DESIGN THINKING: EXPLORING CREATIVITY IN HIGHER EDUCATION

By

Janelle Bouchard

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Environmental Design

2013

ABSTRACT

DESIGN THINKING: EXPLORING CREATIVITY IN HIGHER EDUCATION

By

Janelle Bouchard

This study explored creativity strengths in higher education with design and non-design students and professionals at Michigan State University. Using a quantitative survey method, surveys were used to collect all data. A total of 50 surveys were collected and analyzed using the Torrance Test for Creative Thinking (TTCT) creative strengths and cross tabulation tests.

The research looks at the definition of design thinking, creativity in Landscape Architecture, social interactions, experiences and creativity testing. The variables investigated within this study, derived from the literature review, Jamie Maslyn (2002) case study, and the Torrance Test for Creative Thinking (TTCT). Results indicated some significant differences between the groups. Group 1 (design professionals) scored higher in the majority of creative strengths categories. Social interactions and experiences can influence your creative thinking and process of thinking. Movement/Action, one of the twelve creative strengths tested showed a significant difference for the participants who played youth sports.

Little studies show creativity testing in higher education, this study suggests influences that enhance creativity strengths in individuals.

This thesis is dedicated to the memory of my mother, Sandra Bixman, who instilled in me the drive and determination to follow my dreams and pursue my goals.

ACKNOWLEDGEMENTS

The completion of my thesis would not of been completed without the support of numerous people in my life. I would like to express my appreciation to them in this section.

First and foremost, I would like to thank my thesis committee. I am extremely thankful to my major professor, Dr. Patricia Crawford, whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the subject as well throughout my entire graduate study. I am also very thankful to my committee members, Dr. Eunsil Lee and Dr. Patricia Machemer, who's encouraged and supported me throughout this process and gain a better understanding of the graduate study.

Lastly, I offer my regards and blessings of family and friends who supported me in any respect during the completion of the project.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Research shows that everyone has some capabilities of being creative(Lynch & Harris, 2001). Over the past fifty years, creativity has been researched over and over again (Lynch & Harris, 2001). Research shows that creativity can mean quantity equals quality (Lynch & Harris, 2001). It is said that the more quantity of ideas you have the better the quality of the solution. Also, much research has been done studying small influences that could increase creativity. According to Lynch & Harris (2001), creativity involves fluency and flexibility of thinking, personality, perceptiveness of problems, originality, redefining and elaborating. Creativity has been found to be a key component of everyday life. Wether it is picking out furniture for a home or designing a four story high rise, creativity is used in all areas (Cross, 2011). The average adult thinks of three to six alternatives for a given situation where a child would think of sixty solutions. Why is this? Has education influenced creativity levels overtime? Research has shown that teaching creativity in grade school can help in the long run by increasing children's problem solving skills which will lead them to successful adulthood where they can then take information and analysis it in a constructive manner (Todd & Shinzato, 1999).

Creative thinking has allowed us to avoid boredom. It has also given us a chance to resolve personal conflict and cope with increasing consumer choice, accept ambiguity, make independent choices, use free time constructively, and lets our mind adjust quickly to new comprehension (Storm, 2000).

I have always had a fascination with thinking. How we think, how we approach finding a solution, how we look at something and generate all these ideas, and how others think. We do not all think the same; this is a characteristic that we as individuals are different from one another. Creativity is not just a word it is a fascinating word that can describe anything that is created. Creativity is not a talent, nor is it a casual ability (Perkins, 1985). So if creativity is not a talent, then how does one seek creativity? How do we gain a level of creativity and why are some people 'more' creative than others? Do others influence our creativity levels in any way?

The Purpose of this Study

The study's purpose is to look at the design thinking process and examine potential influences of creativity strengths in higher education. Three objectives are researched specifically within this study. The objectives are:

1. To identify the process of design thinking and creative thinking.
2. To explore any influences that enhances creative strengths in individuals.
3. To explore mixed groups of students and professionals creative strengths within higher education.

Significance of the Study

The creative process has been explored by many researchers over the past fifty years, but little knowledge identifies influences that enhance creative strengths in individuals. Within this study, new knowledge will contribute and compliment the information already explored and tested on creativity. This study will be able to contribute to the information of knowledge of

creativity thinking, creative processes, creative strengths within students and professionals and influences that enhance creative strengths.

Research allows more information to the body of knowledge within the subjected examined. Previous studies mostly look at one aspect of creativity; one influence instead of multiple influences. This study will look at multiple influences that can enhance creative strengths.

Overview of the Following Chapters

From this point the thesis is organized in the following manner:

Chapter 2 looks at literature review that has four main sections. The first section looks at the definition of design thinking as well as the process of design thinking. Also, this section will compare design thinking with other thinking methods. The second section defines what creativity thinking is and the process of creative thinking. Creativity is also compared to critical thinking in this section. Perkin (1985) general principals are introduced, education teaching methods are explored and experiential learning is examined in the second section. A case study, Jamie Maslyn (2002), discusses influences in youth that can contribute to enhancing creative strengths throughout life. Section four looks at different creative testing methods and examines specifically the Torrance Test for Creative Thinking (TTCT) (Torrance & Ball, 1984).

Chapter 3 shows the research method and study. Within this chapter, a description of the research design is given, followed by the development of the survey and criteria of the selected questions of Part 1 and Part 2. Cross tabulation testing is the final discussion of this chapter.

Chapter 4 reports the findings of the significant differences found from a cross tabulations and Pearson Chi-Square tests. Data is reported for Part 1 and Part 2; comparing Part 1 data with Part 2 data and Part 2 data itself compared.

Chapter 5 discusses the study's results based on the survey developed for this research. Further suggestions for continuing this study is also provided.

CHAPTER 2

LITERATURE REVIEW

Three styles of thinking are explored within this literature review; conceptual thinking, systems thinking, and critical thinking. This literature review also consists of articles and books that talk about design thinking, the process of design thinking, and creativity. The research is looking at the definition of design thinking, creativity in Landscape Architecture, social interactions, experiences and creativity testing.

Design Thinking

A very important aspect of what makes everyone human is having thinking skills; the design thinking method is one of many thinking methods that humans have (Cross, 2011). Design thinking begins with a problem, followed by gathering information and analyzing what you already know. Once these methods and processes are completed, a solution to the problem is generated. Many say that design thinking is a specific style of thinking, known as 'creative thinking-in-action' (Cross, 2011).

Questions Compared

Design thinking is a different style of thinking than other styles. What makes design thinking different from others? Three styles of thinking are compared in the literature; conceptual thinking, systems thinking, and critical thinking.

Conceptual, System, and Critical Thinking

Conceptual thinking is different than design thinking. Conceptual thinking looks at understanding a given problem. The problem then become a solution based on the primary issues. Conceptual thinking looks at the combination of issues and factors into a conceptual outline (Rodriguez, 2008). For an example, a conceptual thinker can be considered a philosopher or an entrepreneur. One has to understand many concepts to be creative and create his/her own (Rodriquez,2008).

System thinking is a kind of problem solving, looking at problems as parts of a whole system other than coming up with a solution to one part of the problem. Rather than a linear cause and effect, system thinking focuses on repeated causes and effects (Richmond, 2001). System thinking is not an incomprehensible way to think, it is just another way to look at a problem and use organized 'systems' to link the solution created.

Another type of thinking is critical thinking. Critical thinking is a kind of realistic, attentive thinking. It is an intellectually disciplined kind of process of actively applying and evaluating observation, reflection, experiences or communication which then guides development of an idea. This thinking is judgmental because it is affirmative (Hurson, 2008). In Higher education, Critical thinking is widely taught. Many professions use this type of thinking as it helps to solve problems in a real manor (Facione, 2011).

Therefore, design thinking is a creative process. It is a process of many ideas created for the problem. The process looks at a problem, analyzing the problem with gathered information and coming up with a solution. Design thinking looks at the whole problem first, then using

creativity in generating solutions, and realistically taking each of the potential solutions and placing it into the context of the problem; then finalizing one solution (Hurson, 2008). There are multiple thinking styles that one can pick to find a solution to a problem. Using the design thinking method, one can really explore 'out of the box' ideas and numerous solutions to best fit the problem on a creative level (Cross, 2011).

Today, we are seeing more and more companies hire what they consider to be 'creative' people. Being a 'creative' person can give that competitive edge companies are looking for to create 'idea groups'. Within these 'idea groups', design thinking and creativity is key to generate out of the box ideas (Cross, 2011).

Creativity

According to Webster's dictionary, creativity is defined as a state or quality of being creative. It is the capability to come up with ideas, systems, patterns, interactions, and to create significance new ideas.

Definition of Creative Thinking

Creative thinking is a process which explores new importance, new relationships and new perspectives. It is a type of thinking that is nonjudgmental. With using the method of creative thinking, it is normal to come up with many solutions. Therefore there are multiple ideas to choose from; selecting the perfect fit for the solution (Hurson, 2008).

Creative thinking in comparison with critical thinking is a 'free' type of thinking. Both thinking processes generate a list of ideas or solutions to the given problem. Creative and critical thinking explore new ideas and look for the best solution to the problem. The differences

between these two are that creative thinking is nonjudgmental as critical thinking is. Critical thinking develops a solution using criteria and factorial information where as creative thinking just develops any possible idea (Hurson, 2008).

According to Perkin's (1985), there are six general principles of creative thinking. The first one looks at aesthetics when creating an idea. Creative people want to have original ideas. Therefore, having an original idea becomes based on aesthetics. The second of the six general principles is giving attention to the purpose with as much focus as the solution. Creative people look at multiple solutions and then evaluate the ideas critically. The third principle looks at mobility more than fluency. Mobility in thinking means that the person is thinking movement in ideas rather than the number of ideas quickly generating. Creative people either look at the problem in a broad term or narrow down to a specific term. This means that creative people are coming up with ideas that best fit the problem. The fourth principle focuses thinking on the edge instead of the center of one's capability. Creative people have high standards while accepting difficulties during the process. This leads to stronger competitive ideas and solutions (Perkin, 1985). The fifth principle is thinking depends on being objective as well as being subjective. Creative people look at many different viewpoints as well as come back to projects to let the idea sink in. Revisiting these ideas helps the thinker to branch off the generated earlier ideas; usually strengthening the earlier ideas. Finally the last principle focuses on intrinsic motivation. To be creative to some degree, you have to be motivated (Perkins, 1985). These principles can explain creativity thinking to a level, but not completely. The main force is the person's motivation and/or intellectual competence (Perkins, 1985). Creativity can come from the interest of the individual and what they are doing. 'Being a creative person is a matter of following your intuition and life's work. Interested people do creative things because they enjoy it' (Maslyn,

2002). People that are creative are driven to create not just creating anything, intrinsic motivation can enhance creativity (Maslyn, 2002).

Looking at creativity in education is another important factor. Educators are continuously looking for new ways to enhance creative thinking. Educators teach creativity in the classroom with two general methods (Perkins, 1985). The first method is promoting basic motivation. The second method is introducing problem solving. Students are willing to be engaged more when they see a task as fundamentally motivating; which brings out creativity. Giving students activities to complete allows them to become motivated more and the resulting outcome is more creative (Perkins, 1985). In Jamie Maslyn (2002) case study, 'My ego motivates me to create. I always have something to prove to myself, saids Wenk'. This statement is an example of a person who uses self motivation to increase their ideas and create more. Having group activities is a form of experiential learning for the students. Experiential learning is learning by direct experience. This learning style can enhance creativity by watching others, experiencing, and interacting socially (Perkins, 1985). Learning requires skills linked to creativity. Approaching the subject of creativity and implementing it in the classroom will help maintain a well rounded learning environment that can enhance thinking levels (Perkins, 1985).

Creativity in Landscape Architecture

Why is creativity so important in Landscape Architecture today? Creativity is a word we use in Landscape Architecture that describes a new idea within a space. It is important to be 'creative' because everyone wants to create something new and be innovated. Jamie Maslyn, ASLA (2002) does a case study that explores creativity in seven landscape architects in the Denver, Colorado area. These seven landscape architects were recommended by their

professional peers as the most creative within their field. Mihaly Csikszentmihalyi's conceptual framework is utilized for this study. Csikszentmihalyi's conceptual framework looks at three interacting parts within creativity research; the individual (personality and development), domain (the discipline in which the individual works), and field (the judges and those persons effecting the structure within a domain) (Maslyn, 2002). Two personal interviews and a questionnaire were utilized to collect and analyze data. The interviews were more open-ended questions and the questionnaire was closed-ended response questions. Both the interviews and questionnaire were developed around the conceptual framework of Csikazentmihalyi. Within the results of this case study, the seven participants had parallel factors within answering the questions. Many of them lived in a rural area and played outdoors in natural surroundings. Also, most of the participants were active and social within youth activities. Playing outside in the woods, collecting natural objects and creating something out of those natural materials was also a common activity the participants had. Free time was also spent doing visual arts; drawing, painting and building models (Maslyn, 2002). The results of this case study led my research further into two general groups; social interaction and experiences within youth.

Social Interaction

Social interaction is the affiliation between two or more individuals. Social skills are learned normally in adolescents (Bellini, 2006). Why are social interaction skills important? It is critical to have social interaction skills because it helps with social, emotional, and cognitive development (Bellini, 2006).

Theory in Landscape Architecture: A Reader, (Swaffield, 2002) addresses the amount of social interaction that influences the design process of individuals. Designers are social to the

design team, classmates/co-workers and/or clients. The designers take the input of others about a particular project and influence the ideas created for the outcome of the project. Therefore, this will influence the design thinking pattern that takes place before coming to a solution, generating many creative ideas (Swaffield, 2002). Social interactions influences one way of coming up with a solution for the problem. Gathering information from others and examining that information can lead to influence the process of design thinking (Swaffield, 2002).

Experiences

People use experiences as a learning tool, to help understand, learn and gain skills. If there is no thought about the experiences, then the experience cannot be beneficial in any way. Creativity acts can come from experiences because there is thought about the act experience (Piirto, 2001). If you do not think about what you are doing than nothing will get done (Levine, 2002). Therefore, experiential learning is a part of getting creative juices flowing; which can allow anyone to be unique and express their individuality (Piirto, 2001).

Experiences get us involved and exposed to that specific event or thing. This is what we can call experiential learning. Experiential Learning is a process of comprehending from direct experiences. Also known as 'learning by doing', it is an individual learning process but can be in a group setting, classroom, event or any other space where experiences are taking place. Experiential Learning is a very important teaching tool that can be very beneficial (Kolb, 1984).

Experiential learning can be applied to numerous events like studying abroad. According to William Maddux, PhD., living outside the country can expand minds and help creative thinking. When living abroad, you are able to gain and cherish experiences. This can then lead

for higher creativity levels then others who have not gone abroad (Maddux, 2009). Individual experiences and hands on self exploration is a form of artistic creativity (Steinitz, 1995). With applying experiences to the everyday life, "every experience adds to your reservoir of ideas" (Maslyn, 2002).Therefore, the everyday life unconscious decisions start to mold into conscious decisions when using creativity acts to aid decisions during the day (Maslyn, 2002).

Creativity Testing

How do we test creativity? There are many different kinds of assessments that look at creativity. Since creativity is not a tangible figure, these tests give an idea of the level of creativity within individuals. Assessments look at creativity-relevant skills and/or processes within each test (Kaufman, 2008). The creativity-relevant skills and processes look at a single ability. This ability is to develop ideas that are creative. The ability also looks at ideas that distinguish, discover and solve problems with the creative thinking process (Deci, 1985). Creativity tests are usually divided into four parts: divergent thinking, convergent thinking, artistic assessments and self assessments (Kaufman, 2008).

Divergent thinking generates numerous creative ideas. This type of thinking is spontaneous. The ideas come about because of the thought process behind the ideas. The thought process looks at many possible solutions that can impact final idea. Some strategies are brainstorming, bubble mapping, creating artwork, and free writing (Kaufman, 2008). Within divergent thinking, the responses are then assessed by four factors. These four factors are originality, fluency, flexibility, and elaboration. Originality looks at original responses. Fluency looks are how many responses there are. Flexibility focuses on differences of responses. With elaboration, this focuses on how elaborate or detailed the responses are (Kim, 2006).

Unlike Divergent thinking, convergent thinking looks at specific steps to come to one solution. A series of questions are generated and then answered. This way of thinking requires little creativity. Convergent thinking is a fast, accurate, and logic way of thinking. "The solution is always the best answer to the problem" (Kaufman, 2008).

Artistic assessment is then looked at the test answers by a special admissions group. This group is usually professors, teachers and students (Kaufman, 2008). Self assessment is known as self evaluating. Self evaluating is a great tool to help understand what needs to be worked on in a different way (Kaufman, 2008).

Torrance Test for Creative Thinking (TTCT)

There are a number of ways that researchers have tested creativity levels. In particular, J. P. Guilford and E. Paul Torrance are two researchers who looked at creativity using divergent thinking and problem solving skills. J. P. Guilford was a psychologist who looked at human intelligence. His work included important findings on divergent and convergent thinking. E. Paul Torrance continued Guilford's work further and created the Torrance Test for Creative Thinking (TTCT). The TTCT is a test which looks at creativity in individual participants. This test looks at divergent thinking and other problem solving thinking skills in a simple way which is based on five subscales (Torrance & Ball, 1984; Torrance, 1990).

Fluency The total number of relevant ideas.

Originality The number of statistically infrequent ideas.

Elaboration The number of added ideas.

Abstractness of Titles The degree beyond labeling.

Resistance to Premature Closure The degree of psychological openness.

The TTCT now has thirteen criterion-referenced measures. These are called creative strengths. The thirteen creative strengths are emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of line or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery, and fantasy (Torrance, 1990; Torrance & Ball, 1984).

The TTCT is scored based on the five subscales and the thirteen creative strengths. After a number of these test started showing significant differences in divergent thinking patterns, the TTCT was not only a test for divergent thinking and problem solving but now also a test that measures creativity (Torrance & Ball, 1984).

Concluding Remarks

Design is described as the ability to create something else; it can be fashion or execution on a project as well as have a specific function or plan (Casakin, 2010). Within this literature review, many articles express that social interaction and experiences throughout life can help mold the way an individual thinks. Motivation also influences creativity (Maslyn, 2002). The roles of others play a huge impact on creative ideas (Maslyn, 2002). Group exercises are positive responsive evidence that shows the results of formulating a framework for higher education. But many conclusions are still not clear where or how creativity is developed (Lynch & Harris, 2001).

CHAPTER 3

RESEARCH METHODS

The following chapter will examine the research methods used during this study**.** A description and rationale for utilizing the research design as methodology is presented. Further research methods including survey questions, data collection, and criteria for analyzing the survey are described as well.

Research Design and Rationale

The general goal of this study is to investigate influences that could enhance creativity strengths in individuals. To accomplish this investigation, three main research questions were developed. To answer these research questions, a two part survey was developed. The two part survey consisted of seven questions and a drawing portion. With using a survey, data was easily collected and analyzed. This study tackles an intangible subject, which hopefully can lead to broader findings on creative strengths in individuals.

Participants

Research participants were a mixed group of student and professional level volunteers. The participants were split up into four groups; design professionals, design students, non-design professionals and non-design students. Participants that were design professionals and design students were landscape architects or had education and/or had a background in landscape architecture. Participants that were non-design professionals and non-design students had a

background or degree in science, education, business and medical. The participants were asked at random to take the two part survey. The total volunteers from each group are 10 design professionals (2 female, 8 male), 16 design students (8 female, 8 male), 11 non-design professionals (5 female, 6 male), and 13 non-design students (6 female, 7 male). They range in age from 19 to 61 years old. The mean age for professional groups is 45. 22 is the mean average age for the student groups.

Place of Experiment

Group 1 (design professionals) surveys were administered at a LAAAB meeting held in Human Ecology at Michigan State University. Group 2 (design students) surveys were taken by Landscape Architecture students from 3rd year to 5th year in Human Ecology at Michigan State University. Group 3 (non-design professionals) surveys were taken by university mail at Michigan State University. Group 4 (non-design students) surveys were taken by a fall semester geography 400 level class at Michigan State University.

Duration and Time of Experiment

All surveys were conducted and returned beginning February 2012 (winter semester) to October 2012 (fall semester). The survey, itself, took six to ten minutes to complete.

Instrument

The survey is based on the literature research to test creativity levels across the four participant groups: design professionals, non-design professionals, design students, and non-

design students. All surveys were given an identification number before they were given out to the participants. The survey is broken up into two parts.

Part 1

Part 1 consists of short answer questions. From the case study that was done by Jamie Maslyn (2002), Part 1 is based on the findings within that article. Social Interaction and experiences in youth were introduced again and again throughout the literature and evidence shows that creativity can be influenced by youth social interaction and experiences. Therefore, the majority of the questions ask about relevant experiences and social interactions within youth activities. Gender, age, major, and hometown are also included.

Question one asks the participant to write down their hometown. Question two asks what is participant's highest education level reached. Question three asks about transportation to grade (K-12) school. The participant has to circle all that apply; car, bus, bike, walk. Question four and five asks the participant if they played sports and if they were involved in any extra activities besides sports. If the answer is yes to any extra activities, the participant is asked to list them. Question six asks if any art classes were taken growing up and to rate their imagination level from one to five; one being 'not imaginative' and five being 'very high imagination'. The last question, seven, asks if the participant played outside when they were a child. Questions four, five, six and seven all had yes or no choices to circle (see appendix for sample survey).

Part 2

Part 2 is based off of E. Paul Torrance; *Torrance Test for Creative Thinking*. Participants are asked to draw something with the line that is given, title the drawing and write something about it all within five minutes (see appendix for sample survey).

Coding

Once the surveys completed, a coding system was developed to explore the data. The surveys are number coded into groups for sorting during analysis.

Design professionals: 1

Design students: 2

Non-design professionals: 3

Non-design students: 4

Located on the next page is a table that describes the coding system for Part 1. Age, major, question 2 and question 5's lists were not given codes.

Table 1: Part 1 Coding Scheme

Gender

1 Female
2 Male

Question 3

1 Car	6 Car/Bike	11 Car/Bus/Bike
2 Bus	7 Car/Walk	12 Car/Bus/Bike/Walk
3 Bike	8 Bus/Bike	13 Bus/Bike/Walk
4 Walk	9 Bus/Walk	14 Car/Bus/Walk
5 Car/Bus	10 Bike/Walk	15 Car/Bus/Train

Question 4/5/6/7

1 Yes
2 No
3 No Answer

Question 6

1 Not
2 Low
3 Moderate
4 High
5 Very High

Hometown was given a coding system of 1, 2, or 3 based on the population in each city. 1 being the lowest at having a population of 20,000 or less, 2 being in the middle at 20,000 to 300,000 and 3 being the highest population at 300,000 or higher. By placing these groups and

questions with a number, the cross tabulations was able to read each groups information in an organized fashion.

Part 2 is based on the Torrance Test for Creative Thinking scale. The twelve creative strengths are used to assess the second part of the survey. Emotional expressiveness, storytelling articulateness, movement/action, expressiveness of title, synthesis of incomplete figure, synthesis of lines/circle, unusual visualization, extending/breaking boundaries, humor, richness of imagery, colorfulness of imagery, and fantasy are the thirteen creative strengths Torrance established. I used eleven of the creative strengths because 'colorfulness of imagery' would not be a factor in my survey; the participants were not asked to us any form of color or provided with colored pens or pencils. The three parts, title/drawing/explanation, in Part 2 were all taken into account when assessing the score for the creative strengths. Each of the eleven creative strengths were looked at in all surveys and given a score of 1 to 5; 1 being the lowest and 5 being the highest score. Standards and criteria were developed for all eleven creative strength to aid analyzing Part 2 data. Below is the definition of each of the eleven creative strengths and the criteria that was developed.

- **Emotional Expressiveness** (EE) is the feeling or emotions portrayed in the title, drawing or explanation.
    - 1 – no feeling or emotion portrayed in the title, drawing, and explanation
    - 2 - title or drawing or explanation portrays an emotion
    - 3 – title and drawing, or title and explanation, or drawing and explanation portrays an emotion

- 4 – all three areas (title, drawing, explanation) portrays one emotion
- 5 – All three areas (title, drawing, explanation) portrays multiple emotions

- **Storytelling Articulateness** (SA) is a story that is being shown or told throughout the title, drawing or explanation.
  - 1 – no story shown in the title, explanation, and explanation
  - 2 - title or drawing or explanation portrays a story
  - 3 – title and drawing, or title and explanation, or drawing and explanation portrays a story
  - 4 – all three areas (title, drawing, explanation) portrays one story
  - 5 – All three areas (title, drawing, explanation) portrays multiple stories
- **Movement/Action** (M/A) looks at the line detail in only the drawing part; multiple directions of line movement, curvy lines, thick lines, patterns of lines, shading.
  - 1 – one line movement shown
  - 2 – two line movements shown
  - 3 – three line movements shown
  - 4 – four line movements shown
  - 5 – more than four line movements shown

- **Expressiveness of Title** (ET) looks at the description of only the title.
    - 1 – one word title
    - 2 – two word title
    - 3 – one descriptive word portraying feeling or emotion in title
    - 4 – two descriptive words portraying feeling or emotion in title
    - 5 – multiple descriptive words portraying feeling or emotion in title
- **Synthesis of Incomplete Figure** (SIF) is not touching the given line or completing a shape or picture with the line given. SIF is only looking at the drawing.
    - 1 – both ends of the line given is touched and traced over the given line
    - 2 – both ends of the line given is touched
    - 3 – One end of the line given is touched
    - 4 – the line given is not touched on earthier end, but there is a portion of the drawing around the given line within a inch radius
    - 5 – there is a inch radius around the given line that is not touched
- **Synthesis of Lines/Circle** (SL/C) is touching the given line or completing a shape or picture with the line given. SL/C is only looking at the drawing.
    - 1 – there is a inch radius around the given line that is not touched

- 2 – the line given is not touched on earthier end, but there is a portion of the drawing around the given line within a inch radius
- 3 – One end of the line given is touched
- 4 – both ends of the line given is touched
- 5 – both ends of the line given is touched and traced over the given line

- **Unusual Visualization** (UV) looks at the participants major/education background/title and takes that into account when examining the drawing. The drawing is not a common person/place/thing.
  - 1 – the drawing is a common person/place/thing in detail
  - 2 – the drawing shows little detail but is still a common person/place/thing
  - 3 – the drawing is not a common person/place/thing
  - 4 – the drawing is not a common person/place/thing and shows little detail
  - 5 – the drawing is not a common person/place/thing and shows a lot of detail

- **Extending/Breaking Boundaries** (EB) looks at the drawing within in the box given and if the drawing extends outside of the box frame given. EB is only looking at any marking outside of the box frame given.
  - 1 – marking stay inside the box frame
  - 2 – markings are touching the box frame

- 3 – markings extend outside of the box frame but do not exceed ¼ of an inch
- 4 – markings extend outside of the box frame and completes a shape drawn
- 5 – markings extend outside of the box frame and completes more than one shape drawn

- **Humor** (H) has to do with the positive feelings of the title, drawing and explanation.
  - 1 – no positive thoughts in the title or drawing or explanation
  - 2 – one positive thought in the title or drawing or explanation
  - 3 – two areas give a positive thought; title and drawing or title and explanation or drawing and explanation
  - 4 – All three areas gives a positive thought; title, drawing and explanation
  - 5 – All three areas gives more than one positive thought; title, drawing and explanation

- **Richness of Imagery** (RI) looks at the detail of the drawing only.
  - 1 – no detail in the drawing; plain/simple
  - 2 – little detail in the drawing; one to two line movements
  - 3 – multiple detail in the drawing; three to four line movements

- 4 – the drawing shows a picture that is complete
- 5 – the drawing shows a picture that is complete with shading/texture

- **Fantasy** (F) looks at the title, drawing and explanation and the content within all three areas. These three areas expresses characteristics of fantasy-like ideas; people/place/things that are not the norm.
  - 1 – no unrealistic people/place/thing in the title/drawing/explanation
  - 2 – one unrealistic people/place/thing in one of the three areas; title or drawing or explanation
  - 3 – unrealistic people/place/thing in two of the three areas; title and drawing or title and explanation or drawing and title
  - 4 – all three areas express characteristics of fantasy-like people/place/thing
  - 5 – all three areas express characteristics of fantasy-like people/place/thing and go into multiple details

Once all creative strengths were given a score, they were all added up to receive a grand total. Located on the next page is a table that shows the abbreviations for the eleven creative strengths.

Table 2: Abbreviations for Creative Strengths

EE	Emotional Expressiveness
SA	Storytelling Articulateness
M/A	Movement/Action
ET	Expressiveness of Title
SIF	Synthesis of Incomplete Figure
SL/C	Synthesis of Lines/Circle
UV	Unusual Visualization
EB	Extending/Breaking Boundaries
H	Humor
RI	Richness of Imagery
F	Fantasy

Average Scores Calculated

Each participants score was placed in an Excel spreadsheet and totaled for each category. Then the average score for each category was calculated. Table C: All Averages Scores for Part 2 showcases the average scores. Group 1 (design professionals) scored a higher average in the eight of the eleven creative strengths categories.

Table 3: All Average Scores for Part 2

	EE	**SA**	**M/A**	**ET**	**SIF**	**SL/C**	**UV**	**EB**	**H**	**RI**	**F**
Group 1	**2.9**	**3.2**	**2.4**	**2.4**	**3.1**	**2.7**	2.4	**1.5**	**2.2**	**2.5**	2
Group 2	1.9	2.3	1.9	1.8	1.9	2.2	2.1	1.1	1.7	2.3	2.0
Group 3	2.4	2.5	1.5	2.1	1.8	2.0	2.1	1.1	**2.2**	2.3	2.0
Group 4	2.2	2.5	1.6	2.3	1.9	2.0	**2.5**	1.0	2.1	2.4	**2.1**

Cross Tabulations

Once all surveys were completed, the data was imported into SPSS (Statistical Package for the Social Sciences) for analysis. A cross tabulations test is used to look for significant differences.

Cross tabulation is a process used to compare the data. The process compares at least two different data sources. When using the cross tabulation process, it looks at two groups or more at a time and finds significant differences between the two (Muijs, 2011). This process gave me contingency tables to identify significant differences in the data.

Part 2 looked at comparing one group to another. I only compared two groups at one time looking for significant differences in each of the twelve creative strengths. With Part 1, I compared singular questions to the twelve creative strengths; again, looking for any significant differences.

Once the cross tabulations were complete, I then looked at the Pearson Chi-Square. Pearson Chi-Square is an assessment of two types of comparisons; goodness of fit and test of independence. Goodness of fit looks at distributions differences between frequency and theoretical. Test of independence looks at two variables that are independent (websters, 2011). The Pearson Chi-Square was the determining factor for a significant difference. If the Pearson Chi-Square was .05 or lower, a significant difference was found for that category. Once determined a significant difference, the group was found a mean.

CHAPTER 4

DATA RESULTS

This chapter looks at the significant differences from the cross tabulations test, the Pearson Chi-Square and the mean results of Part 1 and Part 2 within the survey that was developed.

Part 1 Results

When comparing Part 1 data to Part 2 data, significant differences are found. The total of all groups were compared to one question at a time. Each question in Part 1 was compared with all eleven creative strengths.

One significant difference was found for question 3 in Part 1 results. The results for question 3, *How do you get to grade (K-12) school?* shows that there is a significant difference in category SIF (synthesis of incomplete figure). The Pearson Chi-Square shows the significant difference with a .018. Car, bus and walking to school indicated the significant difference. Below showcases the Chi-Square Test results in Table 4.

Table 4. Synthesis of Incomplete Figure (SIF) – Car, Bus, Walk

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.341[a]	33	.018

One significant difference was found for question 4 in Part 1 results. The results for question 4, *In K-12, were you involved in sports?* shows that there is a significant difference in category MA (Movement/Action). The Pearson Chi-Square shows the significant difference was a .051 (see Table 5).

Table 5. Movement/Action – Playing Youth Sports

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.759[a]	3	.051

Four significant differences were found for question 5 in Part 1 results. The results for question 5, *In K-12, were you involved in any extra activities after school besides sports*? (the list of extra activities did not play a factor in this crosstab, just the yes or no was tested) shows a significant difference in EE (emotional expressiveness), SLC (synthesis of line/circle), UV

(unusual visualization, and H (humor). The Pearson Chi-Square shows the significant difference was .022 for EE, .000 for SLC, .000 for UV, and .000 for H (see Table 6, Table 7, Table 8, and Table 9).

Table 6. Emotional Expressiveness – Youth Extra Activities Besides Sports

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.757[a]	6	.022

Table 7. Synthesis of Line/Circle – Youth Extra Activities Besides Sports

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.872[a]	6	.000

Table 8. Unusual Visualization – Youth Extra Activities Besides Sports

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.782[a]	8	.000

Table 9. Humor – Youth Extra Activities Besides Sports

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	50.941[a]	8	.000

One significant difference was found for question 6 in Part 1 results. The results for question 6, *Did you take art class growing up*? (rate your imagination was not tested in these specific results, just the yes or no was tested) shows a significant difference in RI (richness of imagery). The Pearson Chi-Square shows the significant difference was .028 (see Table 10).

Table 10. Richness of Imagery – Art Class in Grade School (K-12)

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.069[a]	3	.028

One significant difference was found for question 6 in Part 1 results. The results for question 6, *Did you take art class growing up*? *Rate your imagination level on a scale of one to five.* (rate your imagination was the only factor being tested in this specific result, the yes or no was not tested for this outcome) shows a significant difference in RI (richness of imagery). The Pearson Chi-Square shows the significant difference was .034 (see Table 11).

Table 11. Richness of Imagery – High Imagination While Growing up (K-12)

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.364[a]	15	.034

One significant difference was found for question 7 in Part 1 results. The results for question 7, *Did you play outside when you were a child?* shows a significant difference in RI

(richness of imagery). The Pearson Chi-Square shows the significant difference was .027 (see Table 12).

Table 12. Richness of Imagery - Playing Outside (K-12)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.184[a]	3	.027

One significant difference was found for hometown in Part 1 results. The results for hometown, shows a significant difference in UV (unusual visualization). The Pearson Chi-Square shows the significant difference was .014 (see Table 13).

Table 13. Unusual Visualization – Playing Outside (K-12)

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.101[a]	12	.014

There were no significant differences for age and gender when compared to the twelve creative strengths. Question 2, *What is the highest education level that you have reached?* And

question 5, *If you said yes please list what you were involved in?* were not comparable to the twelve creative strengths.

Part 2 Results

There are a few significant differences using the cross tabulations test and looking at the Pearson Chi-Square data. In comparing Part 2 data only, groups 1 (design professionals) and group 3 (non-design professionals) showed two significant differences in the twelve creative strengths. Syntheses in Incomplete Figure (sif) and syntheses in line/circle (sl/c) are the two that are showing a .05 or below in the Pearson Chi-Square data. Below is the data for groups 1 and 3 compared; Table 14 and Table 15.

Table 14 showcases the SIF (synthesis of incomplete figure) data. The Pearson Chi-Square indicates that there is a significant difference with .014. The mean for the crosstab data is 3.1 for group 1 and 1.8 for group 3.

Table 14. Synthesis of Incomplete Figure (SIF) – Group 1 and Group 3 Compared

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.667[a]	3	.014

Table 15 showcases the SLC (synthesis of line/circle) data. The Pearson Chi-Square indicates that there is a significant difference with .043. The mean for the crosstab data is 2.7 for group 1 and 2 for group 3.

Table 15. Synthesis of Line/Circle (SL/C) – Group 1 and Group 3 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.171[a]	3	.043

Groups 1 (design professional) and group 2 (design students) showed 3 significant differences in the twelve creative strengths. Below is the date for groups 1 and 2 compared; Table 16, Table 17, and Table 18.

Table 16 showcases EE (Emotional Expressiveness) category. The Pearson Chi-Square indicates that there is a significant difference with .045. The mean for the crosstab data is 2.9 for group 1 and 1.9 for group 2.

Table 16. Emotional Effectiveness (EE) – Group 1 and Group 2 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.044[a]	3	.045

Table 17 showcases SIF category. The Pearson Chi-Square indicates that there is a significant difference with .000. The mean for the crosstab data is 3.1 for group 1 and 1.875 for group 2.

Table 17. Synthesis of Incomplete Figure (SIF) – Group 1 and Group 2 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.606[a]	3	.000

Table 18 showcases SLC category. The Pearson Chi-Square indicates that there is a significant difference with .017. The mean for the crosstab data is 2.7 for group 1 and 2.1877 for group 2.

Table 18. Synthesis of Line/Circle (SL/C) – Group 1 and Group 2 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.227[a]	3	.017

Groups 1 (design professional) and group 4 (non-design students) showed 3 significant differences in the twelve creative strengths. Below is the date for groups 1 and 4 compared; Table 19, Table 20, and Table 21.

Table 19 showcases MA (movement/action) category. The Pearson Chi-Square indicates that there is a significant difference with .031. The mean for the crosstab data is 2.4 for group 1 and 1.615 for group 4.

Table 19. Movement/Action (MA) – Group 1 and Group 4 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.859[a]	3	.031

Table 20 showcases SIF category. The Pearson Chi-Square indicates that there is a significant difference with .001. The mean for the crosstab data is 3.1 for group 1 and 1.92 for group 4.

Table 20. Synthesis of Incomplete Figure (SIF) – Group 1 and Group 4 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.024[a]	3	.001

Table 21 showcases SLC category. The Pearson Chi-Square indicates that there is a significant difference with .001. The mean for the crosstab data is 2.7 for group 1 and 2 for group 4.

Table 21. Synthesis of Line/Circle (SL/C) – Group 1 and Group 4 Compared

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.947[a]	3	.001

There are no significant differences when comparing group 2 with group 3, group 3 with group 4, and group 2 with group 4 (see appendix for all cross tabulations data)

CHAPTER 5

DISCUSSION AND CONCLUSION

The following chapter presents a discussion on the findings from Part 1 and Part 2 of the survey. Following the results discussion are some derived conclusions.

Discussion

This section discusses the findings of Part 1 and Part 2 of the survey developed to explore influences of creative strength categories within higher education students and professionals. Social interactions and experiences in youth show that there are some significant differences the influence creative strengths. This result is supported by the cross tabulations test and the Pearson Chi-Square result. The research objectives stated in the beginning of this thesis are summarized as followed:

RQ1. What is the process of design thinking and creativity thinking?

Explored in the literature review, design thinking and creativity thinking are examined before the survey development. With a good understanding of these two thinking styles, further research was explored. Design thinking looks at a problem and generates an idea with using gathered information (Cross, 2011). This process is said to be out of the box thinking (Cross, 2011). Creative thinking looks at a problem and generates multiple solutions to the problem (Hurson, 2008). This process is also out of the box thinking but generates multiple solutions instead of one solution to the problem (Hurson, 2008).

RQ2. Are there influences that enhance creative strengths in individuals?

Two general categories were explored that could influence creative strengths in individuals; social interactions and experiences. Seven questions were asked in the survey developed that pertained to social interactions and experiences throughout youth (K-12). The results indicate that social interactions and experiences before higher education (college +) can influence creative strengths in individuals.

The Cross Tabulations test backed up my data statistically, re-establishing the significant differences in the compared groups. Between the different groups the creative strengths varied when comparing Part 1 and Part 2 of the survey.

In Part 1 results, question 3 showed a significant different in category SIF. M/A was a significant difference in question 4. In the first part of question 5, the significant differences were categories EE, SI/C, UV and H. Also, question 6, second part of question 6 and question 7 all had RI as a significant difference. UV showed up as a significant difference in hometown.

In Part 2 results, group 1 (design professionals) scored the highest average in the majority of the eleven creative categories. When comparing group 1 and group 3, SIF and SL/C are the significant differences. In comparing group 1 and group 2, there were significant differences in categories SIF, SI/C, and EE. In comparing group 1 and group 4, there were significant differences in categories M/A, SIF, and SI/C (see Table C for total average scores for each creative strength category).

Results show that taking the bus, riding in a car or walking to grade school (K-12) saids that the individual is creative. Playing youth sports show that the individual has a creative

strength in Movement/Action (MA). This could mean that if you were involved in sports you are more likely to create or think about movement/action when being creative. When playing sports, one is more likely to gain faster reflex skills, endurance and motivation to perform at ones fullest potential (Piirto, 2001). This shows parallelism with the literature review; experiences influence creativity and experiential learning influences creativity also (Piirto, 2001).

In question 5, four were significantly different. Question 5 asked if the participant was involved in other extra activities besides sports, which again drive parallel with past experiences and social interaction influencing creative thinking (Maslyn, 2002). By being involved in multiple activities you learn to balance your school work and activities which can bring about emotions. SI/C also showed up as significant (Kolb, 1984). This could mean that activities we are involved in can motivate creative thinking (Maslyn, 2002). In regards to the survey, the line became completed into something else and immersed within the detail. UV and H are also significantly different in question 4. I believe humor is learned by others, if we are not exposed to laughing or silliness then we cannot laugh or be silly. As well as UV, if we are not exposed to unusual things then everything we do is usual and simple.

Question 6 and 7 both showed RI as significantly different. Question 6 and 7 both ask questions along the lines of self assessment and exposure to design thinking, which then can describe why RI became significant. As for hometown, UV is the only significant difference. Hometown was based on the area that the participant grew up in as a child. If the participant lived in the country, then the survey saids that the participant has creative strengths; everyone comes from all background, which can influence the way we think, act and do (Steinitz, 1995). We can be influenced of our surroundings, which can result a temporary to a permit way of

thinking (Maddux, 2009). Table 22. Final Results showcases the creative strengths compared to Part 1 of the survey.

Table 22. Final Results

Creative Strengths

	SIF	**SL/C**	**MA**	**EE**	**UV**	**H**	**RI**
Transportation To K-12	X						
Sports			X				
Extra Activities		X		X	X	X	
Played Outside							X
Art							X
Imagination							X
Hometown					X		

Overall, Part 2 and Part 1 both gave out significantly differences which then lead me to believe that creativity can be influenced by social interactions; social experiences as well as experiences itself.

RQ3. When comparing creative strengths to mixed groups of students and professionals, who has the highest creativity levels?

According to the findings in Part 2, group one (design professionals) has higher levels of creative strengths. Each category may not of shown up as significantly different when compared to other groups, but the over arching statement is that group 1 preformed higher in nine of the eleven creative strength categories. In higher education, design majors get a heavier load of design thinking curriculum than any other major. At Michigan State University, the majority of the classes for landscape architecture students are design based. Therefore, creative strategies and or problem solving thinking strategies are influenced in higher educational design majors. The data shows that this assumption is present in the data findings; design majors get more training in the design thinking process.

Conclusion

The analysis of the survey (Part 1 and Part 2) allowed multiple conclusions in the results of each of the three research objectives. T

The first objective was to explore the process of design thinking and creative thinking. The study did conclude that design thinking and creative thinking were both nonjudgmental styles of thinking. Both processes are important in teaching within education because it helps with problem solving throughout the future.

The second objective of the study was to explore influences that could enhance creative strengths. The study concludes that social interaction and experiences can influence creative strengths. Participating in extra circular activities within youth showed the highest significant

difference among all the seven questions examined in the cross tabulations test. Extra circular activities help individuals to learn by doing; experiential learning. This is a huge impact on youth today. Experiential learning can enhance creativity by examining others, experiencing and interacting sociably (Perkins, 1985). We can gain skills, a better understanding and learn from experiencing activities especially if others are participating too (Perkins, 1985).

The final objective looks at examining creative strengths in students and professionals. We can say with this research that professionals in design fields scored higher in the creative strengths. This may be the result of educational backgrounds of design courses in higher education. If we learn the process of design thinking, we can enhance our knowledge to continue that style of thinking and incorporated it into our everyday decisions (Maslyn, 2002).

In conclusion, we can say that the Torrance Test for Creative Thinking (TTCT) does in fact help understand creativity. We are all creative in some ways but we do not have similar creativity levels. Social interactions and experiences might influence and or help motivate creative thinking. Education can also play a role in hindering or advancing creativity as a whole. But what does this research really mean? According to my research, creativity does lie in everyone. Not one survey scored a 1 on all creativity strengths which means that everyone that participated did in fact have some level of creativity. Although, some participants scored higher on certain strengths then others but with the results of this research we can say we are all creative in some way. Taking an art class can influence the way we process ideas. Playing sports can teach us about hard work, strategies, motivation, and skill levels in all fields. Sports can also influence creative movement.

Social interactions and experiences can influence your creative thinking and process of thinking. Other extra activities besides sports can influence different thinking patterns. All these things listed above influences thinking. Creativity is something that is not tangible therefore we can only test myths of how we are creative and who is more creative. Yes, there are certain actions that can influence us to think one way or the other. Yes, there are different ways to test creativity. So the question becomes now, who is to say that the Torrance Test for Creative Thinking (TTCT) is the most efficient way to test creative thinking? Who is to say that if we play sports we are more creative? Research has shown creativity can be tested and can be scored. Research also has shown that there is no right or wrong way to test creativity, there is only myths and 'ideas' on how to approach this subject.

My research shows that some creativity can be influenced by social interaction and experiences. It also doesn't matter what kind of influences that are played. It matters by the participants personality and willingness to create. Therefore, creativity in higher education is widely spread throughout all majors. According to Cropley (1992) for our societies to prosper in rapid scientific and technological advancement, people need to be inventive and flexible. Creativity is in everyone and we are using creative thinking skills more and more to become innovated within our fields. But the main factor is that we need to be motivated to accelerate creativity within our fields of study. According to Daniel boorstin (1992), creative thinking is "the most illusive, complex, and mysterious of all human processes". Therefore, we can conclude that creativity is such a complex concept that is influenced by numerous factors. These factors are motivation, personality, circumstance, and thinking skills (Meador, 1997).

APPENDIX

SURVEY INSTRUMENT

Number: SURVEY SAMPLE

Age:

Gender:

Major:

1. What is your hometown? _____

2. What is the highest education level that you have reached? _____

3. How did you get to grade (K-12) school? (Circle that apply)

   Car Bus Bike Walk

4. In K-12, were you involved in sports? Yes No

5. In K-12, were you involved in any extra activities after school besides sports?

   Yes No

   *If you said yes, please list what you were involved in?

6. Did you take any art classes growing up? Yes No

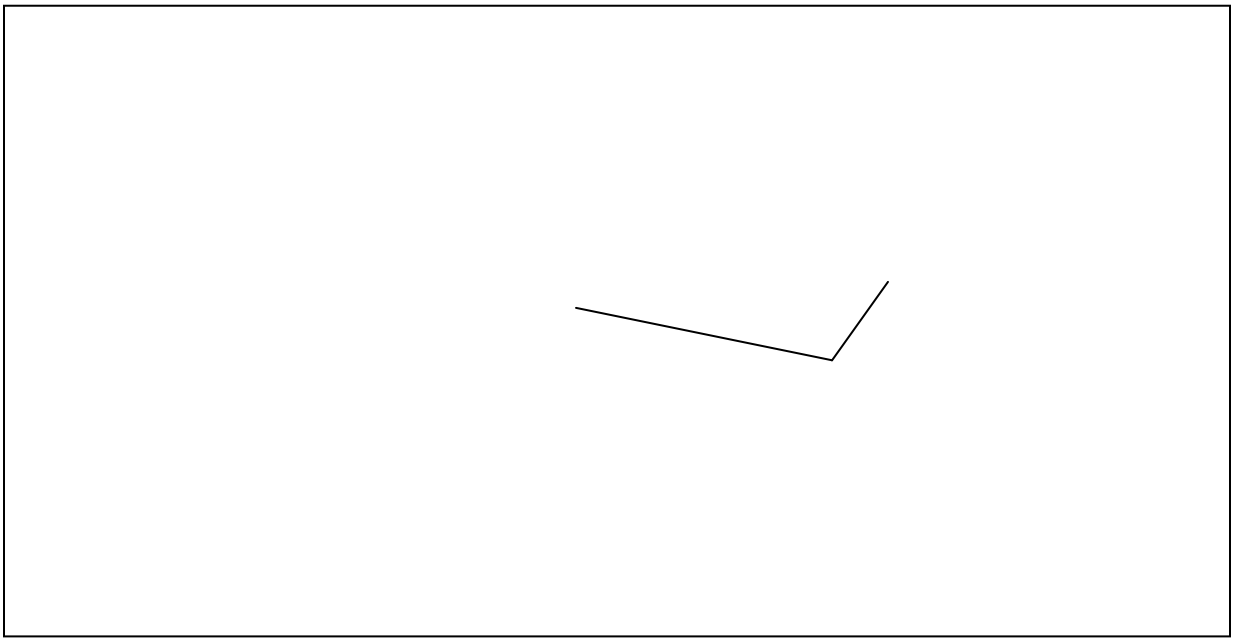
Rate your level of imagination

1	2	3	4	5
Not	Low	Moderate	High	Very High

7. Did you played outside when you were a child? Yes No

You have 5 minutes to use the line in the box to draw something, title it and explain your drawing.

Title:_____



Explain your drawing:

REFERENCES

REFERENCES

Ball, O. E., & Torrance, E. P. (1984). *Streamlines Scoring Workbook: Figural A. Bensenville. IL*: Scholastic Testing Service, Inc.

Bellini, S. (2006). *Building Social Relationships: A Systematic Approach to Teaching Social Interaction Skills to Children and Adolescents with Autism Spectrum Disorder and Other Social Difficulties.* Autism Asperger Publishing Co.

Benson, S. (1995). Thinking Outside the Box. *Garden, Landscape & Horticulture Index.* 182(8).

Boorstin, D. J. (1980). *The Fertile Verge: Creativity in the United States*. Daniel Boorstin.

Breneman, J. A. (1999). Home for the Creative Spirit. Exploring Women's Creativity. Retrieved from http://www.womenfolk.com/creativity/ahome.htm

Brown, Ie D. and Jennings, T. (2003). Social Consciousness in Landscape Architecture Education: Toward a Conceptual Framework. *Landscape Journal.* 22 (2): 99-111.

Casakin, H., Davidovitch N. and Milgram R. M. (2010). Creative Thinking as a Predictor of Creative Problem Solving in Architectural Design Students. *Psychology of Aesthetics, Creativity, and the Arts.* 4 (1):31-35.

Cropley, A. J. (1992). *More Ways Than One: Fostering Creativity*. Ablex Pub.

Cross, N. (2011). *Design Thinking*. Berg Publishers.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum.

Ebert-May, D., Batzli, J. and Weber E. P. (2006). Designing Research to Investigate Student Learning. *The ecological Society of America*. 4 (4):218-219.

Facione, P. A. (2011). Critical Thinking: What It is and Why It Counts. *InSight Assessment*. 1-25.

Hill, M. (2005). Teaching with Culture in Mind: Cross-Cultural Learning in Landscape Architecture Education. *Landscape Journal.* 24 (2): 117-124.

Hurson, T. (2008). *An Innovator's Guide to Productive Thinking: Think Better*. *T*he McGraw-Hill Companies.

Kaufman, J. C., Plucker, J. A. and Baer, J. (2008). *Essentials of Creativity Assessment.* John Wiley & Sons, Inc.

Kim, K. H. (2006). Can We Trust Creativity Tests? A Review of the Torrance Tests of Creative Thinking (TTCT). *Creativity Research Journal.* 18 (1): 3-14.

Kolb, D (1984). *Experiential Learning: Experience as the Source of Learning and Development.* Englewood Cliffs, NJ: Prentice Hall. 3-21.

Levine, D. P. (2002). Thinking About Doing: On Learning From Experience and the Flight From Thinking. *Human Relations.* 55 (10): 1251-1268.

Lynch, M.D., & Harris, C.R. (2001). *Fostering Creativity in Children, K-8.* Needham Heights, MA: Allyn & Bacon.

Maddux, W. (2009). Cultural Borders and Mental Barriers: The Relationship Between Living Abroad and Creativity**.** *Journal of Personality and Social Psychology.* 96 (5): 1047.

Maslyn, Jamie. 2002. *The Modern Landscape Architect and Creativity: What Creates It, Shapes It, and Inspires It.* Landscape Journal 21 (1): 134-136.

Meador, K. (1997). *Creative Thinking and Problem Solving for Young Learners*. Englewood, CO: Teacher Ideas Press/Libraries Unlimited.

Merriam-Webster. (2011). *Merriam-Webster's Collegiate Dictionary, 11th Edition*.

Moore, K. (2003). Overlooking the Visual. *The Journal of Architecture.* 8: 25-40.

Muijs, D. (2011). *Doing Quantitative Research in Education with SPSS.* SAGE Publications Ltd.

Perkins, D. N.(1985). Creativity by Design. *Educational Leadership*. 9: 18-25.

Piirto, J. (2001). *How Parents and Teachers can Enhance Creativity. In M.D. Lynch & C.R. Harris, (Eds.), Fostering Creativity in Children, K-8,* (pp. 49-68). Needham Heights, MA: Allyn & Bacon.

Richmond, B. (2001). *Introduction to System Thinking: STELLA*. High Performance Systems.

Rodriguez, D. (2008). *Conceptual thinking: A New Method of Play Analysis*. World Audience, Inc.

Steinitz, C. (1995). *Design is a Verb; design is a Noun*. *Landscape Journal.* 14 (2): 188-200.

Swaffield, S. ed. 2002. Theory in Landscape Architecture: A Reader. *Landscape Journal.* 22 (2): 164-165.

Todd, S.M., & Shinzato, S. (1999). Thinking for the Future: Developing Higher-level Thinking and Creativity for Students in Japan-and Elsewhere. *Childhood Education*. 7(5): 342-345.

Torrance, E. P. 1990. *The Torrance Test of Creative thinking norms – Technical manual figural (streamlined) forms A & B*. Bensenville, IL: Scholastic Testing Service, Inc.

Wang, Shouhong, and Hai Wang. 2011. Teaching Design Thinking Through Case Analysis: Joint Analytical Process. *Decision Sciences Journal of Innovative Education*. 9 (1): 113-118.