativity and an effective tool is the design process, which follows a planned sequence of analytical, synthetic, and evaluative steps, until the optimum solution is finalized (Lawson 1997). A study of the design process teaches students to clearly define the design problem through questioning, followed by building a knowledge base through researching the various components of the problem. Researching takes the form of reading resources, observing participants, and/or role-playing. In the next phase students use experience, apply abstraction and imagination through brainstorming. The final steps involve a synthesis of a possible solution(s), creation of a prototype, presenting their idea to an audience who provides feedback, and modifying to produce the final chosen result.

'Ready to Innovate' Report

In 2007, the Conference Board, Americans for the Arts, and American Association of School Administrators surveyed American business executives and school superintendents to define and compare their views on the notion of creativity. The report that was published in 2008 is entitled *Ready to Innovate: Are Educators and Executives Aligned on the Creative Readiness of the U.S. Workforce?* (Lichtenberg, Woock, and Wright 2008). The report stated that American employers rate creativity and innovation among the top five skills as needed for new entrants to the 21st century workforce. The report continues to explain that superintendents who are charged with the education of the future workforce overwhelmingly agree that creativity is increasingly important. Both rate arts training as being crucial to developing creativity. However, what the report found was that there are discrepancies between the business employers and school superintendents on what define the important characteristics of creativity. The findings also indicate that most high schools that provide the courses of study where creativity is most encouraged, such as art and design, are taught only on an elective basis. Yet, 85% of employers who want to hire creative people say that they are unable to find the applicants they are looking for.

There are two issues that should be addressed: 1) Administrators need to be convinced that training students to use creative thinking is an important skill for the future and 2) educators need to understand what characteristics best demonstrate

creativity to people who are hiring and defining creativity for their workforce. The first issue may require a shift in the high-stakes standardized testing culture to one that recognizes that students need to demonstrate skills and application of knowledge in other ways. The second issue is that creativity should not only take place in the art or science classrooms, it should be used in learning in all subject areas, by generating original ideas, looking from a new perspective at things we may take for granted, realizing that there may be many ways to solve a problem, and arranging known components in new ways. The design process may be used with each of the top five observable behaviors rated to be important for creativity.

Business Leaders Define Characteristics of Creativity

Problem-Identification or Articulation

When the 89 employers of the “*Ready to Innovate*” report were asked to rank eleven skills of observable behaviors related to creativity, they put “problem-identification or articulation” at the top. This was different than “problem-solving”, which they rated as 8th. The difference between these two is that the first allows students to look at a situation and specify what is needed. The second very likely starts with a problem given to the students by the teacher and students are told to solve it. As Einstein said, “The formulation of the problem is often more important than the solution” (Wagner 2008). Employers want their employees to be able to trouble-shoot, see the problems and identify solutions. Teachers should teach some lessons that are open-ended for students to define the problem.

In the first of three main stages of the design process of problem solving, the *problem stage*, the designer identifies the parameters of the situation, including analyzing the problems and objectives, then researches information related to the problem. For students to mirror this ability, the teacher would give a scenario and ask the students to answer the when, what, why, where, how, and who questions so that they define the problem. Following this format, students learn problem identification.

Ability to Identify New Patterns

The second highest rated characteristic that the business sector named was the “ability to identify new patterns of behavior or new combinations of actions”. This was expounded on when the employers were asked about what they evaluated in an interview. Employers said that they wanted prospective employees to be able to look spontaneously beyond the details of a question. In other words, people who can think creatively can see new ways of approaching a topic. The *creative stage* of the design problem solving process involves brainstorming and visualizing numerous possible solutions, without jumping to the first, most obvious conclusion. Brainstorming exercises assist people in seeing new patterns in a question or new combinations of actions. Brainstorming sessions need “springboards” to encourage creative thinking. One brainstorming technique used in a marketing strategies workshop for generating innovative business, product, or service ideas, involved all of the senses. Colorful gift bags were filled with small items of different textures, tastes, appearances, ingredients, sounds, and smells. In the brainstorming session, groups of three or four people sorted through one of the bags, imagining how the sensory aspects could be incorporated into a new product. After 20 minutes, each group presented their ideas for further

brainstorming from other groups (Kyle). There are many resources that provide good brainstorming exercises, such as *Thinkpak: A Brainstorming Card Deck* by Michael Mickalko (Mickalko 2006) or *Brainstorming Reinvented: A Corporate Communications Guide to Ideation* by Linda Conway Correl (Correll 2004).

Integration of Knowledge Across Different Disciplines

The characteristic of creativity rated third highest by employers was “the integration of knowledge across different disciplines”. Teaching design lends itself very naturally to interdisciplinary teaching. The interdisciplinary model of making connections between or among fields of study creates relevance and context, and assists students in understanding relationships among concepts (Jensen 1998). Such a model is about making meaningful patterns so students are then able to see the relationship of parts to whole or how concepts from various disciplines are interconnected. When information is interconnected and students understand that what is learned in one subject can be applied to other areas, they become more adept at identifying, organizing, and utilizing information (Caine and Caine 1997; D’Arcangelo 1998; Resnick 1987; 2003). Design education provides the context for these goals through teaching about many historical, social, and psychological aspects of life.

Teaching about designed objects relates to the values, beliefs, time, and place for which those objects were intended in a real life situation that may have familiarity to all. Frans Johansson wrote *The Medici Effect*, a book about creative thinking (Johansson 2004). He suggests that we must have a depth and breadth of knowledge in order to maximize creative potential. In order to improve depth, he advocates for grouping students into teams with different knowledge areas. Within the team, it is beneficial to assign specific areas for each to research and be the “expert”.

Ability to Originate New Ideas and No Right Answer

Employers who were surveyed rated the “ability to originate new ideas” as the fourth characteristic and “comfort with the notion of ‘no right answer’” as fifth. In job interviews, these employers were impressed with people who could respond to hypothetical scenarios. The ability to generate new ideas by combining seemingly disparate elements is called synergistic thinking (Adams 2005). Design teachers encourage their students to create original ideas, to themselves and from other students. There are a number of good resources with synergistic exercises, which stretch students’ thinking beyond the usual. Two such resources are *Design Synectics: Stimulating Creativity in Design* (Roukes 1988) and *Synectics: The Development of Creative Capacity* (Gordon 1961).

Establishing an Environment for Creativity

Within the educational atmosphere of standardized testing and the measures used for educational accountability may stifle creative thought. There needs to be a balance. Certain things need to be learned through rote learning but for the most part, students should be given tasks that maintain their intrinsic motivation without the feeling that they are doing a task simply because they are told to do it but do not understand the relevance to their lives (Amabile 1989). Teaching to the test reduces intrinsic motivation and creativity. When giving grades, focus on “what you learned” rather than on “how you performed”. If possible, allow students a chance for revision (Amabile 1989).

The final stage of the design process is a credible approach for students to culminate a project. It includes presentation then revision steps. Students present their design solution to the other students, a group of parents, faculty, administrators, and/or a group of people who are in some way connected to the topic area. The audience would be the “focus group” who will give feedback on the effectiveness of the solution. There are various approaches to presentation, which may involve a planned lecture, a digital program (such as PowerPoint or Prezi), graphics, presentation boards, video and audio documents, among others. In developing a presentation, here are some points to follow: 1) clearly state the design problem, give a brief background of the research, quickly explain the considered solutions, and show the final model stating why it was the best solution. 2) keep the presentation short and simple. 3) be accurate and relevant to your audience. Once the feedback is given, students have a chance to revise their final product. It is about the process of using other people’s expertise and experiences to inform the students on new perspectives and to think beyond their own possibly limited creative ideas. It is also about the product in allowing students to take the information and implement it in a way they think that best fits their ideas.

Conclusion

For students to acquire one of the key 21st Century Skills, that of innovation and creativity, design educators should take the lead. Creative thinking and behavior may take place in any subject area that is taught in school or in any sector of business. But I believe that design educators know best how to motivate students to exercise this skill, which is often demonstrated effectively in their classrooms. I also believe that design teachers should be giving training to administrators and other faculty members in how to approach teaching and learning creatively. *The* third point is for design educators to understand that one of the most effective ways to get support is to educate business leaders that creativity and innovation are important aspects of design education and it is giving them what they ask for in our society and future workforce.

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