

Back to the Drawing Board: Exploring Drawing as a Path to Expand Creativity and Imagination

by

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A REPORT

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Major Professor  
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## **Abstract**

Environmental design is a field that relies on imagination and creativity to produce ideas for creating places. Designers must actively develop their imagination and creativity to design for the increasing complexity of the world (Runco 2004). One activity that expands these elements is drawing. Drawing encourages abstract thought and increases the connections in the brain's neural network (Tallinen et al. 2014). Because of these aspects drawing has the potential to expand the mind's eye. This study attempts to answer the research question "How does the act of drawing as art affect a designer's creativity during the environmental design process?"

To answer this question, an experimental design using a creativity test was used to study the influence of drawing on creativity. The study was conducted using participants from Kansas State University Environmental Design program. In the study, the control group (N=35) takes the creativity test, and the intervention group (N=35) completes a drawing booklet before taking the test. The results were analyzed quantitatively and qualitatively to examine differences in the level of creativity. The study concluded drawing as art increased an individual's originality and elaboration of design. Subjects in the intervention group were able to produce more unique and detailed designs than those in the control group. Overall even adding a short ten-minute drawing exercise to the design process does increase creativity. The study shows that designers can foster their own creativity through the simple process of drawing as art.



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EXPLORING DRAWING AS A PATH  
TO EXPAND CREATIVITY AND IMAGINATION

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# ABSTRACT

Environmental design is a field that relies on imagination and creativity to produce ideas for creating places. Designers must actively develop their imagination and creativity to design for the increasing complexity of the world (Runco 2004). One activity that expands these elements is drawing. Drawing encourages abstract thought and increases the connections in the brain's neural network (Tallinen et al. 2014). Because of these aspects drawing has the potential to expand the mind's eye. This study attempts to answer the research question "How does the act of drawing as art affect a designer's creativity during the environmental design process?"

To answer this question, an experimental design using a creativity test was used to study the influence of drawing on creativity. The study was conducted using participants from Kansas State University Environmental Design program. In the study, the control group (N=35) takes the creativity test, and the intervention group (N=35) completes a drawing booklet before taking the test. The results were analyzed quantitatively and qualitatively to examine differences in the level of creativity. The study concluded drawing as art increased an individual's originality and elaboration of design. Subjects in the intervention group were able to produce more unique and detailed designs than those in the control group. Overall even adding a short ten-minute drawing exercise to the design process does increase creativity. The study shows that designers can foster their own creativity through the simple process of drawing as art. The study shows that designers can foster their own creativity through the simple process of drawing as art.



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# DEFINITIONS

## COGNITION

“Of, relating to, being, or involving conscious intellectual activity (such as thinking, reasoning, or remembering)”  
(Merriam-Webster Dictionary 2018)

## IMAGINATION

“The act or power of forming a mental image of something not present to the senses or never before wholly perceived in reality”  
(Merriam-Webster Dictionary 2018)

## CREATIVITY

“The use of imagination or original ideas to create something”  
(Oxford Dictionaries 2018)

## PROCESS

“A series of actions or steps taken in order to achieve a particular end”  
(Oxford Dictionaries 2018)

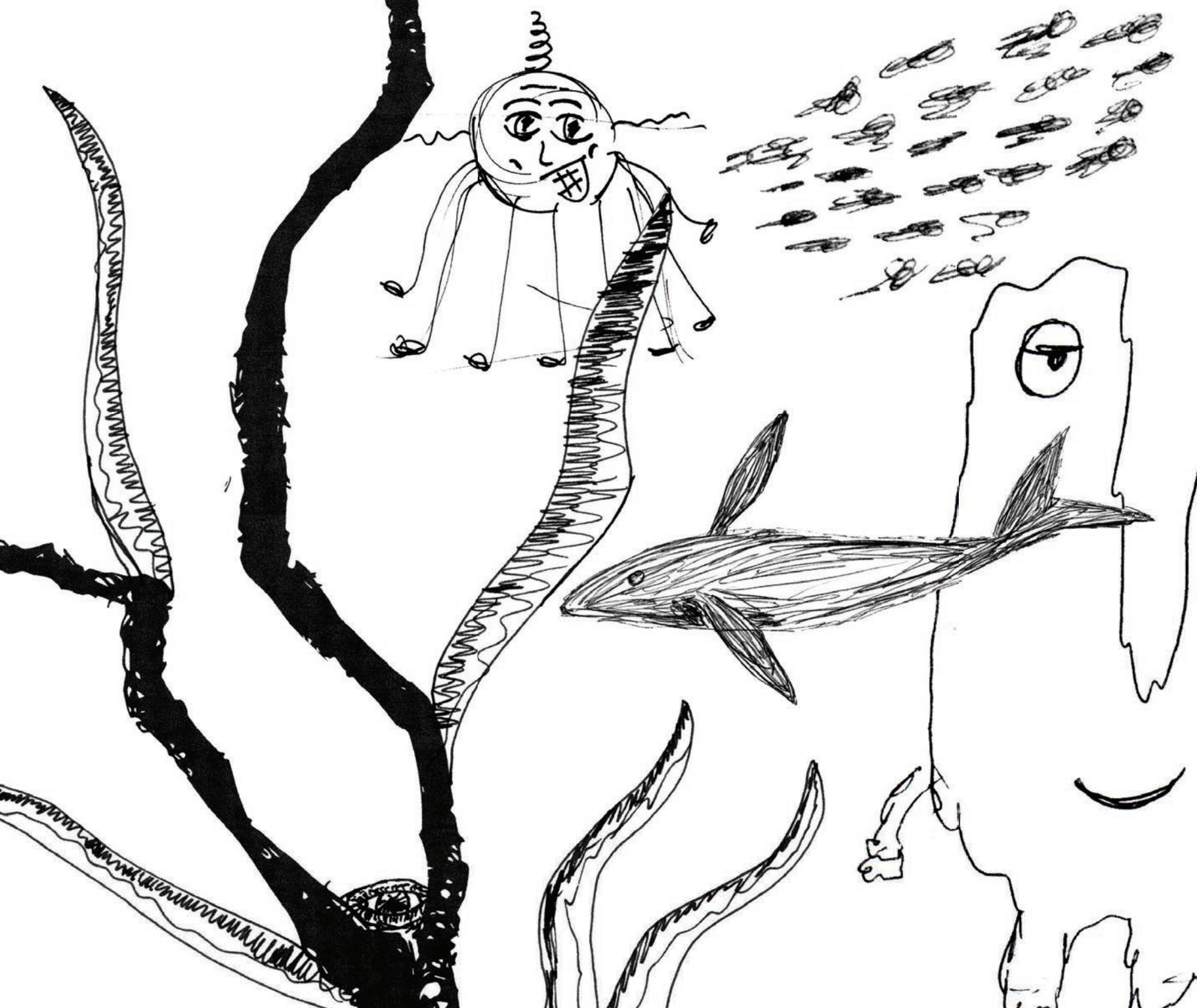
## PRODUCT

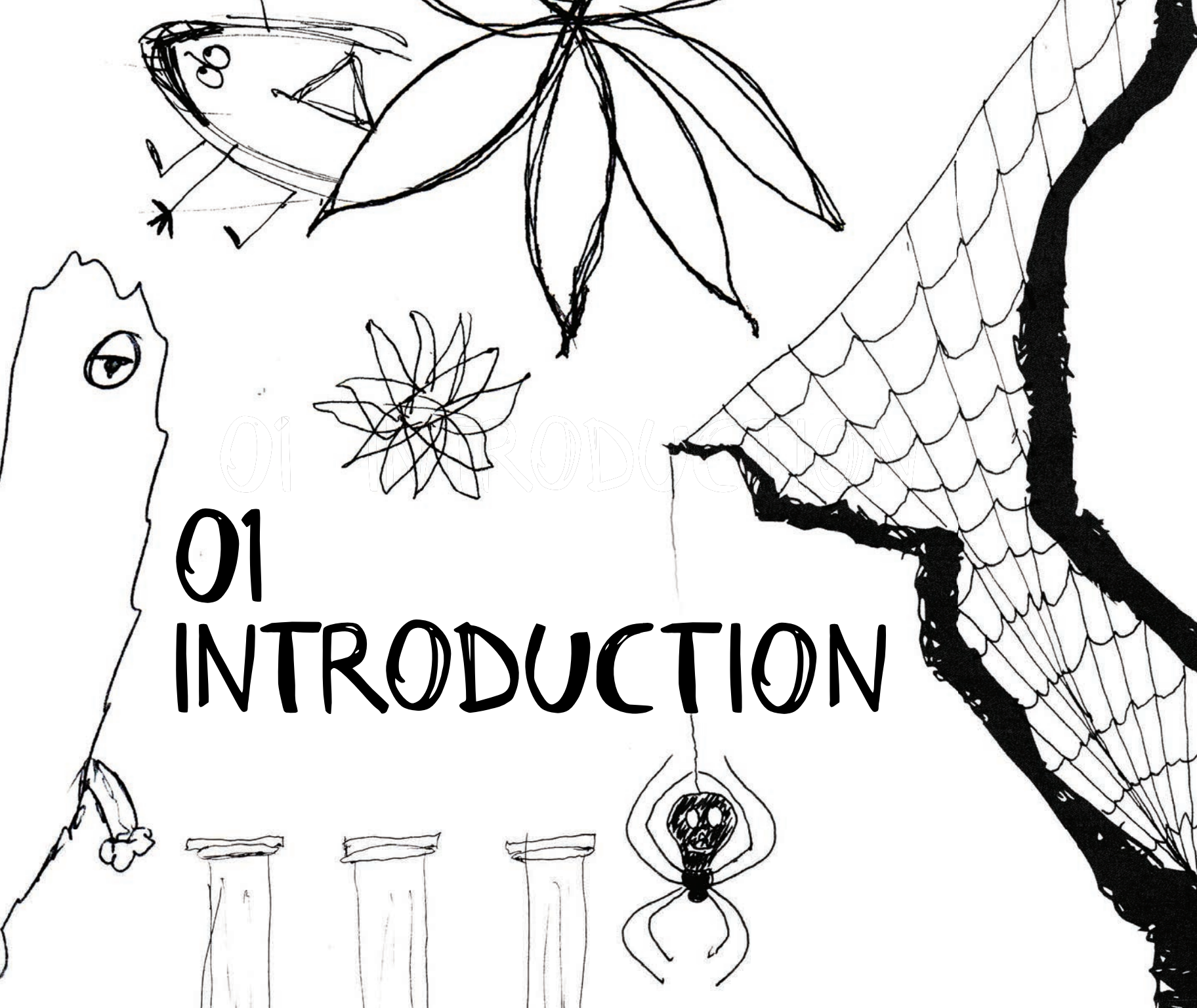
“A thing or person that is the result of an action or process”  
(Oxford Dictionaries 2018)

## DRAWING

“A picture or diagram made with a pencil, pen, or crayon rather than paint.” (Oxford Dictionaries 2018) Drawing in this report refers to the act of creative drawing or doodling.







01  
INTRODUCTION

# THE PROBLEM

The field of environmental design demands that designers be creative and produce original and unique concepts and ideas. In the design process (see Figure 1.1), creativity is the use of imagination in the concrete world (Vygotsky 2004). Imagination is defined as the action of forming imagery of external objects not present to the senses (Hunter 2013). Designers should use their imaginations to be creative. For a designer to become more creative, it is essential for them to engage in activities that expand the mind's eye.

One way to develop our imagination and creativity is through the process of drawing. Drawing is a complex activity that increases connectivity in the brain (Bolwerk et al. 2014). Improving these connections allows participants to engage in abstract thought (Mihov, Denzler, and Förster 2010). Because participants are engaging in this form of thought, it will enable their mind to wander and opens it up to new possibilities. Adding drawing as art to the design process (See Figure 1.1) could improve a designer's imagination thus improving the designer's overall creativity.

In today's environmental design curriculum, most higher education institutions engage principally in tacit ways to develop creative thinking strategies; institutions should explicitly promote creativity in design courses by offering new techniques to foster imagination (Hargrove 2011; Corpley and Corpley 2010; Lewis 2005). In some learning environments, students learn by focusing on the end goal of the project and not on the cognitive functions that help students expand their mind (Hargrove 2011). While students gain valuable skills in this type of education, they may not have an awareness of creative exercises to reach their full creative potential in the world outside of academia (Hargrove 2011). A way to expand creative behavior in design is addressed through the research question, "How does the act of drawing as art affect a designer's creativity during the environmental design process?"

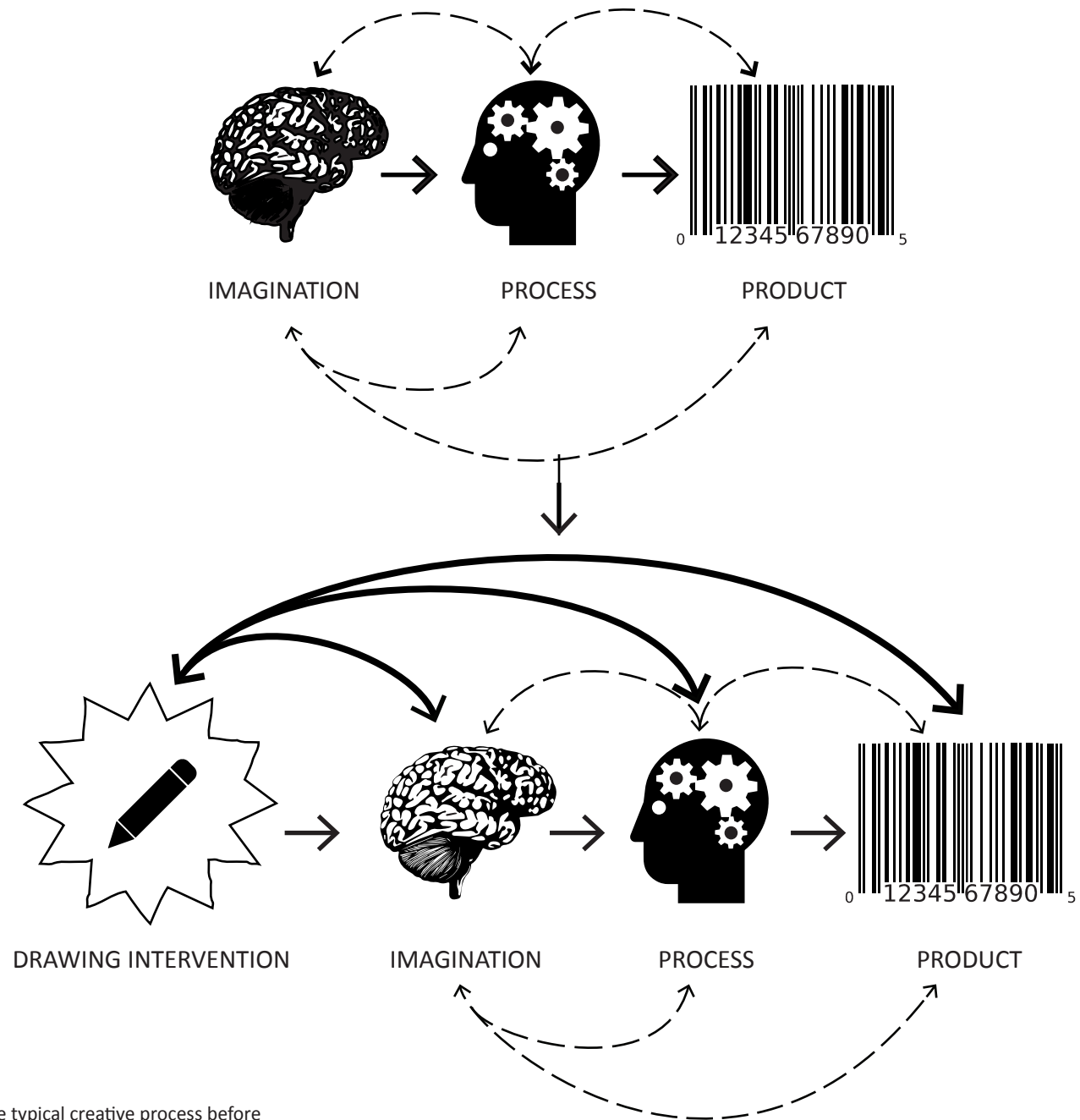


Figure 1.1 - The typical creative process before and after a drawing intervention is added.

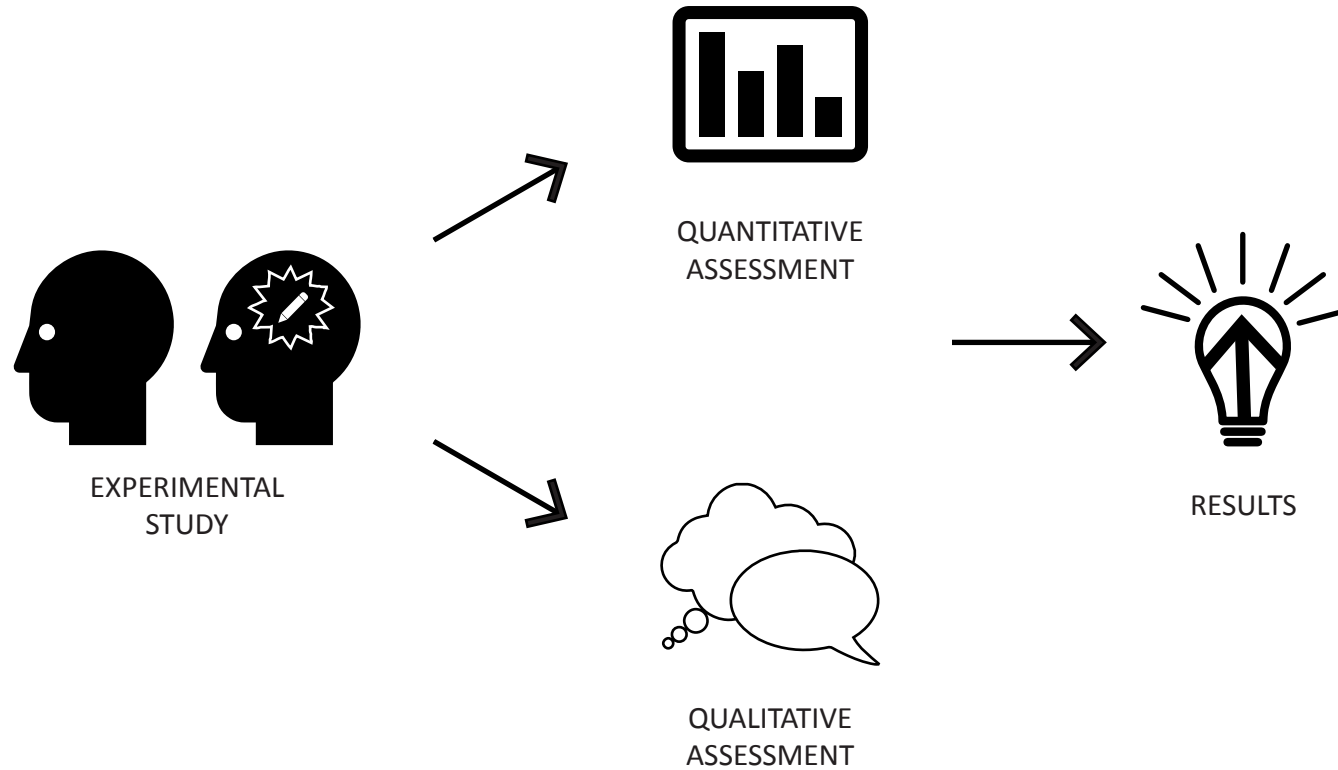


Figure 1.2 - The study flow.

# STUDY DESIGN

To study what affects drawing has on imagination and creativity, this research used an experimental design based on creativity tests to measure the outcome of adding drawing as art to the design process. The tests were designed to relate to environmental design. The study consists of outlines of a scale-free site (See Appendix A.1). Participants were asked to create different designs for the sites.

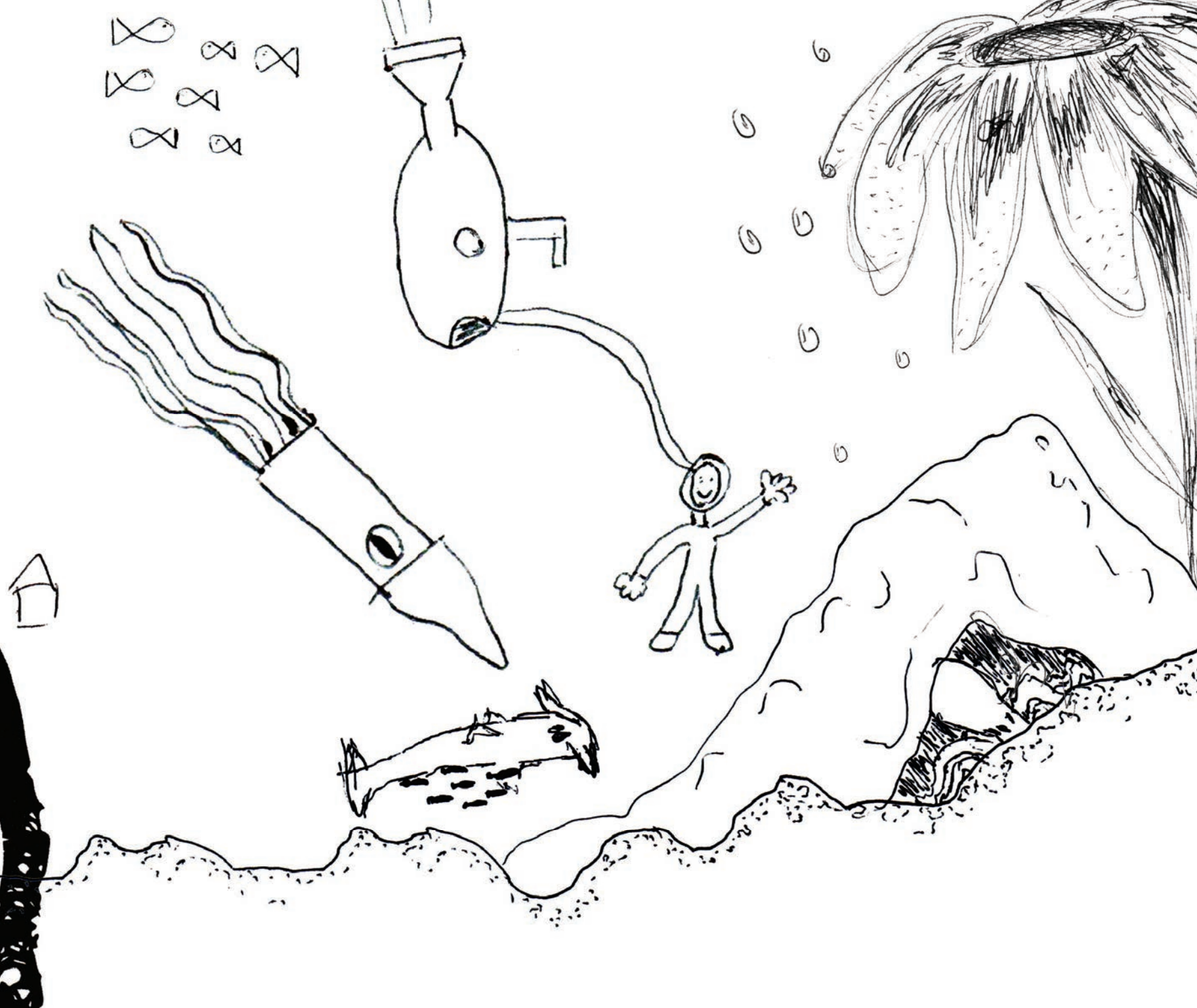
Testing was split into two randomly-assigned groups. The first group, the control (N=35), only participated in the creativity test. A second group, the experimental intervention group (N=35), had the added task of drawing. Subjects in this group were given a drawing booklet filled with different prompts to complete before starting (See Appendix A.2). They then completed the creativity test.

The test results were evaluated to determine what influence the drawing prompts had on the participants. They then were scored based on originality, fluency, flexibility, and elaboration. Each category was rated based on the number of responses given and the depth of those responses. Subjects who earned more points had a higher imagination and creativity than those who received lower scores on each category of the test.

The purpose of this experimental design is to research the effects of drawing as art on creativity and imagination. By splitting the experiment into two separate groups, we can see the differences and similarities between the control and intervention. The results of this experiment gave a more in-depth understanding of ways designers can expand creativity through imagination. Understanding new ways to develop this type of abstract thought is essential to open the design process to new possibilities.



02  
BACKGROUND





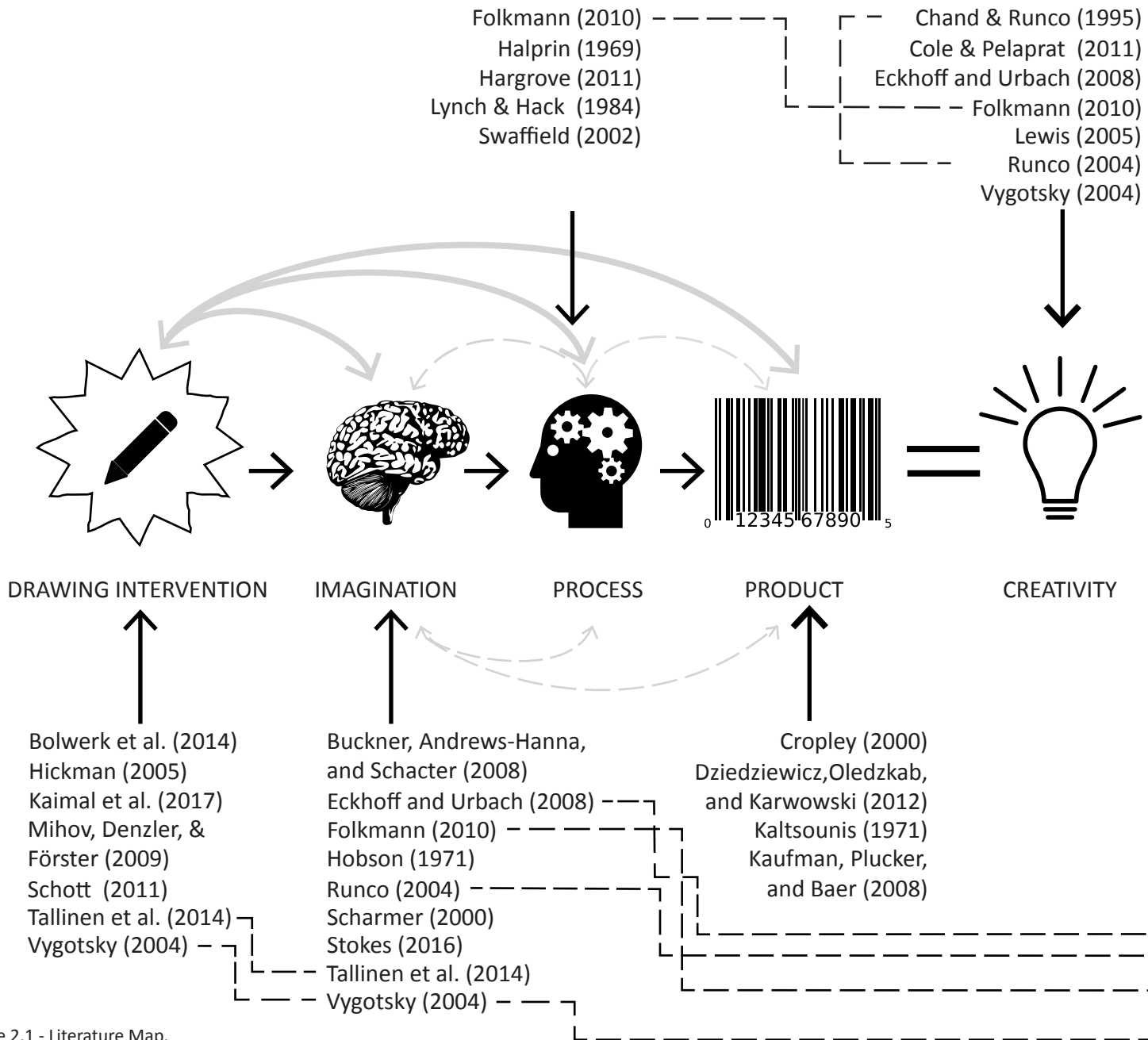
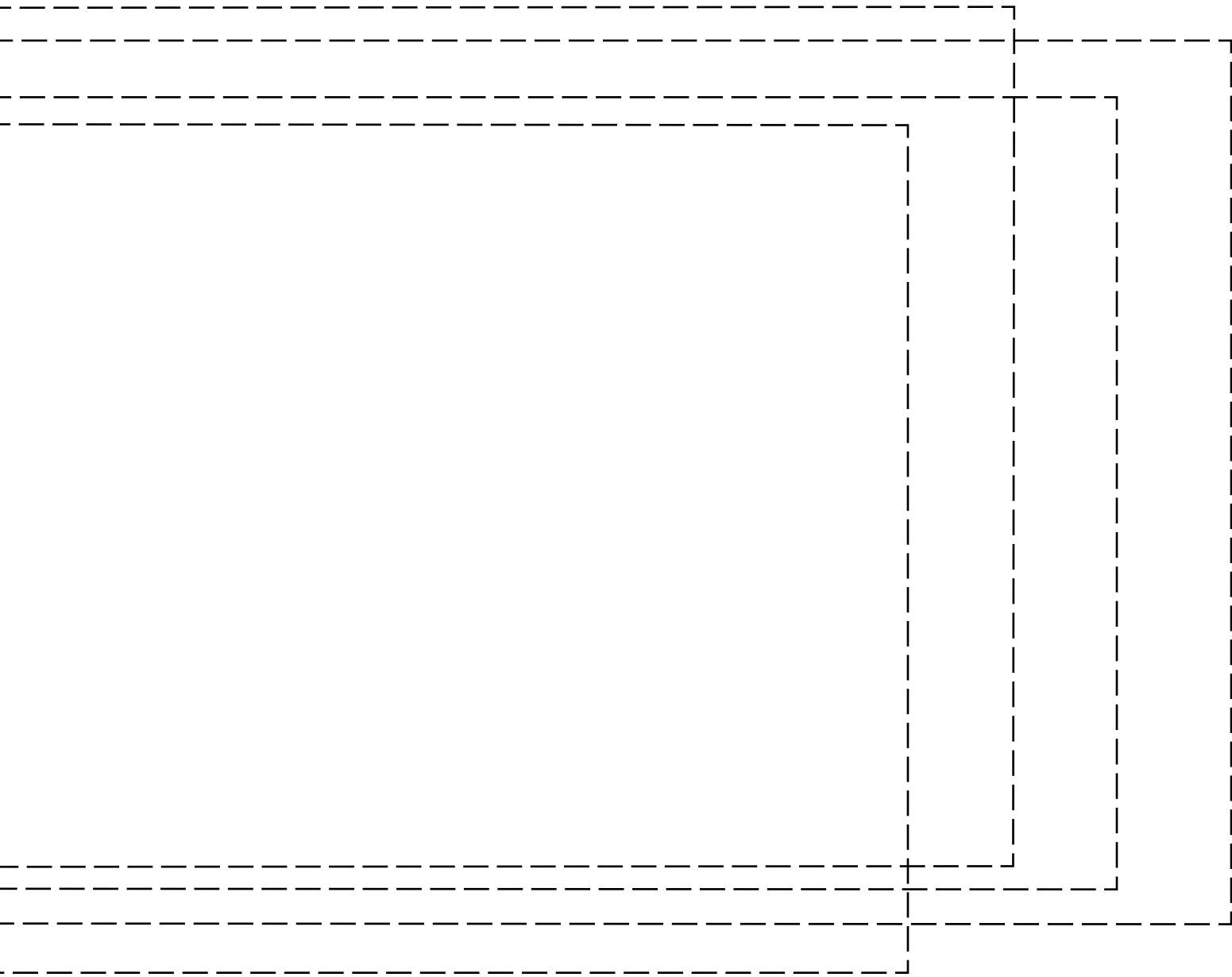


Figure 2.1 - Literature Map.



# LITERATURE REVIEW

In order to understand how to foster creativity, it is essential to understand the creative process and what must be used to increase the productivity of this process. Imagination, the design, process, drawing, and creativity are all essential factors that contribute to the expansion of creativity (See Figure 2.1). The following section examines literature relating to the fostering of creativity. Each section builds upon each other and offers critical insights relating to this experiment.

## IMAGINATION

Imagination is the ability of the conscious mind to visualize unseen forms and concepts not present in the outer world (Folkmann 2010). This ability appears in all humans, but for designers, it has an added value and is an integral part of their everyday lives (Hobson 1971). Environmental designers use the imagery they generate in their inner world to create new experiences for the outer world (Hobson 1971). They synthesize the mind's eye into concrete forms giving them the capability to 'see' before a concept is realized (Folkmann 2010; Scharmer 2000). Without this ability, design would cease to exist.

According to Vygotsky (2004), the processes of the brain and imagination are broken down into two types: reproductive activity and combinational or creative activity (Vygotsky 2004). During reproductive activities, the brain reproduces memories, experiences, and past patterns (Vygotsky 2004). Humans draw information from gained experiences and reconstruct the information in their minds (Vygotsky 2004). During this process, gyrification occurs in our brain; experiences of the outer world create new folds in the cerebral cortex that allows the brain to retain new information (Tallinen et al. 2014; Vygotsky 2004). Also, in this process, the brain is continually making new networks, connections, and folds from outside stimuli that help humans adapt to life (Buckner et al. 2008). The human ability to combine this type of reproductive information to create new ideas is called combinational or creative activity (Vygotsky 2004). Combinational activity is the basis of imagination (Vygotsky 2004).

Environmental designers use reproductive activity to help create concepts and designs. They must balance outside stimuli with creative activity to keep producing new ideas (Folkmann 2010; Vygotsky 2004). Although imagination and creativity are not the same, they are very closely related (Stokes 2016). Both imagination and creativity use mental

processes to balance the outer world with the inner world (Eckhoff and Urbach 2008; Folkmann 2010; Stokes 2016). In the design process, we use imagination to transform the materials of the outside world into design projects (Stokes 2016). This type of imagination is described as productive imagination by both Immanuel Kant and Jean-Paul Sartre (Stokes 2016). In the design process, productive imagination is a vital step (Folkmann 2010). As the field of environmental design becomes increasingly complex, designers must find ways to expand imagination in the environmental design process to create new and creative solutions (Runco 2004).

## CREATIVITY IN THE DESIGN PROCESS

Creativity is a process that occurs because humans can imagine (Vygotsky 2004). If imagination is fostered as adults, then humans can become highly creative (Eckhoff and Urbach 2008). Imagination ends, and creativity begins when the personal creation of the mind turns into an outer product (Cole and Pelaprat 2011; Eckhoff and Urbach 2008). Designers should use their mind's eye to create real-world solutions to design problems. To develop those solutions, a good designer should have knowledge, motivation, imagination, and judgment (Chand & Runco 1995). All these factors work together to create a dynamic system known as the design process (Chand & Runco 1995; Folkmann 2010).

Over the years, leading experts in the field of environmental design have developed many different models for the process (Swaffield 2002). Because of the complex nature of design, the design process must adapt to the individual (Lynch & Hack 1984). All individuals have different mental processes that make each design method unique. (Lynch & Hack 1984). This mysterious ever-changing cycle of design development forces designers to use their knowledge to explore the unknowns of a design problem (Folkmann

2010; Lynch & Hack 1984). During this explorative process, a design is fully realized and given meaning. Designers use the design process to foster creativity and communicate their discoveries (Halprin 1969). Just as imagination is linked to creativity, creativity is linked to the design process, these elements work together and depend on each other to create an original and comprehensive design (Lynch & Hack 1984).

Creativity plays a vital role in the design process (Runco 2004). Development of skills that contribute to the expansion of creativity, imagination, and understanding of how creativity works will lead to more creative designers and solutions (Folkmann 2010; Hargrove 2011; Lewis 2005). Designers must understand their cognitive abilities and discover ways to advance these skills (Hargrove 2011). The skills learned should be integrated into the design process to further improve overall imagination and creativity (Folkmann 2010; Lewis 2005).

## DRAWING AS ART

Drawing is a complex process that activates many regions in the brain (Kaimal et al. 2017; Mihov et al.2009). This activity increases neural networks that improve our ability to process information (Bolwerk et al. 2014; Tallinen et al. 2014). According to Vygotsky (2004), the process of drawing embodies both reproductive activities and creative activities (Vygotsky 2004). Because drawing is an experienced event, the brain is actively taking in new information and processing it as the sketch is being made (Vygotsky 2004). People gain new knowledge while reproducing what they already know. The creative activity of drawing is the actual process. Images form in the brain, and people transform

their imagination into creativity by producing new drawings (Vygotsky 2004). As the image is made, participants are using divergent thinking. Divergent thinking is the concept of generating new and original ideas through the exploration of many solutions. By increasing these thinking skills through drawing, environmental designers can expand imagination and creativity (Hickman 2005).

For this study, art is not the end goal. It is a means to become more imaginative. When an individual creates art, they engage in the form of 'free play' that allows their mind to wonder and explore possibilities. It is through this exploration that people can become highly creative and imaginative (Schott 2011). Individuals can use this creative process to solve problems and generate new ideas (Schott 2011). The process of drawing is much like the design process mentioned in the previous section. There is no one model for drawing. Individuals must explore and discover what process makes them more creative. By doing this and applying it to environmental design with the intention of becoming more imaginative, individuals can expand their knowledge and develop their creativity.

## MEASURING CREATIVITY

Creativity tests are used to measure how creative an individual is. These tests are used to measure the cognitive functions that happen during creative activities (Cropley 2000). There have been many instruments created throughout the years to measure creative thinking (Kaltsounis 1971). The Consensual Assessment Technique (CAT) is used to judge creative products based on expert opinion (Kaufman et al. 2008). Other tests include but are not limited to Torrance Test of Creative Thinking, Guilford's Test of Divergent Thinking, the Remote Association Test

created by Sarnoff Mednick, artistic and self-assessments, Wallach and Kogan's creativity test, and the Creativity Assessment Packet by Frank Williams (See Figure 2.2).

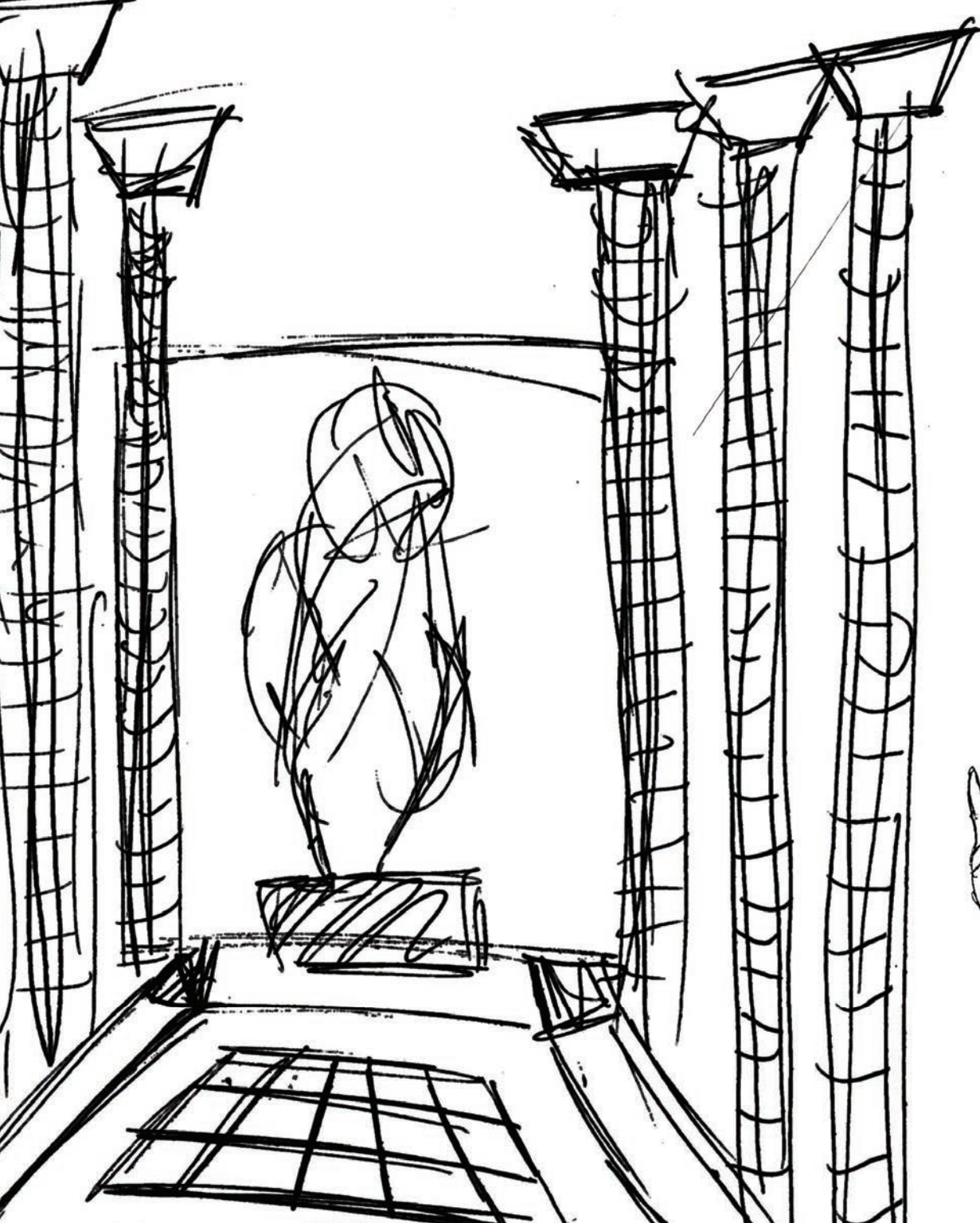
Most of these creativity tests typically measure divergent thinking in the individual. To measure this type of thinking, participants are usually presented with a question or a problem that has many solutions. Other common themes presented in these tests are the making of connections, construction, and the combining of different concepts (Cropley 2000). The measurements taken from the tests rely on a multi-scored system, except for the CAT which has no standard rating system, to accurately assess the creative potential of a given participant (Cropley 2000; Kaufman et al. 2008). Participants who take these types of tests are usually scored based on a system that rates originality or number of unique responses, flexibility or number of responses, fluency or ability to think from different perspectives, and elaboration or the amount of detail of the responses given (Kaufman, Plucker, and Baer 2008). All these tests can be effective in measuring creativity (Cropley, 2000).

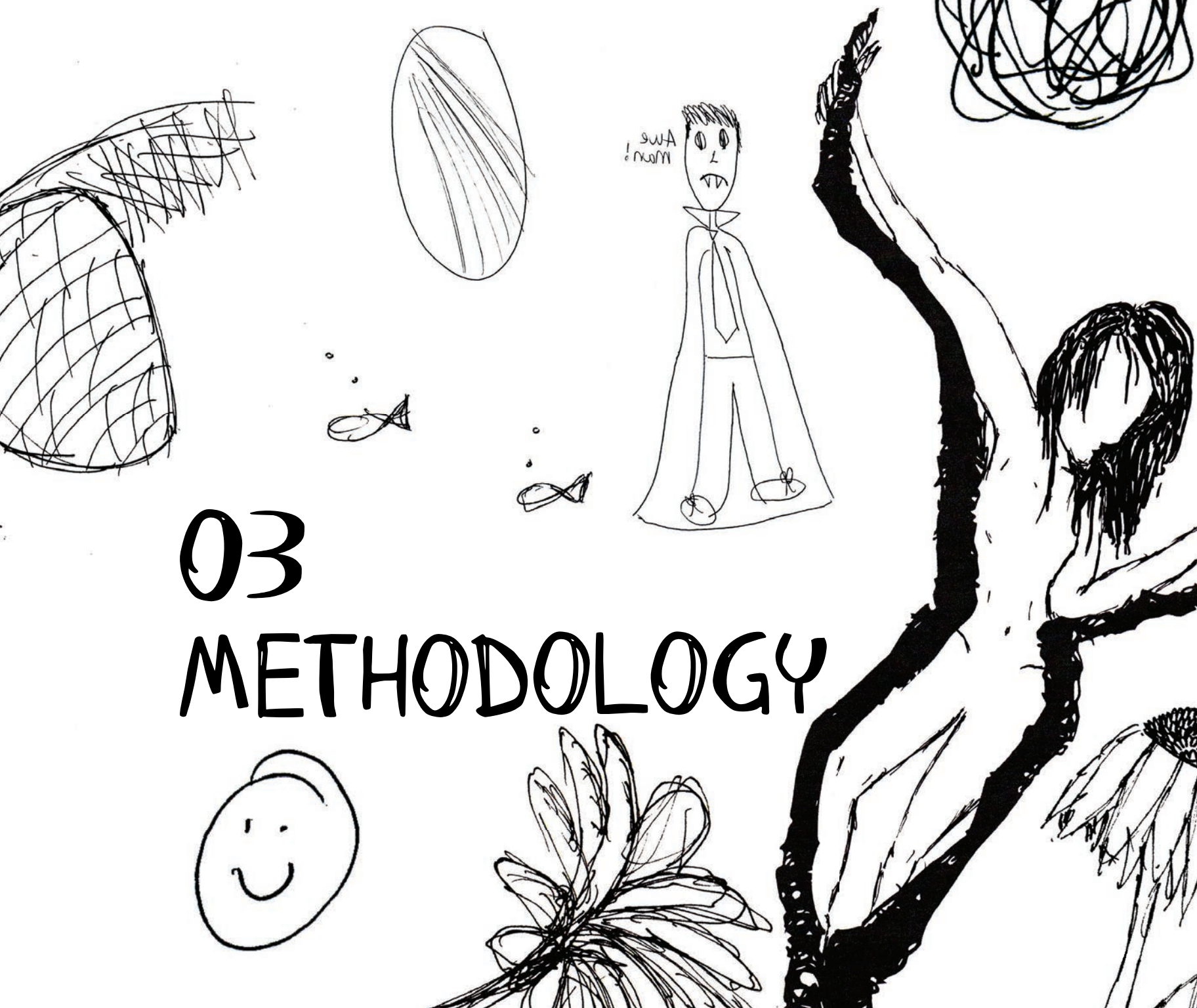
## SUMMARY

Imagination and creativity are essential components of the design process. Designers need their imagination to develop solutions and products for the worlds ever increasing problems. It is critical to engage in divergent thinking activities such as drawing that help create new connections and knowledge in the brain. Overall designers should add exercises to the creative process that allow the mind to wander to develop their imagination and make a more creative product.

<b>METHOD</b>	<b>DESCRIPTION</b>	<b>VARIABLES</b>	<b>EXAMPLE</b>
Torrance Tests of Creative Thinking (Torrance 1966)	A two part test that measures verbal and figural creativity by asking the participant to answer questions and complete images.	Fluency, flexibility, originality, resistance to premature closure, elaboration, and abstractness of titles	Complete the drawing.
Guilford's Test of Divergent Thinking (Guilford 1976)	A test that asks takers to think of as many possible uses for an item they can think of.	Fluency, flexibility, originality, and elaboration.	Name all uses for a window.
Remote Association (Mendick 1962)	A test that measures the ability to see relationships between three objects.	Scored based on number of correct answers.	Call, Pay, Line (Answer: Phone)
Artistic-Assessment Tests	An assessment of an artistic product done by experts in a field.	Score based on expert opinion.	An academy award, Pulitzer Prize, etc.
Self-Assessments	A test taken by someone that measures their perceived creativity.	Depending on the test, scores are measured based on a scale and rating system.	How Do You Think, The Creativity Behavior Inventory, Creative Attitude Survey, etc.
Creativity Test: Wallach and Kogan (Wallach and Kogan 1965)	A test that asks takers to think of as many items as possible that all have a specific component.	A test that asks takers to think of as many items as possible that all have a specific component.	Name things with wings.
Creativity Assessment Package (Williams 1980)	Exercise of Divergent Feeling, Exercise in Divergent Thinking, and a self-assessment.	Fluency, flexibility, originality, and elaboration.	My Child has vivid imagination (Strongly disagree - Strongly agree)

Figure 2.2 - Common tests used to measure creativity (sources in table).





03

METHODOLOGY



# METHODS

## OVERALL

The assessment used in this report measures the imagination and creativity of participants to help answer the research question, **“How does the act of drawing as art affect a designer’s creativity during the environmental design process?”** This experiment was broken down into two separate studies. The first study involved a control group and the second study used an experimental group to test a drawing intervention in the form of a drawing prompt book.

Subjects who participated in the creativity assessment are students in the environmental design program at Kansas State University. After the assessment was completed, participants were rated on a seven-point Likert scale by the researcher and expert reviewers. The test was scored based on flexibility, fluency, originality and elaboration (See Figure 3.1). Participants who scored the highest are more creative than those who score lower.



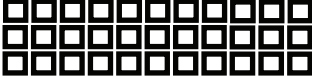

CONCEPT	EXAMPLE	DESCRIPTION
Fluency		Unique responses given by individuals compared to a group.
Flexibility		Number of categories represented in the responses.
Originality		Total responses given by a single participant.
Elaboration		Detail given with responses

Figure 3.1 - Concepts of data collected during the experiment.

# STUDY SUBJECTS

The study subjects were selected among environmental design students at Kansas State University. These students are at the beginning level of design before they enter their disciplinary studies, either Landscape Architecture, Regional and Community Planning, Architecture, Interior Architecture, or Product Design. The subjects were chosen based on their newness to the design process and willingness to learn something new. In the environmental design program students are taught the fundamentals of design and the design process. Because they are just learning design, it is essential to introduce creativity at this stage in order to continue developing it as they advance their careers as design students. The study subjects were randomly assigned into the control group and experimental group of this study. Since this research involved human subjects, the Kansas State University Institutional Review Board (IRB) approval was granted prior to data collection procedure (See Appendix A.3).

# CONTROL GROUP

A control group of 35 subjects was tested using the creativity test described in this report. They were given a brief overview of the report and an explanation that the test is designed to assess their imagination and creativity. Participants then filled out consent forms, and it was explained to them that this is not graded, and they should view it as an enjoyable experience and if they wish to withdrawal at any time they can. After the consent forms were handed in the students received a number to help sort the data. Participants then took the creativity test. They were told that these were scale free sites and they had five-minutes to design as much as the packet as they wanted. When the creativity test was completed it was collected.

# EXPERIMENTAL (INTERVENTION) GROUP

At the beginning of the test, a different group of 35 subjects were told the same introductory information as the subjects in the control group. It was explained to them that they will participate in a drawing intervention before the test is taken. Subjects were given a drawing prompt booklet and a pen if needed. They then were told that the purpose of the drawing is to let your mind wander and to explore new possibilities. The research is not about the quality of the drawing, but about the content. The participants had ten-minutes to draw as much as they could. After they finished the drawing exercise, subjects then completed the creativity test in the same manner as the control group. When all the tests were completed, they were collected with the drawing booklets.

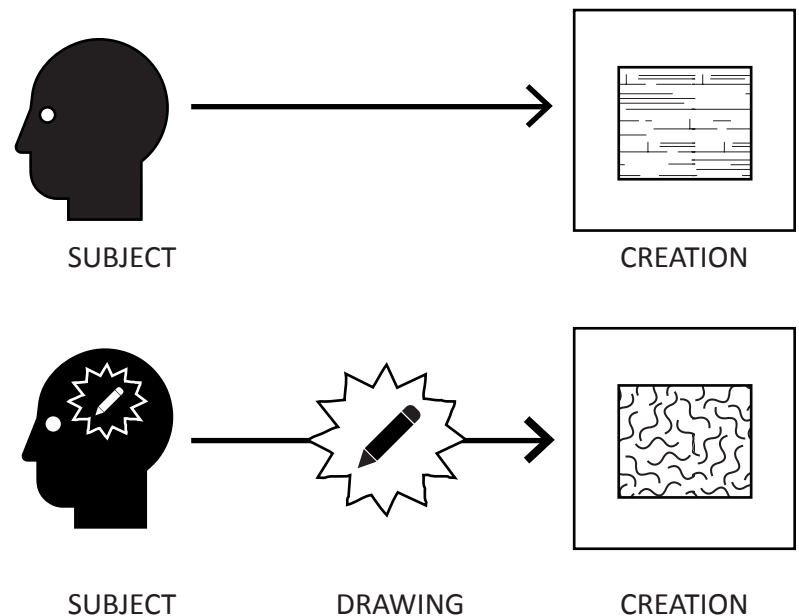


Figure 3.2 - Experimental study design.



Figure 3.3 - Environmental Design students participating in the research.



# MEASUREMENTS & TOOLS

## DRAWING INTERVENTION: PROMPTS

Drawing prompts were created to serve as the drawing intervention for the experiment. The prompts are designed to promote creativity and imagination. They were given to the students to reduce anxiety, insecurities, and creative blocks that could potentially keep the student from participating to their fullest capacity. There are many creative journals, doodle and coloring books, and drawing challenges published to guide users on their path to creativity. This experiment attempts to create an easy exercise that environmental design students can incorporate into their design process to guide their own path to creativity. During the experiment students were given a booklet of eight prompts to draw in. The final design of the prompts is a deck of 75 cards that can guide users in drawing. The prompts vary from still life sketching to drawing from the imagination.

## CREATIVITY TEST

The design of the creativity test is based on the circle test from the Torrance Tests of Creative Thinking (Torrance 1966). The test is modified to be more conducive to environmental design to make the test more relevant to the participants. Students are presented with a packet of five scale-free “sites.” With a verbal prompt stating, “Assume the squares on the following pages are scale-free sites. You have 5 minutes to create designs for as many squares as want.” Each site is represented as a 4” X 4” outline of a square in the middle of an 8.5” X 11” sheet of paper. Each sheet will have a line at the top of the page to put a title for the design to help categorize the results (See Appendix A.1). Tests were completed with a pen, so participants do not spend time worrying about getting the drawing perfect and could not erase. The inspiration and the design of the test were chosen for its simplicity to keep participants from being influenced by additional contexts such as buildings, roads, scale, topography, and various other elements. Students should use their imagination to create the designs for the test. The test is designed this way to give students every opportunity to think outside the box, literally and figuratively. Both the control and the experimental groups took the same test. After all the testing is complete, all papers were collected and analyzed.

# DATA ANALYSIS

Subjects who participated have a number that appeared on their tests and drawing booklet so that all responses are kept organized, together, and confidential. The completed tests are rated based on the criteria provided in figure 3.4 using seven-point Likert scales (1: weakest to 7: strongest). Subjects who earn higher scores are more creative than those who earn lower scores. The between-group differences from the test results were evaluated both quantitatively and qualitatively. The quantitative differences were analyzed by using two independent sample t-tests for between-group comparisons. The qualitative differences were observed and recorded by the researcher.

The creativity tests were also evaluated by experts such as professional practitioners and faculty in the environmental design fields by a survey powered by Qualtrics. All participant names were kept confidential, and evaluators did not see any name associated with the drawings. Evaluators were given a survey with 10 randomized questions that show different creativity tests (five control and five experimental). They were asked to rate each participant on the same scale used by the researcher. Evaluators were asked several questions about creativity and general demographic information. After all, scoring was completed each participant was analyzed to answer the question posed in this report.

CONCEPT	DESCRIPTION	SCORING
Fluency	Total number of responses given	1-7 Point Likert Scale
Flexibility	Number of categories and ideas (Example: River and Space station are different but a river and ocean are both water)	1-7 Point Likert Scale
Originality	Compare to all others - categorise based on similar ideas. Unique ideas receive highest points	1-7 Point Likert Scale
Elaboration	Based on the amount of detail given	1-7 Point Likert Scale

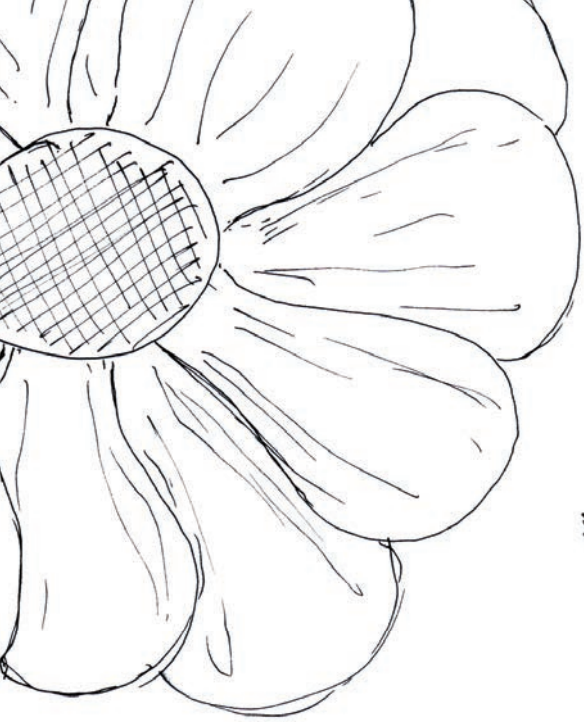
**Fluency** - points given for the number of responses.

**Flexibility** - points for the number of categories.

**Originality** - 1 point for having something, 1 point for each original ideas (not repeated), 1 point for having only original ideas

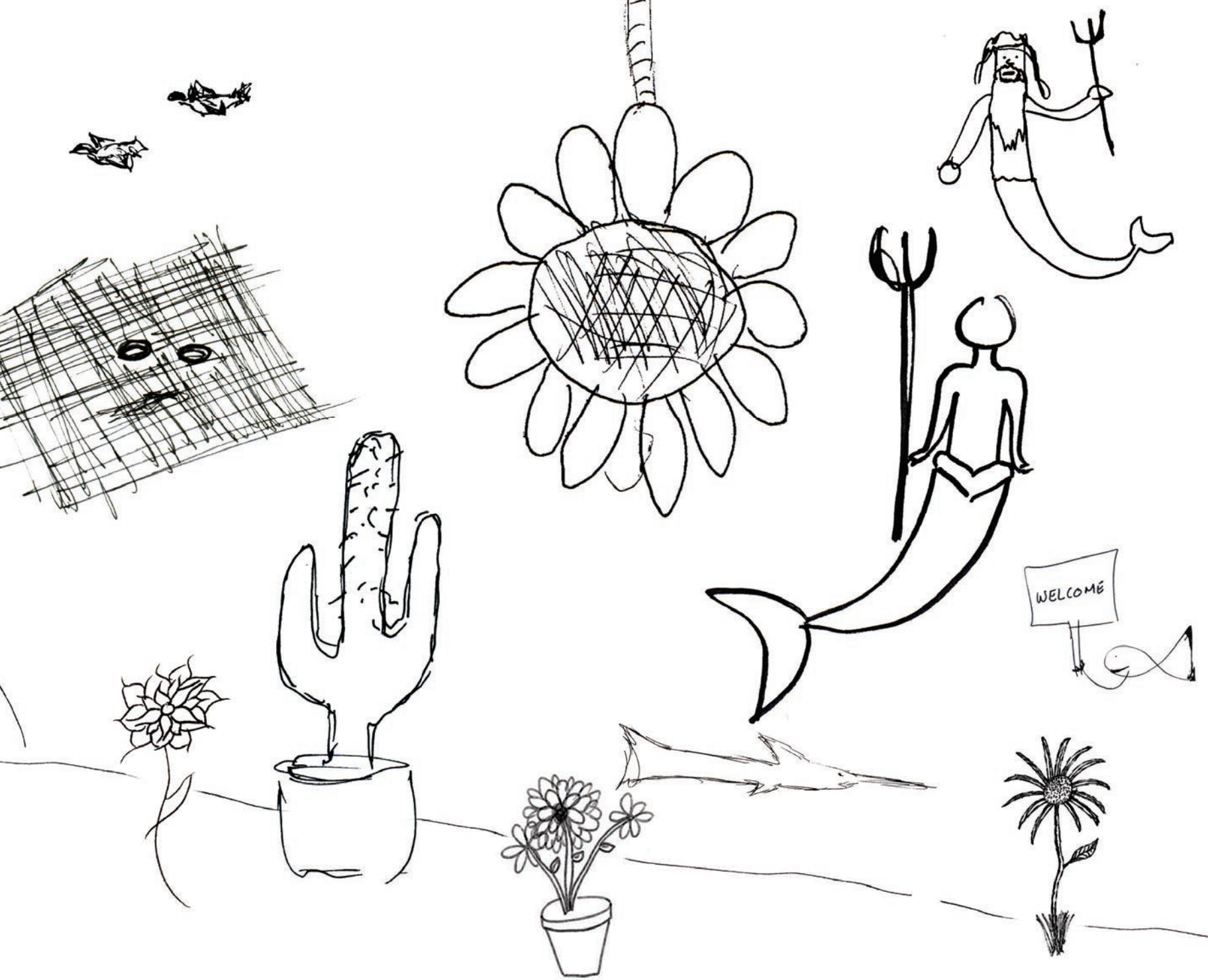
**Elaboration** - 1 point for having anything, 1 point for having more than 3 elements, 1 point for having 5 or more elements, 1 point for having hatching or texture, 1 point for having detail text, 1 point for having a title, and 1 point for having a title phrase

Figure 3.4 - Variables for evaluation.



# 04 RESULTS



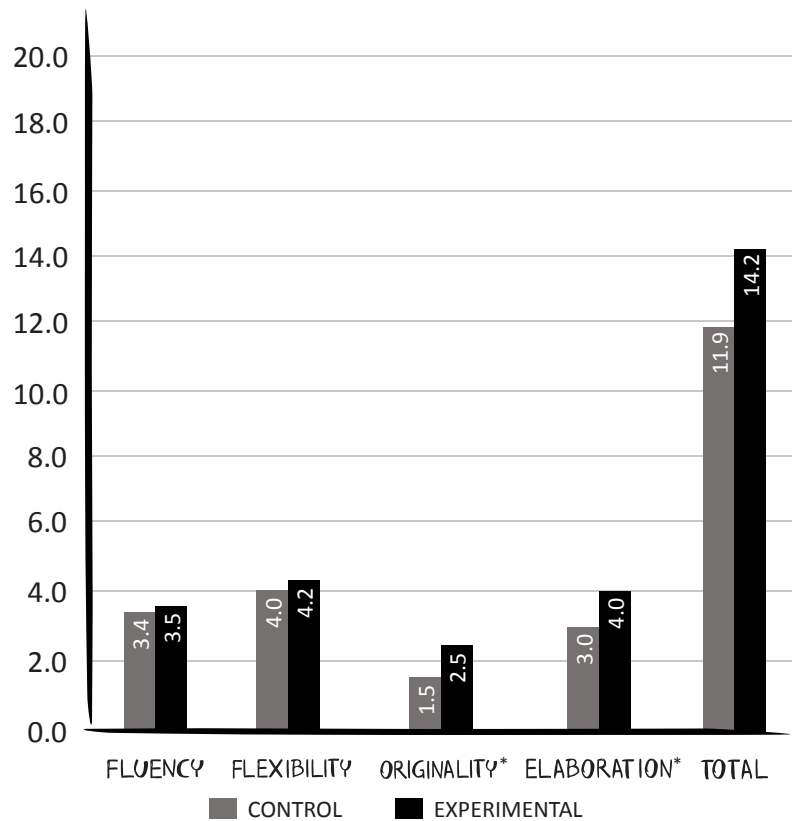




# FINDINGS

## OVERALL

Overall the results of the study showed that subjects who participated in the drawing intervention before they completed the creativity test showed an increase in creativity based on the four categories. For the fluency and flexibility categories, subjects in both groups scored around the same. The independent sample t-test results show that there were no statistically significant differences between the two groups (See Appendix A.9). All subjects were able to produce on average the same amount of ideas and idea categories with or without the added intervention of drawing. However, in the originality and elaboration categories, subjects in the experimental group scored a higher average than the subjects in the control group. The tests showed a significant difference at the .05 level in both categories, and the mean differences were 1.000 in originality; and 0.9714 in elaboration. Subjects who drew before they took the creativity test generated more original ideas and created designs with more detail. Because the experimental group was able to score higher in two of the four categories their average total score was higher for overall creativity. Subjects who added drawing as art to their design process were able to expand their creativity beyond the students who did not participate in the drawing intervention.



\*Statistically significant at the 0.05 level.

Figure 4.1 - Independent sample t-test results.

## SIMILARITIES

The two groups of participants had several instances of similarities between them. The most significant parallels were that of fluency and flexibility. When comparing the numbers, all students had about the same amount of fluency for the designs. Each group produced a similar quantity of concepts. The control group had a total of 85 ideas, and the experimental group had a total of 87 ideas. In the five minutes that the groups were given to complete the test, the students from both groups were able to create about the same amount of designs.

Subjects who participated also showed a similarity in their ability to think from different perspectives or their flexibility —the control group on average presented 2.2 ideas that fell into different categories. For example, one participant had a total of three ideas, but two of those ideas were about cats. Because this participant had designed two of the three sites about cats, they only presented concepts from two different categories. The experimental group had a similar trend and produced on average 2.3 ideas with different topics. Common categories include buildings, architectures drawings such as plans, and geometric patterns. Both the control and experimental groups had ideas that fit in these categories.

Although there was a variety of responses given, some ideas that were consistent between the two groups were houses, floor plans, landscape plans, and plants. One of the least common ideas shared between the two groups was the concept of childhood. Common elements in both groups include geometric patterns, shapes, and traditional components of design such as walls and doors.

## DIFFERENCES

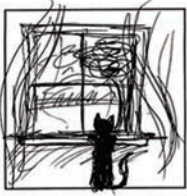
There were many differences between the control and experimental groups. One difference observed was the participant's tendency to literally think outside the box. 51.4% of the experimental group created sites that went outside of the boundary compared to the 31.4% of students in the control group. Subjects who drew before taking the creativity test were more likely to think outside the limits and constraints of the site given to them. Some of the designs that broke the boundaries include robots (head usually was defined by the square site), book pages, picture frames, watch straps, and people observing a mime in a box.

Another difference between the two groups were the ideas the students presented — most of the subjects in the control group designed sites that were archetypical of environmental design. For example, the control group had mostly ideas such as houses, floor and site plans, and products. While the experimental group did also produce archetypical ideas, much of the experimental group did present ideas that went beyond typical design concepts. Some of these ideas included a circuit board, a scrabble tile, and a framed photo of milk (See figure 4.3).

Themes between the two groups varied as well. The control group generally presented less variety and were much more typical such as architectural, objects, and plants. The experimental group showed themes that went beyond typical environmental design such as horror, mystery, humor, and music.

When looking at both the control and experimental group, clear similarities and differences are seen.

Title Window



Title Window

Title Heart of CG



Title Heart

Title Eyes



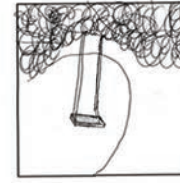
Title eyes

Title Roller w/ smoke



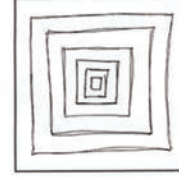
Title Roller

Title Child hood memory



Title Wings of Love

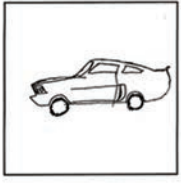
Title Space



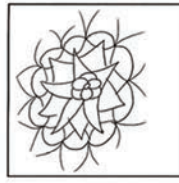
Title Here Asly Asly



Title Space



Title Face



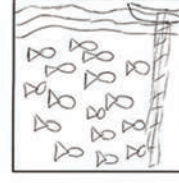
Title SHAPES WITHIN US



Title Shapes in Space



Title A Fall Day



Title Front



Title On the Inside



Title Inside The Box



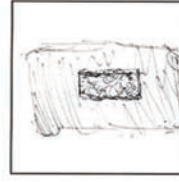
Title The Beginning to a Masterpiece



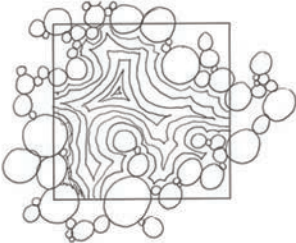
Title Large pink spots



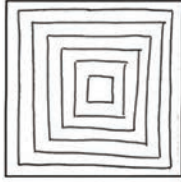
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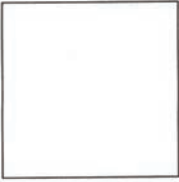
Title Fishing LAKE



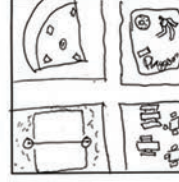
Title Sea



Title Sea



Title Sublimation: chess



Title SMILE



Title Circle



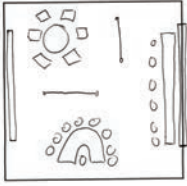
Title Face



Figure 4.2 -Creativity test results (Left - Control Right - Experimental).

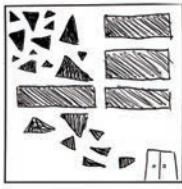
Title \_\_\_\_\_

CLASSROOM PLAN



Title \_\_\_\_\_

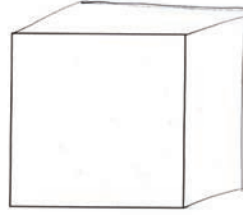
SCHOOL EXTERIOR



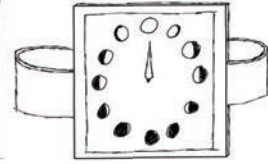
Title Unknown



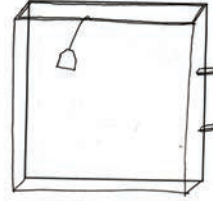
Title Cube



Title Many Means



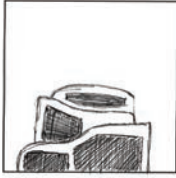
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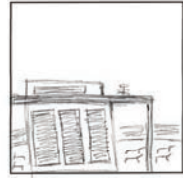
Title FLAGBOARD



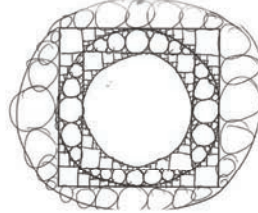
Title Apartment Complex / Office Complex



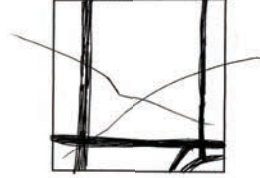
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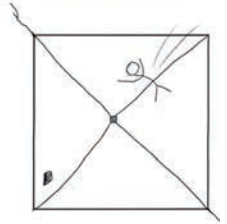
Title My Geometric PATTERN



Title \_\_\_\_\_



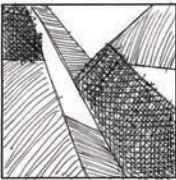
Title FALL



Title Entry



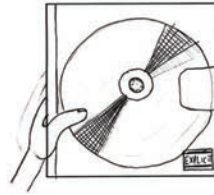
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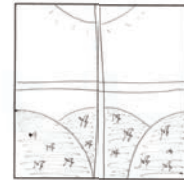
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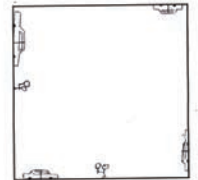
Title Venus



Title Window



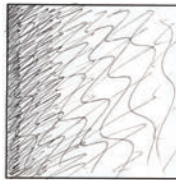
Title Cars



Title Cal Robot



Title Snow



Title White Frost Lake



Title Surf



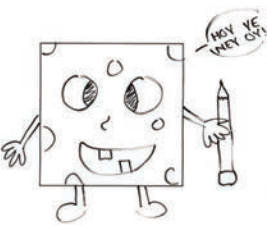
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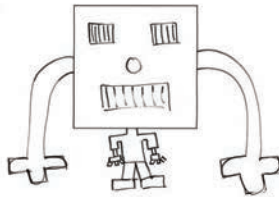
Title flowers in a flower pot



Title \_\_\_\_\_



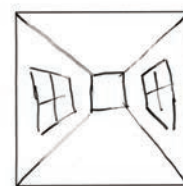
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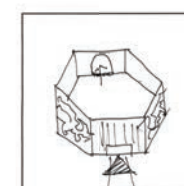
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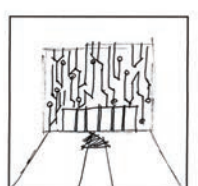
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Title \_\_\_\_\_



Title \_\_\_\_\_



Title Pruning to the Sun



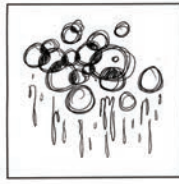
Title \_\_\_\_\_

Title BOX HOUSE



Title \_\_\_\_\_

Title RAIN



Title \_\_\_\_\_

Title CAGE



Title Mountains?

Title COOL CAT DODDLE



Title Overlapping Squares

Title \_\_\_\_\_



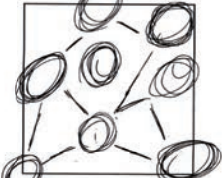
Title Triangles from Squares



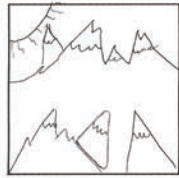
Title House all on the bank



Title Garden



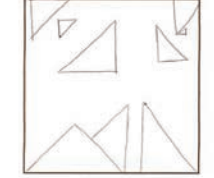
Title HOUSE



Title HOUSE



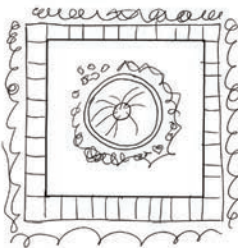
Title \_\_\_\_\_



Title house windy



Title River flowing



Title BOX



Title Creativity



Title Maze



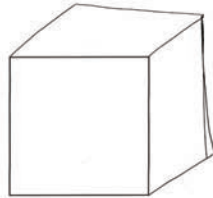
Title River Edge



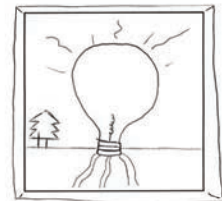
Title ROMAN CASTLE (AERIAL VIEW)



Title Woods of Water



Title day wood table



Title Outdoor pottery class



Title Glass fused clay



Title Forest



Title My dream house (sketch)

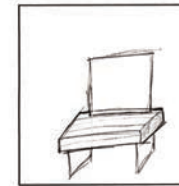
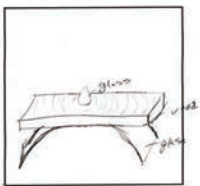
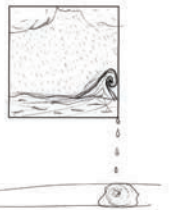


Figure 4.3 -Creativity test results (Left - Control Right - Experimental).

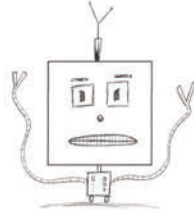
Title The Hub



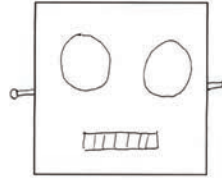
Title CAT IN A BOX



Title ROBOT



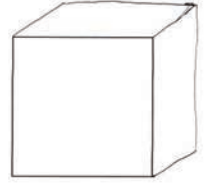
Title Robot



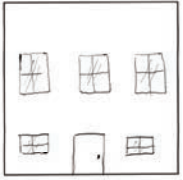
Title Pen



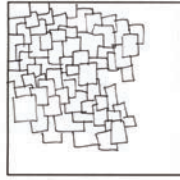
Title BOX



Title EWAGON



Title LAYERS



Title A MISTLETOE WAY WAY



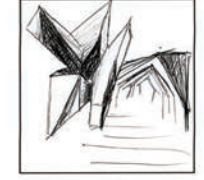
Title 43 my Childhood



Title Mime in a box



Title diy and vlog.com



Title SMY



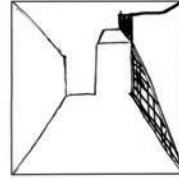
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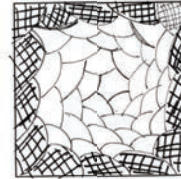
Title Jimmy



Title Change



Title Pit



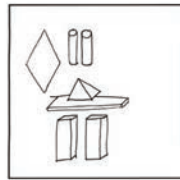
Title REPORTING



Title YOUR AVERAGE COLLEGE LIVING SPACE TO SCALE



Title FAVOR SHOTS



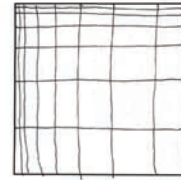
Title SMALL HOUSE



Title is super close?



Title Garden Plot



Title The Angel



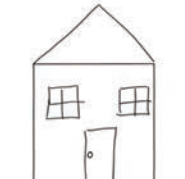
Title Scrabble Tiles



Title Framed Photo of a gallon of MILK



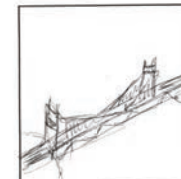
Title A house in the eyes of a 5 year old



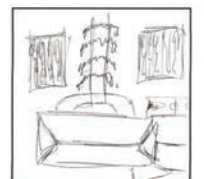
Title FRENCH PRESS



Title BRIEF



Title HOUSE



Title Boy drawing



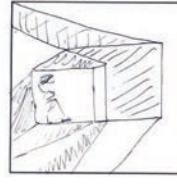
Title Random house w chimney



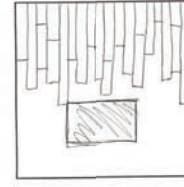
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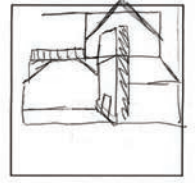
Title "I amie left"



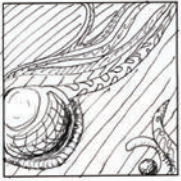
Title \_\_\_\_\_



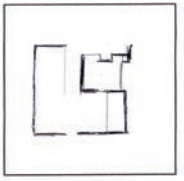
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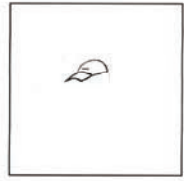
Title Page



Title Parrot Studio & Resonance



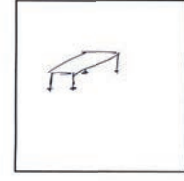
Title Flat



Title BOAT



Title TABLE



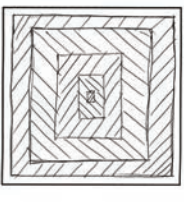
Title Childhood Apperception



Title School



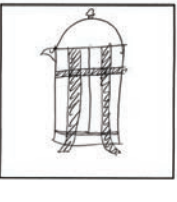
Title zig zag



Title Gift



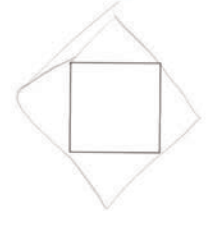
Title French Press



Title Time!



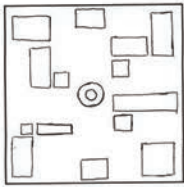
Title Diamond Hand



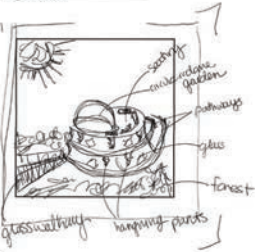
Title Tree



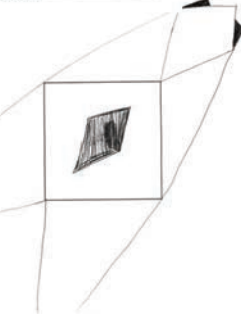
Title Building Complex



Title Beehive



Title Sack



Title Robot Face



Title Light Post

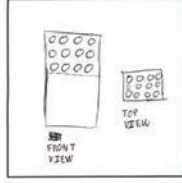


Figure 4.4 -Creativity test results (Left - Control Right - Experimental).

Title BOX HAT



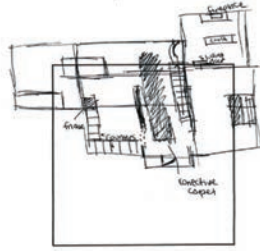
Title Yo-yo/Dolls Holder



Title Enter journal title page



Title house plan



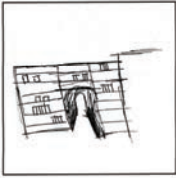
Title THE ROAD



Title Castle Plans



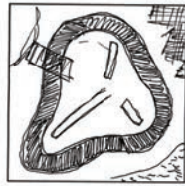
Title Arch bookshelf



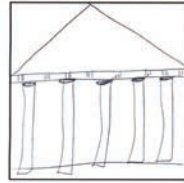
Title A Car



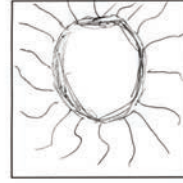
Title PARK



Title \_\_\_\_\_



Title Sun



Title BASIC HOUSE



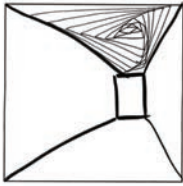
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Title city



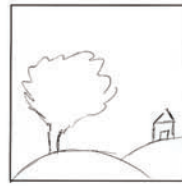
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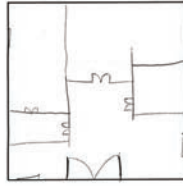
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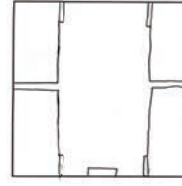
Title FIELD



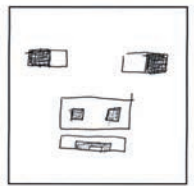
Title \_\_\_\_\_



Title Plans



Title Minecraft Pig



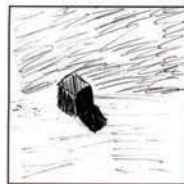
Title A Dream



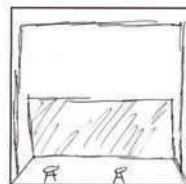
Title Edi Garden



Title \_\_\_\_\_



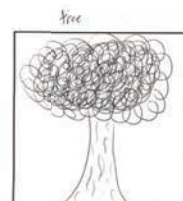
Title THE REAL PICTURE



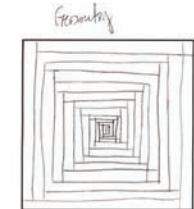
Title House



Title \_\_\_\_\_



Title \_\_\_\_\_





# ORIGINALITY

One clear contrast between the control and experimental group was the increase in originality. Participants who drew before finishing the creativity test showed a rise of original concepts. As mentioned before, both groups produced close to the same amount of ideas, but the experimental group was able to provide more innovative ideas such as a mime, portable TV, and “unknown”. Students with the drawing intervention before the test gave more concepts and designs that were not duplicated by any other participant in the experiment. An inventory of all the ideas (See Figure 4.6) given showed that students in the experimental group gave 50.6% original ideas, and students in the control group only gave 21.2% original ideas. Out of the 87 designs by students in the experimental group 44 of those ideas were not duplicated by any other student. Only 18 concepts in the 85 total designs given by the control group had no duplications (See Figure 4.5). Students who participated in the drawing interventions before the creativity test were more likely to produce original ideas than those students who did not participate.

For the most part, students were not influenced by the wording of the drawing prompts themselves. Students in the experimental group were able to use their imagination to design the square sites, and few of them copied the ideas from the drawing booklet. Although some students did show similarities between their drawings and their designs (greek temple relating to the greek temple drawing prompt), it was not a common trend among the participants. Students who participated in the drawing interventions were able to use their mind to produce unique and original designs.

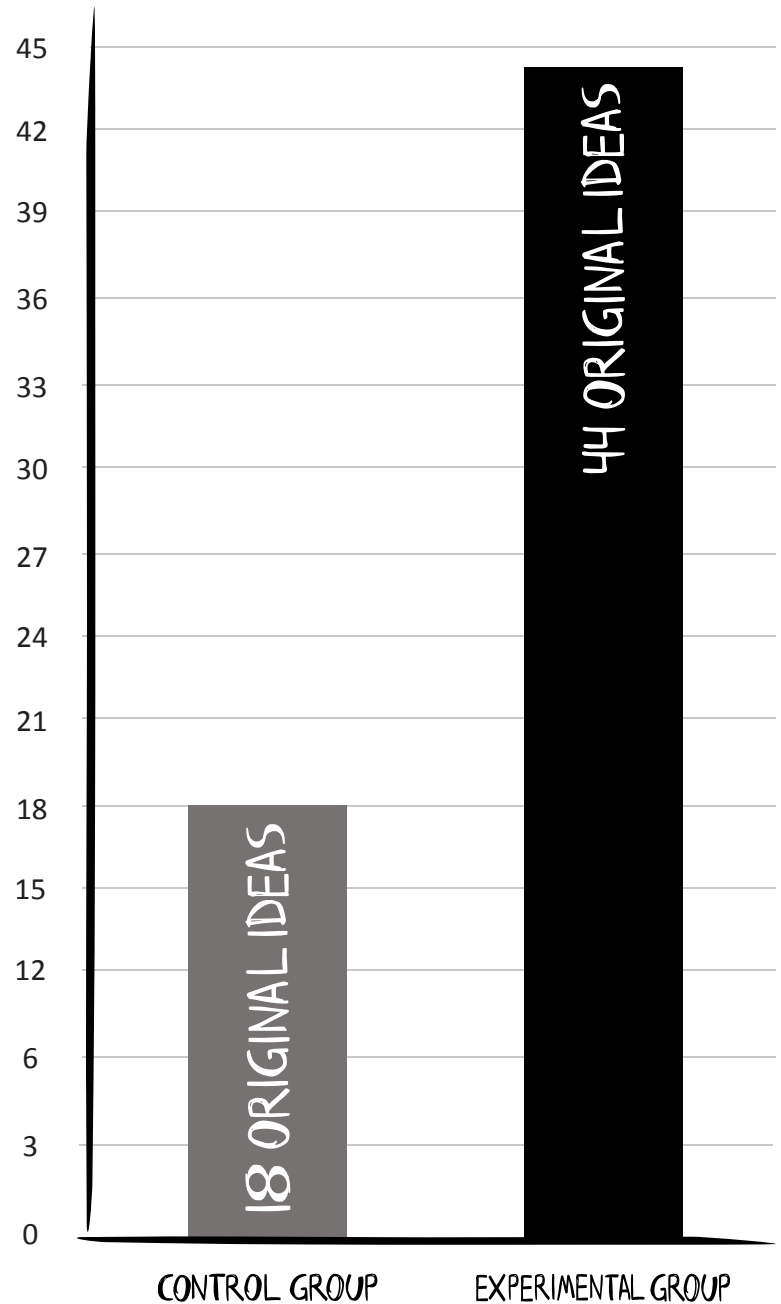


Figure 4.5 - Original ideas produced by both groups of the experiment.

CONTROL GROUP			EXPERIMENTAL GROUP		
Plants	Shapes	Tree	House	Unknown	Bed
Galaxy	House	Shoes	Photo of milk	Mug	Robot
Water	Ocean	Car	Pit	Playground	Color Gradient
Heart	Landscape Plan	Waterfall	Change	Crystal	Calendar
Grid	Chair	School	Apartment/Office	Childhood	Plants
Fire	Chair	Landscape Plan	House	Mime	Hallway
Face	Table	House	Bookshelf	Robot	CD
Plants	House plan	House	House Plan	House	TV
Face	Hat	House Plan	Grid	Doodlebob	Plants
Tree	Boat	Beehive	Abyss	Hallway	Surfer
Galaxy	Table	Boxes Repeating	Monster	Hub	Landscape Plan
House Plan	House Plan	Gift	Scrabble Tile	Circuits	Landscape Plan
Landscape Plan	Childhood	French Press	School	3D Space	House
Box House	Doodle	Time	Class plan	Pen holder	House plan
Chair	House	Tree	House	Car	Minecraft pig
KSU	House	River	House	Drum	Road
Rain	Forest	Cube	Bridge	Shapes	House plan
Cat	Body	Creativity	French Press	Goddess	Picture of room
Face	Grid	Maze	Hat	Robot	Field
Masterpiece	Grid	River	Cross Rosery	Cat	Sun
Boxes Repeating	Mountains	House	Thermos	Falling	Shadow
Circles	Disk Golf	Shapes	Guitar	House	City
Landscape Plan	Shapes	Robot	House	Hallway	Boxes Repeating
Water	Heart	Light Post	Shapes	Squares	House plan
Shapes	Cat	Shapes	Grid	Pen	Tree
House	Cat		Circles	Robot	Greek
Circles	Tree		College Pad	House	Landscape Plan
Plants	Smoke		Cube	Window	Pavilion Plan
House Plan	Boxes		Moon Watch	Cars	

□ □ Original Ideas not duplicated

Figure 4.6 - Inventory of all ideas given by participants.

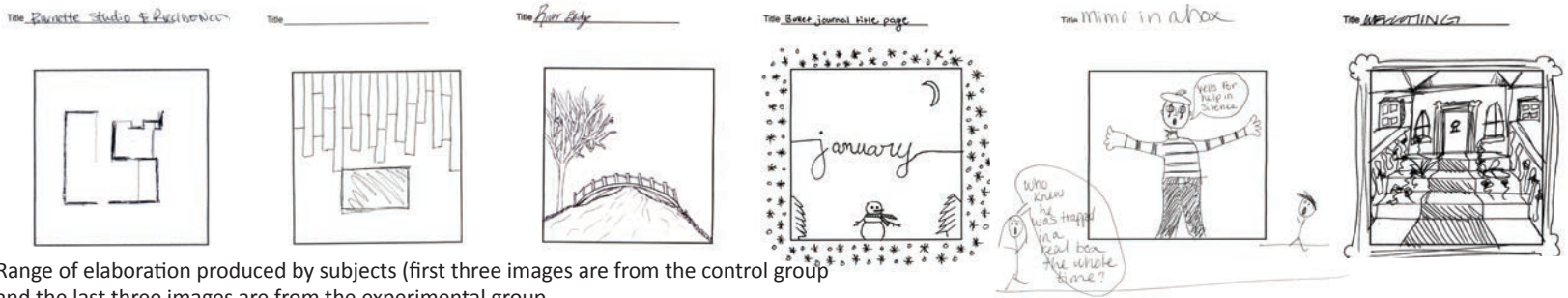
# ELABORATION

Students in both groups also showed a difference in the amount of detail given with the designs or the elaboration of the concepts. On average students in the experimental group gave more detail in their ideas than the students in the control group. Ideas ranged from simple lines and patterns to elaborate designs of college pads (See Figure 4.7). While both sides did give a range of detail (See Figure 4.8) the experimental group did show an increase of detail from the control group.

The experimental group showed an increase in storytelling elements for their ideas and tended to give more detail with the drawings (mime, mime watchers, monsters, and a goddess). and a plot (person falling, "Where I Want to Be" and mysterious hallway). Storytelling usually requires more information for the concept to be understood as opposed to the designs such as floor plans or simple houses. There does not need to be a lot of extra information for an outside person to understand a drawing is of a plan, but it does require more detail to understand what story is being conveyed in the design. Because the experimental group had more storytelling components in their designs, they were required to elaborate and give more detail than those who chose to draw typical environmental design concepts. The students who drew before the test showed an increase in storytelling and elaboration of the designs they created.



Figure 4.7 - Example of an elaborate design done in the experimental group.

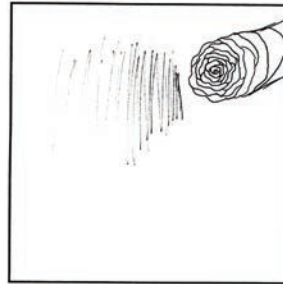


Range of elaboration produced by subjects (first three images are from the control group and the last three images are from the experimental group).

Title 43 my Childhood



Title rolled w/ smoke



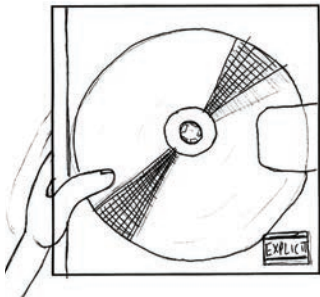
Title Framed Photo of a gallon of Milk



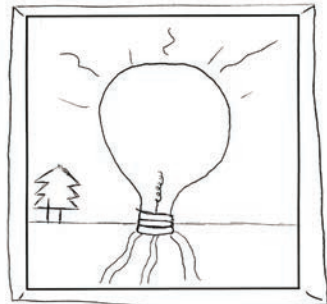
Title waterfalls?



Title Yeezus



Title Creativity



## COMPLEMENTARY EVALUATION BY EXPERT SURVEYS

An expert survey was created to further evaluate the creativity of the subjects. The test used the online survey maker Qualtrics. The ten-question format was designed to randomly circulate between each survey taker. The survey also asked question about the general demographics of the expert and if they thought creativity, art-making, and drawing was important (all survey takers ranked these three concepts a 5 or above on the seven-point Likert scale). Experts were sent a link to the anonymous survey by email and asked to pass the link to other experts.

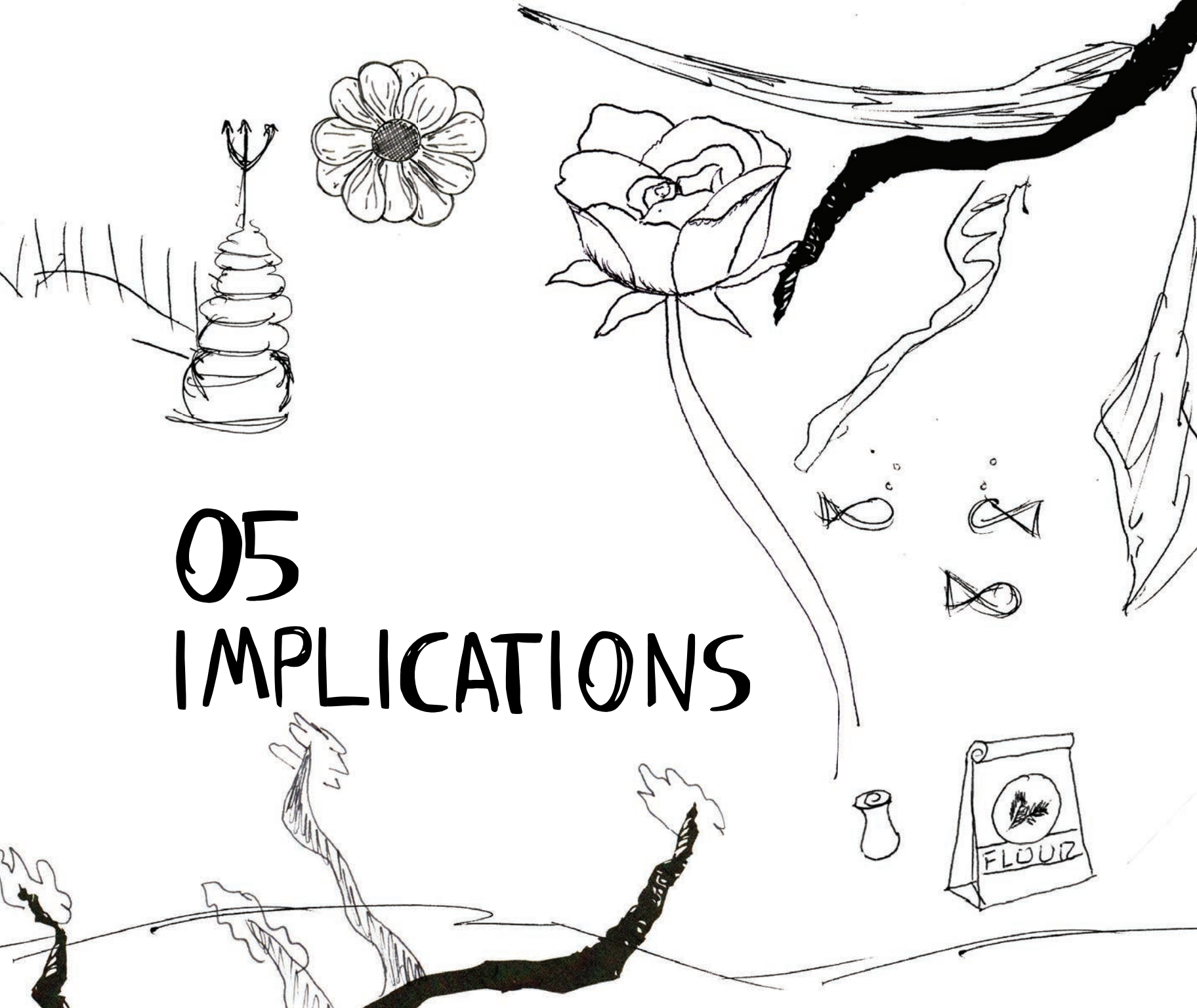
22 experts participated in the survey. The experts generally scored both groups higher than the researcher. The results of the expert survey (See Appendix A.7) showed that there was not much difference between fluency and flexibility of the two groups. This was consistent with the scores counted by the researcher. Between both concepts the scores only fluctuated slightly in both the researchers scores and the expert scores. The scores recorded for originality also were consistent with the researchers with a mean difference of 0.9. However, the elaboration scores from the expert survey showed no increase between the two groups. This was inconsistent with the scores taken by the researcher.

Most of the experts worked in private practice with varying years of experience. Reviewers rated art-making, drawing, and fostering creativity very important during design education and in general design practice. It should be noted that experts were not instructed on how to score each participant and not all designs circulated through the survey. Originality and elaboration are relative and usually need larger context to be evaluated.

Figure 4.9 - Examples of designs done during the experiment.



# 05 IMPLICATIONS



# DISCUSSION

The experimental study showed that the intervention of drawing had a positive effect on the creativity of early environmental design students. Participants who took part in the drawing intervention were able to foster and expand creativity and imagination. The results, like other studies (Dziedziewicz, Oledzka, and Karwowski 2012; Bolwerk et al. 2014; Kaimal et al. 2017) shows that adding drawing as art or another art-making activity can help improve brain functions as well as creativity. By doing drawing as art students of environmental design can develop their design procedure that is unique to their individual preferences (Lynch & Hack 1984). Students can add drawing as art to their process to help promote their creativity and imagination.

According to Vygotsky (2004) imagination is the basis of all creative activity. The drawing prompts in the experimental study were designed to relieve the pressure on the students to draw and allows them to stimulate their imagination quickly. When the students began to sketch, they were creating new neural connections in the brain (Tallinen et al. 2014; Vygotsky 2004). Students who participated in the drawing intervention were stimulating their mind and becoming more imaginative. By increasing their imagination, the students who drew before were able to perform better on the creativity test than those who did not participate in the drawing intervention.

While it could be argued that drawing as art is not an essential aspect of the design process, the cognitive functions that are associated with drawing are essential (Schott 2011). Drawing has the unique ability to stimulate creativity, reduce stress, and heighten concentration (Andrade 2010; Schott 2011). The design process can be a very stressful aspect of design especially in the early stages of design education. By adding drawing as art to the process, it may be possible to increase imagination as well as reduce stress which would further increase creativity in an individual. Even if students were not able to improve their imagination, drawing would still have other benefits that would significantly increase the cognitive ability of an individual (Schott 2011).

## LIMITATIONS & FUTURE RESEARCH

As we experience different stimuli in the outside world, our brain creates folds and neural connections that store the different experiences humans have (Tallinen et al. 2014; Vygotsky 2004). Folds and connections become more defined; the more stimuli are repeated (Vygotsky 2004). One limitation of the research was the short amount of time given to complete the drawing prompts and creativity test as well as the non-repetitive nature of the experiment. Students

had a five-minute time limit on the creativity test as well as one ten-minute period to complete the drawing intervention. This length is a relatively a short amount of to time given to students who are using the design process which is an iterative procedure. Students were not allowed to continue drawing after the time limit had expired. Further research would be needed to determine what long term affects drawing as art has on the environmental design process. Other research would also include a more in-depth analysis of how the drawing as art could fit into the design process and what effects it has on the individual designer.

Another limitation the experiment has was the unknown creativity level of the subjects tested. Subjects did not participate in pretests providing baseline data about their creativity levels before participating. Future studies could examine how drawing as art can increase creativity in individuals before and after a creativity intervention. For example, Dziejewicz et al (2012) measured the effects of a doodling intervention on young children ages four to six, yielding similar results to this study.

The experimental study was taken by students in both afternoon and morning studio. The groups by the entire studio, so some students took the creativity test in the morning and some took the test in the afternoon. Also, during the week of data collection students in the first year environmental design program had a project due the Friday of that week. There was no seen difference between the afternoon and morning studios as well as the in the participants who took the test on the different days. This project deadline could have affected the results of the survey. Even with the project deadline students did show that the creativity test had an impact on their environmental design process. Thus, the assumption of random assignment may be violated.

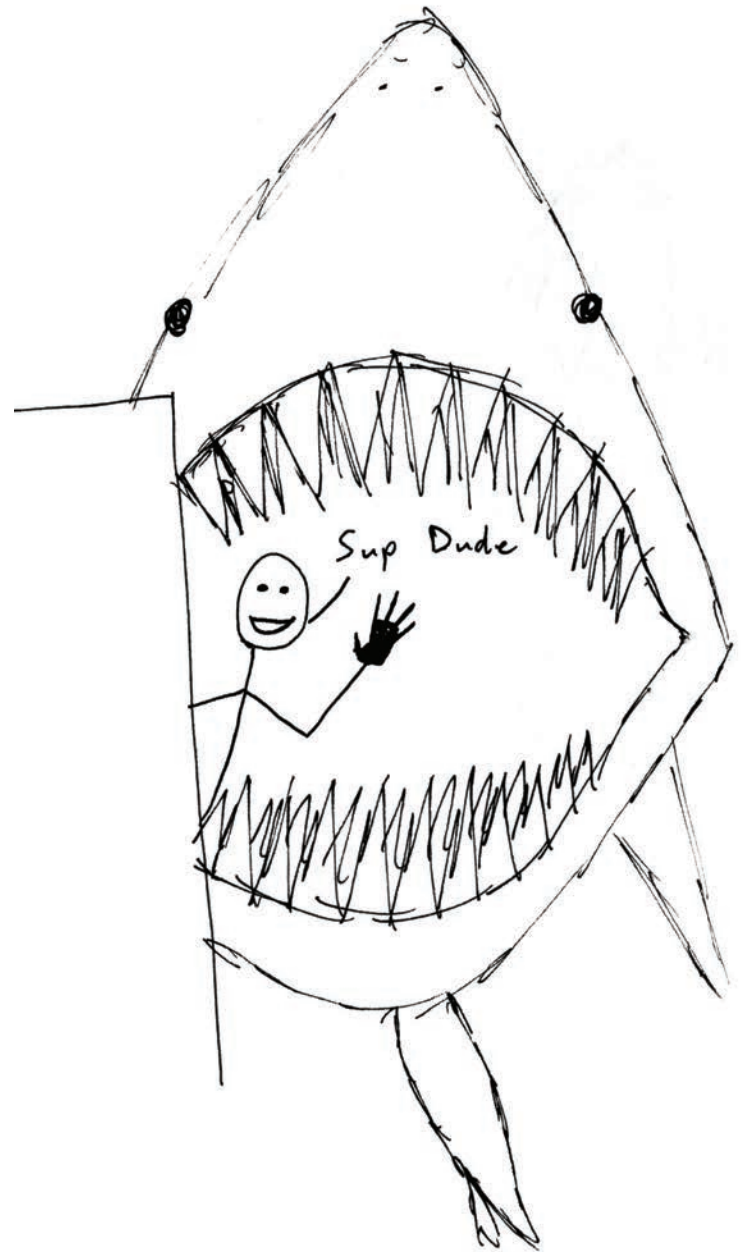



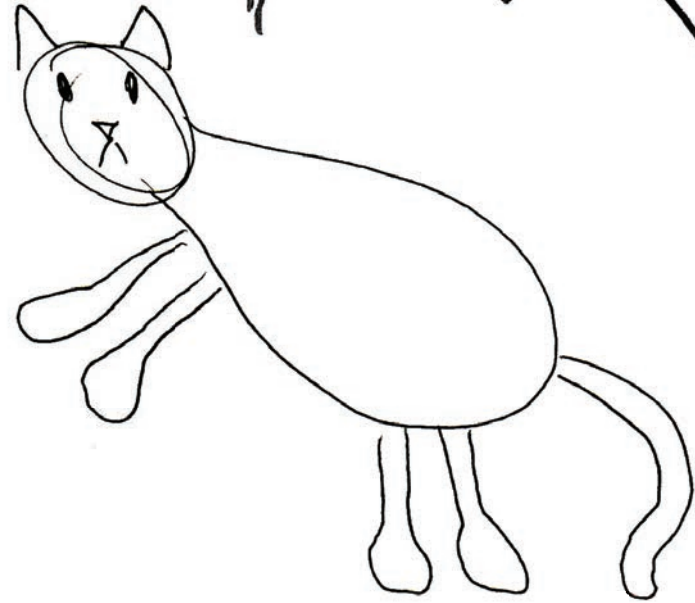
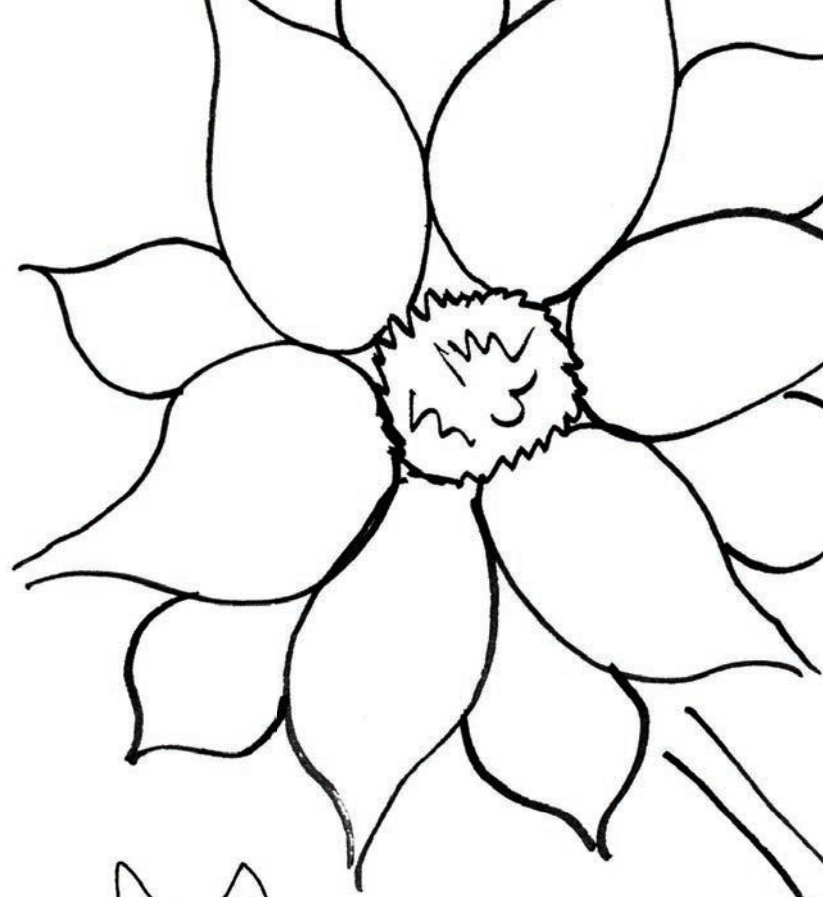
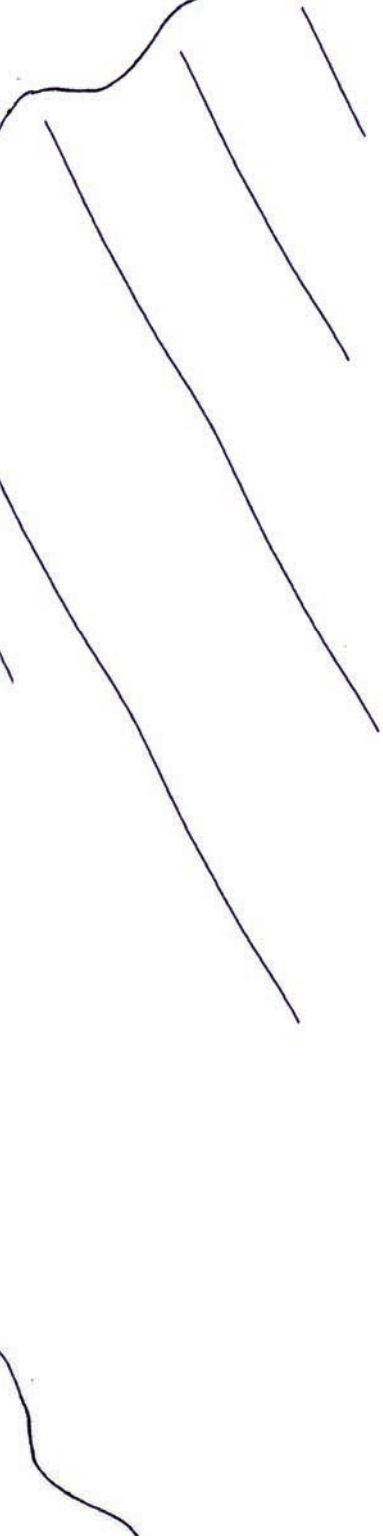
Figure 5.1 - Drawing made by participant in drawing intervention.



A hand-drawn map or topographic sketch. It features a grid of vertical and horizontal lines. A thick, black, irregular path or boundary runs vertically through the center, starting from the top and ending near the bottom right. Several small black dots are scattered across the map. On the right side, there are several irregular, nested contour-like shapes. A small star is drawn at the end of the thick path on the right side. The overall style is sketchy and artistic.

# 06 CONCLUSION





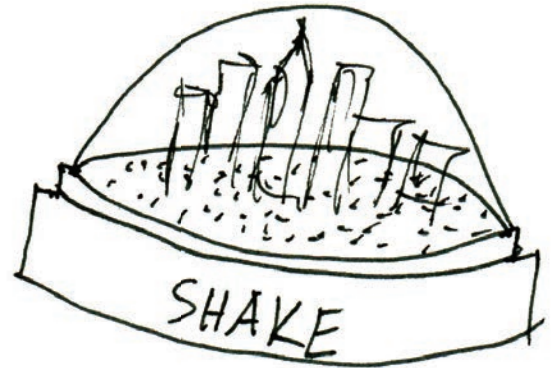
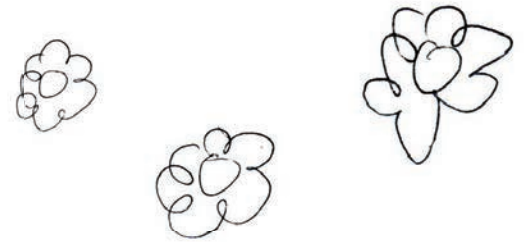
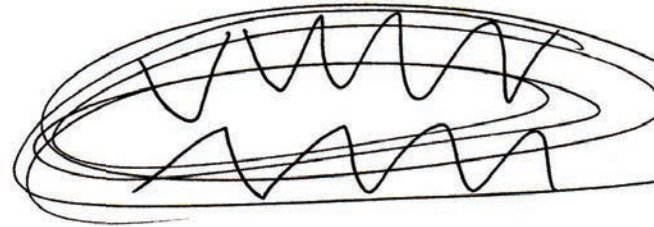
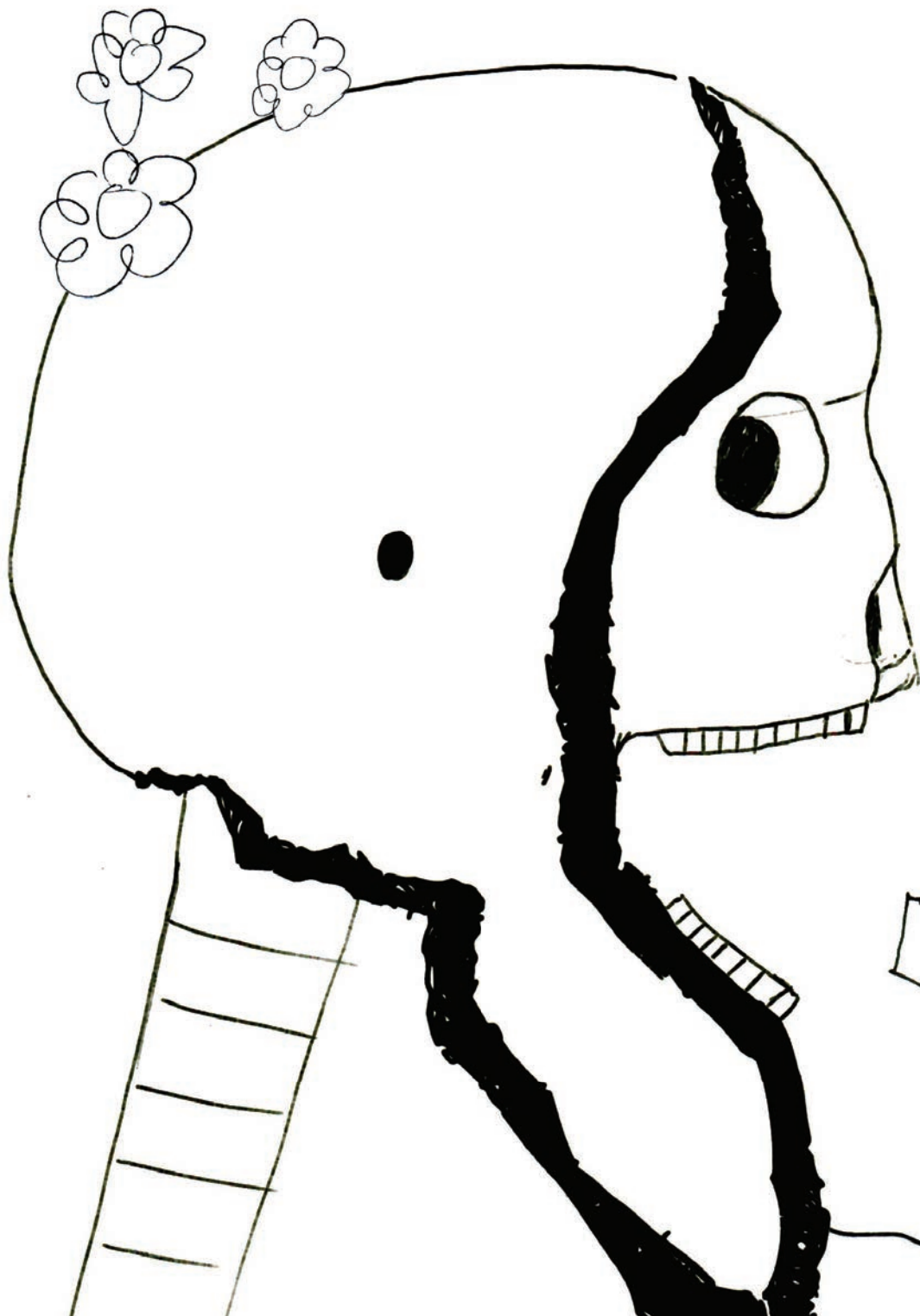


# CONCLUDING THOUGHTS

Through this study and other experiments that test similar concepts and ideas it can be concluded that adding drawing as art to the creative process would be beneficial in promoting imagination and creativity. Although drawing does take up some time it was shown in this study that even small amounts of sketching could have a profound impact on the fostering of creativity. Students are usually encouraged to carry sketchbooks in design school. In these sketchbooks, students could do small drawing interventions of their own to help their imagination. Students should actively attempt to expand their creativity and imagination by doing activities that promote these functions

Environmental design is a highly creative field that needs its practitioners to be highly creative people. Imagination and creativity are fundamental aspects of design. The world needs people to develop innovative solutions for the increasing complexity of its problems (Runco 2004).

It is essential for design students to start developing their creativity at an early age to help solve these problems in the future. One way to build this creativity is drawing as art as presented in this study. Students should be taught and incorporate drawing and other activities that require imagination and creative thinking into their design process as well as their everyday lives to foster their creativity whenever possible. In this study, the drawing intervention demonstrated that an expansion of imagination could be gained by using only a short amount of time. Students did not need to spend more than ten minutes on the drawing exercise and still showed an increase in abilities. Drawing is an activity that is quickly done in almost any situation, and with any amount of time, all a person needs to get started is a pen and a surface to draw on.





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# REFERENCES

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# FIGURE REFERENCES

Figure 1.1 -

Dalke, Madison. 2019. *Creative Process*. Adobe Illustrator.

Figure 1.2 -

Dalke, Madison. 2019. *Study Design*. Adobe Illustrator.

Figure 2.1 -

Dalke, Madison. 2019. *Literature Map*. Adobe Illustrator.

Figure 2.2 -

Dalke, Madison. 2019. *Creativity Tests*. Modified from Torrance 1969, Guilford 1976, Mendick 1962, Wallach and Kogan, 1965, and Williams 1980. Adobe Illustrator.

Figure 3.1 -

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Figure 3.2 -

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Figure 3.3 -

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Figure 3.4 -

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Figure 4.1 -

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Figure 4.2 -

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Figure 4.3 -  
Dalke, Madison. 2019. *Creativity Tests*. Adobe Illustrator.

Figure 4.4 -  
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Figure 4.5 -  
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Figure 4.6 -  
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Figure 4.7 -  
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Figure 4.8 -  
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Figure 4.9 -  
Dalke, Madison. 2019. *Student Designs*. Adobe Illustrator.

Figure 5.1 -  
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Figure A.1 -  
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Figure A.2 -  
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Figure A.3 -  
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Figure A.4 -  
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Figure A.6 -  
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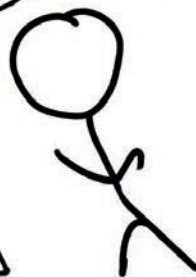
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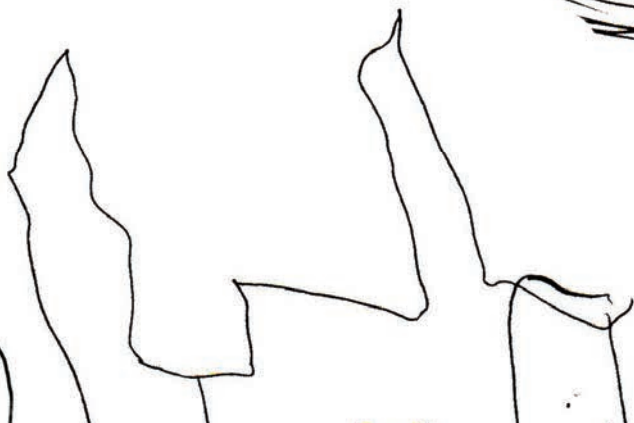
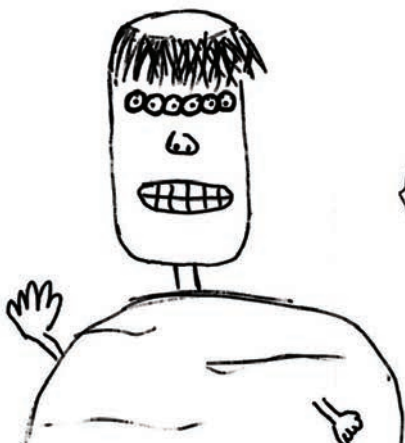
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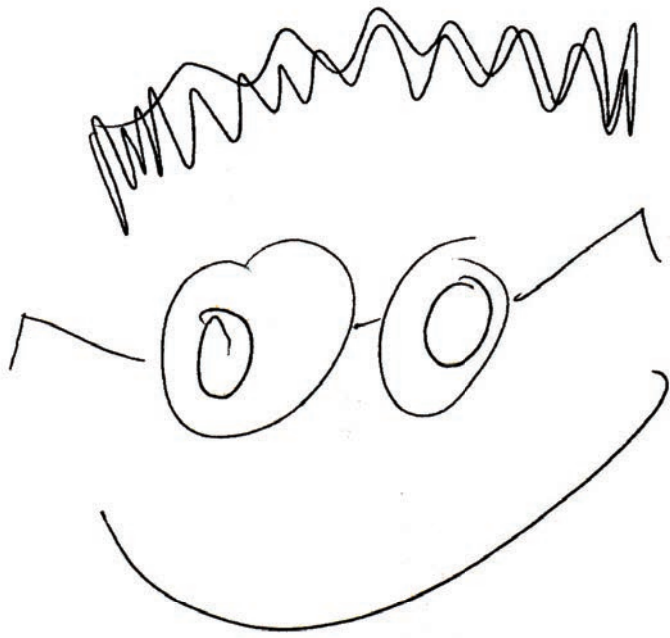
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# APPENDICES

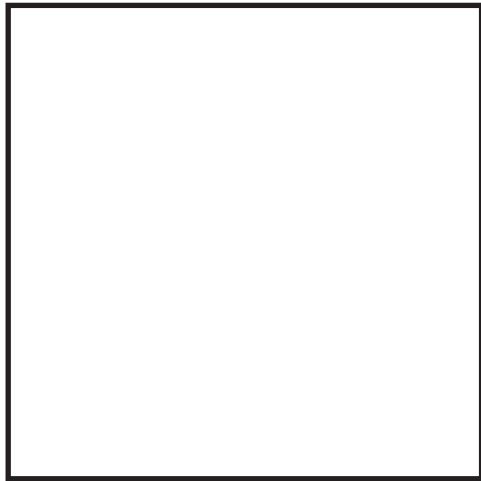






# A: CREATIVITY TEST

Title \_\_\_\_\_



DRAW A SELF PORTRAIT

DRAW YOUR FAVORITE CHILDHOOD TOY

DRAW AN IMAGINARY FRIEND

YOU DISCOVERED THE LOST CITY OF ATLANTIS  
WHAT DOES IT LOOK LIKE?

DRAW THE INTERIOR OF A GREEK TEMPLE

DIVE DOWN TO THE DEEPEST PART OF THE OCEAN,  
DRAW WHAT YOU SEE

DRAW A FLOWER

COMPLETE THE DRAWING



Figure A.1 - Creativity test given to participants in the study.  
57

Figure A.2 - Drawing Prompts used in the study.

# EXPERT SURVEY

This survey is being conducted by Madison Dalke, a graduate student in the Department of Landscape Architecture and Regional & Community Planning at Kansas State University. The purpose of this research is to gain an understanding of how drawing affects designers' imagination and creativity during the design process. This study is strictly on a volunteer basis, and you may withdraw at any time.

The following survey will show you a series of design drawings done by students during a 5-minute creativity exercise. You will be asked to rate each design based on creativity. All responses will remain confidential and anonymous.

If you would like further information about how the research was conducted, please [click here](#).

Thank you for your participation!

If you want to learn more about the research, in general, please contact Madison Dalke at [mkdalke@ksu.edu](mailto:mkdalke@ksu.edu) or Hyung Jin Kim, Ph.D. at [hyungjin@ksu.edu](mailto:hyungjin@ksu.edu)

By continuing this survey, you agree to IRB informed consent. If you have any questions about IRB please contact Rick Scheidt, Committee Chair email: [rscheidt@ksu.edu](mailto:rscheidt@ksu.edu) phone: (785) 532-1483.

Students were given five square scale-free sites and asked to design them for 5-minutes. Please rate on a scale of 1 to 7 (1 being the lowest and 7 being the highest) each separate design image based on the four criteria of creativity: Fluency, Flexibility, Originality, and Elaboration. See below for the definition of each criterion:

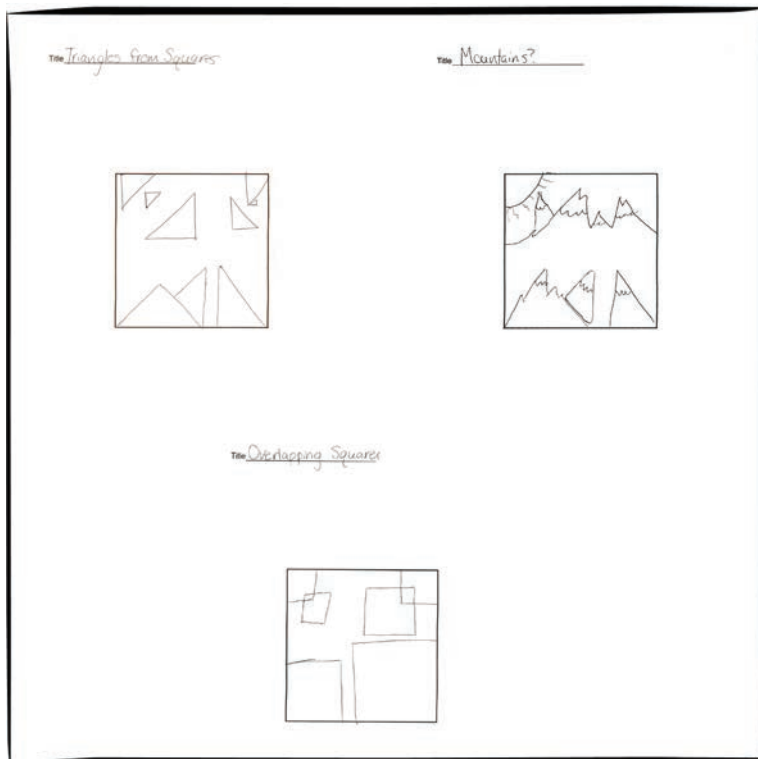
**Fluency** – The number of ideas on each image

**Flexibility** – The number of categories or topics of ideas (ex: a plan of a house and another plan of a house are the same categories, but a plan of a house and a playground or two separate types.

**Originality** – The uniqueness of the ideas on each image

**Elaboration** – The detail of the ideas on each image

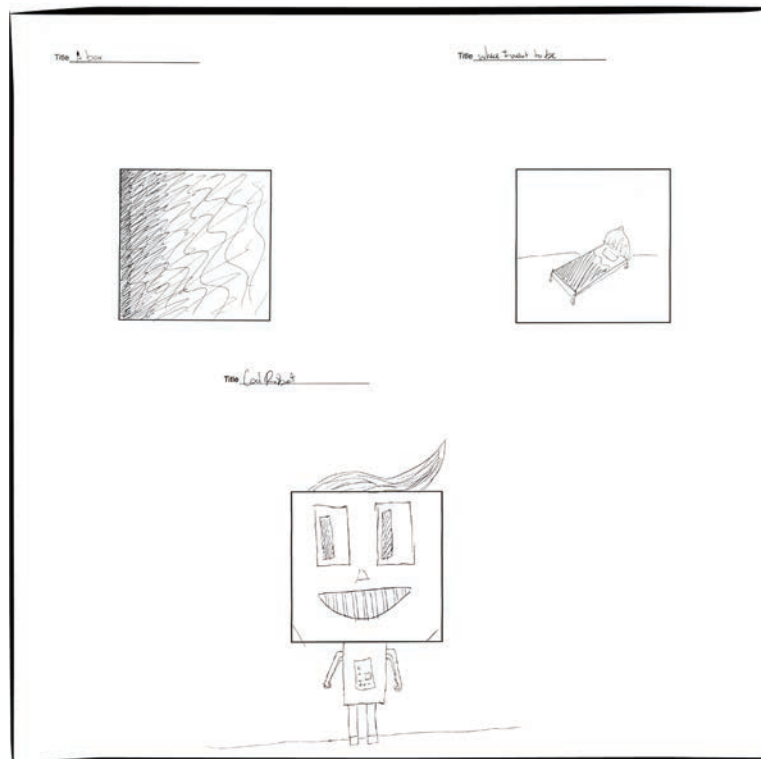
# CONTROL GROUP



Rate the design(s) above:

	1	2	3	4	5	6	7
Fluency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flexibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Originality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# EXPERIMENTAL GROUP



Rate the design(s) above:

	1	2	3	4	5	6	7
Fluency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flexibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Originality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.4 - Reviewers rated 10 randomized (five control and five experimental) questions using the information provided in the survey.

# PERSONAL CREATIVITY

How important do you think the following items are in design education?

	Not Very Important		Neutral			Very Important	
Art-making practice in design education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drawing practice in design education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fostering creativity in design education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How important do you think the following items are in design practice?

	Not Very Important		Neutral			Very Important	
Art-making practice in general design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drawing practice in general design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fostering creativity in general design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.5 - Personal creativity survey questions.

# TELL ME ABOUT YOURSELF

What Gender are you?

- Male
- Female
- Other
- Prefer not to answer

What discipline do you practice? (i.e. Landscape Architecture, Planning, Architecture, Graphic Design, etc)

Write in answer

What type of job do you work at?

Write in answer

How many years of experience do you have?

Write in answer

Figure A.6 - Demographic questions.

Concept	Control					Researcher	Average
	Q1	Q3	Q5	Q7	Q9		
Fluency	3.4	3.9	4.1	4.3	3.1	3.4	3.7
Flexibility	3.6	3.7	3.6	4.3	3.1	4.0	3.7
Originality	4.0	3.7	3.4	3.4	4.0	1.5	3.3
Elaboration	3.9	4.1	4.6	3.6	4.4	4.1	4.1

Concept	Experimental					Researcher	Average
	Q2	Q4	Q6	Q8	Q10		
Fluency	4.3	3.6	3.6	4.3	4.3	3.5	3.9
Flexibility	4.3	3.4	4.0	4.3	3.9	4.2	4.0
Originality	4.9	3.6	4.1	5.1	4.9	2.5	4.2
Elaboration	5.1	4.0	4.3	3.7	4.2	4.0	4.2

Figure A.7 - Results of the expert survey.

### Back to the Drawing Board: Creativity Scores

Participants	Fluency	Flexibility	Originality	Elaboration	Total
1	2	3	1	3	9
2	3	4	2	4	13
3	4	5	2	3	14
4	3	4	2	3	12
5	5	6	1	4	16
6	5	6	2	3	16
7	2	3	1	4	10
8	3	4	1	5	13
9	4	3	1	4	12
10	3	4	1	4	12
11	5	6	3	3	17
12	4	5	2	3	14
13	3	2	2	5	12
14	4	5	3	4	16
15	3	4	4	5	16
16	3	2	2	5	12
17	3	2	1	5	11
18	3	4	1	5	13
19	4	3	1	5	13
20	5	6	1	2	14
21	3	4	2	5	14
22	2	3	3	6	14
23	3	4	3	4	14
24	3	3	2	3	11
25	4	5	3	4	16
26	2	3	1	6	12
27	4	5	3	6	18
28	4	3	1	3	11
29	2	3	1	5	11
30	3	4	1	6	14
31	5	4	2	5	16
32	4	5	3	2	14
33	2	3	1	4	10
34	2	3	1	7	13
35	4	5	5	4	18

Participants	Fluency	Flexibility	Originality	Elaboration	Total
36	2	3	1	6	12
37	4	3	1	5	13
38	5	5	2	4	16
39	3	4	1	6	14
40	5	6	2	3	16
41	3	4	1	5	13
42	3	4	2	5	14
43	3	4	2	7	16
44	3	4	1	2	10
45	2	3	3	5	13
46	4	5	5	4	18
47	3	4	4	4	15
48	2	3	1	5	11
49	2	3	3	7	15
50	3	4	1	5	13
51	5	6	4	5	20
52	3	4	2	6	15
53	5	6	2	6	19
54	3	4	2	7	16
55	4	5	3	4	16
56	2	3	3	4	12
57	3	4	1	5	13
58	2	3	3	7	15
59	5	6	1	3	15
60	2	3	1	6	12
61	2	3	1	5	11
62	7	7	3	4	21
63	3	4	2	6	15
64	4	5	5	4	18
65	2	3	1	3	9
66	2	3	3	7	15
67	5	6	4	5	20
68	7	4	2	5	18
69	5	4	2	4	15
70	5	6	2	3	16

Figure A.8 - Results of the researcher score.

Control					
Participants	Fluency	Flexibility	Originality	Elaboration	Total
1	2	3	1	3	9
2	3	4	2	4	13
3	4	5	2	3	14
4	3	4	2	3	12
5	5	6	1	4	16
6	5	6	2	3	16
7	2	3	1	4	10
8	3	4	1	5	13
9	4	3	1	4	12
10	3	4	1	4	12
11	5	6	3	3	17
12	4	5	2	3	14
19	4	3	1	5	13
20	5	6	1	2	14
24	3	3	2	3	11
26	2	3	1	6	12
28	4	3	1	3	11
29	2	3	1	5	11
30	3	4	1	6	14
32	4	5	3	2	14
33	2	3	1	4	10
34	2	3	1	7	13
36	2	3	1	6	12
37	4	3	1	5	13
38	5	5	2	4	16
42	3	4	2	5	14
44	3	4	1	2	10
56	2	3	3	4	12
59	5	6	1	3	15
60	2	3	1	6	12
61	2	3	1	5	11
62	7	7	3	4	21
65	2	3	1	3	9
66	2	3	3	7	15
69	5	4	2	4	15
Average	3.4	4	1.5	4.1	13.0

Experimental					
Participants	Fluency	Flexibility	Originality	Elaboration	Total
13	3	2	2	5	12
14	4	5	3	4	16
15	3	4	4	5	16
16	3	2	2	5	12
17	3	2	1	5	11
18	3	4	1	5	13
21	3	4	2	5	14
22	2	3	3	6	14
23	3	4	3	4	14
25	4	5	3	4	16
27	4	5	3	6	18
31	5	4	2	5	16
35	4	5	5	4	18
39	3	4	1	6	14
40	5	6	2	3	16
41	3	4	1	5	13
43	3	4	2	7	16
45	2	3	3	5	13
46	4	5	5	4	18
47	3	4	4	4	15
48	2	3	1	5	11
49	2	3	3	7	15
50	3	4	1	5	13
51	5	6	4	5	20
52	3	4	2	6	15
53	5	6	2	6	19
54	3	4	2	7	16
55	4	5	3	4	16
57	3	4	1	5	13
58	2	3	3	7	15
63	3	4	2	6	15
64	4	5	5	4	18
67	5	6	4	5	20
68	7	4	2	5	18
70	5	6	2	3	16
Average	3.5	4.2	2.5	5.1	15.3

Figure A.8 - Results of the researcher score.

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the	
									Lower	Upper
Fluency	Equal variances assumed	1.749	0.19	-0.491	68	0.625	-0.1429	0.2912	-0.724	0.4382
	Equal variances not assumed			-0.491	66.447	0.625	-0.1429	0.2912	-0.7242	0.4385
Flexibility	Equal variances assumed	0.478	0.492	-0.613	68	0.542	-0.1714	0.2795	-0.7292	0.3863
	Equal variances not assumed			-0.613	67.614	0.542	-0.1714	0.2795	-0.7292	0.3864
Originality	Equal variances assumed	7.444	0.008	-4.203	68	0.000	-1.000	0.2379	-1.4748	-0.5252
	Equal variances not assumed			-4.203	56.748	0.000	-1.000	0.2379	-1.4765	-0.5235
Elaboration	Equal variances assumed	0.617	0.435	-3.978	68	0.000	-0.9714	0.2442	-1.4587	-0.4841
	Equal variances not assumed			-3.978	66.97	0.000	-0.9714	0.2442	-1.4589	-0.484

Figure A.9 - Independent Samples Test.

### Group Statistics

Concept	Group	N	Mean	Std. Deviation	Std. Error Mean
Fluency	Control	35	3.371	1.308	0.2211
	Experimental	35	3.514	1.1212	0.1895
Flexibility	Control	35	4.000	1.2127	0.205
	Experimental	35	4.171	1.1242	0.1900
Originality	Control	35	1.543	0.7413	0.1253
	Experimental	35	2.543	1.1966	0.2023
Elaboration	Control	35	3.029	0.9544	0.1613
	Experimental	35	4.000	1.0847	0.1833

Figure A.10 - Group Statistics.



# B:IRB

TO: Dr. Hyung Jin Kim  
Landscape Architecture/Regional and Community Planning  
1102 Seaton Hall

Proposal Number: 9515

FROM: Rick Scheidt, Chair  
Committee on Research Involving Human Subjects

DATE: 11/02/2018

RE: Proposal Entitled, "Mind's Eye: Exploring Art-Making as a Tool to Improve Imagination"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written - and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

TO: Dr. Hyung Jin Kim  
Landscape Architecture/Regional and Community Planning  
Seaton Hall

FROM: Rick Scheidt, Chair   
Committee on Research Involving Human Subjects

DATE: 01/31/2019

RE: Proposal #9515.1, entitled "Back to the Drawing Board: Drawing as a Path to Imagination and Creativity."

A MINOR MODIFICATION OF PREVIOUSLY APPROVED PROPOSAL #9515,  
ENTITLED, "Mind's Eye: Exploring Art-Making as a Tool to Improve Imagination"

The Committee on Research Involving Human Subjects at Kansas State University has approved the proposal identified above as a minor modification of a previously approved proposal, and has determined that it is exempt from further review. This exemption applies only to the most recent proposal currently on file with the IRB. Any additional changes affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Unanticipated adverse events or problems involving risk to subjects or to others must be reported immediately to the IRB Chair, and / or the URCO.

It is important that your human subjects project is consistent with submissions to funding/contract entities. It is your responsibility to initiate notification procedures to any funding/contract entity of changes in your project that affects the use of human subjects.

**PROJECT TITLE:**

Back to the Drawing Board: Drawing as a Path to Expand Imagination and Creativity

**PROJECT APPROVAL DATE:** 10/19/2018 **PROJECT EXPIRATION DATE:** 4/19/2019 **LENGTH OF STUDY:** 6 Months**PRINCIPAL INVESTIGATOR:** Hyung Kim**CO-INVESTIGATOR(S):** Madison Dalke, Graduate Researcher**CONTACT DETAILS FOR PROBLEMS/QUESTIONS:** Madison Dalke, Graduate Researcher email: mkdalke@ksu.edu**IRB CHAIR CONTACT INFORMATION:** Rick Scheidt, Committee Chair email: rscheidt@ksu.edu phone: (785) 532-1483**PROJECT SPONSOR:** Kansas State University LARCP**PURPOSE OF THE RESEARCH:**

The purpose of this research is to gain an understanding about how drawing affects a designers imagination during the creative process. This study is strictly on a volunteer basis. Participants will not receive any benefits besides an increase in knowledge of the subject. If the participant wishes to withdraw without any consequences at anytime please inform Madison Dalke (Graduate Researcher) of your decision.

**PROCEDURES OR METHODS TO BE USED:**

To understand what affects drawing has on imagination and creativity, this research will use a creativity test based on previously established tests to measure the outcome of adding drawing to the creative process.

Participants will be split into a control and experimental group determined before the test is presented.

Control Group: Participants are given 5 minutes to complete the test. After both tests are complete all papers will be collected, analyzed, and documented in a final research report.

Experimental Group: Before any test is given, participants will be provided with a booklet of drawing activities and pens and pencils. Participants will have ten minutes to create as they please. They will then complete the same creativity test as the control group. All papers and booklets will be collected, analyzed, and documented in the final research report.

**ALTERNATIVE PROCEDURES OR TREATMENTS, IF ANY, THAT MIGHT BE ADVANTAGEOUS TO SUBJECT:**

None

**RISKS OR DISCOMFORTS ANTICIPATED:**

Responses given will be published for the public. Participants will be assigned a number and no names will be used.

**BENEFITS ANTICIPATED:**

A deeper understanding of how drawing affects imagination.

**EXTENT OF CONFIDENTIALITY:**

Participants will be asked to provide responses to a creativity test and complete a drawing booklet. All responses given will be analyzed, scored, and documented in a final report that will be published. Participants names will not be revealed within the report.

**IS COMPENSATION OR MEDICAL TREATMENT AVAILABLE IF INJURY OCCURS?**  Yes  No

**PARENTAL APPROVAL FOR MINORS:****PARENT/GUARDIAN APPROVAL SIGNATURE:**

Date:

**Terms of participation:** I understand this project is research, and that my participation is voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

(Remember that it is a requirement for the P.I. to maintain a signed and dated copy of the same consent form signed and kept by the participant).

**PARTICIPANT NAME:**

**PARTICIPANT SIGNATURE:**  Date:

**WITNESS TO SIGNATURE: (PROJECT STAFF)**  Date:

Figure B.3 - IRB Consent Form.