DESIGN THINKING AS COLLABORATIVE LEARNING IN EDUCATION: OBSERVING STUDENT BEHAVIOR THROUGH THE DESIGN THINKING PROCESS

By

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A CAPSTONE PROJECT PRESENTED TO THE COLLEGE OF FINE ARTS OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

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Summary Of Capstone Project

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Chair: Elizabeth Delacruz

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Abstract

The purpose of this research was to discover what behaviors would occur in a middle school art classroom when I created and implemented a curriculum unit based on the Design Thinking process. I became particularly interested in implementing this process when I discovered first-hand success in the Design Thinking course, under the instruction of Brian Slawson, during UF's Summer Studio Intensives. I used action research as a logical philosophy of study and discovered the Design Thinking process was very effective in encouraging positive, collaborative behaviors as well as creative thinking in students. Through Design Thinking, collaboration naturally inspired unity and success. Design Thinking is a human-centered method for making life better for others by collaborating through the opportunities of technology

(Innovation, Design Engineering Organization, 2012). Throughout history, people have come together to successfully problem-solve obstacles in life. In this research, I discovered students developed and displayed positive character behaviors such as leadership, respect, and perseverance when using the Design Thinking process. I also found that shorter, quicker time-periods and projects encouraged more active involvement and enthusiasm. Through Design Thinking, my students created solutions to personal problems, school problems, and improving everyday life. The results of my project, observations, photographs, and video footage are available on my website http://laurieemyers.weebly.com/ .

Contents

Introducing Design Thinking

In classrooms throughout the nation, many students are sitting aimlessly in their seats—attempting to sit still, trying to take in the teacher's information, and struggling to remain focused. "You need to know this for the test," teachers say as mandated assessments threaten to drive funding for education. Presently, "academic achievement is limited to a single measure: the standardized test. As pressure mounts for all students to meet a specific standard on these assessments, more emphasis is placed on the preparation needed to meet this goal at the expense of all else" (Barrier-Ferreira, 2009, p. 138). Common assessments and raising test scores have become the primary topic of concern at faculty meetings.

A vital inquiry regarding the effects of standardized testing is: "What is forgone when teachers spend inordinate amounts of time teaching to tests that might have a minimal connection to what students really need to learn?" (Sacks, 1990, p. 12). I have some ideas of my own. I want to teach kids *how* to think instead of *what* to think. We must equip our children for the future. It's important to prepare students to be responsible and respectful leaders. Kids deserve the opportunity to solve problems. Students are becoming complacent with easy access to the Internet. Could it be kids are just accustomed to information being given to them rather than what they might discover? Kids have a thirst for learning. By providing direction and likelihoods for meaningful learning, students will rise to the occasion. I want to provide my students with a safe environment where they can explore, question, collaborate, succeed, and fail. Through these opportunities, I believe students are more likely to experience meaningful learning and ultimately succeed. Based on my concerns for future generations and 25 years of teaching experience, I decided to study the Design Thinking process and its effects on the behaviors of my students.

Statement of the Problem

The problem motivating this capstone research involves the lack of unique opportunities for students to exercise their creative imagination, work collaboratively, and problem-solve in a traditional school setting. This problem should be studied because it is my belief that many students become jaded and uninvolved in school learning. Perhaps by the way individuals learn, possibly due to the pressures of standardized testing, or to other forces, it seems to me both students and teachers have lost their connection and passion for education. Addressing the variety of learning needed to support all students and providing opportunities of discovery over lecturing is vital to an individual's future (Benson, 2003).

Fast Company is a business magazine focusing on technology, business and design. Fast Company's online site is dedicated to innovation and creativity in order to produce success in business and design. The professionals of Fast Company have the same concern about taking the focus off testing and on to preparation for the future. Teaching kids Design Thinking will equip them with what they need to solve the world's biggest problems (Fast Company, 2012).

> Our world desperately needs leadership in achieving sustainable social justice, not simply learning the answer to a test question. America needs massive change in our understanding of the learning experience, not simply in our exam results. Simply put, to change the world, we need a generation of new minds equipped with new ways of thinking. We need to drastically shift our conception of education and then completely transform how we facilitate learning. (Fast Company, 2012)

I believe educators understand the premise that students do not all learn the same way. However, in my experience, I realize it is difficult to plan and implement lessons with a range of teaching styles. Bringing a variety of learning styles together with the opportunity to work

together and explore, I think, is critical to the success of our education system. The Design Thinking process naturally encourages students of all learning styles and intelligences to work together toward a common goal. As the process is student-led, kids are given opportunities for learning and growth through creative brainstorming, problem-solving, and leadership.

My capstone research project explores the philosophy and process of Design Thinking and the effects the process can have on my students' behavior and success in the classroom. My study seeks to answer the questions: How will using the Design Thinking process affect student behavior? How does a Design Thinking approach impact student motivation, responsibility, collaboration, and leadership in the classroom? If given more open-ended opportunities to plan their own learning, will children behave in more creative ways in my classroom? I found the answers to these questions and more as I implemented Design Thinking into my 7th grade curriculum.

Purpose of the Study

The purpose of this study was to accomplish the following: (a) introduce Design Thinking as a collaborative effort to make life better at Rolla Middle School better and (b) to observe and document the behaviors of my 7th grade students as they participate in the Design Thinking process. The outcomes I expected from this study include: (a) positive behaviors (i.e. respect, acceptance, and responsibility), (b) natural leadership, (c) creative problem-solving, and (d) collaboration towards a common goal. I also hoped to observe enthusiastic and actively involved students. Furthermore, it is my desire to share these findings with others in hopes to prepare students for the future--above and beyond standardized testing. Sharing these conclusions could prove beneficial to the success of students as well as teachers in all subject areas.

Research Questions

Using a participatory action research method of investigation, the following specific research questions guide my investigation.

1. What happens when I introduce Design Thinking into my classroom?
2. How can Design Thinking facilitate creative problem-solving behaviors in 7th graders?

Significance of the Study

I believe that the incorporation of Design Thinking in the classroom is significant to the future success of all students. In today's test-score-driven style of education, students do not experience as much opportunity to collaborate, brainstorm, take control over their own learning, or problem-solve. Understanding how the Design Thinking process works helps students use it more effectively. Experiencing the effects of this process has had a substantial impact on my own teaching methods and learning within my own classroom. The process introduces skills needed to take action when challenged with a problem. This type of problem-solving and collaboration can only benefit education.

Assumptions

I believe the Design Thinking process is one which will encourage many positive behaviors. I also am confident these experiences will position these students to experience success. Given the opportunity to explore and brainstorm, I think, prepares students for future success more so than merely preparing for standardized testing. As an educator, it should be my primary concern to prepare my students to be responsible, independent, motivated adults. I can assist children by boosting their social skills, leadership opportunities, independent thinking, and

creativity through Design Thinking. My assumption is: as students are given the chance to exercise collaboration and creative problem-solving; they will become more active as attentive, interactive, and passionate learners. I assume my students will exhibit enthusiasm, responsible behavior, strong leadership skills, creative problem-solving, positive behavior, collaboration, and success through Design Thinking.

Definition of Terms

The following terms are used in this paper:

Area of Special Interest (ASI) is a portion of *Pride Time* at Rolla Middle School. Students participate in ASI classes when they are not attending RtI. ASI classes are taught by counselors, principals, exploratory teachers (art, industrial art, library skills, computer technology, music, physical education, and health education) and paraprofessionals. ASI courses are one semester long, providing students to participate in two different interests.

Design Thinking is a human-centered approach to innovation which draws from collaboration in order to integrate the needs of people, the potentials of technology, and the requirements for success (Innovation, Design Engineering Organization, 2012). Through empathetic research, students define the problem they would like to address. Students then brainstorm to come up with a creative solution in which encourages a prototype. Finally, ideas are tested for feedback (kdtconsulting.org/design-thinking, 2012).

Pride Time (RtI/ASI) is a time devoted to providing additional instruction to students in a small group setting for all students at Rolla Middle School. Students can be selected by teachers to clear up confusion, to close the gap, or to create challenges (rolla.k12.mo.us, 2013). Pride Time meets three days per week for 30 minutes. This flexible program switches students every two weeks of six sessions.

Response to Intervention (RtI) is part of Pride Time at Rolla Middle School. RtI is a system of early identification and support of students with learning and behavior needs. The RtI process begins with high-quality instruction and general screening of all children in the core area classrooms (rtinetwork.org, 2013). Students struggling with specific topics are provided with interventions in small groups to accelerate their rate of learning.

Literature Review

Introduction and Definitions

Archimedes once said, "Give me a place to stand and a lever long enough and I can move the world" (http://thinkexist.com. para. 1). Each person brings his/her own lever of tools, skills, and point of view to any team. Combining energy and intelligence with the right lever can generate an extraordinary, powerful force (Kelley, 2005). By working together toward a common goal, people can make the world a better place. Through Design Thinking, individuals can contribute their expertise to a group in order to design something better. Design Thinking facilitates this process, and not only encourages, but subtly demands each person become part of the action.

Design Thinking is about collaborating with others in order to bring change through a better, more effective design (Berger, 2009). Merriam-Webster dictionary defines *design* as "to create, fashion, execute, or construct according to plan" (http://www.merriam-webster.com). Much more than style, design, as perceived by the authors I encountered, is a way of viewing the world in a way to make it better. In the 2009 book *Glimmer*,[1] Warren Berger contends "a designer must be able to see not just what is, but what might be" (p. 3). This literature review will contain my findings from diverse sources and answer the following questions: what exactly is Design Thinking, how has it been used in the past, how it works, and; why is it important to education. The major claims I will be talking about include: design has been around for much of history; the Design Thinking process of collaboration is an effective method of problem-solving and; implementing Design Thinking in schools will provide assurance for a successful future.

[1] *Glimmer* is about the history and future of design. The book relates to this research project in that it shows how designers approach problems and arrive at solutions.

Background of Design Thinking

Design Thinking is a human-centered approach to innovation which draws from collaboration in order to integrate the needs of people, the potentials of technology, and the requirements for success (Innovation, Design Engineering Organization, 2012). Collaborating with others in order to bring change through a better, more effective design is part of the problem-solving process of Design Thinking (Berger, 2009). In education, Design Thinking is about helping students identify what their levers may be and serving human need. The Design Thinking process is a process in that students are asked to work collaboratively, in groups. As a teaching method of education, collaborative learning involves groups of students working together to solve a problem or accomplish a task. Collaborative learning is built on the idea that learning is naturally a social act where learning occurs through conversation (Gerlach, 1994). But Design Thinking also differs from collaborative learning in that the Design Thinking process asks students to jointly identify and solve specific problems, conduct research, and generate possible solutions to the problem they identified. The actual Design Thinking process blends art and science and is driven by human empathy (Kelley, 2005).

Design is a way of solving problems and reinventing the world. In his book *Glimmer*, Warren Berger collaborated with top designer Bruce Mau, shared how great designers think. In *Glimmer*, Berger described how design could potentially improve our world through the use of innovative principles of design: personal, universal, social, and business. For Berger, principles identified in his collaboration with Mau are intended to show ways to improve how people think, work, and live. Challenges are met by people who look at the problem in a fresh way and see a glimmer of possibility for how things might be done differently (Berger, 2009). According to Berger, "Mau believes that an engineer becomes a designer when he/she truly begins to

empathize with human needs and desires, instead of just making thinks work mechanically" (2009, p. 12). Berger further argues that Design Thinking can play a major role in addressing issues in almost any challenge and help find a better solution, or, as he states, "Progress happens by design" (Berger, 2009, [video file]). Design Thinking is a proven methodology for solving problems. It is available to everyone—not just designers. These glimmer moments open up a whole new world of possibilities (Berger, 2009). Through empathy, definition, ideas, and prototypes; people collaborate to solve problems. Although not a new concept, collaboration through design(a fundamental aspect of Design Thinking) has not always had significant impact or even acceptable in education (Fast Company, 2012).

History of Design: When Has It Been Used?

The beginnings of modern design exploration can be traced to Galileo in the early seventeenth century through his writing *Dialogues Concerning Two New Sciences* (Buchanan, 2001). In his writings, Galileo discusses the design in the great collection of machines and instruments of Venice. The influence of the Bauhaus in Europe (1919-1933) and then in the United States as the New Bauhaus of Chicago incorporated design into the arts (Droste, 2002).

Design has been an important aspect of business-thinking since Herbert Simon's first edition of his 1969 book *Sciences of the Artificial*. Fast-forward to his 1996 third edition, Simon stated "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (p. 111). In the 1996 edition, Simon discussed the lack of teaching design in most disciplines. According to Simon, schools have been absorbed by academic propriety which called for tough, logical, formal, and teachable subjects. "The damage to professional competence caused by the loss of design from professional curricula gradually gained recognition in engineering and medicine and to a lesser extent in business" (Simon, 1996, p.

112). Simon stated a call for "an inclusion in the curriculum" of design in engineering as well as natural science which has since been influential to design's incorporation in education (p. 114).

Emerging in America around 1975, design research centers worked through collaboration between faculty and students researching the science and practice of design. A large part of this design teamwork was directed towards increasing the abilities of computers in order to support design (Simon, 1996). However, the specific Design Thinking method became popular from the work of David Kelley at Hasso-Plattner Institute of Design, also known as *d.school*, at Stanford University in the 1980s (Brown & Wyatt, 2010). Kelley found himself always adding the word "thinking" when people would discuss design with him. David Kelley Design created Apple Computer's first mouse in 1982. Bill Moggridge and his firm, ID Two, developed the first laptop. IDEO, Innovative, Design Engineering Organization, was formed in 1991 as David Kelley Design and ID TWO combined (Berger, 2009). Focusing primarily on traditional design of consumer products, IDEO began switching gears by 2001. Instead of creating consumer products, IDEO took on the challenge of designing consumer experiences (IDEO, 2012). In an interview with *Business Week,* Kelley suggested that most people are trained in analytical thinking, but there is part of the brain that can take creative leaps (2012). These creative leaps are the innovative momentum of design. Described as a methodology, Kelley asserted that the Design Thinking process is a new tool to add to your tool belt, a new way of thinking.

The Design Thinking Process: How Does It Work?

Typically presented in three overlapping spaces and five or six areas of consideration, the Design Thinking process is relatively simple. However, it can be used in brainstorming and problem-solving even the most complicated problems.

> The design thinking process is best thought of as a system of overlapping spaces rather than a sequence of orderly steps. There are three spaces to keep in mind: inspiration, ideation, and implementation. Inspiration is the problem or opportunity that motivates the search for solutions. Ideation is the process of generating, developing, and testing ideas. Implementation is the path that leads from the project stage into people's lives. (IDEO, 2012)

Calling the system *spaces*, instead of steps, is intentional, because these three things are not always completed in order. Topics may return to inspiration, ideation, and implementation as a group works through brainstorming and problem-solving. The process can seem chaotic to those experiencing it for the first time. But through the life of the project, participants become aware that the process makes sense and results are achieved, even though its form differs from typical linear, milestone-based processes (Brown & Wyatt, 2010).

Even though designers do not always progress through the three spaces in a specific order, the process typically begins with the problem or topic at hand; the inspiration space. Whatever inspires people to search for solutions obviously motivates them and creates a starting point. The inspiration space sets the framework of the project, goals, and objects. Topics such as human need, price, necessary, technology and marketing are considered. This space is the creative realm from which ideas develop. "A better starting point is for designers to go out into the world and observe the actual experiences of smallholder farmers, school-children, and community health workers as they improvise their way through their daily lives" (Brown & Wyatt, 2010). This type of observation assists in the design process, by building understanding and credibility. "To learn to think like a designer, it makes sense to employ a tool that designers themselves use extensively: observational research" (Berger, 2009, p. 9).

Ideation, the second space of design thinking, allows for thoughts and concepts to be explored. People who make up a team should have a variety of interests and backgrounds in order to demonstrate quality and work effectively. Through a diverse team of people, divergent thinking provides innovation. Moving into a structured brainstorming process, interdisciplinary teams begin by questioning. "Taking one provocative question at a time, the group may generate hundreds of ideas ranging from the absurd to the obvious" (Brown & Wyatt, 2010, p. 34). Ideas are made visual, often written on sticky-notes, so the team members can comprehend the variety of concepts. As many ideas as possible are presented with judgment being excluded. The best ideas will be evident. Discouraging those who take on the hindering, deterring role of the devil's advocate is important to the brainstorming process. Innovation is a vital part of the design thinking process. Kelley claimed "the Devil's Advocate may be the biggest innovation killer in America today" (2005, p. 2). Bringing people together to investigate new ideas without hindering any possibility will bring remarkable results. After a definite plan is in place, implementation may begin.

How does implementation occur? Once the best ideas are developed into a solid plan of action, implementation begins. Brown and Wyatt (2010) elaborated, "At the core of the implementation process is prototyping, turning ideas into actual products and services that are then tested, iterated, and refined" (p. 35). Prototyping helps the teams determine challenges and unplanned concerns as well as validate the future success of the project. Prototypes may be cheap or expensive, simple or complex, recognizable or indistinguishable. Once the project nears conclusion, prototypes become more comprehensive. A communication strategy, usually storytelling through multimedia, is also developed once the prototype is done. Throughout the three spaces, six areas define a focus.

Within the three spaces of the Design Thinking process,[2] displayed below, more specific direction is achieved through six particular methods: empathize, define, ideate, prototype, and test. Observing the audience in which the designing will occur is part of the development of empathy. Defining the problem precisely helps bring the team on the same page where ideation can evolve. Brainstorming for creative solutions is the heart of ideation. Finally, building some sort of prototype displays the team's ideas to show others and allows testing for feedback.

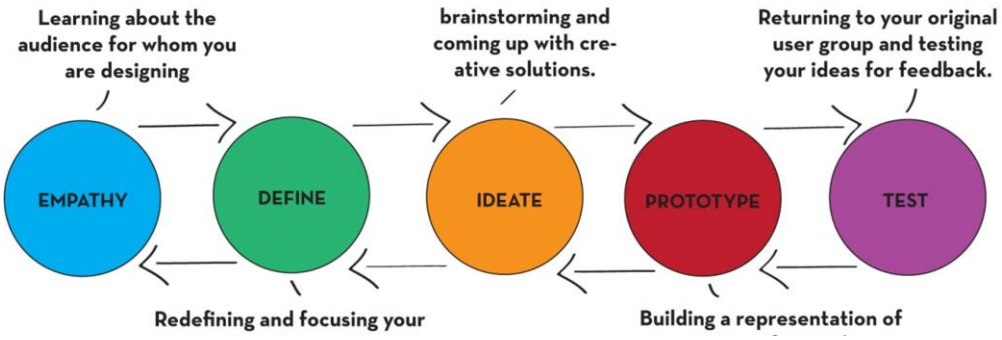

Figure 1. The Process, kdtconsulting.org/design-thinking (2012)

How Does Design Thinking Fit into Education Theory?

Design Thinking involves collaborative work toward a common goal. Lev Vygotsky's framework of learning and development noted collaboration through nearly everything people do, beginning with dependence on caregivers (John-Steiner & Mahn, 1996). The Vygotsky School is based on people giving each other respect and working together to overcome problems. Vygotsky scholar, Blunden believed if people could agree on what needed to be done then it didn't matter that different ways were expressed. As long as a common idea is shared, there is no need of controlling other's behavior (2001). Learning and using collaboration to solve problems

[2] Permission to share The Process by KDT Consulting.

and to make life better is beneficial to everyone. In today's test-score-driven education, students have fewer opportunities to work together, problem-solve, or brainstorm. Students have become used to being given the needed information as educators are pushed to teach to the test. According to reformer, Ted Sizer, "Standardized tests provoke a kind of drilling mentality. It's a game. And so students learn the game" (Merrow, 2001, para. 39). Diane Ravitch, historian of education, believes the current assessment methods may be training a generation of children who are deterred by learning, thinking it only concurs with meaningless work, test preparation, and test-taking (Ravitch, 2010).

Art educator, Elizabeth Delacruz offered me an insightful opinion when I concluded that kids I encountered in the classroom today seemed lazy, compared with kids of earlier years:

> I wonder if it's not that kids are lazy, but that they are habituated by adults to having things done in advance for them and spoon fed to them such that they don't get practice making decisions, making open ended explorations, putting forward plans of their own, etc. So maybe the problem is the way we teach and through our methods, we force kids to take a back seat in their learning. (E. Delacruz, personal communication, October, 26, 2012)

The call for humans to be engaged in relevant educational practices is not novel in education, as educators have long sought to embrace both the liberal arts and humanities in education. In fact, John Dewey explored the relationship among art, science and practice in 1929. He suggested science as art, rather than science as primary and art as secondary (Dewey, 1938). So, more than 80 years later, Design Thinking continues to connect art and science, and grows in importance to educators insofar as Design Thinking connects and integrates useful knowledge from both the

arts and sciences as a way to solve real-world problems (Buchanan, 1992). Buchanan explains, "The liberal arts are undergoing a revolutionary transformation in twentieth-century culture, and design is one of the areas in which this transformation is strikingly evident" (1992). Buchanan finds that integrative, active disciplines of understanding and communication, knowledge can be sensibly extended to serve the purpose of enriching human life. According to Buchanan (1992), *Neoteric arts*, or arts of "new learning" are changing our culture - both externally and in its internal character. Kelley adds that "[Design Thinking] principles can revive creativity in K through 12 education" (Lao, 2009, para 1). The process is relatively simple to follow and very much student-driven. According to Kelly, "Having confidence in your creative ability is on that level of being as important as literacy"(La O', 2009). Based on his work at Stanford University's Education Program and Stanford Hasso-Plattner Institute of Design in which they developed and implemented a collaborative unit for schools to help kids develop the skill set to incorporate design thinking into their lives. Kelley finds that students are "capable of coming up with new ideas, different ideas, and personal ideas that make them feel good about themselves" (La O', 2009). Finally, benefits of a Design Thinking approach in education are thought to extend to society. Goldman and Roth assert that teaching students how designers tackle a problem generates a competitive advantage in today's global society. Through design, children learn they have the power to change the world (Goldman & Roth, n.d.).

Concluding Thoughts: Why Is All of This Relevant?

As this literature review shows, Design Thinking is thought by proponents to be relevant not only to the business world but also to contemporary education and to the overall future success of society. With standardized test scores shaping school culture and impacting funding for education, students are given fewer and fewer opportunities to create and think on their own.

Ask a child a question and he/she is quick to access the Google search bar. Give a student a problem to solve, and they look for the "single right answer". Answers are at children's fingertips through the digital age of smartphones, tablets, and laptops. Or worse yet, teachers and textbooks are seen as the authoritative source of knowledge in schools, and students demonstration of learning or mastery of subjects areas are both pre-determined and predictable. Design Thinking requires a shift in thinking and behavior. Through the teaching of the Design Thinking process of identifying problems, collaboration, research, and ideation, students are given the opportunity to take control over their learning and work together toward a common goal. What better way to develop meaningful learning, social skills, positive character traits, and independence from the spoon-fed phenomena than using the Design Thinking process?

I have been made aware of my responsibility as an educator to provide students with a quality art education. A quality art education fosters the confidence necessary to develop into responsible, thoughtful, engaged citizens who are poised to problem-solve and work collaboratively. Through the Design Thinking process, I believe that my students can address meaningful problems through teamwork. I hope my students will truly learn, develop their own thoughts, and express who they are while embracing the world around them through the application of the principles of Design Thinking.

Research Design

My research questions focused on introducing Design Thinking into my middle school art classroom and how it would influence student behavior. Students in my 7th grade Pride Time class were studied for a period of six weeks. Various team-building activities were presented at the beginning of the study to instill unity and comfort among the participants (see Appendix E).

Students learned the Design Thinking process through discussion, video, and a sample group activity. The sample group activity involved using the Design Thinking process to create an original and useful app for an iPod.

Figure 2: Original apps on 3'x 5' student created iPod.

Next, students were asked to keep a log for 24 hours of things they found challenging (see Appendix D). Once the log was completed, a large group discussion produced common problems. Students individually wrote down their most significant issues and posted them together on a large piece of black paper. Of the many challenges presented, students selected the following as being the most important: transportation to and from school, crowded hallways, lockers, feeling tired, crowded gym, and announcements. I randomly grouped 3-5 students together through different color cards. Given the topic of how to make life better for a seventh grader, students collaborated on deciding which topic to tackle. Over the course of three class

Figure 3: Brainstorming with sticky notes

periods, teams defined and focused on the problem and then began brainstorming to come up with creative solutions. I encouraged students to continue research outside of class by interviewing others, engaging in online discovery, and making observations over the weekend. Through a large group discussion, we talked about how some things can seem worse than they are. I asked each group to come up with two positives about their problem. I believe this was important because of the topic involving ways to make their life better. I didn't want everything to seem negative.

The study took place in my classroom; a public school setting in a middle school art room. I used the method of action research to study what happened in my classroom. I collected and acted upon my observations, analysis, and plan in order to enhance my art curriculum (May, 1993). I organized, analyzed, and presented photographs, student works, reflections, and a teaching journal on my professional website. As far as analyzing this information, I found trends and themes through the active engagement involved in the topic at hand, talking about the subject, content specific conversations, and time on task during the project. I found my students to be engaged through active collaboration, participation, and conversations at all times. However, I found the students displayed more enthusiasm when the issue to problem-solve and brainstorm was shorter, as in the creation of an original app. This observation led to a few short-term projects after tackling the problems of 7th grade life. These shorter projects included new inventions for transportation and designing the camera of the future. Grouping students by commonalities as well as mixing boys and girls also proved more successful.

Figure 4: Team building activity, the Human Knot

Observing my students enabled me to identify particular behaviors which helped me analyze the success of this project. Specific behaviors I saw during this active collaboration included respect, responsibility, acceptance, and leadership. Students also gradually became less dependent on asking me questions. The fear of failure was evident in the beginning of the study but became progressively less significant throughout the brainstorming process. On days where I started the class with warm-up or team-building activities, positive behaviors were more obvious.

Subjects

I studied the behavioral effects of 7th grade students after Design Thinking was implemented into my classroom. The students demonstrated a diverse group of socio-economic backgrounds and ranged from age 12 to 14. The majority of these students were Caucasian. A few students in this group spoke English as a second language and were of Middle Eastern and East Indian descent. African American and Asian students were the minority of this group.

Figure 5: Students demonstrated a diverse group of socio-economic backgrounds.

Research Site

The research of this project took place in a public school in a rural community in Missouri. The school is considered a middle school and educates approximately 900 students in the 5th, 6th, and 7th grades. The rural community population is 19,506. An engineering university within this town attracts a diverse group of cultures.

Data Collection Procedures

My research methodology was action research. Action research is a form of investigation that helps teachers improve their own teaching. I believe action research was the best choice for my study because it is very appropriate for educators seeking to improve an understanding of a situation in order to increase effectiveness (Department of Library Science & Instructional Technology, 1999). I believe that the practicality of making a better learning environment by evaluating the effectiveness of Design Thinking in my classroom will improve my curriculum. Action research has helped me explore factors to predict success or failure in my classroom. The data sources I gathered included photographs of the classroom, instructional materials, still and video images of students working, student artwork, student writings, plans, and sketches, informal interviews with students and teachers, and my own teaching journal reflections.

Data Analysis

Through action research, I created my curriculum plan, acted on the plan, observed, reflected, and revised the plan, both as it unfolded in real time and at the end of the unit of study. I found myself revising the plan; acting on the new plan in my subsequent teaching, and continuing the cyclical process of observation, reflection, and revision (Department of Library Science & Instructional Technology, 1999). This self-reflective inquiry both helped me remain

organized and facilitated my work as I developed new strategies. I documented student collaboration, student artwork, progress of prototypes, and students' reflections about their experiences. I analyzed this data by creating a tally sheet of the behaviors and outcomes I observed. From this tally sheet I compared the behaviors exhibited by the students each week. I found trends, themes, similarities, and commonalities of student behavior during the Design Thinking process. I also video recorded the students in order to review their behavior. My plan period followed the group in which I conducted my research. This gave me ample time for consistent documentation of student behavior and observations. At the end of the four weeks, I gave the students a survey to better understand their thoughts about the process of Design Thinking.

Documentation

In order to document the student activity in this project, I continued my role as a teacher, but also took a step back and watched. I constantly walked around the classroom but allowed some independence of my students while being aware of their behaviors. To document my observations of student behavior, I photographed the students at work as well as their finished prototypes. I also video recorded the students while they collaborated, thus capturing their behavior and conversations. My teacher journal was placed on a blog on my professional website along with the photographs. I also used a system where character words were already written on a piece of paper, so I could quickly check off what I observed (Appendix C). These documentations were critical to my analysis of the project. However, there were some limitations.

Limitations of the Study

I believe as children grow to be adults, they will be more successful in all aspects of life if they learn and experience Design Thinking. Because this was not something I could prove in the short amount of time of this project, I had to settle for personal observation. Pride Time (ASI/RtI) is the first 30 minutes of three days per week. In small group settings during Pride Time, students experience extra help with a difficult concept or an extracurricular activity designed by the teacher. This was an excellent situation for me to complete my research because this class is separate from my art classes where I already have my curriculum in place. The

Figure 6: Students constructing a prototype for a staggered bell schedule to reduce crowding.

population of my sample was small, including 25 students in an ASI (Area of Special Interest) class. Our meeting times were comprised of eighteen, 30 minute sessions. These periods rotated some of the students in the group every two weeks for a semester. The inconsistency of student presence and the nature of the schedule inhibited stability in learning the Design Thinking process. I found it necessary to post and revisit the process frequently. Due to the inconsistent presence of students, I found it helpful to create and make available a worksheet type paper so the teams could have it to brainstorm and use as a reference (Appendix F).

The limitations of this research included: a restricted timespan for the study to be conducted; a very small group of students; an inconsistent population of students; limited to one classroom, and; a slight language barrier among some of the children. Working with an inconsistent population of students every two weeks provided more variety but created more challenges for collaboration. The small group of students may or may not have been a good sampling of the student population at my school. Because I will not be able to observe if behaviors continue outside of my research, I will not be confident that Design Thinking truly encourages positive behavior or improves grades or test scores. A small number of my students were not fluent in English. However, the slight language barrier did not become a factor.

Findings

The main purpose of my study was to observe the behaviors of my 7th grade students as they participated in the Design Thinking process. I had two important questions: What happens when I introduce Design Thinking into my classroom? How can Design Thinking facilitate creative problem-solving behaviors in 7th graders? Most of my observations were expected but exciting while some of the behaviors I noted were surprising and interesting.

First Observation: Design Thinking encourages positive behavior

From the very first Design Thinking class, only positive behaviors were observed. Students showed interest and enthusiasm as they learned they would be experimenting with a unique and specific style of problem-solving. One student named Rachael[3] said, "I felt like I was a scientist inventing something to make people's lives easier." Good character traits, such as responsibility, acceptance, leadership, perseverance, consideration, and cooperation, became evident in each student. Students did not argue or ever respond in a negative manner. I only witnessed two kids seriously debating why one idea was better than the other. However, they settled on a combination of their ideas without my suggestion. I was pleasantly surprised to the

Figure 7: Students brainstorming a new and improved playground

openness of all ideas and the ease in which students came to agreements on final decisions. Two of the quietest girls unexpectedly displayed leadership to solving a problem after others

[3] All student names are fictitious.

were unsuccessful. Watching my students collaborate to create their prototypes was so exciting! I was simply amazed by the work my students did together. Each day they impressed me even more. They seemed to enjoy what they were doing as they smiled and laughed. Yet, at the same time, each took their jobs seriously, all without complaining. I also observed positive words, sharing, helping each other, focus, brain-storming, and leadership from even the quietest kids.

Second Observation: The environment plays an important factor in success

I was reminded that both the physical and emotional environment is crucial to student success. After 25 years of teaching, I understand the importance of greeting my students at the door each day. A couple of days I was preoccupied by a phone call and then distracted by the needs of a neighboring teacher. Although these situations were necessary to attend to, the behavior of many of the students was different than usual. I became aware of having to repeatedly remind them of simple expectations like making their way to their seats and keeping their hands to themselves. I also believe the energizers used as warm-up activities helped get the kids interested and excited. Many students would ask what their warm-up would be each day. If I didn't have one, they displayed obvious disappointment.

As far as the physical environment, a few students needed assistance finding supplies. This observation led to adding images to the words labeling some of my supply drawers to make the room more visual and accessible. The rows of drafting tables were often inhibiting to group work. Upon several occasions, students rearranged the tables into small groups, worked in a larger space on the floor, asked to work in the hall, or moved to what we call our Harkness Table. This table is based on the 1930s philosophy of Edward Harkness to make class more involving, smart, fun, and the subject more interesting (tip.duke.edu, 2013). With each new art

class, I empower my students with the expectations around the Harkness Table. Students naturally collaborate, rather than compete, with each other when sitting at the table. I've discovered over the years of having a Harkness Table in my classroom, that students seem to more easily respect one another's ideas and work. The table also provides a safe place to learn and interact. I had not considered the Harkness Table being an asset to this study but have now learned that just placing students in a circle or oval encourages positive interaction—regardless of a designated table.

Third Observation: Shorter projects create more enthusiasm

I envisioned my students tackling a big project. I discovered they were more open to and more excited about smaller projects that took less time or had less time in between meetings. They displayed enthusiasm and interest about each project but were more focused when three days were used to tackle a problem as opposed to six days. The Design Thinking process allows students to move from one phase to another and back again with little down time. The biggest project, the playground conundrum, carried over to the next rotation of Pride Time. Getting the new team members up to speed and finding it necessary to revisit collaborated ideas between rotations hindered some of the earlier enthusiasm. This noticeable challenge led me to returning to a shorter problem. I made a variety of useful materials available to eliminate barriers to success. In the more involved projects, which addressed personal problems of 7th grade and the playground project, students had to go on location, work outside of class, and have computer access. This was very challenging for 7th graders because of the inconsistency and short time of the ASI class. I've found my students are more responsive and enthusiastic if the projects are shorter. Between snow days and only meeting three days per week, the inconsistency provided some challenges. Adjusting to shorter, quicker problems to solve ignited the enthusiasm.

Fourth Observation: Boys and girls solve problems differently

Through my observation, I discovered more of the girls addressed solving problems through talking, writing, and sketching. The boys were quick and eager to solve problems by constructing three-dimensional prototypes. One young man named Paul said, "I enjoyed building prototypes. You really have no boundaries. You can be as creative as you like." The girls often needed a little encouragement to move to the prototype step, especially if it was three-dimensional. The boys would rush through the first steps just to be able to build their design. When I mixed girls and boys together, teams were more successful than if genders were separated.

Fifth Observation: Groupings chosen by the teacher are more successful

I quickly learned that allowing students to group themselves did not generate as much success. This reminded me of why I was not a fan of collaborative learning over my years of teaching. When students grouped themselves, they were typically off-task and more critical of each other's ideas. Because they created teams of friends, some students would be left out. Interestingly, I did find students would invite individuals into their group if I publicly asked the lone student which team they were on. I also discovered creating games in order to group students by commonalities created more unity and acceptance. Some of the ways I assembled kids were by common traits such as: birth month, eye color, number of siblings, height, and favorite subjects.

Figure 8: Student success through teacher-controlled groupings and facing each other. Limitations were evident through physical placement of tables.

Discussion and Conclusion

Design Thinking is basically an exploratory process that, when done correctly, will make unexpected discoveries through a collaborative process (Brown, 2009). It is essentially a human-centered innovation process emphasizing observation, collaboration, quick learning, visualization of ideas, and rapid prototyping (Lockwood, 2009). The process involves three overlapping spaces and five simple areas of consideration: empathize, define, ideate, prototype, and test. A team of people work through the areas of consideration in order to solve a problem or make something better. This collaborative method is vital to productivity in the business world. However, Design Thinking has become more popular in education. Teaching the Design

Thinking process to students can give them the opportunity to work together for the common good. I believe this method is an effective way to develop meaningful learning, social skills, positive character traits, and independence from the spoon-fed phenomena.

With this capstone, and through action research, I have discovered what happens when I introduce Design Thinking into my classroom. I have investigated Design Thinking and the influence it has on character development. I am confident it will improve my curriculum and assist my students in positive behavior, brainstorming, and creative problem-solving for years to come. I am hopeful that in sharing my research with others, Design Thinking will become commonplace in all subjects in education.

Interpretations of my Findings

Based on my observations and research, I believe the Design Thinking process is a very effective way to teach students how to think instead of what to think. I have seen this process encourage positive character and behavior. I have witnessed excitement and a passion for learning as students took control of their own learning. Jason, a seventh grader, believes "Design Thinking seems to be a much better way to learn because you can get your ideas out." Through collaboration, problem-solving, and brainstorming, students displayed enthusiasm, natural leadership, and acceptance.

Significance of my Findings and Recommendations

Educators of all subject areas who are interested in developing meaningful learning within their classrooms should become familiar with and implement Design Thinking. Twelve-year-old Joyce was part of my study. She is "confident students would be happier to learn this way than just sitting down and doing a worksheet." As my research reveals, this process provides

opportunities for students to learn they can be successful—even through failure. Learning to problem-solve and brainstorm through this effective method will provide assurance for a successful future for individuals and for society. According to Amy, "Design Thinking will help me in the future because sometimes you have to work with people you don't really know or like. It's good practice to learn to understand or even get help from other kids." This human-centered approach, driven by human empathy, can bring change through building relationships and by combining ideas.

Author of *Glimmer*, Warren Berger provided me some interesting answers when asked about Design Thinking in education:

> I think it would be good to teach design thinking to kids. Whether or not it's called by this name, I think it's important for kids to learn creative problem solving -- how to think about a problem, learn more about it, ask the right kinds of questions, come up with ideas, and then try to act on those ideas. If kids can deeply absorb some form of this process, it can help them throughout their lives. Start with teachers: help them understand what's going on with design thinking, why it's important and effective in today's world, and help them to grasp the basic principles. Once they've taken that in, they will be the best ones to figure out how to transfer it to kids, how it should be presented, which parts are most useful / relevant to their students, etc. I think if the teachers truly understand & believe in it, they will figure out how to teach it. (W. Berger, personal communication, May 6, 2013)

I am excited to fully incorporate Design Thinking into my curriculum of journalism and art. I will make it a priority to educate other teachers to consider it as well. My suggestions will

include my findings of successful grouping, emotional environment, physical settings, and the length and consistency of addressing problems. As Berger communicated, how Design Thinking is presented can be determined by the teacher. This suggestion in itself securely incorporates meaningful learning. Through the plethora of new information online, my contact information and documentation recorded on my professional website, other educators have easy access to integrate Design Thinking into their own classroom.

Figure 9: A playground prototype

Figure 10: Example prototypes solving problems with lockers, transportation, crowded places, and being tired.

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Appendix A

UF | Institutional Review Board
UNIVERSITY of FLORIDA

PO Box 112250
Gainesville, FL 32611-2250
352-392-0433 (Phone)
352-392-9234 (Fax)
irb2@ufl.edu

February 14, 2013

TO: Laurie E. Myers
PO Box 584
Rolla, MO 65402

FROM: Ira S. Fischler, PhD; Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Approval of Protocol #2013-U-0145**

TITLE: Design Thinking as Collaborative Learning in Education

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants. Your protocol was approved as an expedited study under category 7: *Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.* Given your protocol, it is essential that you obtain signed documentation of informed consent from the parent or legal guardian of each participant. When it is feasible, you should obtain signatures from both parents. Enclosed is the dated, IRB-approved informed consent to be used when recruiting participants for the research.

> It is essential that the parents/guardians of your minor participants sign a copy of your approved informed consent that bears the IRB approval stamp and expiration date.

If you wish to make any changes to this protocol, ***including the need to increase the number of participants authorized***, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

This approval is valid through **February 3, 2014**. If you have not completed the study prior to this date, please telephone our office (392-0433), and we will discuss the renewal process with you. **Additionally, should you complete the study on or before the expiration date, please submit the study closure report to our office. The form can be located at http://ib.ufl.edu/irb02/Continuing_Review.html** It is important that you keep your Department Chair informed about the status of this research protocol.

ISF:dl

Appendix B

University of Florida – Department of Art Education

Student Assent

Design Thinking as Collaborative Learning in Education: Observing Student Behavior Through The Design Thinking Process

Hello, _____.

I am a graduate student at the University of Florida. I would like to observe and learn how my art students collaborate after learning the Design Thinking process. I will be conducting a study of you using the Design Thinking process and working with each other for four weeks during your regular Area of Special Interest (ASI) time. During the four weeks, you will be asked to brainstorm and problem-solve in small groups with your classmates while using the Design Thinking process. During the 25 minute classes I will take photographs and video of you and your art. I will also ask you to complete short interviews and surveys. There are no known risks to participation. You do not have to be in this study if you don't want to and you can quit the study at any time. I will respect your decision and it will not affect your grades. Your parent/guardian said it would be okay for you to participate. Would you be willing to join in this study?

Thanks for your consideration,

Mrs. Myers

Approved by
University of Florida
Institutional Review Board 02
Protocol # 2013-U-0145
For Use Through 02/03/2014

_____YES _____NO

I have received a copy of this description.

Participant_____Date_____

Principal Investigator_____Date_____

Appendix C

University of Florida – Department of Art Education

Dear Parent/Guardian:

I am currently working on my Master's Degree in Art Education from the University of Florida. I am conducting research on the effects of a problem-solving process called "Design Thinking" under the supervision of Dr. Elizabeth Delacruz. The purpose of my research is to discover what behaviors occur in a middle school art classroom when I create and implement a curriculum unit based on the Design Thinking process. The results of the study may help other teachers better understand the Design Thinking process and allow them to design instructional practices accordingly. These results may not directly help your child today, but may benefit future students. With your permission, I would like to ask your child to volunteer for this research.

The participating students will learn and participate in the Design Thinking process of brainstorming and problem-solving. This collaborative effort by the students will result in designing prototypes with a common goal of making life better in some way. I will ask students to answer questions about their experience. The procedure will be presented by me during the Area of Special Interest (ASI) class. The project will take place for 25 minutes, three days a week, for four weeks during the month of February and may follow into March. With your permission, your child and his/her artwork will be videotaped and photographed during the instructional period. Their identity will be protected and confidential. Some video footage and images will be accessible on my professional website. My website address is http://laurieemyers.weebly.com/

If permission is granted, I will never use your child's name with their artwork, nor will I put their name with their picture, or say their name during videotaping. Their identity will be kept confidential to the extent provided by law. Participation in this study will not affect the children's grades or placement in any programs.

You and your child have the right to withdraw consent for your child's participation at any time without consequence even after the course is over. There are no known risks or immediate benefits to the participants. No compensation is offered for participation.

Please return this permission slip as soon as possible if you are in agreement. If you have any questions about this research protocol, please contact me, my building administrator, Mrs. Monica Davis at (573) 458-0120, or Dr. Delacruz at edelacruz@ufl.edu. Questions or concerns about your child's rights as a research participant may be directed to the IRB02 office, University of Florida, Box 112250, Gainesville, FL 32611, (352) 392-0433.

Thank you for your consideration,

Laurie Myers

Please complete one form and return to me at your earliest convenience. The second form is your copy.

I have read the procedure described above. I voluntarily give my consent for my child,

_____, to participate in Mrs. Laurie Myers' study of Design Thinking in the classroom. I have received a copy of this description.

_____ _____

Parent/Guardian Date

Approved by
University of Florida
Institutional Review Board 02
Protocol # 2013-U-0145
For Use Through 02/03/2014

Appendix D

What bothers you?

From the time you wake up in the morning until the time you lay down to go to bed, keep a log of what bothers you during one school day. Bring it to Design Thinking next week.

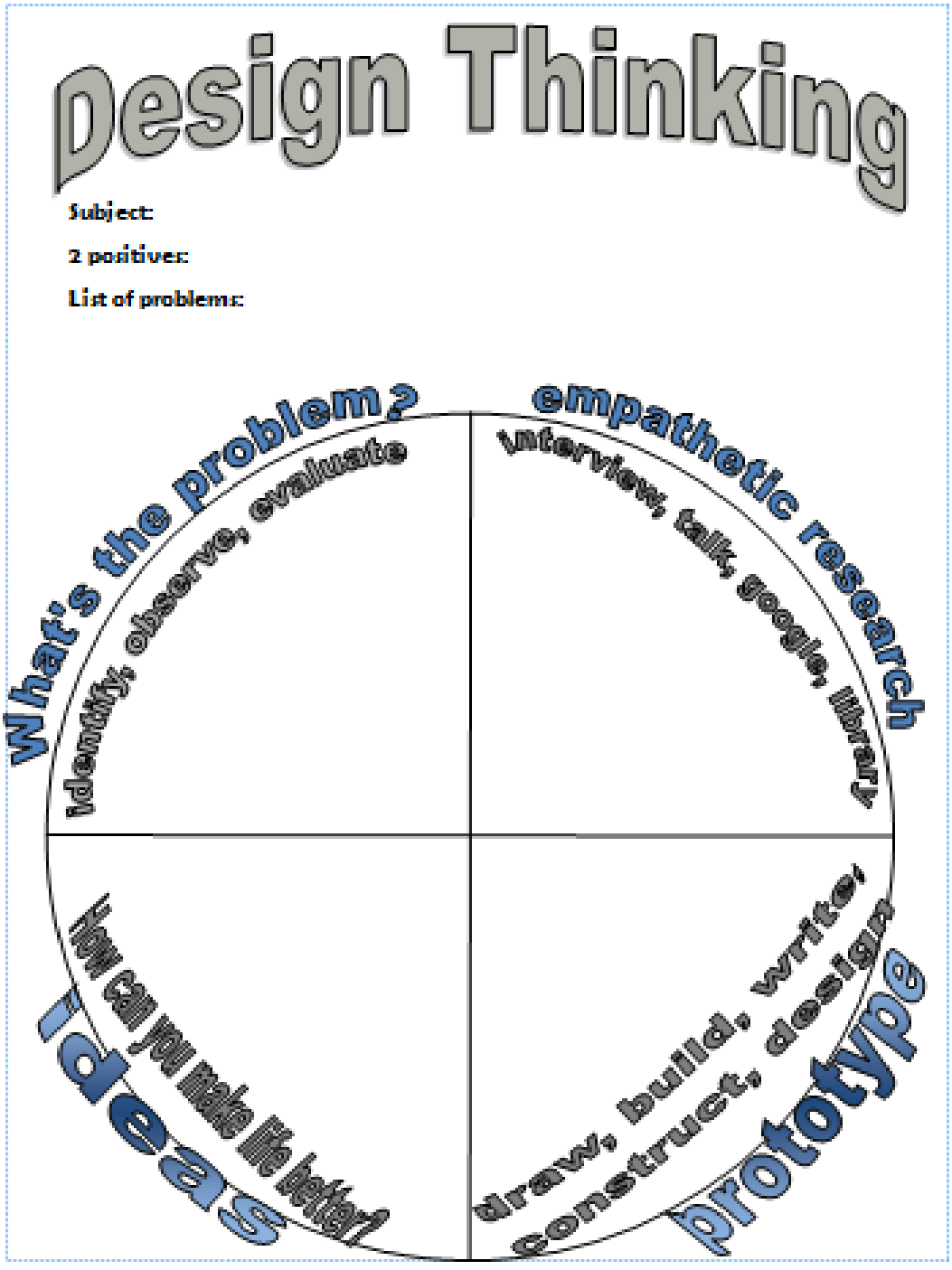
What time is it?	What is the problem?	Why is this a problem?	Do you believe this problem can be solved?
1			
2			
3			
4			
5			
6			
7			

Appendix E

FIND SOMEONE WHO

LOVES CATS	WAS BORN IN A DIFFERENT COUNTRY	CAN WHISTLE
CAN PLAY A MUSICAL INSTRUMENT	ENJOYS MATH	WOULD SING A SOLO
WANTS TO BE AN ENGINEER	IS AN ONLY CHILD	LIKES TO DRAW
CAN SPEAK ANOTHER LANGUAGE	ENJOYS COUNTRY MUSIC	IS TALLER THAN YOU

Appendix F


Design Thinking
Subject:
2 positives:
List of problems:
What's the problem?
identify, observe, evaluate
empathetic research
interview, talk, google, library
Ideas
How can you make it better?
prototype
draw, build, write, construct, design

List of Figures with Figure Captions

Author Biography

Laurie Herrman Myers has been teaching art in Missouri since 1988. Her teaching experiences include 5th grade to adult in the areas of art and journalism. She is a graduate of Rolla High School in Rolla, Missouri. Laurie completed her Bachelor of Science degree in education from William Woods University in Fulton, Missouri, with an emphasis in art and English. A lifelong participant in the arts, Laurie especially enjoys drawing, painting, and photography. Her other hobbies include kayaking and four-wheeling with her family.