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GRAPHIC DESIGN STUDENTS' PERCEPTIONS OF USING APPLE iPADS TO CREATE SKETCHES AND PROMOTE IDEA GENERATION

by

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A Dissertation

Submitted to the Graduate Faculty

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for degree of

Doctor of Philosophy in Teaching & Learning Higher Education

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This dissertation, submitted by Elizabeth A. Becker in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Dr. Lori Swinney

Dr. Timothy O'Keefe

This dissertation is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

Dean of the School of Graduate Studies

December 1 2016

Date

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Department	Teaching & Learning
Degree	Doctor of Philosophy

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Elizabeth A. Becker

November 29, 2016

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ABSTRACT

Artists and designers typically utilize sketching during the early stages of the design process because it provides them with an opportunity to transfer ideas from their head onto paper, computer, or mobile device. Sketching is regarded by researchers in the field of design to be an essential part of the design process.

The existing research in this field is focused on comparing paper and pencil sketches with sketches completed on computers. There is a void in the literature examining sketching completed on mobile devices like the Apple iPad. Therefore, this study aimed to fill that void.

The purpose of this study was to explore the effectiveness of graphic design students' use of iPads for sketching activities. The experiences and perceptions of 10 graphic design students who completed a sketching activity using iPads, were examined during the spring and fall semesters of 2016 at a university in the Upper-Midwest.

Qualitative phenomenological research methods were used in the study. Data was gathered from interviews and from analysis of the participants' iPad sketches. The general categories for the participants' perspectives included background information, design workflow, attitudes on sketching, experience using the iPads, and quality of the iPad sketches. Three themes emerged from an analysis of the data.

The first theme addressed the reasons why students preferred sketching with paper and pencil. The second theme explained the benefits students found when

sketching on iPads. Finally, theme three expounded on alternative idea generation techniques that could be accomplished on iPads.

CHAPTER I

INTRODUCTION

For centuries artists and designers have utilized sketching for brainstorming and idea generation because it provides them with a means to transfer their initial ideas from their heads onto paper or a computer. Today, sketching is regarded by researchers and educators in the field of design as an essential part of the design process. Sketches can be completed anywhere and on anything from the back of an envelope or a napkin, to a computer with state-of-the-art software, and in recent years, on mobile technologies. According to the 2015 Pearson Student Mobile Device Survey, 51 percent of college students surveyed stated they use tablets at home, school and elsewhere. A similar study done in 2016 by the Educase Center for Analysis and Research (ECAR) reported that 56 percent of students own a tablet with 49 percent of those being Apple iPads. This, in particular, begs the question: What does this mean in relation to sketching and graphic design?

The purpose of the study was to explore the effectiveness of graphic design students' use of iPads for sketching activities. The investigation focused initially on students' perceptions of sketching on the iPads for the purpose of generating ideas for graphic design projects. The study also looked at the quality of sketches produced and how those sketches compared to traditional paper and pencil sketches. In this research, student participants were studied during Spring 2016 and Fall 2016 semesters at a university located in the Upper-Midwest.

In this chapter, the reader is provided with background information on graphic design and sketching. Also described in this chapter are the problem statement, need for the study, research questions, definitions, and organization of the study.

Graphic Design and Sketching

Graphic design is defined as "the art and practice of planning and projecting ideas and experiences with visual and textual contents" (Cezzar, 2015, AIGA website) or as "taking an idea and giving it visual form so others can understand it" (Samara, 2014, p. 06). Graphic designers combine photographs, typeface, graphics and in some cases audio, video, and animations in order to communicate a message to a target audience. The message can be cultural, political, social, educational, and more. Graphic designs come in many different forms. Some are printed, like posters and brochures, while others are digital, like web pages. They also come in many different shapes and sizes. They can be as small as a postage stamp or as large as a billboard.

There is, however, more to graphic design than creating aesthetically pleasing messages. Graphic design "is about solutions to real problems" (Sommese & Sommese, 1997, p. 33). The "real problems" Sommese and Sommese refer to vary depending upon the needs of the client. For instance, one client could be just starting out with a new business and want to find ways to get the company's name recognized by the public. In this example, the problem is that the new company does not yet have an "identity." Another client might be associated with a long-standing company but wants to update the company's look to be more current. In this case the problem is how to reinvent the company's image. The problems graphic designers are tasked with solving change on a daily basis and no two clients' needs are the same.

Having the ability to solve these types of problems requires that the graphic designer be creative, able to imagine solutions, and generate different design ideas. In her 1998 study, Pica reported that creative individuals are able to express themselves and imagine new ideas. The early stage of the design process is, accordingly, primarily about the generation of different design concepts or solutions to the design problem. During this phase, designers are free to generate and explore ideas without the constraints that exist in later design stages. Benami and Jin (2002) explained that the more concepts created during this early phase of the design process, the more options there will be to choose from, eventually leading to a more fully developed final design. Pan, Kuo, and Strobel (2012) added "unlike a structured problem-solving task with a definite solution, design is a process which requires designers to use different skills to identify and analyze problems, synthesize ideas, and then generate and test solutions to create new approaches" (p. 1).

According to Grabska's (2009) Theoretical Framework for Creative Visual Thinking, "the main work of creative visual design is done through dialogue with graphical outputs" (p. 1). She explained that designers need to be able to make sense of the mental images in their heads and that sketching is one of the best ways to express design ideas. Thring (1977) also stressed the importance of "thinking with hands" in order to develop ideas (p. 89). This notion is supported by existing research in the area of design and the study of creativity. Sommese and Sommese (1997) recommend designers follow three basic steps for improving their creativity and to help them solve real problems in graphic design: defining the project, conducting research, and spending time brainstorming about the problem. Dong (2005) added that drawing sketches is critical to

the design process because it acts as a graphical representation for thinking, communication, and the evaluation of design ideas. Denton and Williams (1996) added that "sketching can be used to quickly model a range of ideas" and that this is "more successful if students try to develop a range of initial sketches rather than work in detail over one idea" (p. 19).

With the advent of computers, however, how graphic designers "sketch" design ideas have changed. A designer must now choose the medium he or she will use to create the sketch. The designer may use the traditional paper and pencil medium or choose to use some sort of computer-aided sketching design tool. As one would expect, the advent of this new medium has raised questions among graphic designers and graphic design instructors. Is this new medium effective or could it stifle creativity? Does it promote or inhibit idea generation?

Problem Statement

Accordingly, the purpose of this study was to explore the effectiveness of graphic design students' use of iPads for sketching activities. The specific goal of the study was to discover and understand a) whether or not sketching on iPads has an impact on students' idea generation process, b) whether or not students perceive a difference in sketching when using iPads versus paper and pencil, and c) whether or not students were able to produce higher quality sketches on the iPad than on paper with pencil.

Need for Study

This study sought to increase understanding of whether or not mobile devices, such as the iPad, have an impact on graphic design students' ability to generate creative design solutions. There was a need for this study for two reasons:

1. There has been little research that specifically looks at the use of iPads for sketching. Current research focuses on paper/pencil, computers, and Wacom drawing tablets. With an increase in the use of mobile technology, like the iPad, in education, discovering whether or not such devices can be used for idea generation warrants investigation.
2. While there has been an increase in research over the last few years on the use of mobile technology in higher education, few studies have looked specifically at their use in the fields of art and design.

The research presented in this study will fill these gaps in the literature and be of use to inform graphic design instruction.

Research Questions

The research was guided by the following questions:

1. Does the use of iPads have an impact on graphic design students' idea generation process, specifically regarding the quality of the sketches produced?
2. What are the students' perceptions of sketching on iPads as compared to other mediums, like paper and pencil?

Organization of the Study

Chapter I conveyed an overview of creativity and sketching in graphic design. It also includes a discussion of the problem statement, need for study, research questions, and organization of the study.

Existing research related to this study is reviewed and discussed in Chapter II. This section is divided into four main areas: idea generation, paper/pencil vs. computer,

use of iPads in higher education, and sketching on iPads. In addition to looking at existing research on sketching, studies on writing and note-taking were also examined.

The methodology used for this study is described in Chapter III. It begins with a rationale for choosing a qualitative approach. Next, the data gathering techniques (i.e., interviews and document analysis), coding procedures, and validity measures that were used in the study are explained.

In Chapter IV, results of the data from interviews and the design activity that were sorted and coded for similarities are conveyed. The themes that emerged are discussed with reference to the literature. Additionally, in this chapter the study participants' individual perspectives are shared. Consistent categories are used to express the participants' perspectives and provide the reader with background information, design process, and thoughts regarding sketching on the iPads.

A summary of the study is provided in Chapter V. Limitations and recommendations are also provided in this chapter.

CHAPTER II

LITERATURE REVIEW

The purpose of this study was to explore the effectiveness of graphic design students using Apple iPads for sketching activities. In this chapter, the researcher will show the gap that exists in current research by exploring the existing research on 1) idea generation, 2) use of paper and pencil vs. computer for sketching, as well as writing and note-taking, 3) the use of iPads in education, and 4) sketching on iPads.

Idea Generation

Idea generation is defined as the "act of generating novel ideas" and "is the activity most frequently associated with creative problem solving" (Herring, Jones and Bailey, 2009, p.2). While the focus of this study is on sketching to generate ideas, the researcher believed it was important to look at other areas where idea generation occurs, particularly in writing. According to Jalongo "Drawing and writing involve some of the same psychomotor skills, depend on similar cognitive abilities, are both developmental, and are both purposeful" (as cited in Mackenzie, 2011, p. 323).

The connection between drawing and writing is supported by the research of Adoniou (2011). Adoniou's study on writing development for English Language Learners found that drawing or sketching before writing improved students' writing skills. Since English was not their first language the students often struggled to articulate certain ideas with words and by first drawing out their ideas they were later able to provide more information and better explanations in their writing.

Flowers' and Hayes' (1981) Cognitive Process Theory stated that the act of writing involves three major elements: 1) the writing task (what the author will be writing about), 2) the writer's long-term memory, and 3) the writing process. The writing process focuses on planning, translating, and reviewing ideas. A pivotal 1988 study by Kellogg looked at this writing process. In his study participants were randomly placed into two groups. Group one began writing immediately while group two spent 10 minutes outlining prior to writing. Kellogg (1988) found that "preparing an outline can yield a better and longer product" (p. 359). In his book, *How to Write a Lot: A Practical Guide to Productive Academic Writing*, author Paul Silva (1997) explained that outlining is an important part of the writing process because it allows the writer to make important decisions about the paper and organize thoughts before trying to communicate them. De Smet, Brand-Gruwel, Broekkamp, and Krischner (2014) stated, "outlining allows generating, clustering, and ordering at an early stage in the writing process, and forces writers to consider both hierarchical and structural relations" (p. 353).

De Smet et al. (2014) researched the effects of electronic outlining on student writing. They had students complete two argumentative writing tasks. The students were randomly placed into three groups 1) control, 2) single outline, and 3) repeated outline group. For the first writing task the control and single outline groups began writing immediately while the repeated outline group completed an electronic outline using Microsoft Word prior to writing. Later a second writing task was performed, this time with both the single and repeated outline groups generating an electronic outline. The researchers found in both tasks that the students who utilized electronic outlining did a better job with "structure presentation, which focused on reader orientation and correct

and sufficient use of headings, paragraphs and connectives" (p. 362). Students in the repeated outline group also did better in generating argumentative points.

Similar to research that shows that outlining is an important part of the writing process, studies on sketching support the idea that it is a worthwhile part of the design process. Prats, Lim, Jowers, Garner, and Chase (2009) found that the creation of initial sketches allowed designers to make comparisons, pull out key parts, and combine and rearrange elements to make additional sketches. Eventually, this led to more developed final designs. Stones and Cassidy (2010) stated:

> ...to have several ideas in the early stage of a design is useful since it enables the designer to have a rich set of solutions to choose from, enables the client to be shown more solutions, and it can also confirm the strength of a particular solution by comparing it to many other attempts. (p. 441)

Schutze, Sachse, and Romer (2003) studied the value of sketching in the design process. In their study 45 mechanical design students were asked to design a garden grill with specific characteristics (e.g., parts needed to be easily removed for cleaning). The 45 subjects were placed into three groups of 15. Groups one and two were asked to sketch their grills using paper and pencil. The first group was able to sketch with no constraints while the second group had their paper and pencils taken away after they had completed 50 percent of their sketches. The third group was asked to solve the problem mentally and was not allowed to sketch. The study concluded that those who were allowed to sketch without constraint produced a significantly higher quality solution. They also produced alternative designs not only for the entire garden grill but for the various parts. Schutze, Sachse, and Romer (2003) added that "sketching served as an aid

for analysis, short-term memory, communication and documentation. It proved to be helpful for the development of testing of solutions as well as for the identification of errors" (p. 95).

Despite being over 20 years old, a significant amount of research on sketching continues to reference Eugene Ferguson's 1994 book *Engineering and the Mind's Eye*. In his book Ferguson identifies three types of sketches: thinking, talking, and prescriptive. According to Ferguson, thinking sketches focus on the designer's individual thought process. Talking sketches involve designers sharing or collaborating on sketches with other designers. He states, "Such sketches make it easier to explain a technical point, because all parties in the discussion share a common graphical setting for the idea being debated" (p. 97). McGown, Green, and Rodgers (1998) added that when producing talking sketches "designers may actually pass the pencil back and forth as they talk and draw together on the same sketch. It is a way of clarifying complex and confusing parts of the sketches" (p. 46). The prescriptive sketch is more polished and detailed. It is used to communicate design ideas to those outside the design process such as a teacher, employer, or client.

In his study titled "How sketching can affect the idea generation process in design group meetings," van der Lugt (2005) expanded on Ferguson's ideas with a technique called brain sketching. He explained that brain sketching is done in rounds. In the first round designers sketch their ideas individually. Then they share ideas and switch papers. In the second round they use the other designer's initial sketches as a source of inspiration for further sketches. His study found that "in idea generation groups, sketches

can stimulate creativity, especially in the immediate individual idea generation process, by providing new directions for idea generation" (p. 119).

Bilda, Gero, and Purcell (2006) conducted a study with three professional architects, two of whom were award winning. In the first part of the study the architects completed a design task while blindfolded in which they were not allowed to sketch but rather asked to think through their ideas out loud. In the second part of the study, participants completed a similar activity only this time sketching their ideas. The results found no difference between the quality of the design solution regardless of whether or not the participants sketched or not. However, participants in the study commented that they struggled with remembering earlier ideas or solutions and that sketching made "design thinking easier by seeing it and storing it" (p. 607). Bilda, Gero, and Purcell (2006) stated that despite the results of their study they do not disregard sketching as an important design tool. They explained that the results of their study may have been impacted by the fact that the participants were design professionals. They added when "design students learn how to sketch they are also learning how to develop ideas, such as starting with one design proposal and developing it into another one. Thus, students learn how to progress their ideas through sketching" (p. 609).

While the focus of this study was on sketching, the researcher acknowledged that there are many other types of idea generation techniques. In preparing this literature review, particularly the section on idea generation, the researcher believed it was important to look at studies that examined other types of brainstorming techniques. While the existing research on sketching was critical to the study including studies on tasks like outlining helped to better illustrate that idea generation practices are important

parts of the creative process. The research for both sketching and outlining demonstrated that these types of activities help individuals to think about the task, organize thoughts, put ideas onto paper, and come up with different solutions. While the research supports the notion that engaging in idea generation or brainstorming is important, the medium used for these tasks is frequently debated by researchers.

Paper and Pencil vs. Computer

"It seems that paper and pencil are increasingly being replaced by screen and keyboard. The widespread presence of digital technologies is modifying the way in which people share, consume and create knowledge" (Farinosi, Lim, & Roll, 2016, p. 410). In their article Noyes and Garland (2008) explained that studies comparing the use of computer vs. paper-based tasks date back decades and still continue to attract research interest. Studies comparing the use of computers to paper-based tasks have been conducted in reading, writing, test-taking, math and sketching, just to name a few. The findings of some of those studies are described below for comparative purposes.

Note-taking

In their 2009 study Herring, Jones, and Bailey described several techniques for generating ideas, one of which was documenting. They defined documenting as the process of "designers writing down ideas (physically or electronically). This includes journaling, writing stories, and taking notes" (p. 5).

Andrade (2009) conducted a study on the effects of doodling. She had 40 students listen to monotonous telephone conversation. One-half of the group was randomly placed into the doodling group and asked to shade in shapes while listening to the telephone call. Following the call participants were tested on what they remembered; specifically, they

were asked to recall the names of people coming to a party. Those in the doodling group were able to recall 29 percent more of the names than those in the non-doodling group. Andrade (2009) concluded that doodling reduced daydreaming and aided in concentration.

While note-taking is primarily seen as a writing task notes can also include sketching or drawing. In his book *The Sketchnote Handbook* author Mike Rohde (2012) explained that sketchnotes are "rich visual notes created from a mix of handwriting, drawings, hand-drawn typography, shapes, and visual elements like arrows, boxes and lines" (p. 2). Designer and illustrator Craighton Berman (2011) added that sketchnotes appeal to visual learners and that they strengthen observation and listening skills. Sketchnotes can be done with paper and pencil as well as with digital tools.

Bui, Myerson and Hale (2013) explored note-taking on the computer. Their study was divided into three experiments: one compared taking notes by hand with taking notes using a computer and the effect the method had on test performance; the second experiment focused on the types of lecture notes taken; and, the third looked at the role of working memory when using different note-taking methods. Experiment one focused on the methods of note-taking (hand vs. computer) and types of notes taken (transcribed vs. organized). In that experiment participants watched an 11-minute lecture and took notes, some by hand and others on a computer. Those in the organized group were told to summarize the lecture and organize their notes while those in the transcribe group were told to record as much of the lecture as possible. Afterwards the students were immediately tested on the information from the lecture. The results of the experiments were that "when people used a computer to take notes, they took more notes and recalled

more of the lecture than when they took notes by hand" (p. 302). Specifically, those students who transcribed the lectures had more detailed notes and did better on the test than those who typed out summarized or organized notes on the computer and both groups that took handwritten notes. In experiment two all of the lecture notes were taken on the computer with one group transcribing the lecture word for word while the other group organized their notes by themes or key points in the lecture. Following the lecture one-half of the participants were tested immediately while the others were tested following a 24-hour delay. Those in the delay group were not allowed to study their notes. Similarly, to experiment one, those tested immediately performed better on the exams when they had transcribed the lectures. However, those that organized their notes by themes scored better on exams following a 24-hour delay because their notes allowed for a deeper understanding of the material. In experiment three all of the notes were taken on the computer and all participants were tested following a 24-hour delay. In this experiment one-half of the participants were allowed to study their notes while half were not. The researchers found that those who had transcribed the lectures and studied their notes performed better on the exams because they had better recall of the material than those who took more organized notes. However, those who did not study prior to the exam performed better when they had taken the more organized notes.

In a similar study, Mueller and Oppenheimer (2014) studied the differences between taking lecture notes longhand on paper versus on a laptop. An analysis of the students' lecture notes showed that students who took notes on their laptops tended to write down verbatim what the lecturer said, while students who took notes longhand did more summarizing and synthesizing of key points. Their study found that the students

who took notes longhand with paper and pencil performed better on exams because they had a deeper understanding of the material.

Fink (2010) noted that allowing students to take notes on the computer during class could also prove to be a distraction. He observed that rather than taking notes students were sending e-mails, visiting social media sites, shopping online, surfing the web, and more. Therefore, he banned the use of laptops in his courses. He stated, "This course has now been conducted twice with these policies in place and the students survived and even did well" (p. 114). This is supported by the research of Wood, Zivcakova, Gentile, Acher, De Pasquale, and Nosko (2012) who examined the impact of off-task multi-tasking with technology during class time. In their study four multi-tasking activities—texting, instant messaging, emailing, and Facebook—were explored. Their findings concluded that students who took notes by hand did better on exams than those who were distracted by Facebook and instant messaging conditions. This is also supported by the 2016 ECAR survey which reported that of students get distracted during class because of social media (39.3 percent), instant messaging or texting (42.2 percent), sending or reading email (40.6 percent), playing online games (17.1 percent), and by surfing the web (35.8 percent).

What these studies seem to suggest to the researcher is that there are many benefits to taking notes longhand. Taking notes longhand prevents students from transcribing the lectures verbatim and encourages them to focus more on key points. Summarizing or synthesizing the lecture material leads to a deeper understanding of the information because students have to draw meaning from their notes rather than just memorizing what was said during the lecture. Taking notes longhand also decreases the

possibilities for becoming distracted during class. The research on note-taking also suggests that notes do not have to be words. Drawing sketches of ideas and concepts or even just doodling can help with remembering information presented during lectures. While the existing research appears to favor taking notes with paper and pencil what about other tasks such as writing and sketching?

Writing

As stated previously there is a connection between writing and sketching; both involve similar motor skills and cognitive abilities (Mackenzie, 2011) which is why the researcher included studies on writing as part of this literature review. Fortunati and Vincent (2014) conducted a study in Italy comparing reading and writing on paper with reading and writing digitally. Their study was repeated by Taipale (2014) in Finland and again by Farinosi, Lim, and Roll (2016) in the United Kingdom, Italy, and Germany. In these studies, students were asked to write reflectively and answer four questions:

1. Describe the difference you find when using pen and using the computer. Furthermore describe what you like and dislike about both these modalities.
2. Describe which differences you find in reading on paper and reading on a screen. Furthermore describe what you like and dislike about both those modalities.
3. Think now of the gestures and postures you assume in reading and writing using paper and on a screen. Reflect and describe them.
4. Think now to your use of computer/Internet. This tool allows multimodal communication (images/videos, texts, sound, music and so on). How do you use it? Reflect on your personal experience and then describe it. (Fortunati & Vincent, 2014, p. 44; Taipale, 2014, p. 535; Farinosi, Lim & Roll, 2016, p. 413)

In all three studies, researchers concluded that students saw handwritten work as more personal and preferred it for things like thank-you-notes, cards, journals and diaries. They also indicated that writing with paper and pencil allowed for better creativity. Students explained that they often wrote notes or doodled in the margins of the paper or organized thoughts through mind mapping. A student in the original 2014 Italian study stated that writing with pen and paper "promoted the formulation of sentences, in particular a handwritten phrase is usually already fully formed in one's head" (Fortunati & Vincent, p. 45).

Students in all three studies preferred computer generated writing for longer pieces, such as research papers. In two of the studies, students reported one of the benefits of writing on the computer was the fact that word processing programs allowed them to check for spelling and grammar, use built in thesauruses, and easily move sections of the paper around by copying and pasting text (Fortunati & Vincent, 2014 and Farinosi, Lim, & Roll, 2016). However, Taipale (2014) stated that students in Finland were more critical of computer aided correction tools and cautioned against blindly trusting them. This criticism of computer aided correction tools is supported by the research of McGee and Erickson (2007). They found that these tools could negatively influence writing. "Most [students] simply accept the authority of this smart machine to police their grammar" (p. 318). They also argued that by relying on things like spell check students are not learning how to spell or use grammar correctly.

Indiana University School of Medicine learning specialist, Patricia Ann Wade stated, "When it comes to learning and remembering course material, the pen is mightier than the keyboard," (as cited in Pearson, 2014, para 3). She explained that writing by

hand on paper uses more mental energy and uses more areas of the brain than typing keys on the keyboard. She added that because it is a slower process it is useful during the brainstorming phase, which requires time and deliberation. This is supported by research conducted by Longcamp, Boucard, Gilhodes, Anton, Roth, Nazarian, and Velay (2008), which looked at visual recognition of shapes when written by hand versus keyed. Their study was comprised of 12 participants who underwent three training sessions to learn how to write 10 new characters either by hand or typed on a keyboard. The characters were modified from Bengali and Guajarati alphabets. Six of the participants learned the characters by typing them on a keyboard. The keyboards were predesigned with the new characters labeled and all in a row. The other six participants wrote the characters on a sheet of paper. Six weeks after the last training session the participants were tested. The typing group was given a keyboard with the labels on the keys removed. They were then shown images of the 10 characters in random order and asked to press the corresponding key on the keyboard. The handwriting group was asked to write down the characters. The study found "a more accurate recognition of new characters that had been written by hand than those that had been typed" (Longcamp et al., 2008, p. 5).

Overall the results of the studies on writing with paper and pencil versus the computer appear to be mixed. Handwritten work was viewed as more personal and creative. Writing by hand was also shown to require more mental energy and, similar to the studies on note-taking, result in better retention of material. However, when it comes to long pieces of writing, such as essays or research papers, the studies reported that students prefer typing on the computer because it is easier to rearrange sections by copying and pasting. Writing on the computer also allows users to take advantage of

features like spelling and grammar checking. However, other studies caution against becoming too dependent on these features because it prevents users, particularly young learners, from learning how to spell and use grammar properly. This mixed view on writing on the computer versus with paper and pencil is consistent with the studies on sketching.

Sketching. While sketching is often accomplished with pencil and paper, it can also be accomplished on the computer, using the mouse, a digital drawing tablet, or with digital pens. A study by Bilda and Demirkan (1999) was designed to gain insight about designers' cognitive processes while sketching with traditional media versus on the computer. They found that traditional media had advantages over the digital media, such as supporting the perception of visual-spatial features, organizational relations of the design, production of alternative solutions, and a better conception of the design problem. In a similar study, Stones and Cassidy (2010) had their participants complete two different sketching activities, one using paper and pencil and the other using the computer. They were interested in students' abilities to reinterpret their sketches—a student may start drawing something only to have it turn into something else, thus leading to an entirely new design. The researchers found that the ambiguity of hand-drawn sketches is advantageous because it allows for better reflection and reinterpretation. They argued that using computer programs for sketching could be restrictive due to the finished appearances of typefaces, shapes, and lines selected from a menu. They explained that inexperienced designers often mistake the high level of finished work created on the computer for design proficiency. The researchers found that when using paper and pencil the participants were able to generate more ideas than they

were able to when using the computer. They also noted that students judged their digital work more harshly and would often delete or undo things they did not like when using the computer.

In contrast, Yeoh (2003) examined whether computer technology enhanced or hindered creativity in terms of idea formation. He found that technology seemed to inspire and help users develop new opportunities by allowing them to multi-task, explore, conceptualize, customize, manipulate, personalize, and produce in an interactive environment. It forces graphic designers to think, draw, manage, and produce. In their study, Tang, Lee, and Gero (2011) focused on technology that could mimic free-hand sketching behaviors. They had study participants complete sketches using Wacom tablets and sketching software that emulated the pencil and paper method. Results indicated that sketching using technology that allowed for free-hand drawing had the same impact on idea generation as the traditional pencil and paper sketches.

In his study, Johnson (2005) explored sketching in the digital age. He argued that while Computer-Aided Design (CAD) software has the potential of being a "conceptual tool capable of developing new ways of perceiving and conceiving design," the current commercial tools "tend to be driven by production needs (efficiency and accuracy), rather than creativity" (p. 622). This is supported by the research of Dorta (2008) who explored what he refers to as the ideation gap. He explained that idea generation is still done using analog tools because the computer-aided design tools do not meet the needs of designers. "They serve representation, but not ideation" (p. 124) because they are equipped with set menus, tools and geometric shapes.

Veisz, Namouz, Joshi, and Summers (2012) also explored computer-aided design versus hand-drawn sketches. According to their study the experienced design educators did not believe computer-aided design tools should be used for idea generation. One educator stated, "They shouldn't be [using CAD] because at that point you have committed to a very detailed solution" (p. 330). However, the novice designers in the study disagreed. They liked using the tools because they believed it saved time and offered more design freedom. The industry professionals who participated in the study expressed some concerns regarding the use of CAD for generating ideas. One participant worried that using the software could result in too detailed of an idea, therefore novice designers could believe that they were done and not explore other ideas. Veisz, Namouz, Joshi, and Summers (2012) concluded that the conceptual phase of the design process required more human tasks such as decision making and problem solving whereas later stages of design process lend themselves better to the computer when the focus is more on accuracy and well rendered details.

Educators are now asking, where do iPads and other such mobile devices fit?

Apple iPads in Higher Education

In the 2012 New Media Consortium (NMC) Horizon Report, Johnson, Adams, and Cummins listed mobile apps as one of their "Time-to-Adoption: One Year or Less" technology trends for higher education. They stated, "Mobile apps embody the convergence of several technologies that lend themselves to educational use, including annotation tools, applications for creation and composition, and social networking" (p. 11). According to Pearson Education's (2015) "2015 Pearson Student Mobile Device Survey," tablet usage amongst college students is on the rise. The final report revealed

that 51 percent of college students surveyed use a tablet at home, school and elsewhere. This was up six percent from the same study conducted in 2014 and up 11 percent from 2013. The study also showed an increase in the number of times per week students used their tablets for college work. The study found that 41 percent reported using their tablets at least two to three times per week or more, which is an increase of seven percent from the 2014 study. A similar study, conducted in 2016 by ECAR, found that 56 percent of college students had tablets and 41 percent were using iPads. Earlier, in the literature review, the researcher provided studies comparing note-taking, writing, and sketching on the computer versus with paper and pencil. However, with the use of tablets by college students on the rise it is important to also consider how these devices compare.

Schepman, Rodway, Beattie, and Lambert (2012) explored the use of mobile apps for note-taking—specifically the app Evernote. In addition to allowing users to record keyed or handwritten notes, the app allowed for recording audio and photographs. Multiple training sessions were provided to allow participants time to become familiar with the app and ask questions of the researchers. Two months after the first training took place the students met one-on-one with an interviewer to discuss how they used the app and to share their notes. The researchers found that, in addition to taking notes during classes, students used Evernote in some innovative ways. For example, some students used the camera and voice recording features to take photos of lab experiments and then voice-annotated them as a reminder of different procedures. Students also used the app for personal use such as recording gym workouts, keeping a journal, and making to-do-lists. The study found that, of the notes categorized as academic, 47.5 percent were

study notes, 16 percent were brainstorming ideas, 10.3 percent were organizing notes, and 4.0 percent were personal reflections.

A study by Sessions, Kang and Womack (2016) also explored the use of apps in education. They conducted a study on using iPads to improve writing instruction in elementary and high school education, kindergarten through twelfth grade (K-12). In their study they compared writing with paper and pencil to writing on the iPads. The researchers separated a class of fifth graders into two tracks. Track A students wrote with paper and pencil while Track B used iPads. The students in Track B were given access to Dragon Dictation, a speech to text app; Toontastic, which allowed them to create animations; Popplet, a mind mapping app; Story Builder, which helped weave a story together; Paper, a sketching app; and Tamajii, which is an app to help with visualization by providing background images, people, and other image prompts. Their study found that the students who used the iPads "demonstrated increased use of sensory details" and that the iPads "helped the Track B students most in their sequencing skills, which was lacking in Track A students" (p. 221). They also found that the student stories in Track B were more dynamic as they were able to create animations rather than static pictures. The authors stated that, "Perhaps the most marked effect of using the iPad apps in comparison to paper and pencil use was in students' approach to writing and the decisions made" (p. 222). Students in Track B reported that the apps helped them to make decisions regarding characters and plot development. Their study also found that the students with access to the iPads were more motivated to write. One student in the study stated, "It's like a tool that lifts you up and helps you so you can see writing like a movie instead of just a problem to solve" (p. 223). Sessions, Kang and Womack (2016)

also stated that the study had some unexpected results. One, for example, was that students who may have been categorized as low achievers in reading and writing had an aptitude for using technology. They were able to teach their classmates how to use the iPads and/or the various apps. The researchers (2016) also discovered that writing on the iPads was more social and students were excited to show each other what they had worked on, offer feedback, and share ideas.

Sullivan (2013) further studied the social aspects of writing on the iPads by exploring the use of iPads for collaborative writing. She stated, "A student set of Apple iPads has reinforced my approach to writing instruction in a collaborative, inclusive classroom" (p. 1). Sullivan (2013) conducted a study in her undergraduate writing course where she had an iPad cart in her classroom that included 25 iPads for student use. The iPads were equipped with the standard built-in apps (Safari, Photos, FaceTime, YouTube), and the app Good Reader was purchased and installed so that students could read and annotate portable document format (PDF) files. The researcher had students use the iPads to access Google Docs and write collaboratively on a writing assignment or to provide comments on a classmate's draft. She also noted that the "standard iPad is equipped with various assistive features including a voiceover screen reader, support for closed captioning, and an assistive touch screen" (p. 2). She explained that this fact allowed her to create a course that made writing accessible to different types of learners. One student in her class, for example, used his device as an e-reader and used speech-to-text apps when writing papers. Sullivan (2013) also noted that not every classroom provides computers for every student and in those that do, the computers are often stationary. However, with the iPads students were able to move around the room and

collaborate with their peers. Sullivan (2013) ended her article by stating, "As a device that fosters fluency, creativity, and accessibility, tablets are proving to be a new tool for teaching the very traditional art of good writing," (p. 2).

Similarly, Pennsylvania State University partnered with Apple to incorporate iPads into a technical writing course. Students were given iPads with an accessory keyboard to use for the semester. Apple provided students with iTunes gift cards to apply toward the purchase of writing apps and a gift card from publisher Bedford/St. Martin to cover the cost of the digital textbook. Course instructor Michael Faris stated that his "students found the iPad's light weight convenient and told him it was a great tool for doing simple tasks. However, they also reported having trouble writing more extensive papers with it" (States News Service, para. 6). Nico Kovacevic, a junior taking the course, agreed and noted the usefulness of having easy access to the Internet, class files, course notes, email, calendar, textbooks, etc. all on one device that is lighter and easier to carry around then a laptop. He did add that when it came to writing papers the iPad was cumbersome. Kovacevic explained that the auto-correct typing feature of the iPad often made it feel like he was writing on his cell phone and he found doing page formatting difficult.

While the above studies focused on the use if iPads in writing courses, British researchers Souleles, Savva, Watters, Annesley, and Bull (2015) conducted a phenomenographic study that aimed to discover the educational potential of iPads in studio-based art and design courses. Students were given iPads with pre-installed free apps in four categories: utilities, social networking, productivity and creativity. The participants were not given any instruction on how to use the iPads and they were not

instructed to do anything specific with them. Students were later interviewed about their experiences using the devices. Some comments from the participants included, "I used it for note taking and picture taking, and the sketchbook app was great for getting down ideas and showing people" (p. 135) and "I would sketch on the iPad, transfer it to the laptop and immediately have it opened for editing" (p. 137). Students also noted that it was lightweight and portable which allowed the tablets to be taken everywhere. Others noted that it was inconvenient for typing, and that they preferred having a computer and mouse for writing papers.

Apple Distinguished Educator Cathy Hunt (2013) used iPads with her art students. She asserted that for art education iPads are advantageous because students can carry them everywhere and they are equipped with image galleries, brushes and more image creation tools. She added that iPads allow students to create art in new ways by drawing, taking photographs, producing animations, and even sharing their work over social media.

The existing research on the use of iPads or similar tablet devices in education appears positive. Tablets are typically lightweight and portable allowing users to easily move around with the device and work collaboratively. There are a variety of apps available that allow users to preform various tasks. For example, the studies on note-taking described how users could use the device to take pictures or record video to supplement notes. Studies on writing discussed how apps could be used for creative storytelling, especially for K-12 students. Students can use apps to draw pictures, create animations, or make movies to bring stories to life. Instructors also appreciated that there were apps that made learning more accessible to different learning styles.

While there has not been as much research specifically in art and design, educators in those fields are seeing the potential for incorporating iPads or similar devices into their courses. One of the possible potentials that both students and educators see is with regards to drawing or sketching on the devices.

Sketching on the iPad

As stated previously little research has been done on the use of iPads for sketching. One of the closest studies this researcher could locate was a study completed by MacLean, Tausky, Labahn, Lank, and Marzouk in 2011. Their study explored sketching out math equations on tablet devices. They divided tablets into two categories:

1. A Tablet PC, which usually runs on a Windows operating system and has a high resolution where "the primary mode of interaction is with a stylus" (p. 8).
2. Multi-touch tablets, (like iPads) which generally have a lower resolution but allow for interaction with both stylus and finger.

Their study was designed to discover if the lower resolution and limited processing power of these multi-touch devices made sketching feasible. They collected from 30 participants mathematical expressions completed on a Tablet PC, on the iPad with a stylus, and on the iPad with a finger. They then ran the sketches through a math recognition system. Their results indicated that while the Tablet PC was better for recognizing fine details, most features were adequately recognized on the multi-touch devices.

In 2014 Ugo Braga Sangiori conducted an electronic sketching pilot study with Belgium developers. For his study the program GAMBIT (Gathering and Meetings with Beamers and Interactive Tablets) was utilized. Study participants were divided into three

groups: desktop, smartphone, and tablet. Instead of using iPads, those in the tablet group used Samsung Galaxy Tab 3. The subjects were asked to design a game for kids and sketch out the interface. Results indicated that the subjects were not very satisfied with the experience. Those in the smartphone group indicated that the screen was too small to make any sort of detailed drawings. Their article did not provide any specifics with regards to sketching on the tablets as it was more about the features of the program GAMBIT.

A study by Sun, Xiang, Chen, and Yang (2015) looked at using iPads for collaborative sketching in industrial design. Their study included three stages. In stage one participants were introduced to the study and given time to familiarize themselves with the iPads and the app Sketchfans. In stage two participants were asked to use the iPads and Sketchfans to sketch three ideas and add them to an idea tree. An idea tree shows the connection amongst the various ideas. "The first node on the tree is a description of the design task, and following nodes are ideas that present solutions. Every branch is an evolving path on which ideas are developed from prior ones" (p. 413). During this stage the study participants could add a new idea or build on an existing one. In the final stage the participants explained their ideas, reported any problems they had, and gave suggestions regarding the app. In the end the students created an idea tree made up of 20 branches with 90 different ideas. Some branches had only one idea while others were longer and made up of multiple ideas each building on the previous one; the longest branch had 14 ideas. Sun, Xiang, Chen, and Yang (2015) found that it was not the good ideas that were further developed on the tree but rather the not so good ideas. Participants would take the not so good ideas and expand or modify them. Branches that

began with the worst ideas often ended with the best ones. The researchers found that the Sketchfans app supported the collaborative sketching process because it allowed participants to easily "understand relations among ideas on the idea tree and click on the idea nodes" (p. 425).

Other studies (Beaman 2012; Stewart, 2014; and Delson and Van Den Einde, 2015) focused on specific sketching apps. Delson and Van Den Einde (2015) explained that the use of touch screens for the creation of content is still new. Their research looked specifically at the Spatial Visualization Trainer (SVT) app, which features a single color pen, eraser, and grid of dots. Beaman (2012) explored an app called Morpholio Trace, which allows users to store, share, and evaluate design work with other users. It was believed that the ability to share sketches could prove beneficial to the design process. This supposition was based upon the earlier work of McGown, Green, and Rodgers (1998) who found that sketching with paper and pencil collaboratively can help clarify complex or confusing parts of the sketch. In 2014 Craig Stewart, managing editor of Creative Blog, stated, "If you're an illustrator, artist or graphic designer, you can now work effectively on the move – sketching, painting, prototyping, and annotating photos" (para. 2). He then proceeded to provide a review of 22 different sketching apps. Some were simple and consisted of nothing more than a single color pen while others had a full color palette, different brush types, and provided shapes. Some apps even allowed users to record audio annotations or comments, which can be useful for recalling thoughts or information regarding sketches. While these studies sought to evaluate the usability of iPad apps, none of them sought to assess the quality of the sketches produced. Additionally, none of them sought to gain students' perspectives on their usefulness.

This literature review conveyed the basic and intermediate concepts and terminology of idea generation in design, writing, mathematics, and other disciplines. The studies on outlining and note-taking tie in with the literature on sketching in design because both writing and drawing involve similar cognitive processes.

Sketching, as an idea generation technique, has been studied for years. This literature review provided a strong foundation for comparing research about traditional paper and pencil sketches with those executed on computers. With regards to these two mediums much of the literature is mixed. Several studies argue in favor of the traditional paper and pencil approach because it allows for better reflection and reinterpretation of design ideas. The authors of those studies feared that by using the preset shapes and lines novice designers would create too detailed of a sketch, believe they were done, and not explore other solutions. Other researchers disagreed and believed that sketching digitally could be beneficial because the technology can often inspire designers to think in new ways by allowing them to explore and multi-task. So where do tablets, like iPads fit in? This literature review, also showed that there is little research about sketching and idea generation using tablets. The research cited, in this chapter, that is relevant to this topic focused primarily on engineering, industrial and architectural design, not graphic design.

In recent years there has been an increase of studies regarding use of iPads in education. However, there is limited research with regards to its use in art or design education. This study aims to add to the literature and understanding about graphic design students' perceptions of using iPads to create sketches and promote idea generation.

The methodology used for this study is described in the next chapter, Chapter III Methodology. The chapter begins with a rationale for choosing a qualitative approach. Next, the procedures and data gathering techniques (i.e., interviews and document analysis) that were used in this study are explained. Finally, the validity measures are explained.

CHAPTER III

METHODOLOGY

This phenomenological study utilized a qualitative research methodology to explore the effectiveness of graphic design students' use of Apple iPads for sketching activities. The specific goal of the study was to discover and understand a) whether or not sketching on iPads had an impact on students' idea generation process, b) whether or not students perceived a difference in using iPads versus paper and pencil for sketching, and c) whether or not students were able to produce higher quality sketches on iPads. This chapter includes the overall approach to the study along with a rationale for why the particular methods were selected, description of the participants, data collection methods, data analysis, and procedures for addressing validity.

Qualitative Study

Creswell (2003) suggested that the decision of which research method should be used depends on the research problem, the personal experiences of the researcher, and the audience for whom the report will be written. Certain types of research problems call for specific approaches. The researcher's rationale for selecting the qualitative research methodology for this particular study can be best explained using the description provided by Glesne (2011):

> With the research goal of interpreting the social world from the perspectives of those who are actors in that social world, it follows that the research methods include interacting with people in their social contexts and talking to them about

> their perceptions . . . You observe, ask questions, and interact with research participants. You may look for patterns in your analyses, but you do not try to reduce the multiple interpretations to numbers, nor to a norm. Your final write-up will be quite descriptive in nature. These methods tend to be called qualitative. (p.8)

This study utilized a social constructivist paradigm. According to Creswell (2007) the goal of research when using a social constructivist paradigm is to "rely as much as possible on the participants' views of the situation." (p. 20) Utilizing this paradigm, the aim of this research study was to answer the following research questions:

1. Does the use of iPads have an impact on graphic design students' idea generation process, specifically regarding the quality of the sketches produced?
2. What are the students' perceptions of sketching on iPads compared to other mediums, like paper and pencil?

Following this paradigm, it is believed that the students' perceptions are constructed from their past experiences taking design classes, working at internships, sketching, using technology, etc. The participants all come to the study with different experiences that shape not only how they design but potentially how they perceive sketching and working with technology like iPads.

While there are many different ways in which this research could be conducted, the researcher, believed that a phenomenological approach was the best fit for this study. Welmen and Kruger (1999) described the phenomenological approach to qualitative research as being "concerned with understanding social and psychological phenomena from the perspectives of people involved" (p. 189). Patton (2015) added that this method

aims to discover how the study participants perceive, describe, feel about, judge, make sense of, and talk about the phenomenon being studied. He also explained that the phenomenon being studied can be anything, including an emotion, experience, program, organization, or culture. Therefore, the researcher aimed to conduct a phenomenological study exploring how students perceive the effectiveness of using an iPad for sketching and idea generation. She wanted to learn from their experiences.

Phenomenology

According to Edmund Hursserl, the earliest proponent of phenomenology, we spend our everyday lives living in a natural attitude (Giorgi, 1997; Sokolowski, 2000; Stewart & Mickunas, 1974).

> The natural attitude is the focus we have when we are involved in our original, world-directed stance, when we intend things, situations, facts, and other kinds of objects. The natural attitude is, we might say, the default perspective, the one we start off from (Sokolowski, 2000, p. 42).

While experiencing the natural attitude we make judgments or assumptions and take things for granted (Giorgi, 1997; Moustakas, 1994; Sokolowski, 2000). Stewart and Mickunas (1974) explained:

> In fact, the essential attitude of human life is this natural attitude. Whenever one is conscious, he is always related to this natural world, which includes matters of fact, processes, practical aspects, values, other persons, social interactions, cultural creations, and a host of other entities. He relates to this world by means of spontaneous activities, such as observing, calculating, conceptualizing, inferring, willing, making decisions among alternatives, having emotions of joy desire,

aversion, hope, and so forth. (p. 24)

Giorgi (1997) argued that this view of the world is naïve because things are not always what they appear to be. The phenomenological attitude calls for a more reflective approach to viewing the world. When people take a more phenomenological view of the world they become more "detached observers" or "like spectators at a game" (Sokolowski, 2000, p. 48). Moustakas's (1994) transcendental or psychological phenomenology is comprised of four steps: 1) the epoche, 2) phenomenological reduction, 3) imaginative variation, and 4) synthesis.

The Epoche

Epoche, a Greek term used to refer to a "suspension of judgment", was used by Husserl to encourage a "questioning of presuppositions until they could be established on a firmer basis" (Stewart and Mickunas, 1974 p. 26). The epoche is a reflective-meditative process and involves clearing the mind of any preconceived notions. "From the epoche, we are challenged to create new ideas, new feelings, new awareness and understandings" (Moustakas, 1994, p. 85). In practicing the epoche, researchers review their current thoughts and feelings regarding the phenomenon. They then set aside any biases or prejudgments so that they can look at the phenomenon from a fresh perspective (Moustakas, 1994).

Phenomenological reduction

Hursserl created the notion of phenomenological reduction as a way to make research findings more precise (Giorgi, 1997). It involves narrowing one's focus to what is essential to the problem (Stewart & Mickunas, 1974). In his book, *Phenomenological Research Methods,* Moustakas (1994) described the dimensions of phenomenological

reduction. The first involves bracketing. As Hursserl was a mathematician bracketing is based on mathematical metaphor. Stewart and Mickunas (1974) explained that in mathematics part of an equation is often put into brackets in order to treat it differently than the rest of the problem. "By bracketing the equation, the mathematician does not eliminate it, but merely places it out of the question for the present, while the larger context of the equation is investigated" (p. 26). Following this metaphor, researchers bracket past knowledge regarding the phenomenon and put it aside, allowing the focus of the research to be looked at with fresh eyes and described as it is experienced (Giorgi, 1997).

The next dimension in phenomenological reduction is horizonalization. In the early stages of horizonalization all statements hold equal weight. Later in the process repetitive, irrelevant, and overlapping statements are deleted. The remaining statements are referred to as horizons. The horizons are then clustered into themes that form the textural description of the phenomenon (Moustakas, 1994).

Imaginative variation

Imaginative variation seeks possible meanings through imagination, different frames of reference, and approaching the phenomenon from different perspectives (Moustakas, 1994). The major task of imagination variation is to describe the essential structures of the phenomenon. "Imaginative variation enables the researchers to derive structural themes from the textural descriptions that have been obtained through phenomenological reduction" (p. 98). Husserl (1931) explains how this process comes about:

The Eidos, the pure essence, can be exemplified intuitively in the data of

> experiences, data of perception, memory, and so forth, but just as readily…in the play of fancy we bring spatial shapes of one sort or another to birth, melodies, social happenings, and so forth, or live through fictitious acts of everyday life. (p. 57)

Synthesis

Synthesis of meanings and essences is the final step in phenomenological research. It is the process of combining the structural and textural descriptions into a unified statement of the essences of the experiences of the entire phenomenon (Moustakas, 1994).

Data Collection

This qualitative study used phenomenology to obtain the experiences of 10 upper-level undergraduate graphic design students, five men and five women, with regards to sketching on iPads. The researcher captured the personal experiences of the participants, and drew out rich descriptions and deep meaning through the use of interviews and document analysis, which will be described in detail later in this chapter.

Setting and Participants

The researcher examined the Spring 2016 course catalog at a university located in the Upper-Midwest to identify an upper-level graphic design course. Participants for this study were selected using purposeful sampling. According to Maxwell (2005) one of the main reasons for choosing purposeful sampling is that it is representative of the selected settings, individuals, and activities. Creswell (2007) added that in phenomenological studies it is important for all of the participants to have experienced the same phenomenon. In the case of this study all of the participants completed the entry-level

design courses and should therefore have a strong understanding of the traditional design process. They had also engaged in paper and pencil sketching and other idea generation activities in their design courses.

After selecting a course that met the researcher's requirements for the study, she contacted the course instructor via email (Appendix A). The researcher explained the purpose of the study and received permission from the instructor to visit the instructor's advanced graphic design class to distribute information about the study and ask for student volunteers. During the classroom visit the researcher introduced herself to the students, stated the purpose of the study, gave a brief explanation that the study would entail two interviews, a sketching activity on an iPad, and what the expected time commitment would be. She answered questions the students had and informed them that they would receive a $10 gift card for participating in the study and be entered into a drawing for an additional $50 gift card. She also provided the students with a handout (Appendix B) that contained information about her study and contact information. Following the classroom visit the researcher asked the instructor to send an email (Appendix C) to the students, on her behalf, with a link to a sign-up form (Appendix D) for the study.

Of the 17 students in the Spring 2016 course, six students, two males and four females, signed up to participate in the study. After signing up, the participants were contacted by the researcher to schedule an initial visit. During each initial visit the participant was given the Informed Consent form (Appendix E) to sign and date. The consent form described the purpose of the study, the expected time commitment, the need for volunteers, and provided the researcher's contact information.

The consent forms also made it clear to the participants that their confidentiality would be maintained. Glesne (2011) emphasized the importance of the research participants' right to privacy and that "when they give you permission to observe and interview, you will protect their confidences and preserve their anonymity" (p. 172). Glesne further explained that researchers could protect anonymity by using fictitious names, changing physical characteristics, switching gender, etc. In accordance with this, the researcher communicated to the students that she would use pseudonyms whenever referring to any of the research participants.

After the consent forms were signed the researcher conducted initial interviews. At the end of each interview the researcher demonstrated the sketching app that would be used in the study. Upon completing the initial interview and training, the participants were given Third Generation Apple iPads to take home for 48 hours. The iPads were 9.5 inches high by 7.31 inches wide with a display that is 9.7 inches diagonal. The device has a resolution of 264 pixels per inch. The participants were also given a stylus that was 4.5 inches long and had a quarter inch rubber tip. After completing the sketching assignment, the iPads were collected and the sketches analyzed. The participants then returned for a follow up interview.

This procedure was repeated during the 2016 fall semester in an additional upper-level graphic design course. The purpose of including a second course was to add data to strengthen the researcher's findings. The second course had 12 students. Four students agreed to participate in the study, three males and one female. All participants were given a $10 gift card for their participation in the study and entered into a drawing for an additional $50 gift card.

Data Gathering Techniques

Initial Interviews. Prior to sketching on the iPads the participants were asked to participate in an initial interview. Seidman (2006) explained that in phenomenological studies the first interview should focus on past experiences. Therefore, during the initial interview the researcher asked questions regarding the participants' past experiences sketching with paper and pencil and on computer. The researcher asked open-ended questions that garnered more thought-filled responses. Roulston (2010) explained that asking open-ended questions "invites the reader to tell a story," (p. 12) which not only generates high levels of detail but also creates the possibilities for follow-up questions. For example, some questions during the first interview were:

- What is your design process?
- Have you ever used a computer or other technological device in your graphic design coursework? If so, what did you use and how did you use it?
- What advantages or disadvantages could you see if you were doing your sketching on a computer or other technological device?
- What advantages or disadvantages could you see if you were doing your sketching using paper and pencil?
- Besides sketching, describe any other idea generation methods you utilize.
- Describe your artistic abilities and how you believe they impact your ability to generate sketches for assignments.

In order to ensure that the participants felt at ease, the researcher began each interview with a social conversation (Moustakas, 1994). For example, she asked how their semester was going and if they were working on any big projects in their classes.

This helped to open the participants up more and also helped the researcher get to know each participant a little better.

According to the 2016 ECAR survey 56 percent of college students own a tablet, with 41 percent owning an iPad. It was possible, therefore, that some of the participants in this study had their own iPads and had used it for sketching. Therefore, the researcher also asked:

- Do you have your own iPad or tablet?
- If so, have you ever used your iPad for sketching?
- If so, describe the sketching apps you have used.

In order to have some background information on the participants, demographic questions such as year in school, major, and types of design courses taken were also asked. (See Appendix F.)

The researcher used a semi-structured approach when conducting interviews. Roulston (2010) explained that during the interview the researcher will refer to a prepared interview guide that includes a number of open-ended questions. After each question "the interviewer follows up with probes seeking further detail" (p. 15). The researcher took notes during the interviews and also audio recorded them. Following the interviews, the audio recordings were transcribed.

Document Analysis. For this study, the participants were given Third Generation Apple iPads with the ProCreate sketching app installed. ProCreate, an app created by Savage Interactive, offered different types of pens, brushes, and colors for use while sketching. The app also allowed users to change the thickness of the lines as well as the opacity. The app came with some pre-defined canvas sizes as well as the option for

creating a canvas using custom dimensions. Like other design software, ProCreate allowed for the use of layers, and different parts of the sketches could be selected, moved and resized. ProCreate also recorded a video while the participants sketched for later playback. The participants were given a stylus and told they could make their sketches with either the stylus or their finger. Although some of the newer generation iPads have a feature that allows styluses to be pressure sensitive, adjusting the line width depending upon the pressure placed upon the stylus, the styluses utilized in this study did not have this ability.

The participants took the iPads home for 48 hours and completed a design activity where the researcher asked them to come up with a sketch for a new brand of cereal. They were asked to create sketches for both a logo and the cereal packaging. Logo and packaging design was familiar to the participants as both topics were covered in their design courses. The participants were told they could use whatever features of the ProCreate app they wished. Additionally, no set number of sketches was required. Denton and Williams (1995) stated that it is common for design educators to require a specific number of sketches. They argued that requiring a set number of sketches is often meaningless because once the student finds the "best" solution they will then just create variations of that idea in order to fulfill the number requirement. The researcher instructed the participants to sketch as they normally would for a class assignment. After completing their sketches, the iPads were returned to the researcher for analysis.

After collecting the iPads from the participants the researcher downloaded their sketches as well as watched the ProCreate video recordings for document analysis. The videos were not as useful as the researcher had initially predicted when selecting the app.

They were recorded as an instant replay and had to be slowed down considerably in order for the researcher to view them. Additionally, some of the participants appeared to have disabled the feature as a few of the sketches had no video file. However, a few of the recordings were used to help form research questions. Marshall and Rossman (2016) stated that gathering and analyzing documents either found or created for research purposes, is a good way to supplement interviews. They explained that one way it can be utilized is in the creation of research questions. In this study the researcher asked the participants questions about their sketches in order to understand what they were thinking about during the activity.

The researcher also looked at the quality of sketches. Marshall and Rossman (2016) stated that "the analysis and interpretation of documents should be approached cautiously" and that the "meaning of the documents is never transparent" (p. 143). They added that if document analysis is going to be utilized as part of the study, the researcher will need to indicate how she plans to corroborate her interpretations. Therefore, the researcher first looked at the sketches herself and assessed them for quality using a rubric. The rubric focused on three main criteria: 1) How well did the sketches communicate the idea, 2) How original or creative were the sketches, and 3) How much detail did the participants include in their sketches? (See Appendix G.)

The course instructor also looked at the sketches separately and assessed them using that same rubric. The researcher and the instructor then discussed the quality of the sketches and why they evaluated them in the way that they did. This helped to corroborate the researcher's interpretations, and to address any biases regarding sketch quality that the researcher might have had. This process is referred to as interrater

reliability (Patton, 2015). The instructor also shared with the researcher her evaluation of the iPad sketches in comparison to paper and pencil sketches the students had completed previously. This comparison helped to show whether or not sketching on the iPads resulted in higher quality sketches.

Second Interview. After the participants completed their sketches and those sketches were analyzed, they returned for a second interview. Seidman (2006) explained that the second interview should focus on the new or present experience, therefore the second interview focused on the participants' experiences sketching on the iPads. Creswell (2007) explained that in phenomenological studies the participants are asked two broad questions: 1) What have you experienced in terms of the phenomenon and 2) What affected your experience with the phenomenon (p. 61). Therefore, first the participants were asked to describe their experiences sketching on the iPad. This was followed by asking questions about the ProCreate app and use of the stylus, as the researcher believed both played a role in how the phenomenon was perceived. Other questions asked during this interview were:

- How long did you spend sketching on the iPad?
- How does that compare with the amount of time you typically spend sketching?
- If given the opportunity to sketch on an iPad in the future, would you? Why or why not?
- In the first interview we talked about other ways you generate ideas. If possible, how could the iPad be used to assist you with those techniques? (See Appendix H.)

In some instances, the researcher also asked specific questions about a particular participant's sketches or the sketch recording. For example, when viewing the recording for one of the participants the researcher noticed the student spent a lot of time erasing her sketches and starting over. This prompted questions as to what triggered the behavior and if it was typical of how the participant usually sketched or was it because of sketching on the iPad. Those responses as well as other participant comments will be shared in the next chapter.

Data Analysis

Marshall and Rossman (2016) stated that the "tough intellectual work of analysis is in generating categories and themes" (p. 219). In Colaizzi's (1978) phenomenological method, data is clustered into themes that are common for all participants. Creswell (2007) explains that in phenomenological research the themes are then used to generate textual and structural descriptions that describe what the participants experienced and factors that may have influenced those experiences. The descriptions will then be used by the researcher to compose a statement that "presents the essence of the phenomenon" that focuses on the "common experiences of the participants" (p. 62).

Creswell (2007) explained that in phenomenology there are very specific and structured methods for the data analysis.

The researcher began with what is referred to as the Epoche. During this step the researcher suspended any judgements she had already made and clarified her research biases. Marshall and Rossman (2016) explained that the researcher should write out a full description of her experiences with the phenomenon being studied "thereby bracketing off [her] own experiences from those of the interview partners" (p. 153).

Writing the statement helped the researcher to acknowledge that she had a preconceived idea of what the results would be. As a graphic designer she had set beliefs regarding the importance of sketching and as a design educator she also had opinions regarding students' perspectives of the activity. She also considered the students to be "digital natives" and assumed going into the study that they would have a lot of experience using iPads and would embrace using the device as a tool for sketching. It was important to set aside these ideas so that they would not influence her later interpretation of the data. The researcher's full Epoche statement can be found later in this chapter during her discussion of validity.

Next the researcher went through phenomenological reduction. During this process the researcher went through the transcribed interviews as well as the related literature and developed a list of significant statements. As explained earlier in this section this step is known as horizonalization and at this state each of the statements was given equal value. For example:

- I still felt I needed to sketch before I went on the iPad for some reason.
- I had to learn a whole new way of sketching.
- It was kinda like Photoshop just without Photoshop. I mean they, like, have layers that you can work with, you had colors you can work with, and then you had, like, different sketching utensils.

The researcher listed all non-overlapping, non-repetitive statements and grouped them into three themes. Those themes were 1) *participants preferred sketching utilizing paper and pencil*; 2) *participants perceived some benefits to generating sketches on the iPads*; and 3) *participants perceived alternative methods for idea generation using the iPads*.

The researcher then utilized the themes to create a textual description of the experience. The textural description explained what the participants of the study experienced and included verbatim examples from the transcripts. These will be explored in detail in Chapter IV.

Finally, the researcher synthesized the themes in order to create the "essence" of the experience. The essence will be discussed in more detail in Chapter V.

Validity

Creswell (2007) explains that "validation in qualitative research [is] an attempt to assess the 'accuracy' of the findings, as best described by the researcher and the participants" (p. 205). He provides a list of eight validation strategies to be used by qualitative researchers and recommends utilizing at least two of them. For the purpose of this study, the researcher utilized three: clarification of research bias, peer review, and member checking.

Research Biases

As stated in the previous section the researcher began her data analysis by writing out a full description of her experiences with the phenomenon being studied. Glesne (2011) includes an example of a clarification of research bias statement at the bottom of page 49 of her book titled *Becoming Qualitative Researchers* that the researcher has modified with regards to her study:

> I have been studying and working as a graphic designer for over 10 years; therefore, it is important for me to remain objective as I conduct my research and analyze the data. My prior experiences in graphic design and subsequent knowledge about sketching may lead me to analyze the data in a way that

> supports my own ideas and beliefs. I may see what I want to see or expect to see rather than what is actually there. I also work in a technology-related field and have attended and taught workshops on how to incorporate technology, including iPads, into teaching and learning. My familiarity with the use of iPads in higher education could also influence how I interpret the data.

The researcher believes that being able to refer to this statement while analyzing the data for the study helped to ensure that she was aware of any potential biases. She also noted any questions or concerns she had regarding her analysis, in relation to potential biases, and discussed them with colleagues following a peer review of the research findings.

Peer Review

Carspeken (1996) suggested asking a colleague to examine your data and analysis in order to determine whether or not you are ignoring some areas while giving too much attention to others. Marshall and Rossman (2016) added that peer debriefing is helpful for "talking through logic and clarity of interpretations and for answering the all-important questions: 'Have I got it right?'" (p. 203). After completing the data analysis on the interviews and documents, the researcher shared her findings with two colleagues: the course instructor and her editor, who is not only a former graphic design instructor, but also someone who has completed research about creativity and idea generation. They looked at the study findings and pointed the researcher in directions that she may have initially missed. Discussing her analysis with colleagues was useful in discovering places where the researcher may have made generalizations based on her own experience with the subject and encouraged her to reflect on those biases.

Member Checking

Creswell (2007) explains that member checking involves "taking data, analyses, interpretations, and conclusions back to the participants so they can judge the accuracy and credibility of the account" (p. 206). Maxwell (2012) adds:

> This is the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective they have on what is going on, as well as being an important way to identify your biases and misunderstandings. (p. 126-127)

After the data analysis was completed the researcher showed the participants the final themes to see if they were in agreement with the findings. This was primarily done with the four participants from Fall 2016, as the data analysis was not completed in time to check with the participants in Spring 2016. Those spring participants were given the opportunity to respond via email when analysis was completed, but not all of them chose to respond to the researcher. None of the participants who responded, expressed any concerns or requested any changes be made to how the researcher interpreted the data. They just indicated that "yes" they agreed with the findings. No other feedback was provided.

In summary, this chapter provided a detailed description of the study research methodology. A qualitative phenomenology methodology was used to explore upper-level graphic design students' perspectives of sketching on iPads. The participant sample included 10 purposefully selected individuals from two different upper-level graphic design courses. Data were collected through personal interviews and document analysis. It was then analyzed through Moustakas' (1994) modification of the van Kaam

method. Validity was accounted for through clarification or research biases, peer review, and member check.

In Chapter IV, results of the data from interviews and the design activity are conveyed. The themes that emerged are discussed with reference to the literature. Additionally, in this chapter the study participants' individual perspectives are shared. Consistent categories are used to express the participants' perspectives and provide the reader with background information, design process, and thoughts regarding sketching on iPads.

CHAPTER IV

RESULTS

This study explored how upper-level graphic design students experienced creating idea generation sketches on Apple iPads. Previous studies on idea generation documented the importance of sketching at the early stage of the design process. Additional studies also compared sketching on the computer with those accomplished with traditional pencil and paper. There is, however, a void in the literature and prior research regarding the use of iPads or similar devices for sketching and idea generation. This void, along with the researcher's education and background as a graphic designer, compelled her interest to investigate students' perspectives regarding this activity.

The researcher utilized a phenomenological qualitative framework to guide her study's data collection and analysis. The results are shared primarily in the students' voices in order to provide their perspectives on the experience. In order to understand how students perceived sketching on iPads, the researcher focused her study on two guiding questions:

1. Does the use of iPads have an impact on graphic design students' idea generation process, specifically regarding the quality of the sketches produced?
2. What are the students' perceptions of sketching on iPads as compared to other mediums, like paper and pencil?

In this chapter the researcher presents the study findings that emerged from data that was collected through two separate interviews with 10 undergraduate graphic design

students recruited from two upper-level design courses during the spring and fall semesters of 2016. Additionally, sketches completed by student participants on iPads were collected for document analysis. In *Becoming a Qualitative Researcher*, Glesne (2011) stated, "Authors use a variety of strategies to organize their presentation of qualitative research" (p. 229). She provided several strategies to use as a starting point including "Separation of Narrative and Interpretation" (p. 230). Accordingly, the researcher will now present a narrative account of the research findings and will follow this by her interpretation of that narrative. This narrative section includes details and dialogue from the participants. In the next section of this chapter, the researcher presents her interpretation or analysis of the data, which includes discussion of the emergent themes with reference to the literature.

Description of Participants

The participants in this study were 10 undergraduate graphic design students recruited from two different upper-level design courses during the spring and fall semesters of 2016 at a university located in the Upper-Midwest. Participants for this study were selected using purposeful sampling. All of the participants had completed the entry-level design courses and had a strong understanding of the design process. They also had utilized sketching and other idea generation activities in their design courses prior to their participation in this study.

The sample of five males and five females ranged in ages from 20 to 24. All 10 participants were graphic design majors, but many had also completed courses in art, communication, marketing, and entrepreneurship, giving them a wide range of experiences and perspectives. Seven of the ten participants were seniors, meaning that in

addition to the upper-level design courses, they were also enrolled in their senior capstone course, which indicates that they are at the end of their baccalaureate program of study. Nine of the participants were Caucasian and one was an international student from Asia. Of the ten participants, only two indicated that they had previously used a sketching app on an iPad or similar device. In addition, three participants mentioned having used a drawing tablet like a Bamboo or Wacom device. Eight of the ten participants completed the cereal box packaging design activity, while two of them submitted sketches of their choosing. One of those two participants created sketches for a class assignment and the other created sketches of personal interest. The researcher chose to leave them in the study because, while the did not complete the assigned sketches, they still experienced sketching on the iPads. Both of these students participated in the two interviews and the researcher found what they had to say contributed to the study. The participant demographics are depicted in *Table 1*.

Table 1. Participant Demographics

Participant	**Age**	**Gender**	**Academic Status**	**Race**	**Prior experience sketching on tablets**
Kevin	21	M	J	Caucasian	iPad using Adobe Draw
Carrie	23	F	S	Caucasian	Bamboo Tablet
Natalie	21	F	J	Caucasian	None
Maria	22	F	S	Caucasian	Doodling on phone
Emily	22	F	S	Caucasian	None
Benjamin	21	M	J	Caucasian	iPhone using Adobe apps
Michael	22	M	S	Caucasian	None
David	23	M	S	Caucasian	Wacom
Austin	24	M	S	Caucasian	Has a tablet but never used for sketching
Sarah	20	F	S	Asian	Doodling on phone

Participant Narratives

In this section of Chapter IV, the researcher shares participants' perspectives by providing the reader with the following information: a) background, b) design workflow, c) thoughts on sketching, d) experience sketching on iPads, and e) quality of iPad sketches. The quality of the iPad sketches was based on participant comments as well as a rubric completed by the researcher and course instructor. Since the instructor of the two courses had provided students who participated in the study with extra credit, she was aware of the participants' identities. Therefore, she was also able to compare the participants' previously completed paper and pencil sketches with those done on the iPad. The information in this chapter was gathered from two separate interviews. Pseudonyms were used to help maintain the confidentiality of the participants. Following are the descriptions of the participants in order of when the researcher first spoke with them.

Student Kevin

Background. Kevin is a 21-year-old junior majoring in graphic design. In addition to his graphic design courses, Kevin has also taken courses in music, photography, entrepreneurship, and industrial design, which all require him to think creatively. Kevin owns an iPad and frequently used the app Adobe Draw when working on class assignments.

Design Workflow. "I like to be efficient," Kevin stated when asked to describe his design process. He explained, "My process is to dive right in. I don't usually sketch. I will start with an initial idea and then fine tune." Kevin stated that going online helps him generate his initial idea. "I will just hop on Google Images and just type in what I

am looking for and use that to gather my ideas," he said. Kevin also likes listening to "crazy music". He explained that a sound or lyric will often inspire an idea.

Sketching. When asked about sketching Kevin stated:

> I definitely think I can sketch but I don't think they are very good. I don't prefer to do it. So I am probably not good at it because of that. I would much rather not sketch but instead create a first draft on the computer and then take it from there.

Kevin explained that if he does sketch he prefers to sketch digitally on his iPad because he believes it is more efficient than sketching with paper and pencil. He explained:

> When you sketch on paper and then want to transfer that idea to the computer you have to recreate that whole entire idea there, where on the iPad you could just take a screen shot and send it to [Adobe] Illustrator or like with that Adobe app, I was telling you about. You just sync it automatically [with Adobe Illustrator] and you don't have to recreate the entire piece.

Experience sketching on the iPad. Compared to the other participants, Kevin had a different perspective to bring to the study as he typically sketched on the iPad, but used Adobe Draw instead of ProCreate. He liked that Adobe Draw exports directly to the Adobe Creative Cloud so he could work with it in Adobe Illustrator. While he liked the different brush and color options that ProCreate had, Kevin wished the app had preset shapes and lines that he could use rather than having to draw them by hand.

Kevin spent approximately 25 to 30 minutes sketching on the iPad. When asked how this compared to the amount of time he would normally spend sketching, Kevin said it depends. He explained:

> I didn't really know what I was going to do for this you know, so I just kind of put my stylus on the iPad and just kinda started drawing. But in previous projects I have done I usually spend, I don't know, as little as five minutes and if I already know what I want to do, like if I am trying to create more of a finished design, I guess [I may spend] up to a couple of hours. But I guess just on the sketching side of things I usually don't spend too much time on it because I already kinda have an idea of what I want it to look like. So I'd say just sketching, I'd typically spend 5 to 10 minutes tops.

If given the choice as to whether or not Kevin preferred the use of paper and pencil or the iPad for sketching, Kevin said, "The iPad still, just not that app [ProCreate]. I think that app is geared more towards a finished design or maybe an artistic piece rather than a concept sketch."

Quality of iPad sketch. Kevin believed that compared to other sketches he had done using paper and pencil, or even those done using the Adobe Draw app, the ones he generated using the app ProCreate were not the same level of quality. Kevin conveyed that the ProCreate app did not have preset shapes or a typing features, causing him to rely on his own hand, which he said resulted in "...lines that aren't very straight. I could probably get more precise with a pen and paper or a different app," he added. (See Appendix I.)

When analyzing the cereal box sketches using the rubric (Appendix J) the researcher and course instructor both thought the idea of the box was communicated well—you could tell it was cereal in a box. However, the sketch did not communicate what type of cereal it was, e.g., whole grain, fruit, marshmallows, etc. Both also believed

the sketch could use a lot more detail. The instructor stated, "These sketches are parallel to those he hand-draws in class." She added, "This student typically counts on the viewer to already know the concept being portrayed. He typically has to do a lot of verbalization to fill in the missing information not conveyed by the rough format he uses for sketches."

Student Carrie

Background. Carrie is a 23-year-old senior majoring in graphic design. She has a background in music and also spent several years playing tennis. She believed both aided her in designing and sketching because they helped her to develop strong hand-eye coordination. In addition to graphic design courses Carrie also took courses in photography and dance. She stated that she often doubts her artistic ability when it comes to drawing or sketching, but that others tell her she is good. Carrie considers herself a perfectionist and stated, "When I want to get more artsy and actually draw something in-depth, I will, but I will draw it over and over and over again until it looks right to my eye."

Design Workflow. Carrie explained that she likes to begin designing by setting the tone for the project and creating a music playlist. "Like last year, I had to do a project and I based it off of Dr. Seuss. So I had like all Dr. Seuss' themed music playing while I was working on brainstorming and designing," she said. She added that music helps keep her going. She also likes to create word associations and brain maps or look at artwork that inspires her. Carrie said that when she is meeting with a client she provides them with a few basic ideas and then builds from there.

Sketching. When sketching, Carrie prefers paper and pencil. She explained:

> It gives me a break from staring at a screen. I am on the computer so much that it just gets to a point where my head hurts from it and I start getting a headache and stuff like that. So I will take a break and start sketching.

Carrie often does several sketches when working on a project. She explained that she likes to do an initial sketch that is quick and rough. Then she will create a more detailed sketch before developing it on the computer. She said that the only problem with paper and pencil sketches is that sometimes she will have an idea and realize she does not have the resources at hand. "If you get a random idea—trying to make sure you have a pencil and paper around all the time is challenging 'cause sometimes I don't have that. I will have one or the other but not both."

At the start of this study Carrie had never sketched on an iPad or mobile device, but stated she does own a Bamboo sketching tablet. The tablet has to be connected to a computer to use and you draw on the tablet while looking at the screen. She said it was hard to get used to at first but thanks to her good hand-eye coordination she was able to figure it out quickly. She also stated, "It's a little more time consuming to change the thickness of what you are drawing and that stuff. If you want to change the thickness or some angles you have to go into some menus." She explained that with a regular pencil she can just change the thickness by how she holds the pencil or how hard she presses on the paper.

Experience sketching on the iPad. Carrie found sketching on the iPad challenging. She explained:

> Um, it's good for like quick sketching but for those that put their hand on the surface when they go to sketch or write or anything, it had issues 'cause it kept

> sensing there was something there. So I had to learn a whole new way of sketching and that was bothering me because of that.

Carrie also found it difficult to draw shapes, especially circles. She stated that she felt drawing a circle was "basic stuff" and it bothered her that she kept having to hit undo and start over. "I was just getting so frustrated. I think I hit undo over 100 times," she said. According to Carrie, she spent over two hours sketching on the iPad. When asked how it compared to other ways of sketching Carrie said, "Normally I would have a lot more done in two hours." When asked if there was anything Carrie liked about using the iPad, she said she liked that the ProCreate app allowed her to change colors quickly, and also that she could use layers when sketching.

Quality of Apple sketch. Carrie choose not to turn in the iPad with any of her cereal package design sketches saved. The only thing on the iPad was a rough drawing of Disney's Mickey Mouse. (See Appendix I.) She stated that she had done the cereal packaging sketching with paper and pencil but despite promising on several occasions to turn them in she never did. When asked how Carrie would compare the quality of the sketches, Carrie stated:

> It is kind of hard to compare something that is pixels versus paper because they are two different platforms. Um, it is almost like comparing apples to oranges. Overall I think, um, if you know how to use it correctly and can put the time in and know how to draw without putting your hand down, you would be able to probably get the same kind of quality and it would be faster 'cause instead of going from paper to digital you are already in digital.

She did state that she found it harder to draw circles and other shapes using the iPad.

Despite not following the activity guidelines the researcher and course instructor evaluated the iPad sketch using the rubric. (See Appendix J.) Both the researcher and instructor believed that Carrie's sketch was definitely recognizable as Disney's Mickey Mouse. The instructor mentioned that Carrie is passionate about Disney and will frequently incorporate Disney characters into her designs. Therefore, she has seen the student draw Mickey on other occasions. With regards to the quality of the iPad sketch compared to ones accomplished on paper, the instructor stated, "Actually, she seems to do much better sketching on the iPad."

Student Natalie

Background. Twenty-one-year-old Natalie is a junior majoring in graphic design. In addition to her graphic design courses she has also taken courses in photography, communication, and music. She has also gained valuable design experience working at her on-campus graphic design internship. Natalie has completed some sketching and drawing courses, as well. She said those classes helped her learn how to better communicate her design ideas. "I feel like it's pretty easy to tell the point I'm trying to make or convey. So, I definitely feel like the sketching classes helped," she said.

Design Workflow. Natalie likes to start designing by looking for inspiration. Her favorite place to go for that is Pinterest because there is so much variety to look at and topics of interest to explore. After looking for inspiration on Pinterest, Natalie said she sketches a couple of ideas and then narrows them down to the one she likes best. Then she takes that one sketch and develops it further on the computer. She also likes to

do other types of brainstorming like generating word clusters. “Creating word clusters helps me connect different ideas together,” she said.

Sketching. “It helps get ideas out,” Natalie said with regards to sketching. When asked what her preferred method of sketching was, Natalie stated that she preferred pencil and paper. “It’s what I am used to,” she said. She added, “You can usually find paper anywhere. There is always paper somewhere. You don’t have to charge it to use it. I feel like it’s a lot easier to have on hand.” The one thing she doesn’t like about sketching is the smudging that happens when erasing or when she moves her hand over the paper. “It can be messy,” she said.

While Natalie’s parents have an iPad, she had never used it or a similar device, nor any apps, for sketching. “I just haven’t come across anything like that,” she said.

Experience sketching on the iPad. Natalie thought using the different tools on the iPad was a lot of fun to play around with but she believed she needed to sketch on paper first. When asked why, she explained:

> I don’t know if it is just that it reminds me of like the computer and everything. Like you can use all the tools you can use on the computer so I just figured it was like that only with a different screen sort of. I don’t know; I must just be stuck in the idea of pencil sketching.

What Natalie liked most was the different tools available in the ProCreate app. She particularly liked that she could access all the different colors and textures.

Unlike other participants, Natalie did not sketch on the iPad all at one time. Rather she sketched in shorter 15 minute intervals for a total of about 45 minutes. She believed that she spent a lot more time sketching on the iPad then she would normally do

when using paper and pencil. “It took more time because I had to keep starting and stopping and erasing everything,” she said. She explained that she typically does not erase a lot when sketching but rather just “scribbles out” the part she does not like or starts a new sketch.

Quality of iPad sketch. When asked to compare the quality of sketches created on the iPad with those created using paper and pencil, Natalie stated: “I feel like the writing is a little weird, different than how I would normally write. I feel like it is a little bumpier. But the drawing part I didn’t think was much different.” (See Appendix I.)

Natalie’s iPad sketches were evaluated, using a rubric, (Appendix J) by the researcher and the course instructor. Based on the rubric evaluation the researcher and instructor believed that Natalie was able to generate high quality sketches using the iPad. Her sketches included details, such as texture, color, and shading. She also used perspective and was able to achieve dimension. They agreed the sketch was able to communicate Natalie’s ideas for *Astro Puffs* cereal. While the researcher found Natalie’s sketches to be exemplary in every category, the instructor wanted to see what the “puffs” actually looked like. The instructor also noted that Natalie’s iPad sketches were actually more complete than those she usually generates for class “because of the addition of color and texture which her pencil sketches do not usually contain.”

Student Maria

Background. Maria is a 22-year-old senior double majoring in graphic design and business management. While she has not taken any art or design courses from other departments, she has taken some courses in marketing and entrepreneurship, which also required her to think creatively. She has a graphic design internship on campus that

provides her with the opportunity to work on design projects outside of the classroom. She stated that she has a high level of imagination and creativity skills. She believes that her strength in design is that "I have an eye for how to lay out things on the page," she said.

Design Workflow. For Maria, design always starts with finding out what the client wants. After that she goes to Google or Pinterest to look for inspiration. She explained:

> I'll go in and usually, um, Google or go on Pinterest and get some kind of inspiration behind what kind of design I want to do. And then I will add my own touches to it and go off that or combine a few things I see online into a new design.

After that she sketches ideas and then goes to the computer to start designing.

Sketching. Aside from occasionally doodling on her phone, Maria stated that she did not have any prior experience sketching on an iPad or similar device. She has mostly used paper and pencil for sketching in the past. "It is what I am comfortable with," she explained. She added, "I can easily just sketch out an idea really quickly and if I need to, you know, scratch that idea and make a new one, I can just rip off a new piece of paper and start something new."

Maria appreciated that one of her graphic design professors taught them how to sketch. She explained that she has been able to take the knowledge learned in class and transfer it to the "real world". She stated:

> I have an internship on campus. I am their graphic designer and I do sketch a lot of my projects. Usually, I'll sketch most likely for the overall theme of the

> lectureship or symposium we are having. From there I will be able to make a cohesive program, poster, and flyer. I found that in order to be very successful I need to do what she [the teacher] taught us and sketch. 'Cause that skill from class has been able to translate into the real world.

Maria added that sketching is a good way to "visualize what you want to do" and get "ideas out there." She explained, "A lot of times what I sketch isn't what I end up with but it is a process of helping me to get to where I end up. I think if you don't sketch it's really hard to just sit down at the computer and think of what to do."

Experience sketching on the iPad. "It was an interesting experience," was Maria's first response when asked to describe sketching on the iPad. She went on to explain that she got frustrated with it because she believed in the hour she spent sketching on the iPad she would have been able to produce more detailed and fine-tuned sketches on paper. Her main challenge with sketching on the iPad was using the stylus. She explained:

> I mean it sounds kinda silly because I did have the stylus which is kinda the same as drawing with a pencil but it was hard to manipulate it the way you can manipulate a pencil. So that alone was kinda frustrating or a challenge for me. The thickness of the pen I wanted to use not being like—not looking the way I wanted it to look. I didn't have the same kind of coordination I thought I would have as it acts like a pen or pencil. It fits your hand the same way but it's still just the way it reacts to the iPad isn't the same way paper and pen react to each other.

There were however, some things that Maria liked, particularly with regards to the ProCreate app. "Um, the layers, the color, the different pen options, the undo button was

helpful," Maria said. She also liked that she could use layers for different parts of the sketches. "If you were on one layer you could draw or erase or whatever and then go to the other layer and the stuff on that layer wouldn't have been affected from the changes made to the previous layer." She also liked that she could create several different artboards and have different sketches going at once.

Quality of iPad sketch. When asked to compare the quality of her iPad sketches with those done on the computer Maria responded, "I think it was less or lesser quality on the iPad. As far as sketch quality goes, with pen and paper they look a lot more of what I can do with my ability on the computer than say the iPad does." (See Appendix I.)

Based on the rubric scores (Appendix J) the researcher and instructor believed that Maria's sketches for "Crunch" cereal were proficient. The sketch of the cereal box had some nice detail and it was clear where she intended to put information and what the package would look like. However, it was not clear what kind of cereal this was going to be (e.g., whole grains, fruit, etc.) or what it would taste like. The instructor thought the iPad sketches were typical of what she has seen from this student.

Student Emily

Background. Twenty-two-year-old senior, Emily, is majoring in graphic design. Emily explained that she started off as a pre-med major but switched because she wanted to do something more creative. "I was a pre-med major for my first years and almost finished all those classes before switching to graphic design," she said. In addition to taking the graphic design courses, Emily completed some drawing, photography, and entrepreneurship courses.

Design Workflow. "So usually I will have an idea or I won't," Emily said with regards to her design process. If she has an idea she will either draw it or write it down in order to get the idea out of her head. If she does not have an idea she will look at different websites for inspiration. In particular, she likes to look at other graphic designers' portfolios. She also likes to spend time just playing around with the software, particularly Photoshop. Emily stated that she also procrastinates. She explained:

> I use time, I use procrastination, which is bad, but if I procrastinate it kind of allows me to think more about what I want to use 'cause if I am just given a blank sheet of paper sometimes my creativeness is zero percent, so, like if I am allowed to like procrastinate and kind of look at things or like, um, I don't know, I also like to try to incorporate things that I am interested. Which isn't being as user friendly but I guess that is just how I am.

Sketching. When sketching Emily stated that her preferred tool to use is a Sharpie marker. She explained, "I like that it's permanent and it just stands out and a marker glides across the paper better than pen or pencil." She has never sketched with an iPad, and preferred paper and pencil to the computer. When asked why, she explained that paper and pencil are more convenient as she always has them with her or if she does not, it is easy to borrow them from someone else. She also explained that sketching is a quick way to convey an idea to someone else. In order to illustrate her point, she provided the following example:

> I had like a 42- x 58-inch poster I had to design [for a class] and I had done like two drafts previous on the computer and just got them destroyed by my professor. And they took me hours—just like hours of work. So for this last one

> I literally sketched out every part of the poster on pieces of paper and like puzzled them together and explained to him my reasons for designing this and then I went to the computer. So I had literally sketched every single thing out, drew all my pictures, because I did not want to spend 10 hours and then get it ripped apart again. It is a lot easier to sketch something on paper that would take you a half hour to an hour to make rather than something that would take you 10 hours on the computer and then get ripped apart. So that is kind of my outlook on it. If I can sketch it first and explain it, I would rather do that then make it on the computer and then have to remake it again.

Experience sketching on the iPad. Emily's opinions regarding sketching on the iPad were mixed. When asked if she would sketch on an iPad again in the future she responded, "Yeah, I would. But if that was my only option, to sketch on the iPad, I would be a little sad 'cause I would miss paper and pencil. I like both." She added that it was a fun experience and something new. She believed she would like it even more after more practice and experience. She liked that she could change colors quickly and when asked about her use of color she laughed and said, "I just used color because I could. I was like, I'm going to change color now. It was definitely not a logical tactic. I was just kinda like oh, I am sick of this color so I am going to change it." She said color is not something she normally incorporates into her sketches. She also liked being able to create a new artboard for her different sketches.

Emily disliked the lack of detail she was able to achieve with the sketches. She found using the stylus a challenge. She explained:

> I would say like not having the fine point like you are used to when you are sketching with any other writing utensil was a challenge. And like there was a little lag in time of when you draw something and it appears. When you draw something yourself [with paper and pencil] it like happens right as you are thinking about it, but when you are drawing on that [iPad] there was a teeny little lag before it appeared on the screen.

Emily also thought the blend looked sloppy and fake when compared to shading or blending with paper and pencil. She explained that with graphite there is texture and you can get different levels of shading (darker or lighter) depending on how much you do and that was not the same on the iPad. "It looked funny," she said.

Quality of iPad sketch. When asked to compare her iPad sketches with those she typically does on paper Emily said, "My sketching is very childlike anyway, so I don't know if it made my quality of sketching any better." She also mentioned that the stylus does not work great as a writing utensil, which meant she had to go back and undo or erase a lot as she was sketching. (See Appendix I.)

Using the rubric (Appendix J) the researcher found Emily's sketches proficient in terms of detail. She thought the front and back of the package were identified, and that the sketches showed what the shape of the cereal would look like. She also believed the sketches provided a lot of good descriptions regarding what information would be on the package. On the other hand, the instructor believed the sketches needed more work. She thought Emily relied too heavily on using words to communicate her ideas. "Without the text you would have no idea this is a box, cereal or buckwheat, from the shapes presented," the instructor explained. The instructor also stated, "color and amount of

detail is pretty average for her skills overall. The tool does not seem to have affectively changed her ability to be creative or generate ideas."

Student Benjamin

Background. Benjamin is a 21-year-old junior majoring in graphic design with a minor in visual arts. He has always been interested in graphic design but, being from a small town, did not have the opportunity to take any courses until he came to college. He did, however, complete some art courses in high school. He stated that he can "really think outside the box" and that he likes designing in areas that are of interest to him, like sports. He also follows several professional designers on social media and YouTube, which he said "gives him a heads up" regarding what people are looking for in this day and age.

Coming into this study Benjamin had never sketched on an iPad or drawing tablet, though he stated that he had always wanted to. He said he had, however, tried drawing on his smart phone. "I have messed around with some of the Adobe ones [apps] that they have for the iPhone. I kinda just like tried to draw something and got frustrated. It is so small on a phone especially with your finger."

Design Workflow. Benjamin described himself as a "mental" sketcher. He explained that he starts his designing by asking the teacher or client what they want and then looking at what has already been done either on Google Images or other designers' websites. "I just kinda get inspiration off of them" he said. He added that Google has a search for everything. After looking for inspiration Benjamin spends time thinking about his design. "I'm more of a mental sketcher first before I put down on paper. I might put

it down on paper or I might just like open up Adobe Illustrator and go from there," he said.

Sketching. Benjamin admitted that he is not really a fan of sketching using paper and pencil. "When someone asks me to do something or like design for them, I don't sketch at all, really," he explained. When asked why, he answered that going straight to the computer is faster. He prefers going straight to the computer and working from there where he can use different shapes and the pen tool. He also believed that paper and pencil sketches have a disadvantage because once you draw them you have to scan them if you want to work with them on the computer. "It's just getting it from the actual sketch to the computer that is the really hard part. Especially for kids our age who don't carry around scanners anymore." He added that once the sketch is in the computer, in order to work with it, the sketch needs to be traced. This takes time and is repeating a step as you basically redraw the same sketch.

Experience sketching on the iPad. During the second interview, in response to the researcher's request for the participants to describe their experience sketching on the iPads, Benjamin said that it was fun and he really enjoyed the experience. In particular, he liked that "it was really easy to color and they give you so many different brushes that you are obviously not going to have anywhere near you when sketching [on paper]." He added that when he was sketching his cereal package and logo he was able to use a big watercolor paint brush to create the logo. He also added that he liked that the app had a big color palette that allowed him to choose whatever color he wanted to use. He explained that not being able to sketch in full color is a big limitation in paper and pencil sketches. One of his favorite features of the ProCreate app was that it auto-saved the

sketches. He explained that this was an advantage over the computer because the programs he uses generally do not auto save. “I have had them [programs] crash before I save with two-to-three hours of work down the drain,” he said.

However, Benjamin did not like that it was hard to erase on the iPad. “I think I had that logo [for my cereal RASE] drawn like three times as far as the R A and then I’d go to write the S and wouldn’t like it. I would go to erase [the S] and it would erase half the A.” He also found the overall size of the iPad and canvases to be a challenge, “compared to a regular piece of paper it just seemed really small when drawing on it.”

Having previously tried sketching on a smartphone with his finger, by comparison Benjamin found the stylus to be a big improvement. He also explained that on the computer the mouse can be hard to use and that the stylus is much easier to work with. He is looking into getting an iPad or tablet because he sees graphic design professionals use their tablets for designing. He was interested in the newly released iPad Pro with a 12.9 inch screen and Apple pen because it has a finer stylus point and it is pressure based.

Quality of iPad sketch. When asked to compare his iPad sketches with those accomplished with paper and pencil Benjamin explained, “I think my pencil and paper sketches would have a little finer details. They wouldn’t be as blocky or anything. There would probably be a lot more lines drawn too if it was with a pen and paper.” Benjamin added that his handwriting was also not great on the iPad. (See Appendix I.)

Despite the participant stating that his sketches lacked detail, the researcher found them to be exemplary, in particular, she liked the level of detail he gave the different dried fruits and grains. She also thought the package was creative and appreciated that the sketch went so far as to show how the box would open for pouring the cereal. (See

Appendix J.) While the instructor agreed that the cereal itself was well communicated, she believed he could have done a better job tying the cereal into the barn shaped box. In terms of comparing iPad and paper sketches the instructor stated, "The student's iPad sketches are a bit weaker than what he can do by hand. It seems like a bit of his finished concept is lacking likely from spending a bit more time concentrating on the tool instead of the concept."

Student Michael

Background. Twenty-two-year-old Michael is a senior majoring in graphic design. He said he picked that major because, "I thought it would be really unique to take my imagination and creativity and bring it to life." He also liked that there are a lot of different job opportunities in the field. Aside from his graphic design courses, Michael also gained experience working as a designer during an internship he had at a local television center.

Design Workflow. Michael explained that he typically begins designing by going out and looking for inspiration. He likes to start with Google Images. "If I have to make a logo for something, I can type in logo samples just to get some ideas." Next he said he spends time sketching his ideas in a notebook in order to see what works. Then he goes on the computer. Once he has finished, he shows the design to friends, his professor, or his employer in order to get feedback on his design. Finally, based on the feedback, he will make necessary adjustments. Michael added that he likes to keep his designs simple, not busy. "Less is more," he said.

Sketching. When asked if he preferred sketching with paper and pencil or the computer Michael stated that sketching on paper works best for him. Michael explained:

> It is just to get your ideas down and you can always change it later. When you do it on the computer I just feel like that's a more painful process. I think it looks good but then I don't want to have to change anything else. Sketching is just to generate your ideas and just to see what works. And you know you don't want to really have to be like an artist so you don't have to really be good at drawing; you just want to see, hey maybe if I did it like this, maybe I could add this or maybe I could add that. You can never have too many ideas.

Michael stated that the only thing he did not like about sketching on paper is that it is hard to incorporate color. It is all just typically black and white.

Experience sketching on the iPad.

"It was kinda like Photoshop just without Photoshop" was Michael's response when asked to describe his experience sketching on the iPad. He explained, "I mean they had like layers that you can work with, you had colors you can work with, and you had like different sketching utensils. I saw there was a pen and paintbrushes—just so much variety to work with for sketching." He also liked that he could change the opacity and the thickness of lines.

However, Michael found the size of the iPad canvas problematic. "When I sketch with paper and pencil, um, I have a lot of room to work with versus on the iPad." Michael also commented that because of the size he had to create additional canvases and could not have more than one open at a time. "You only have that one space and usually I always like to look at my ideas all at once, not have to exit to look at the next sketch just to see what it was like."

Michael said he spent about 30 minutes on the packaging design sketching activity. When he was asked how that compared to sketches he would do with paper and pencil he said that sketching on the iPad took more time. He explained that with both the computer and iPad it is easy to get caught up in playing with the different features.

Quality of iPad sketch. Michael believed that the quality of the sketches (Appendix I) on the iPad was the same compared to paper and pencil. He stated:

> I felt like they were, I mean, they look pretty much the same. I mean, I think it is probably what I would have done on paper as well. I guess the only thing that was different was just the color and the thickness of the different tools that I used. I still think I would have had the same general idea of what I wanted to if I did it on the iPad or not.

Based on the rubric (Appendix J) the researcher found the sketches to be somewhat clear as to what type of cereal it was going to be. It was clear by the details put into drawing, like the baseball and diamond, that the cereal had a baseball theme. However, the researcher was not sure as to what flavor the cereal was going to be, and the shape of the package was unclear. Was it supposed to be shaped like a diamond or was it just drawn from an odd perspective? The instructor agreed with the researchers' analysis that the sketch needed work. She said, "The viewer knows what the product is for since he spells it out with text instead of the visual sketch." She added that this style of sketching was typical for Michael. She also explained that while the quality of the actual iPad sketch was the same, his writing was much better on paper.

Student David

Background. David is a 23-year-old fifth-year senior. He explained that he was a transfer student. David also has formal training in fine arts and comes from a family of artists. His mother does sculpting, and when it comes to art and design he believes he has "some kind of natural, don't want to say talent, but is an instinct that is there." He added that having an art background has definitely helped him in generating realistic sketches as opposed to rough ideas. He has an iPad but has never used it for sketching. He also has a Wacom, but admitted that he has yet to "put it to good use".

Design Workflow. When asked about his design process David laughed and said, "There is a method to my madness." He explained that rather than sketching on the computer he will instead brainstorm ideas on the computer.

> For instance, logo design for a brand, new company or something, um, definitely what I do is make 16 variations of the logo digitally so that is kind of where I start with them. The company will pick one or two and from there I am already working on the digital aspects of it. So I can easily modify those and go from there. I think that drives my idea generation more than a sketch would because the client is actually seeing color, actually seeing perfect circles or something. So I usually, just in a way, sketch on the program itself. So kind of skipping a step, but I think it is more efficient and less time consuming.

David added that working on the computer is useful for him because he is colorblind. When using the computer, he can utilize named color swatches so he knows what color he is using. The software also provided him with color guides that help select colors that go together. David stated that if he does not have a computer nearby and an idea comes to him he sketches it out on paper.

Sketching. As stated previously, David's preferred way to sketch is on the computer. He likes that drawing on the computer saves time because he does not have to scan his sketches into the computer in order to work with them. "It's already digital," he said. He also likes that the computer is more environmentally friendly. He explained that on the computer he makes as many sketches as he wants without using paper. "So, you are reducing your resources," he said. He also added that paper can degrade over time.

While the computer was his preferred method for generating ideas he did believe that paper and pencil sketches had some advantages. For starters, paper and pencils do not rely on power or a battery. They are more readily accessible. He also believed that paper and pencil sketches have more detail because they are easier to shade and have finer point lines.

Experience sketching on the iPad. David liked all the different brushes and pencils, and that it was easy to increase or decrease the brush size with a slider. He also liked the fact that he could use color when sketching without having to pull out a box of colored pencils. However, because he is color blind he stated that he would have liked named swatches instead of a color wheel. He joked that without names he could be choosing purple when he was trying to select blue and not know it.

Overall David found sketching on the iPad difficult. "I couldn't rest my hand on the iPad to draw, which is the only way that I draw," he said. When asked to elaborate, David explained that if he rested his hand on the screen it either left a mark or caused the iPad not to register the stylus. "Um, it is definitely not how I would sketch with my hand

up in the air." David also found the size of the screen and canvas a challenge. He explained:

> I feel like it was easy to use up the iPad space of the artboard and if I had paper that big I feel like it would be easier to draw smaller and fit more on there. Um, because I was using a stylus and it was not a really fine point, it was the bigger round tip, it definitely made it harder to be exact with my lines. So I just ended up having to draw bigger.

David said he tried zooming in but found that negatively affected the quality and the resolution of his sketches.

David stated he spent a total of 30 minutes sketching on the iPad. He believed this compared with what he would normally spend on paper and pencil sketches if he was required to make them for a class assignment. "I didn't want to spend too much time analyzing everything because I got my idea down," he said. When asked how sketching on the iPad compares with paper and pencil he said it does not compare. He acknowledged though that a different app, stylus or tablet might have different results. "I think there is probably some effective technology that would probably change my mind such as the iPad Pro and Apple Pen. Ah, yeah, this app and this stylus was difficult to work with." He compared the standard tablet stylus with the one for his Wacom. "I like the idea of a stylus. I think it is kind of neat to be drawing digitally, um, but having drawn with a Wacom, it is not even close," he said. He explained that the Wacom pen has different tips that can be changed out. It is also pressure sensitive and he believed the Wacom only registered the actual pen allowing him to place his hand on the device. He did like that the iPad was small and sleek. It is portable and easily fit into his backpack.

Quality of iPad sketch. "It just doesn't compare," David said when asked to compare his iPad sketches with those done on paper. He explained that his paper sketches would have much more detail and precision. (See Appendix I.)

Using the rubric (Appendix J) the researcher evaluated David's sketches as exemplary with regards to the ability to communicate the idea of a French Toast cereal. However, the course instructor believed he could have done more. The researcher and instructor agreed that a French toast cereal was not the most creative of ideas as there are several similar cereals in stores already. The instructor did not believe the use of the iPad had any effect on the quality of the participant's sketches or the level of originality in his ideas. These are "par for him," she said.

Student Austin

Background. Austin is a 24-year-old, fulltime graphic design major. He called himself a "super senior" because he has been in college for more than four years. He explained that he started off majoring in engineering but switched to graphic design because it sounded like it would be more fun. He said what he liked most about graphic design is the creating part of it. "I love making things, so when I finish a project, I'm filled with a sense of, um, accomplishment," he said. He added that he wanted to do something fun and more hands on. "I haven't looked back since," he said.

Design Workflow. Austin said that he starts by looking at what other people have done. He explained that he typically starts by viewing Google Images.

> So, like, if we are doing business cards the first thing I will do is, like, the most basic of Google searches, Google business cards, and just see what some of the more common ones are. Then I start getting more specific. I start looking into

interesting business card designs, crazy business card designs, awful business card designs. Just to see what everyone else has been up to.

After looking for inspiration, Austin creates a rough concept sketch. Then he goes to the computer and works in Adobe Illustrator. "So I usually start with sketching and then jump right into the software," he said. Austin explained that moving from paper sketches to the computer is fluid.

Sketching. Austin stated that he sketches primarily to communicate his ideas. He said that in graphic design the point is to "sketch to communicate and not sketch to create." He explained that when he sketches the first thing he does is make what he calls gesture drawings. "When I sketch I actually do a heavy gesture. So, like, I do a lot of sketching around the shape that I think I want the shape to be, so it's an exaggerated pencil look." He likes that this type of sketch is quick and does not take a lot of time. He also likes that sketching with paper and pencil has a tactile feel and can be manipulated. "Like, say you are making a brochure or a business card. Um, you might be able to relate and identify more if you are sketching on paper. You can fold it and actually feel how it would work," he explained.

Austin does have a tablet but has never sketched on it. He said he would like to someday but it is a Windows tablet and does not have as many apps as an iPad or Android device.

Experience sketching on the iPad. Austin found sketching on the iPad to be an eye opening experience. There were several things he did not like about it. He said he had a harder time getting a "feel for the sketch" because he missed the tactile experience he would have touching and manipulating paper. He also found it difficult to undo or

erase parts of the sketch he did not like. He explained that compared to paper, sketching on the iPad:

> ...felt more permanent because if you realized you made a mistake five lines ago or something you couldn't very well just hit the back button, you had to actually go in there with the eraser tool which could get awkward at times. Whereas with paper and pencil you can just take the sharp part of your eraser and just get in there.

He also thought that the stylus felt awkward because there was no point, just a wide round rubber tip, so he could never be 100 percent sure where he was drawing at on the canvas. He said a stylus like that is good for browsing the web but not so much for sketching. He also felt constrained by the size of the iPad screen and canvas. He explained that when sketching in his sketchbook he often does six or more sketches on one piece of paper and he could not do that using the app.

After listing all of the things he did not like, Austin laughed and said, "Wow, I probably shouldn't have started with the bad stuff because now it seems like it was a terrible experience. But by no means was it. It was actually a lot of fun." He stated his favorite feature was being able to shade by using the stylus or his finger to blur lines. "It gave it a cool effect; it gave it a misty morning kind of effect. I thought that was kind of cool," he said.

Austin said that because of a busy week at school he was only able to spend about 60 to 90 minutes sketching. He believed that was typical and stated that he does not like to spend too much time sketching. He explained that if you spent too much time sketching it gets to the point that you are doing more designing then sketching.

Quality of iPad sketch. With regards to the quality of the iPad sketches (Appendix I) compared to those done on paper, Austin explained:

> Well, ah, I suppose the sketches on the iPad were probably less detailed and also less roughly penned or penciled in. When I sketch on paper, I actually do a heavy gesture so, like, I do a lot of scratching around the shape that I think I want the shape to be. When I was doing the same thing with the iPad, although I started to do that way, I found I was making a concentric circle and lines and such that were just solid in structure.

While Austin elected to sketch for one of his class assignments instead of the cereal package activity, the researcher still evaluated the sketch using the same rubric. (See Appendix J.) The researcher was not familiar with the assignment and believed that had Austin not labeled it "light fixture" she would not have been able to identify what it was supposed to be. The instructor on the other hand found the sketch proficient at communicating the idea and stated, "Although rough, it definitely gets the point across." She added that typically Austin's sketches were more elaborate when drawn on paper.

Student Sarah

Background. Sarah is a 20-year-old international student majoring in graphic design. In her home country Sarah was studying animation but she did not like coding, so when she came to the United States she switched to graphic design. "Graphic design is more creative," she said. She explained that a lot of animation is fixed: You use certain codes to make things move or react in a specific way. "I like graphic design more than animation because with graphic design you can be more creative, I think. In graphic design there are no rules. Well there are rules, but you can break them," she explained.

She also liked that graphic design allows her to express what is on her mind, sometimes without using words.

Design Workflow. "I like to brainstorm first, before I sketch," Sarah said. She explained that she does not always start by drawing pictures but will instead list words. She then bases her sketches around the words. Sarah also likes to search websites for inspiration. "...especially on Pinterest," she said. "That is my go-to-site to get ideas."

Sketching. Sarah stated that she prefers sketching with paper and pencil because she does not feel as free with the mouse. "I feel like if I am sketching on a computer it is not really sketching. I don't know, it is just different," she said. She also stated that she does not feel comfortable sketching on a device like her brother's Wacom because she is afraid she will break it. She explained that when she is sketching she presses really hard on the paper.

She shared that a lot of graphic designers say, "Oh, I don't know how to draw so I can't sketch." But Sarah disagrees. "You do not need to be a good drawer to sketch," she said. "Even though it is just crap, at least you get your ideas out or something. The idea is just like freely out instead of just in your mind. Kind of like saving information."

The one thing that did appeal to her about sketching digitally was that it was more permanent as she was able to save her work or take a screenshot. With paper if, "...for example you spill something or you lose the paper, it is gone," she said. She added that when she sketches on paper she often takes a picture of it with her phone so that she has a record of her idea.

Prior to this study she had never sketched on an iPad or similar tablet. She had, however, tried her brother's Wacom and also had sketched on her phone. She shared that

the newest iOS (the Apple mobile operating system) allows for sketching inside of text messages. She thought that was fun but had not used it for any graphic design work, just for sending fun texts. She also shared that when she was in high school she used to play around with Microsoft Paint on the computer, but again, found it challenging because of the mouse.

Experience sketching on the iPad. When asked to describe her experiences sketching on the iPad, Sarah admitted that she struggled at first because she could not remember where things were. So she spent time figuring it out. "I am not comfortable sketching on the tablet," she said. She also did not like that she could not put her hand down on the iPad when sketching.

Sarah spent approximately 45 minutes sketching on the iPad and stated that this was a lot longer than when she sketched with paper and pencil. "I am pretty fast sketching on paper. I just spend like 15 minutes, but because this is new to me it took longer," she explained. She also believed that the quality of sketches did not compare because the texture was different. She explained that she tried using the shading function of the ProCreate app, but did not like how it looked compared to shading on paper. "I mean it is nice to have but it is different on paper. The paper gives it a different shade," she said. She also did not believe she could achieve the same level of detail with the stylus that she can with a pen or pencil.

There were some things she liked. For example, she liked how clean it was to erase. There were no marks on the canvas and no mess (or "dirt" as she called it), like you get when physically erasing on paper. She also liked that the ProCreate app allowed her to export her sketches as jpg or png files. She thought this was nice for bringing the

sketches into Adobe Photoshop or Adobe Illustrator to work with. She said that with paper and pencil sketches you have to scan them and sometimes they are faded. When scanning paper sketches, Sarah explained, "I would have to put them in Photoshop and edit them and that can take a lot of work."

When asked if she would sketch again on an iPad or similar device, Sarah hesitated. "I like sketching on paper. That is just how I grew up. I draw and I like to draw. I have my sketchbook." She added that it might be a generational thing. She explained that her young niece has grown up with technology like smartphones and iPads. Her niece uses an iPad to draw, play games and watch movies. Sarah reiterated that not having grown up with the technology, sketching on the iPad is new to her and she is not very comfortable with it. "I am used to drawing on paper," she reiterated.

Quality of iPad sketch. Sarah stated that while sketching on the iPad she also generated ideas for cereal packaging by sketching on paper. The biggest difference to her was in the texture the paper provides. She explained that pencil lines and shading all have a different look on paper that could not be achieved on the iPad. (See Appendix I.)

Sarah created a variety of sketches on the iPad showing different ideas. She also created a word diagram to show her thought process and how the different parts fit together. Both the researcher and the instructor believed she did an exemplary job communicating her idea. However, since there is already a cereal called *Honey Stars* it probably was not the most original idea, but Sarah was able to make it her own and had some unique ideas for the packaging. The instructor said Sarah does typically create more polished sketches, especially when she takes her time. (See Appendix J.)

Data Coding

Data in this study was analyzed and coded following Moustakas's (1994) version of the Stevick-Colaizzi-Keen method. After clarifying her biases, the researcher went through the interview transcripts and listed significant statements. From those statements the researcher was able to generate three themes: 1) *participants preferred sketching utilizing paper and pencil*; 2) *participants perceived some benefits to generating sketches on the iPads*; and 3) *participants perceived alternative methods for idea generation using the iPads*. In this section, the author explains each of the themes utilizing the words of the participants as well as making supporting references to the literature.

Theme One: Participants preferred sketching utilizing paper and pencil

Nine of the ten study participants indicated that after experiencing sketching on the iPads they still preferred to sketch using paper and pencil. "It just doesn't compare," one participant said. Another stated that the iPad still "felt" like a computer, which made her want to sketch on paper first while another participant called the iPad a gadget and explained, "a gadget is not like paper. So it, like, limits your freedom." The factors that appeared to contribute to this belief were challenges using the iPad devices, issues using the ProCreate app, and trouble using the stylus. Experience using iPads also appeared to be a consideration for many of the participants.

Apple iPad. Several of the study's participants had issues with the iPads, most particularly with regards to its size. Benjamin found the 9.7" diagonal size of the iPad to be his biggest challenge when sketching. He said, "compared to a regular piece of [8.5" x 11"] paper it just seemed really small when I was drawing on it." He explained that he had to zoom in and out while he was sketching only to find, when he zoomed out, that

what he had drawn was bigger and took up more of the drawing canvas than he expected. Michael also commented on the size of the iPad screen:

> What I didn't like was, that I guess when I sketch with, like, paper and pencil, um, there is a lot of room to work with versus the iPad. You only have that one space and usually I always like to look at my ideas, like, all at once, not have to exit out of the sketch just to see what it was like. I had to keep going back to the gallery to see what I had before versus when you have it on paper you can look at all of them together.

David also commented on the size of the iPad screen. He said, "If I had paper that big I feel, like, it would be easier to draw smaller and fit more on there." Austin added:

> I felt, like, um, no matter how big the canvas was I was always limited to the screen. The size of the screen. I guess, I wanted to work on the same canvas but say in the top left corner be able to do like sketch one, sketch two, sketch three. I would have liked the ability to do that instead of having to go back out [to the gallery]. Kind of like how I can use the same page of a sketchbook and do, like, six different sketches.

In addition to the physical size of the iPads, participants had other issues with the screen. One study participant commented that she was afraid of placing her hand on the screen because she was worried about damaging the device. Other participants noted that putting their hands on the screen "made marks on the canvas" or "caused the iPad not to register the stylus". Carrie stated, "for those who put their hands on the surface when they go to sketch or write or anything, it [the iPad] had issues 'cause it kept sensing there

was something else there, besides the stylus. So I had to learn a whole new way of sketching and it was bothering me."

David added:

> Sketching on the iPad was kind of difficult. The main thing I didn't like is that I couldn't rest my hand on the iPad to draw, which is the way that I draw. So yeah, just having to hold the pen up with my hand just kinda in the air. If I put my hand on the canvas it would leave marks or just not register anything once I rested it [hand] on their [iPad screen] and tried drawing. Um, it is definitely not how I would sketch with my hand in the air.

During the interview Sarah also demonstrated to the researcher how she had to sketch with her hand in the air so as not to place it on the screen.

Study participants also commented on the lack of tactile feel that the iPads have. Study participants believed the screen was missing the texture you have with paper. Sarah commented that shading looked more natural on paper because the texture of the paper gives shading a dimension that was lacking on the iPad sketches. Emily also thought shading looked "sloppy and fake" on the iPads because it was missing the texture you get with graphite from the pencil. Another participant commented that paper allowed him to model what he was designing. He explained that if he was making a brochure he could fold it and see how the different sections would look, or if he was sketching his cereal box on paper he could have folded the paper and used tape to form his box so he could see the different sides of the package and better visualize the final outcome.

These findings are consistent with the existing research on iPads. Souleles et al. (2015) found their results to be mixed with regards to how students felt about using iPads

in art and design courses. They grouped their findings into three categories: A) those who found the iPad useful, B) those who reported both positive and negative viewpoints, and C) those who preferred using non-digital tools. Those in categories B and C also listed the size of the iPad screen and lack of tactile feel as challenges with using the iPads.

ProCreate App. The app ProCreate, by Savage Interactive, was an Apple Design Award winner in 2013 and was listed by Apple as an "App Store Essential." Apple iTunes's description of the app says, "Procreate is the most powerful sketching, painting and illustration app ever designed for a mobile device" (p. n.a.). Despite these claims participants in this study found many aspects of the ProCreate app difficult to work with. Kevin, the only participant in the study who preferred sketching on the iPad, stated that he preferred paper and pencil to the ProCreate app. He explained that ProCreate seemed to be geared more toward artists wanting to create an artistic piece rather than a designer working on concept sketches. Kevin, along with several other participants, did not like that the ProCreate app did not provide preset shapes and lines for them to use when they were sketching. Kevin said:

> I don't like that there is no way to just have shapes, like, readily available, you know. You are at the mercy of the tools and there really was, like, no straight lines you could use. It was really more like brush strokes rather than, like, straight design elements that you can implement right into your design idea.

He went on to explain that other sketching apps like Adobe Draw have preset shapes that you can select from and size to fit your design. "That goes along with just more precision, I guess, 'cause you can make a square by drawing it but it is not going to be

exactly straight, you know." Emily also found the lack of shapes a challenge. She commented that she spent a lot of time trying to draw a perfect circle. She explained that with paper she should could just place a round object or a stencil on the paper and trace it, whereas on the iPad she had to draw the circles by hand. She stated that she tried drawing the circle 100 times before getting it right.

Other participants found trying to write words by hand a challenge and would have preferred being able to type text on the screen. When comparing their iPad sketches with ones they had created in the past using paper and pencil several participants stated their handwriting was much better on paper. Additionally, the instructor commented that the participants' handwriting was better on paper then it was on the iPads.

The desire to have preset shapes, straight lines and type is consistent with prior studies on sketching with paper and pencil vs. the computer. However, there appears to be a difference of opinion amongst researchers with regards to the benefits of using preset shapes during the concept stage of designing. Stones and Cassidy (2010) explained that inexperienced designers often mistake a high level of finished work for design proficiency. They argued that selecting typefaces, shapes, and lines from a menu can actually limit creativity and that having ambiguous shapes can lead designers to reinterpret their drawings and form new ideas. In a contrasting study, Stacey and Eckert (2003) argued against ambiguity and supported the idea of using exact shapes and straight lines when designing. Their study, which focused on fashion design, found that ambiguous, roughly drawn shapes could negatively affect how designs are interpreted and are often misleading.

Stylus. Another factor that appeared challenging for the participants was using the stylus, which was a standard stylus with a quarter inch round rubber tip. Participants found this challenging because it prevented them from achieving details in their sketches. One participant said, "it is not as fine of a detail as like a writing utensil," while another added, "it just feels different then a pencil." Maria stated, "I didn't have the same kind of coordination I thought I would have. It fits in your hand the same way but just the way it reacts to the iPad isn't always the same as the way paper and pen react to each other." Austin explained:

> There was no point on the stylus, so that was probably the most difficult part. The stylus is maybe wonderful for web browsing or just using as a replacement for the mouse, but because there was no, um, point on the stylus I could never be 100 percent sure where I was going to start drawing at. That was probably the biggest disconnect between me and what I was working with.

David added, "It was not a really fine point stylus; it was the bigger round tip. It definitely made it harder to be exact with where I wanted my lines." He also compared the stylus with the one he has for his Wacom and said, "It's not even close." He explained that the Wacom stylus has changeable tips that have a finer point then the one used in this study. Carrie stated that with an actual pencil she accomplishes more detail.

In addition to drawing with the stylus participants found that it was difficult using it to erase. Because of the wider tip on the stylus participants commented that when they would try to erase a small part of the sketch they would often end up erasing more than they had intended. Maria said, "I guess a challenge for me was, I guess, if I messed up a

little bit it was hard to erase just a little bit instead of a lot. With a pencil and paper I'd be more likely to just erase a little part of it. Austin added:

> . . . you actually had to go in there with the eraser tool which could get awkward at times whereas with paper and pencil you can just take the sharp end of your eraser and just get in there. So I did feel that there was kind of a utility difference and obviously there would be but I guess I noticed it firsthand.

Participant comments on the stylus appear consistent with existing research. Souleles et al. (2015) found that students did not like the styluses. A participant in their study said, "I didn't like using the stylus at all" (p. 135). In the MacLean et al. (2011) study on using tablets for sketching mathematical equations, they stated "symbol recognition accuracy on the iPad was higher when drawing with a finger than with an iPad stylus" (p. 2).

Experience. Lack of experience with the iPads also appeared to play a role in participants' preferences to sketch with paper and pencil. Natalie said she preferred paper and pencil sketches because, "I have been doing that for so long. I am used to it." Sarah added, "I am not comfortable sketching on the tablet. I like sketching on paper. That is just kinda how I grew up."

Despite preferring paper and pencil the majority of participants indicated that they would be willing to try sketching again on the iPads. Emily explained, "I think it would take time for me to, like, use it really often." Maria added:

> I think I would sketch on the iPad again if I practiced on it more and became more comfortable with it. It wasn't a bad tool to have. It's just, um, I wasn't used to it

so I wanted to go back to what I was used to. So I think if I was more used to it I am sure I would use it a bit more often.

Participants also commented that sketching on the iPads took more time because they had to spend time figuring out the device and app. Michael, for example, explained that he spent a lot of time "playing" on the iPad. "I was just playing around with all of the features," he said. Another participant said, "When I was sketching I couldn't remember where stuff was so I was kinda, like, figuring it out."

These findings are consistent with first time exposure to iPads in education. Schepman et al. (2012) found that 30 percent of their respondents indicated that the reasons they did not use the Evernote app for notetaking were "related to having to learn new habits, a new way of working, or remember how to use the new software" (p. 314). A participant in their study explained that while Evernote seemed to be a useful piece of software, she found herself not using it "due to a force of habit" as she was used to taking notes in other ways. Souleles et al. (2015) also found that time was one of the barriers students experienced when using the iPads. In their study, the researchers provided students with iPads and several pre-installed apps. Students reported that they did not use a lot of the provided apps because they did not have enough time to fully explore them.

Theme Two: Participants perceived some benefits to generating sketches on the iPads

Despite the fact that the study participants preferred paper and pencil sketches they all agreed that the iPads offered some benefits when it came to sketching. Those benefits had to do mainly with time saved in the later stages of design and access to

resources. The ability to "go green" was also seen by several participants as a benefit to digital sketching.

Time. While most participants believed sketching on paper was faster than on the iPads, they agreed that sketching digitally did have some benefits later on in the design process. Kevin explained that sketching on the iPad is more efficient because the sketches could be synced with design software. Adobe Draw, which he typically used for sketching, allows designers to upload their sketches to the Adobe Creative Cloud and then download them to Adobe Illustrator. Similarly, the ProCreate App allows designers to save their sketches as an image file (jpg and png), an Adobe Acrobat (pdf) file, or a Photoshop (psd) file. The ProCreate app works with other apps like Dropbox for saving sketches or allows for sketches to be emailed as an attachment.

Participants liked this functionality of the app because it saved them time when they got to the later stages of the design process. They explained that when sketching with paper and pencil it was hard to work with those sketches later on the computer. Sarah and Benjamin both explained that they often scan their sketches but that the scans are often really light requiring them to trace over the lines using the software. Another participant mentioned that when sketching on the iPad app she was able to use layers. This was helpful because when she saved the sketch as an Adobe Photoshop file those layers remained intact allowing her to work with the layers in the software. "I couldn't have done that with a paper sketch. If I, um, like, scanned the sketch it would just be, like, on one layer." Kevin added that sketching on the iPad and then importing it directly to the design software saved him time because he did not have to recreate his entire idea.

Participants in Souleles's et al. (2015) study had similar responses. They reported that in art and design the iPad complements the laptop. A participant in their study said, "I would sketch on the iPad, transfer it to the laptop and immediately have it opened in Photoshop for editing" (p. 137).

Resources. Study participants also agreed that the iPads provided them with access to resources that they typically would not use when generating paper and pencil sketches. The number one feature of the ProCreate app for participants was being able to incorporate color into their sketches. Michael said, "I really enjoyed the color palette as there was a variety to choose from." Carrie stated that she liked being able to sketch using color because, "some people are more visual when it comes to color versus black and white," while Natalie stated "it might help the idea better if you see it in color or make it stand out more than if it was black and white." Maria liked the different color options because when sketching with paper and pencil, she often does not have colored pencils nearby and even if she does she is limited to the colors available in the box. With the app's color wheel, she said, the scope of available colors was unbelievable. David thought selecting colors in the app was faster than having to get out colored pencils. The instructor also commented that the addition of color enhanced some of the participants' sketches.

In addition to color, participants liked having access to the different types of pencils, pens, and paint brushes. Benjamin explained that he liked the effect the watercolor brush gave the logo he sketched. "It's not like I am going to have that around. Usually it is just pencil or a pen," he said. Maria added, "the different pencil options were nice, too, because often times, unless you are an experienced sketcher with a log of

different pencils, you probably only kinda have that one thing to use. So it was nice to have different options."

Going green. Study participants mentioned "feeling guilty" as one of the disadvantages of sketching with paper and pencil. Austin, for example, explained:

> The best reason for using an electronic device [for sketching] is you don't have to feel guilty for making as many sketches as you need. Um, you are not worried about constantly using more paper. On it [the iPad] I can do all the gesture sketches I need without worrying about being wasteful.

David added that when sketching digitally, "you can have an infinite amount of sketches because you are not limited to paper or ink. You are reducing resources."

This apparent advantage expressed by the participants is supported by other research studies. For example, Swallow (2011) stated, "Paper usage reduction is one of the more obvious ways that the iPad has helped businesses get in touch with environmentally friendly side." (Reducing Paper Usage, Para. 1). For example, the architecture firm BCRA recently adopted iPads as a way of reducing their impact on the environment and also as a way to cut costs. They used iPads, instead of paper, when meeting with clients to show presentations, design blueprints, and maps. They estimate that by moving from paper to iPads they have saved approximately 41 pounds of paper per month. Additionally, the United States Air Force is also reducing paper by replacing flight manuals with iPads. They estimate that by eliminating the need for paper flight manuals, the Air Force will save approximately 250 to 490 pounds of paper per aircraft, depending on the size of the crew. The reduction in weight, caused by eliminating paper, will also save on fuel (Rogers, 2013). Similarly, Alaska Airlines, launched two

initiatives, which they are calling "Bye, Bye Flight Bag". They are using iPads not only for flight manuals but also for aeronautical navigation charts. They estimate they are saving about 2.4 million pieces of paper. Additionally, they are removing weight from the aircraft and preventing back injuries as the typical pilot flight bag can weigh 50 pounds or more (PR Newswire, 2011). Cities are also using iPads to cut costs and save paper. According to an article in USA Today (Lackey, 2010), cities across the nation are using iPads for government business. The mayor of Hampton, Virginia estimated they are saving $18,000 a year by switching to iPads and a spokesperson for Redwood City, California stated that they expect to save more than $30,000 a year in printing costs.

The participants, however, did not take into account the resources being consumed by manufacturing the device and keeping it powered. According to the Electric Power Research Institute (EPRI):

> … the average energy used by all iPads in the market is approximately 590 gigawatt hours (GWh). In a scenario where the number of iPads tripled over the next two years, the energy required would be nearly equivalent to two 250-megawatt (MW) power plants operating at a 50 percent utilization rate. A quadrupling of sales in two years would require energy generated by three 250-MW power plants. (Malik, 2012, para. 5)

The EPRI also expect the new iPads to consume 65 percent more electricity per year. Therefore, while the use of iPads may decrease the amount of paper being used they are using more of other resources like electricity.

Theme Three: Participants perceived alternative methods for idea generation using the iPads

While the focus of the study had been on how students perceived sketching on the iPads, another major theme to emerge from this study was that the *participants perceived alternative methods for idea generation using the iPads*. The iPad is a lightweight, portable device and, in addition to sketching, allows users to play music, browse the web, connect with others via social media, take pictures, and more. "With the iPad you have the Internet right at your hands," one participant said.

In addition to sketching, Herring, Jones, and Bailey (2009) listed active and passive searching as types of idea generation techniques used by designers. Active searching referred to designers looking for materials related to a particular solution. This could include browsing the web for images related to a product or searching for the demographics of a particular population, while "passive searching referred to designers looking without searching for a particular solution to a problem. They are simply looking for inspiration" (p. 5). Laing and Masoodian (2016) added that searching for ideas might involve researching the client in order to get a sense of their brand or searching the web for design examples. In their study, researchers Herring, Chang, Krantzler, and Bailey (2009) found that:

> Examples have many benefits in design, particularly in the preparation and idea-generation phases. Examples were mostly cited [in their study] as being an aid in not only providing a scope of what is already on the market, but also for providing inspiration for new ideas. Benefits of examples in design include: they provide a visual framework, allow for reinterpretation of ideas, and are used as a validation tool in later stages of design. (p. 89)

A previous study by Laing & Masoodian (2015) also found that designers seek out and collect examples for their own professional development.

The prior research is consistent with this study's findings. All 10 participants reported utilizing some sort of active or passive searching as part of their design process. The most common were searching Google Images or looking on Pinterest boards. Sarah called Pinterest her "go to" for getting design ideas or seeing what is already out there. Maria stated:

> I usually, like, go on Pinterest or look in magazines or sometimes go to Bēhance, um, and just kinda search for some inspiration. Sometimes I'll type in, like, poster inspiration or if I am going for a more modern look I will do modern design inspiration. It will kinda spark ideas or maybe you see a few things and you are, like, I could put all those together in a new way or do a little bit of this and a little bit of that.

Michael explained:

> I look on Google just to get some ideas. Depending on what the project is, um, I want to see how other people design like logos, brochures, or whatever. I then would use one I really like and would take some of the details from the inspiration and make my own version of it. For example, we had to make an Infographic for class and I found an example on how to make scrambled eggs. I liked the simplicity of it and the way it flowed. I didn't make my Infographic on scrambled eggs but I used some of the flow it had. I like to look online because there's so much variety out there and it like really helps me narrow down what I want to design. Um, sometimes you would, like, see something that's, like, really eye

> catching and you think "Hey that looks really strong. Maybe I can do something like that."

As stated earlier, Austin reported that he starts with a basic search for say business card designs and then narrows his focus looking for more specific ideas such as interesting or crazy business card designs.

In addition to Pinterest and Google Images participants also mentioned viewing YouTube videos, looking at other graphic designers' portfolios, and following designers on social media. Benjamin stated:

> I like to follow certain designers on social media. They also have graphic design social media, too, like Dribble [a show and tell for designers]. So I just follow a lot of people and they post like daily new designs. So I just kinda get inspiration off of them.

Another participant reported that he liked to look at the work of other designers because it helped him to learn about new trends in design in order to keep his designs current or "with the times." The participants also believed that searching for ideas aided them in sketching. Emily stated, "Inspiration is a big part of sketching, like just seeing things helps get the ideas flowing." Natalie added, "You still need to have some sort of picture in your head. You still need like inspiration to sketch."

The study's participants were in agreement that the iPads could help with this part of their creative process. One participant stated:

> It's like a phone and a computer in one. So, like, you can go on and you can Google search while you are on it. You can go on social media while you are

> designing. It is a portable computer only a better version of a laptop because of the touch screen.

Emily added, "So, like, what is cool about the iPads is you can jump around from app to app when designing." Another participant explained:

> There are apps for everything. I love using like Pinterest so on the iPad I could have the Pinterest app and go from it to the, um, browser and, like, search Google Images. Or I could go over to YouTube and watch, like, a tutorial on how to do something in Photoshop.

Several participants also believed the iPads were convenient because they were like having multiple devices in one. One participant explained that the iPad was convenient because, "it's all right there." Sarah added, "Instead of having three options, for example when designing, I have music on my phone, then I have my computer to search for inspiration, and then my sketchbook for sketching; with the iPad I could just do it all on one device. Austin explained:

> If you are at a coffee shop and just have your sketchbook and you need to look for external media, like, if you need to look at prototypes of other work done, you are landlocked or should I say tech-locked, um, whereas if you have an iPad you can actually from that point, as long as you have Wi-Fi [or data] connection, um, you have access to the entire world of the Internet.

While the same things could be accomplished with a laptop computer, study participants liked that the iPads were lighter weight and fit more easily into their backpacks. The iPad also has a built in camera for taking photographs as well as video. "Graphic design

is everywhere. I could see using the, um, iPad to take, like, pictures of cool things I see, like a cool movie poster or flyer on a bulletin board." Another participant added:

> I get inspired by all sorts of things, um, not just what I find, um, online but also in the world around me. Like the color of a flower might trigger an idea or something like that. With my phone, or an iPad, if I had one, I can take pictures or video of the things that inspire me.

Pei-Jung Cheng (2016) from the Department of Media Design at Tatung University in Taiwan has been developing a mobile app specifically for generating ideas. He based his research on designers' search behavior. Cheng stated:

> The development of the Internet has enabled people to search for knowledge or resources online. The mode of searching and retrieving online resources has altered the behaviors of designers, meaning that they are becoming accustomed to referring to and being inspired by online resources. (p. 75)

Cheng (2016) added that mobile apps allow users to use the camera option to record unexpected ideas. He further explained that, "the light weight of mobile devices increases the likelihood that people want to carry these devices" (p. 75). Therefore, Cheng's study focused on an "app for generating creative ideas (AGCI)" (p. 76). He argued that designers should first think of ideas in terms of key words or phrases, then search or look for inspiration, and then sketch their ideas. Cheng believed that a mobile app that incorporated all three options would aid designers during the early stages of the design process. Therefore, his AGCI prototype focused on three main parts: a mind-mapping tool, which allowed designers to form word associations and draw connections

between different ideas, a search engine for exploring online inspiration, and a sketchpad for sketching design ideas.

Summary of Findings

During the fall and spring semester of 2016, the researcher conducted her study on sketching using iPads with 10 undergraduate graphic design students in two upper-level design courses. The students participated in two interviews and also took the iPads home for 48 hours to complete a "Packaging Design" sketching activity. The participants were asked to generate sketches for a new brand of cereal. They were instructed to include both the logo and design of the cereal package in their sketches. The sketches were then collected and analyzed using a rubric by the researcher, course instructor, and an external graphic design educator. The purpose of including the second design educator was that the participants were unfamiliar to her; therefore, she was able to offer a perspective free of biases. The interviews were also coded.

Participant narratives and the three themes that emerged in this study were described in Chapter IV. The three themes were:

1. Participants preferred sketching utilizing paper and pencil;
2. Participants perceived some benefits to generating sketches on the iPads;
3. Participants perceived alternative methods for idea generation using the iPads.

Theme one discussed reasons why the participants preferred paper and pencil to sketching on the iPads. The reasons included difficulties using the iPad, problems using the ProCreate app, issues using the stylus, and a lack of experience using iPads. References to the literature were used to support these findings.

Theme two described the perceived benefits participants experienced sketching digitally on iPads. Reasons included time saved in later stages of the design process as well as access to resources they would not typically have when sketching with paper and pencil. Participants specifically appreciated being able to use a variety of drawing utensils and being able to incorporate color into their sketches. An additional benefit participants realized was that using the iPads was "green." Existing research was provided to support these findings.

Finally, theme three provided alternative techniques for generating ideas using the iPads. This theme focused, specifically, on participants engaging in active and passive searching of information, design ideas, and inspiration. The researcher made connections to existing research whenever possible.

Chapter V will provide a more detailed summary of the findings as well as a discussion of the study's limitations and recommendations.

CHAPTER V

SUMMARY, LIMITATIONS, AND RECOMMENDATIONS

Summary

This chapter begins with a summary of the research findings as a result of interviewing 10 upper-level graphic design students who participated in the Apple iPad sketching activity. Next, the researcher describes the study's limitations and makes recommendations for graphic design students and educators, and makes suggestions regarding areas for further researcher. Finally, the researcher provides her concluding thoughts.

This qualitative phenomenological study explored the effectiveness of graphic design students' using iPads for sketching activities during the idea generation phase of the design process. A qualitative phenomenological approach was used because the researcher was concerned with understanding the phenomena being studied from the perspective of the participants (Welmen & Kruger, 1999). The researcher used interviews and document analyses to understand the experiences of ten graphic design students, five male and five female, from two different upper-level graphic design courses at a university located in the Upper-Midwest. The results were organized into three major themes: 1) *participants preferred sketching utilizing paper and pencil,* 2) *participants perceived some benefits to generating sketches on the iPads*, and 3) *participants perceived alternative methods for idea generation using the iPads*.

Theme One: Participants preferred sketching utilizing paper and pencil

The first major finding of this research is that study participants preferred sketching utilizing paper and pencil to sketching on the iPads. "It doesn't compare," one participant proclaimed. This was because of difficulties using the device, issues with using the app ProCreate, challenges using the stylus, and lack of experience using the iPads.

The biggest complaint about the device was related to the screen size; for example, participants believed the small screen size limited their ability to sketch. Austin commented that no matter how big he made the canvas he was limited by the size of the iPad screen. Other participants explained that with paper they could generate a number of sketches on a single sheet. They did not like having to return to a gallery to view their different ideas.

Participants also complained about their experience using the touch screen. Participants found that they had to "learn a new way of sketching" because they could not rest their hands on the device like they could with paper. Resting one's hand on the device created unwanted marks on the digital canvas or caused the iPad not to register the stylus. Participants also missed the tactile feel of paper. Some believed that the texture of both the paper and pencil graphite added dimension to sketches, particularly when shading, that was missing on the iPad sketches. Other participants missed being able to manipulate their sketches like they could with paper. One participant stated that he wanted to be able to physically fold the paper to get a better idea of how the final product would look.

Participants also had issues using the app ProCreate. They wanted to be able to create shapes, lines and text without having to draw it by hand. Kevin believed the app was geared more toward artists then it was graphic designers. Several participants mentioned having to erase and redraw parts of their sketches multiple times in order to "get it right". This perceived lack of precision was also related to challenges participants discovered while using the stylus. Participants thought that the stylus "felt different than a pencil" and did not allow for "as fine of detail" when sketching. Participants reported that because the stylus had a larger tip it was difficult to be exact and add fine details to their sketches. Austin stated that the stylus seemed more appropriate for browsing the web then it was for sketching. The wider tip also made erasing difficult for participants because they would accidentally erase more of the sketch then they desired.

Lack of experience was also a factor in participants' preference for sketching with paper and pencil. Participants explained that paper and pencil was what they were used to or most comfortable using for sketching. Some of the participants indicated they spent more time "playing" on the device or that they had to spend time figuring out how to use the device and/or sketching app. Participants expressed the need for more experience using the device in order for them to become comfortable enough to use it for sketching in place of paper and pencil.

These findings were consistent with existing research, particularly the Souleles et al. (2015) study on the use of iPads in an art and design course. Participants in their study also reported issues with the iPad's screen, using the stylus, and amount of time spent using the device.

Theme Two: Participants perceived some benefits to generating sketches on the iPads

The second theme to emerge from the study was that despite preferring to sketch with paper and pencil, participants did perceive some benefits to sketching on the iPads. One of the benefits participants discovered while sketching on the iPads was that their sketches appeared to save them time later on in the design process. With the ProCreate app users could save their sketches in a variety of formats and upload them to the Cloud using a file sync and share digital tool like Dropbox or send them via email as an attachment. Participants' explained that this allowed them to work with their sketches in design software without having to recreate their ideas from scratch. Several participants shared that they often take a photo or scan their paper sketches but then have to trace them once they get them into the software, which takes time.

Probably the biggest benefit the participants found using the iPads was access to resources they would not have when sketching with pencil on paper. For example, the participants reported that they liked being able to incorporate color into their sketches. Participants explained that they do not typically use color when sketching because they do not have colored pencils nearby. One participant also mentioned that even with colored pencils she is limited to the colors in the box whereas with the iPad there was a full color wheel with what seemed like unlimited choices. In addition to color the ProCreate app also provided different sketching utensils such as pencils, pens, and paintbrushes. Participants stated that this provided them with access to tools they would not generally have access to when sketching with pencil on paper.

Study participants mentioned "feeling guilty" when sketching using paper and pencil. Therefore, they appreciated being able to generate an unlimited number of sketches without wasting paper. "Going green" with iPads is becoming more common. Swallow (2011) explained that reducing the use of paper is one of the biggest ways the iPad has helped businesses become environmentally friendly.

Theme Three: Participants perceived alternative methods for idea generation using the iPads

While the focus of the study had been on how students perceived sketching on the iPads, the third major theme to emerge from this study was on other ways the iPads could be used to generate ideas during the early stages of the design process. Study participants reported that they often used Google Images, Pinterest, social media sites, YouTube, and designers' portfolios for inspiration when designing. The study's participants were in agreement that the iPads could help with this part of their creative process. Participants explained that with the iPads they had access to apps like Pinterest and YouTube and could use the Internet for Google searches or to visit designers' website. They could also play music and use the device to take pictures or record video of things they find inspirational. Participants explained that inspiration is an important part of the design process and directly relates to their ability to sketch design ideas.

The use of iPads to promote idea generation is a growing area of research interest. Cheng (2016) is working to create an "app for generating creative ideas (AGCI)" (p. 76). His AGCI prototype includes a feature for creating a mind-map for forming word associations, a search engine to explore online inspiration, and a sketchpad for drawing design ideas.

Quality of student sketches

Additionally, the researcher, course instructor, and an external graphic design educator analyzed the sketches generated on the iPads. The sketches were evaluated using a rubric that looked at the ability to communicate the idea through the sketch, originality and creativity of the ideas, and the level of skill, technique, and details utilized. The rubrics included three achievement levels: exemplary, proficient, and needs work. Overall the course instructor and the researcher found the participants' sketches to be proficient or exemplary at communicating ideas for the logos and cereal box packaging. The external graphic design educator, however, believed that the participants needed more work in this area because most of them focused on only one or two ideas rather than generating many different ideas. She believed they were doing more designing than actual idea generation by sketching. This, however, may have had very little to do with the fact that the students were sketching on the iPads. When evaluating the sketches, the course instructor noted that in most cases the quality of the iPad sketches seemed comparable with what the students typically produced in class using paper and pencil. The two big differences being that 1) students' handwriting was better on paper and 2) when sketching on the iPads students incorporated more color and textures.

While it is correct that most of the participants did only generate one or two ideas, the researcher did not require them to produce a particular number of sketches for two reasons. First, as the course instructor indicated, while she required sketching as part of class assignments, she did not require students to produce a specific number of sketches. The researcher wanted to keep the activity as close as possible to what the participants

experienced when sketching for their class assignments, therefore, she did not require a specific number of sketches be drawn on the iPads. Additionally, research indicates that requiring a specific number of sketches can be limiting (Denton and Williams 1995). Students may generate one idea and then make variations of that one idea in order to meet the instructor's requirement or they may stop sketching when they have completed the assigned number of sketches.

In addition to evaluating the sketches using the rubric, the course instructor also provided a comparison between those completed on the iPads, and paper and pencil sketches the participants completed previously in her classes. For some, the instructor believed the iPad sketches were enhanced by the use of color and texture. She also indicated that the participants' handwriting was typically better with paper and pencil. Overall she believed the iPad sketches were comparable to what participants accomplished in her classes with paper and pencil. She mentioned that the level of skill, technique, and detail was similar to what she had seen from the participants previously. Based on the course instructor's comments, it appeared that the quality of the sketches had more to do with the amount of time participants spent on the activity and less to do with the medium used.

For example, with regards to Kevin, the instructor believed his iPad sketches were "parallel to those he hand draws in class." She also mentioned that Kevin prefers to sketch digitally and added, "you would think he would push his talent harder than he does." For several other participants the instructor noted that, "Unless he/she is passionate about the topic, this is about as much energy he/she typically puts forth." Finally, for Sarah the instructor commented, "Depending on how much time she allows

herself dictates the skill level shown. When she has more time, the sketches typically are more polished."

Limitations

This study was impacted by several limitations. First, the population size of the participants for the research was small, consisting of only ten students from two graphic design courses. The smaller population size may have limited the number of different viewpoints that could have been obtained with a larger population. Second, nine of the ten participants were of the same ethnicity and all were attending a university located in the Upper-Midwest. Additionally, nine of the ten participants had very little to no prior experience using iPads for sketching. Therefore, the results of this study may not be similar to other graphic design students at other universities. Participants with a different demographic or from a different geographic location or university would have expanded the scope of the study and may have produced different results. Additionally, the instructor for the courses offered the participants extra credit for completing the study. This, too, limited the number of participants who chose to participate and may have limited the sample size to participants who were in need of the extra credit. Third, because of time constraints and limited access to the iPads, the researcher was only able to allow participants to take the devices home for 48 hours. Additionally, the researcher did not require participants to produce a specific number of sketches and therefore, most participants did not spend adequate time sketching to generate more than one or two ideas. Fourth, the participants also did not spend adequate time using the iPads to develop their skills and techniques beyond a novice level. This may have impacted the quality of sketches produced, number of sketches produced, and participants' perceptions

of their experiences. Fifth, the ProCreate app did not prevent participants from deleting their sketches. Despite asking participants to retain all of their sketches, a few of the participants indicated during the interviews that they deleted sketches they did not like. This prevented the researcher from viewing and evaluating all of the sketches. Sixth, since the researcher did not collect any paper and pencil sketches to compare to the digital sketches, she could only rely on the opinions of the participants and course instructor with regards to the quality of the sketches produced on the iPads. Having paper and pencil versions of the packaging and logo designs would have allowed the researcher to make a more direct comparison regarding differences in sketching quality. Seventh, participants used Third Generation iPads, standard styluses and the ProCreate app. Using other devices such as an iPad Pro or Microsoft Surface tablet might have produced different results as these devices work with styluses that have finer tips and are pressure sensitive. A different app might also have yielded different results as participants reported wanting tools ProCreate did not have. Eighth, participants in the study were juniors and seniors who have primarily generated all of their sketches for class assignments using paper and pencil. Therefore, their experiences with sketching digitally may be different from those participants who sketch digitally earlier in their design program. Finally, recognizing that bias can occur in research planning, data collection, analysis, and study conclusions, every effort was made by the researcher to be aware of any personal biases. However, the researcher acknowledges it is possible that her own experiences as a graphic designer and design educator may have impacted her interpretation of the data and is therefore a limitation of the study.

Need for Further Research

The findings of this study help fill a void in the existing research and offer a foundation from which to build on as future investigation continues to explore the use of iPads in graphic design. Recommendations for future research are provided.

Incorporating iPads into a semester-long course or into an entire graphic design program may allow students to gain more than a novice-level of experience using the device and software. This inclusion would allow the study to be conducted with an increased number of participants who would have a prolonged exposure to the devices and software. The study population could also be expanded to include entry level design students who are just learning sketching skills and other idea generation techniques. Participants in this study reported that they were "used to" or "familiar with" sketching using paper and pencil. Therefore, it would be interesting to compare these study findings with a study whose participants started sketching on iPads earlier in their design education. The study could also be accomplished utilizing different devices and styluses such as the iPad Pro and Apple Pen, or the Microsoft Surface tablet. The findings of this study appeared to indicate that the device and stylus were a key factor in students' preferences to sketch with paper and pencil. Therefore, it would be worthwhile to compare these findings with ones using different devices and styluses. Similarly, the study could also be conducted using different sketching apps. There are numerous sketching apps that offer different options such as shapes, lines, and typing tools. Since the lack of these features was a reported challenge for students, it would be interesting to compare the results to similar studies which used different apps for the sketching. Additionally, researchers could study alternative ways the device could be used to

support other idea generation techniques. There are many techniques, besides sketching, that students use for brainstorming ideas such as mind-maps, word clusters, and active/passive searching. Finally, one of the study participants mentioned being color blind and finding it helpful to be able to select a named color from a list. Therefore, a study could be conducted looking at iPads or other similar devices in order to explore how they might be used as a type of assistive technology.

Conclusions and Recommendations

Dating back to the Renaissance, artists and designers utilized sketching for brainstorming and idea generation. It provided them with a means to transfer ideas from their heads onto paper. Researchers in the field of design have long considered sketching to be an essential part of the design process. Benami and Jin (2002) explained that the more concepts created during the early stages of the design process, the more options there will be to choose from, eventually leading to a more fully developed final design. Dong (2005) added that drawing sketches is critical to the design process because it acts as a graphic representation for thinking, communicating, and evaluating design ideas.

Today, sketches can be made anywhere and on anything. Designers can sketch on paper with a pencil or draw digitally using a computer or mobile device like an iPad. Recent reports indicate that more than 50 percent of college students have iPads or similar devices—and that number appears to be increasing each year. Cheng (2016) explained that because these devices are lightweight, they are easy for people to carry around. Stewart (2014) added, "If you're an illustrator, artist or graphic designer, you can work effectively on the move—sketching, painting, prototyping, and annotating photos" (para. 2).

In the world of graphic design and design education, sketching matters. And yet, while numerous studies have been conducted comparing paper and pencil sketches with those generated on the computer, there was a void in the research regarding sketching on mobile devices. Therefore, this study aimed to fill that void by exploring how upper-level graphic design students perceived sketching on iPads.

The majority of the participants in this study indicated that they still preferred sketching with the more traditional paper and pencil, however they did find some benefits to sketching with the iPads such as the ability to use color and different drawing utensils. The participants also reported utilizing the iPads to promote other types of idea generation techniques such as active and passive searching. Therefore, the researcher believes iPads could be incorporated into design courses as a way to supplement current teaching practices. For example, students could utilize paper and pencil for initial idea generation sketching and then use the iPad camera to photograph the sketches they wish to develop further. The students could use a sketching app to add color or change the look of lines.

Students could also be encouraged to use iPads to explore professional graphic designers' portfolios, connect with other designers via social media, view software tutorials, create Pinterest boards, and search websites. Evers and Kendra (2002) recommend that graphic design students keep an inspiration file containing other people's work or anything they find inspirational. "While you are looking for things to collect, you are opening yourself up to a wider range of visual cues by paying attention to what you may have overlooked in the course of everyday life" (p. 9). Rather than keeping a physical, hard copy inspiration file, students could be encouraged to create one on the

iPads. They could use the camera to take pictures of or video everyday things they find inspirational. They could also download and save items found online. The files could be stored on the device and/or backed up to the Cloud for safekeeping.

Final Assertion Statement

Despite the difficulties encountered, the participants and researcher still believe this type of technology has potential. The ProCreate app, Third Generation iPad, and standard stylus may not have been the optimal choice, but the possibilities are so great as to make the disadvantages moot. The researcher believes this type of technology has a place in graphic design education and should be incorporated into courses. More importantly, the participants also believed they should be using tablets in their design courses. Benjamin perhaps said it best when he explained, "I follow a lot of designers on social media and I see a lot of designers who are professionals use tablets to do a lot of their work. As students we should be learning what is current in the industry."

The process of meeting and interviewing students for this study, as well as analyzing their iPad sketches, was an interesting and enlightening research experience. The researcher looks forward to exploring this phenomenon further in the future.

APPENDICES

APPENDIX A

E-MAIL TO INSTRUCTOR

Greetings,

My name is Elizabeth Becker. I got my undergraduate degree in communications with an emphasis in Graphic Design. I then got my Masters in Industrial Technology and during that time was a GTA for some Graphic Design courses. I wrote my Thesis on how Graphic Design students develop creativity specifically look at the and in all of the courses, I taught, having students sketch out their ideas was part of every assignment. But after a while I noticed that students were rushing through their sketches just to get them done or were in fact waiting until after the assignment was complete and then sketching just so they wouldn't lose points for not having them.

I am now working on my Ph.D. in Teaching and Learning. I am still passionate about graphic design and sketching ideas. Additionally, I have also developed interests in the use of instructional technology. For my dissertation I am expanding on my masters and looking at how iPads could be used for sketching and idea generation. I understand, from looking through the course catalog. that you are teaching an advanced graphic design course this semester. I was wondering if you would be open to my coming to the class to explain my study and see if students are interested in participating.

Thanks so much for taking the time to read my email, Elizabeth Becker

APPENDIX B

STUDY HANDOUT

Students' perceptions of using iPads to create sketches and promote idea generation

Study Purpose:

a) Whether or not sketching on iPads has an impact on students' idea generation process

b) Whether or not students perceive a difference in using iPads versus paper/pencil for sketching

c) Whether or not students are able to produce higher quality sketches on the iPad.

What this would mean for you:

- About a two hour time committment which would include two interviews and taking home an iPad for a 48 hours and completing a sketching activity.
- The first interview would be the longest and in addition to the interview include reading/signing the Informed Consent Form and learning how to use the sketching app.
- For your participation you will recieve a Stylus and your choice of a $10 iTunes or Amazon Gift Card.
- You will also be entered into a drawing for a $50 iTunes gift card.

If you are interested in participating you can contact me at elizabeth.becker@und.edu or fill out the study sign-up sheet at https://und.qualtrics.com/SE/?SID=SV_03dCH0tGGpQZICR.

APPENDIX C

FOLLOW UP E-MAIL TO STUDENTS

Greetings,

I would like to thank you for listening to my presentation today describing my dissertation study. I would greatly appreciate it if you would be willing to participate. Like I explained during class you will meet with me for two separate interviews and also take home an iPad for up to 48 hours to do a sketching activity. For your participation you will be receive a $50 iTunes or Amazon gift card and be entered into a drawing for a $50 gift card. If you are interested and willing to participate please sign-up at https://und.qualtrics.com/SE/?SID=SV_03dCH0tGGpQZlCR or if you have any questions please contact me at elizabeth.becker@und.edu.

Thanks,

Elizabeth

APPENDIX D

STUDY SIGN-UP FORM

Please provide the following information.

Name

Email

I am hoping to meet with you for the initial interview between Monday, September 12 and Friday, September 16. I am willing to meet with you at whatever time works best for you (morning, during the day, evening, weekends). In the space below, please provide a couple different days/times that would work for you. This first meeting should take about an hour. During that meeting we will go over the consent form (and if you are interested in participating will sign it), then will have a brief interview, and finally I will show you the sketching app and give you the iPad to take home for 24/48 hours.

What type of gift card would you prefer?

- ○ iTunes
- ○ Amazon

If you have any questions about the study please contact me at 701-777-2737 or at elizabeth.becker@und.edu

APPENDIX E

CONSENT TO PARTICIPATE IN RESEARCH

TITLE: Students' perceptions of using iPads to create sketches and promote idea generation

PROJECT DIRECTOR: Elizabeth Becker

PHONE #: 701-777-2737

DEPARTMENT: College of Education and Human Development

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about the effectiveness of graphic design students utilizing iPads for sketching activities because you are taking advanced graphic design.

The purpose of this research study is to discover and understand a) whether or not sketching on iPads has an impact on students' idea generation process, b) whether or not

students perceive a difference in using iPads versus paper/pencil for sketching, and c) whether or not students are able to produce higher quality sketches on the iPad.

Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 28 people will take part in this study at the University of North Dakota.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in this study will last approximately two hours for 2 interviews and to complete a sketching assignment on an iPad.

WHAT WILL HAPPEN DURING THIS STUDY?

During the initial visit you will participate in a 30 minute interview, which will be audio, recorded. Following the interview, I will demonstrate how to use the ProCreate Sketching App on the iPads. You will then be given the iPad to take home for a period of 24-48 hours for the purpose of completing a sketching assignment. After you have completed the sketching assignment you will return the iPad with the saved sketches to me. At that time will schedule a time to come in for a second 30-minute interview. During the interview you are free to skip any question you wish.

WHAT ARE THE RISKS OF THE STUDY?

There are no foreseeable risks to participating in this study.

WHAT ARE THE BENEFITS OF THIS STUDY?

You may not benefit personally from being in this study. However, we hope that, in the future, other people might benefit from this study because this study seeks to increase an understanding the effectiveness of using iPads for sketching in Graphic Design courses.

The study findings may help educators, researchers, and others affiliated with graphic design programs to develop best practices that can be used to assist students in developing design concepts using iPads.

ALTERNATIVES TO PARTICIPATING IN THIS STUDY

If you still wish to complete the sketching assignment on the iPads, but do not want your sketches included in the study and do not wish to be interviewed, you may elect to do so. You are able to check out the iPads with the ProCreate app regardless of you whether or not you choose to participate in the study.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will not have any costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study. However participants will receive a $10 iTunes or Amazon card and be entered into a drawing for a $50 iTunes or Amazon gift card.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of using pseudonyms. All research records will be kept in a locked file cabinet or on a password protected computer that only the researches have access to. Questionnaires and interview transcripts will be kept for a minimum of 3 years before they are shredded. The interview recording will be destroyed immediately after it has been transcribed. You will have the option of reviewing the transcripts for accuracy. Original sketches will be deleted from the iPads and screenshots will be kept for a minimum of 3 years before being erased.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota.

If you decide to leave the study early, we ask that you we ask that you notify the researcher of your decision. You may be asked come in for a close out interview.

You will be informed by the research investigator of this study of any significant new findings that develop during the study which may influence your willingness to continue to participate in the study.

CONTACTS AND QUESTIONS?

The researcher conducting this study is Elizabeth Becker. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Elizabeth Becker at 701-777-2737 during the day hours from 8:00 am – 4:30 pm. If you wish to contact the research after hours you can do so by sending an email to elizabeth.becker@und.edu.

You may also contact the researcher's advisor Dr. Mary Baker. She can be reached via email at mary.baker@und.edu or by phone at 701-777-6759.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at (701) 777-4279 or UND.irb@research.UND.edu.

- You may also call this number about any problems, complaints, or concerns you have about this research study.
- You may also call this number if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.
- General information about being a research subject can be found by clicking "Information for Research Participants" on the web site: http://und.edu/research/resources/human-subjects/research-participants.cfm

I give consent to be audiotaped during this study.

Please initial: ____ Yes ____ No

I give consent for my quotes to be used in the research; however I will not be identified.

Please initial: ____ Yes ____ No

I give consent for my sketches to be used in the research; however I will not be identified.

Please initial: ____ Yes ____ No

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects Name: _____

Signature of Subject Date

I have discussed the above points with the subject or, where appropriate, with the subject's legally authorized representative.

Signature of Person Who Obtained Consent Date

APPENDIX F

INITIAL INTERVIEW QUESTIONS

1. What is your design process?
2. What is your preferred method for sketching?
3. Do you own an iPad?
4. Have you ever sketched on an iPad or similar device before?
5. If so, what sketching apps have you used previously?
6. What advantages do you see to sketching with paper and pencil?
7. What disadvantages do you see to sketching with paper and pencil?
8. What advantages to do you see to sketching digitally?
9. What disadvantages do you see to sketching digitally?
10. What are your preferred idea generation techniques?
11. What is your major?
12. What other courses have you taken?
13. In addition to your courses what other design experience do you have?
14. What year are you in school?
15. How old are you?
16. Describe your artistic ability.
17. How does your artistic ability affect your sketching ability?

APPENDIX G

SKETCHING ANALYSIS RUBRIC

Criteria	Levels of Achievement		
	Exemplary	Proficient	Needs Work
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail

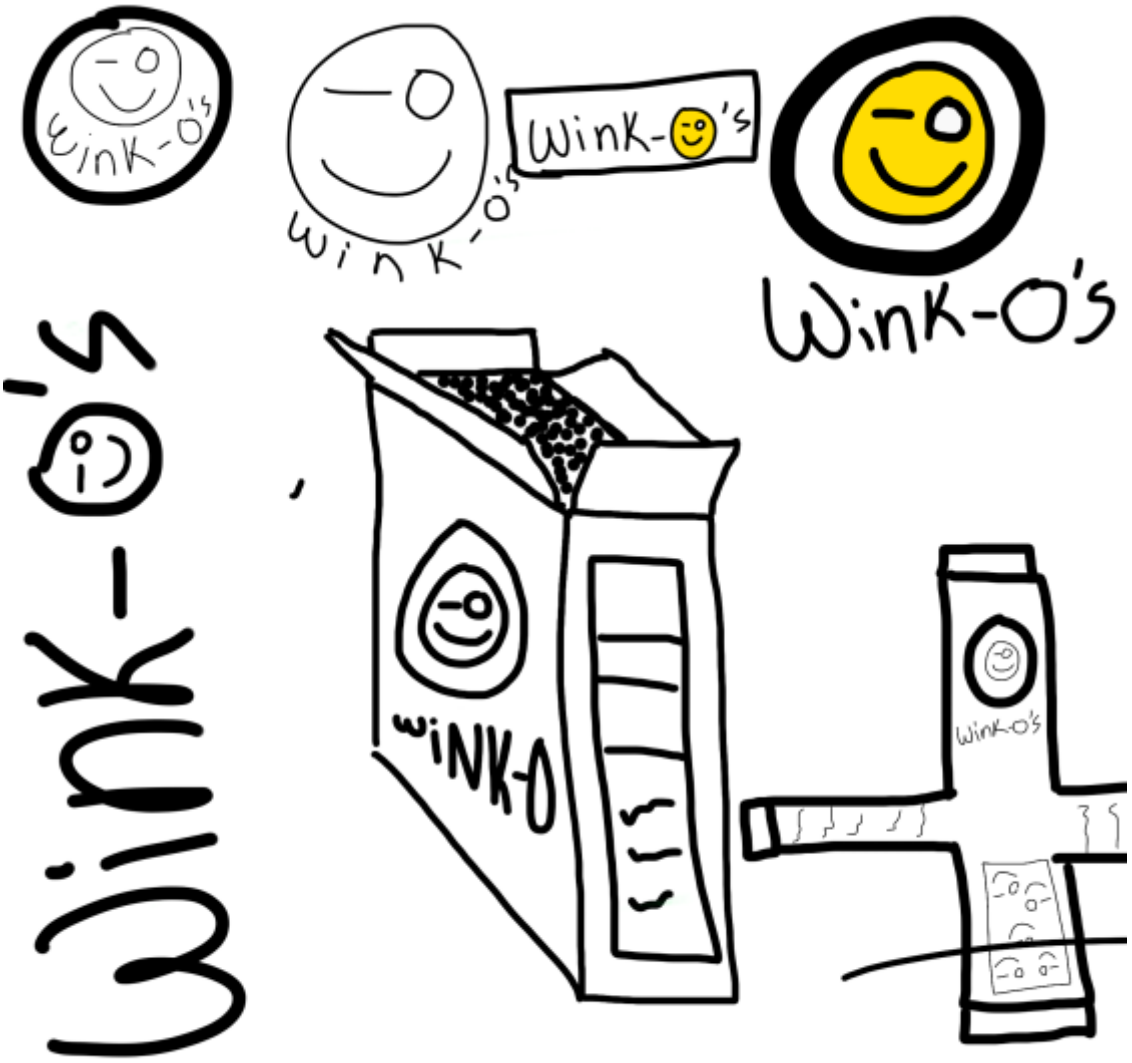
APPENDIX H

SECOND INTERVIEW

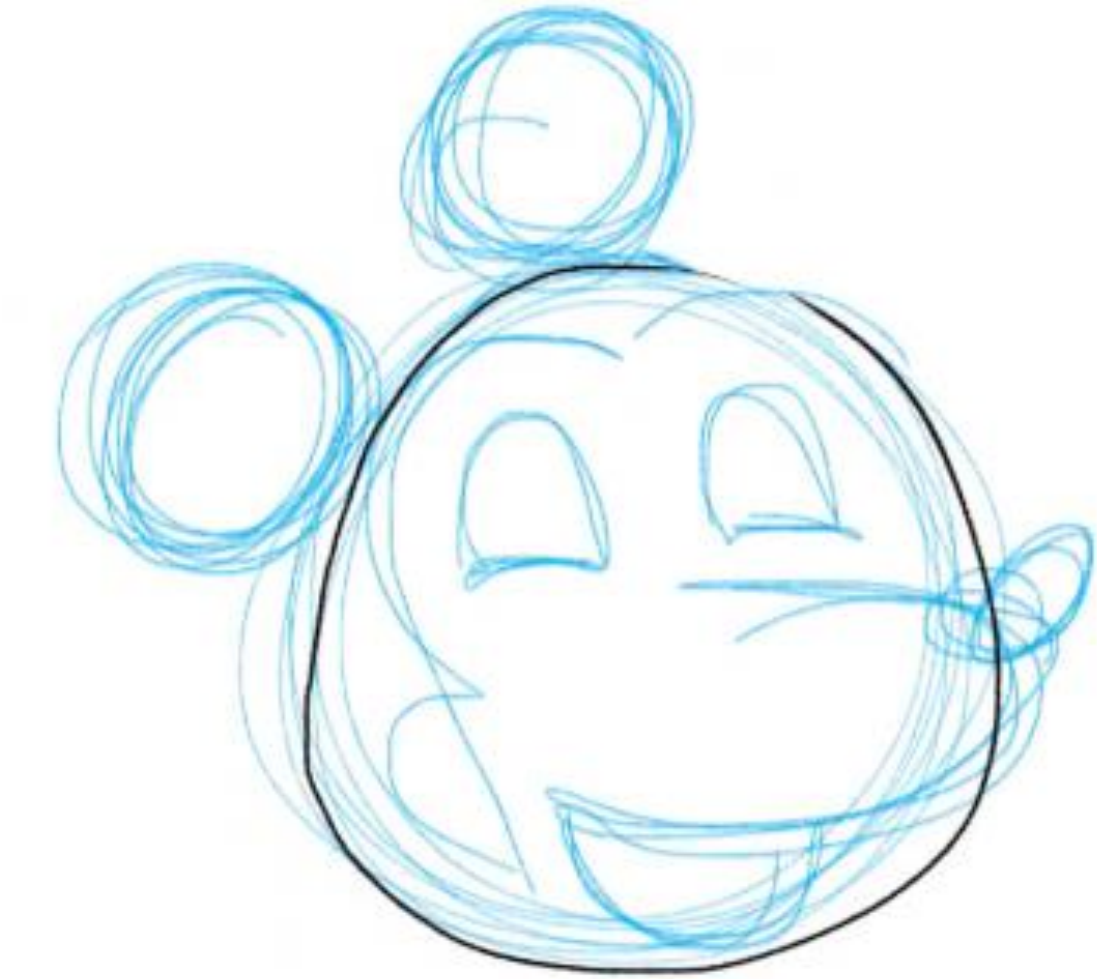
1. Describe your experiences sketching on the iPad. What did you like? What did you not like?
2. With regards to the ProCreate app what features did you find useful?
3. With regards to the ProCreate app what features did you not find useful?
4. How much time did you spend sketching?
5. How does that compare to time you typically spend sketching with paper and pencil?
6. How would you compare the sketches you did on the iPad with ones you have done in the past with paper and pencil?
7. Which do you prefer, paper and pencil or iPad for sketching? Explain your answer.
8. Would you sketch on the iPad again? Why or why not?
9. How did you find using the stylus?

APPENDIX I

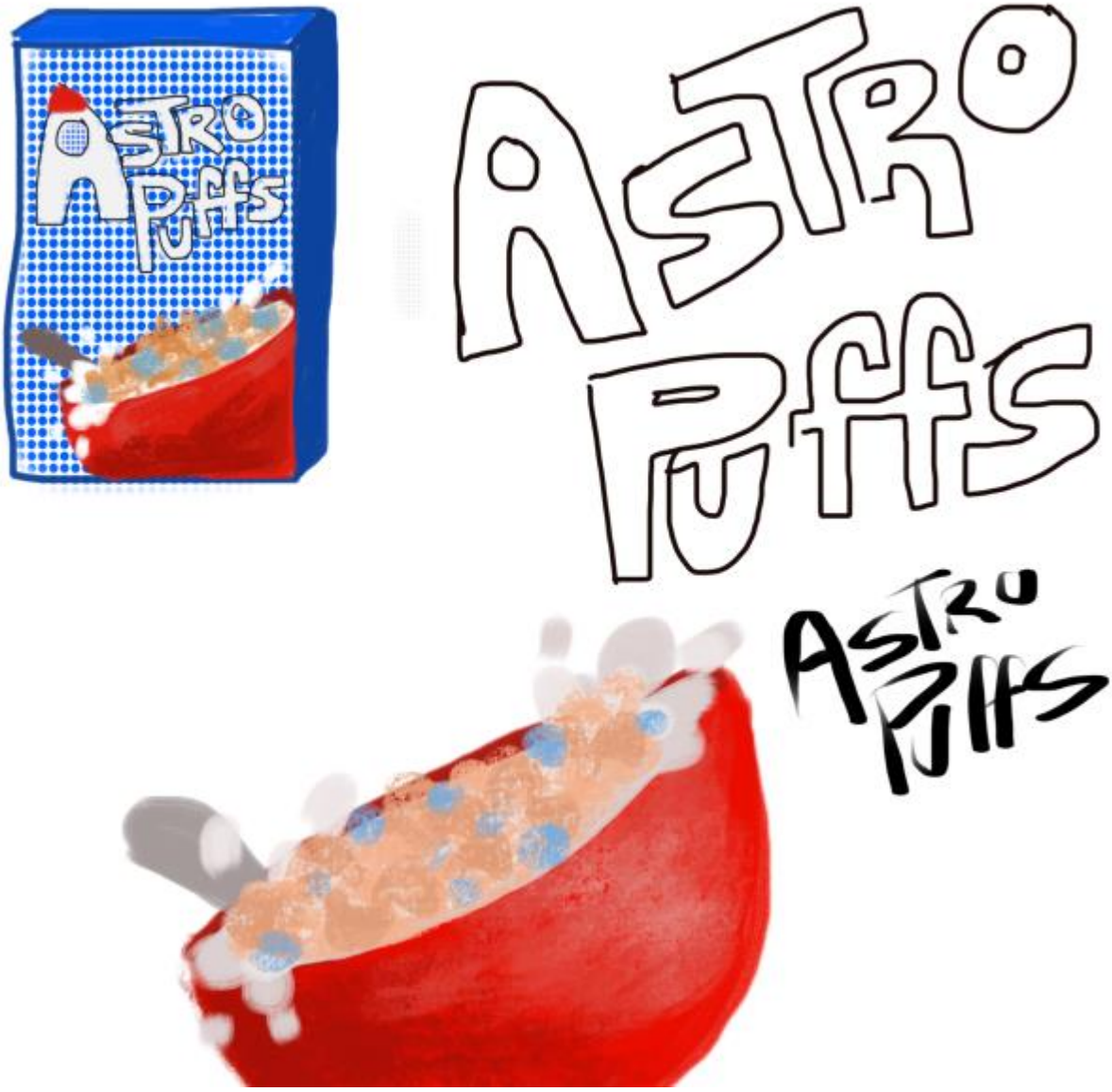
STUDENT SKETCHES



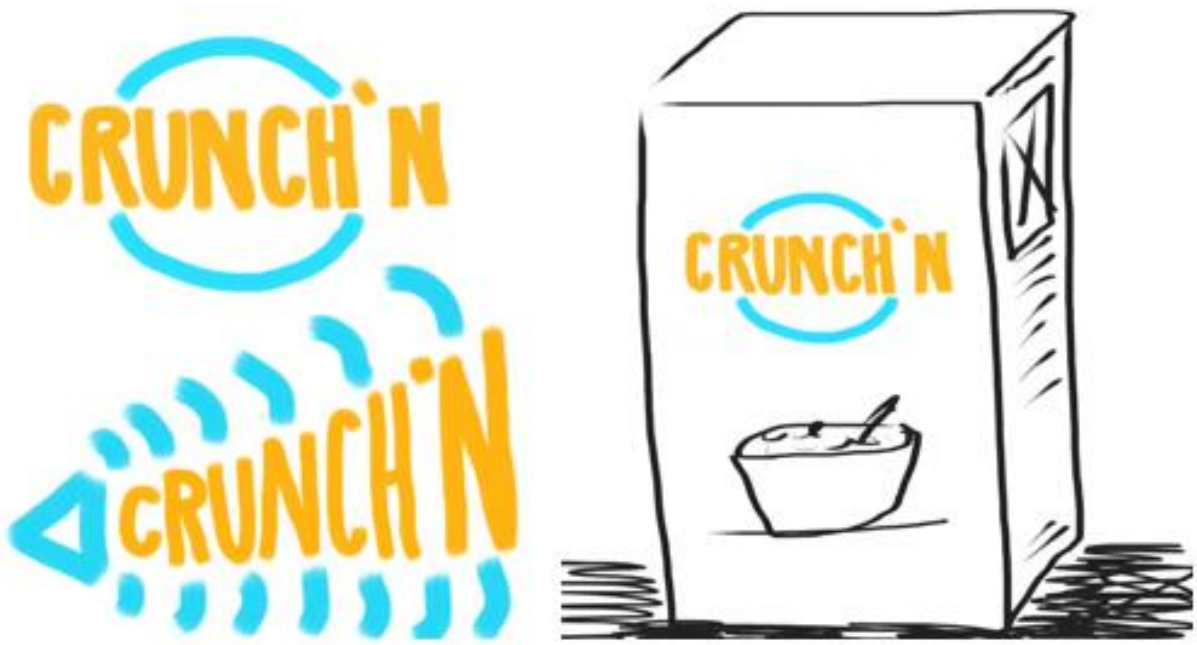
Kevin's iPad Sketch



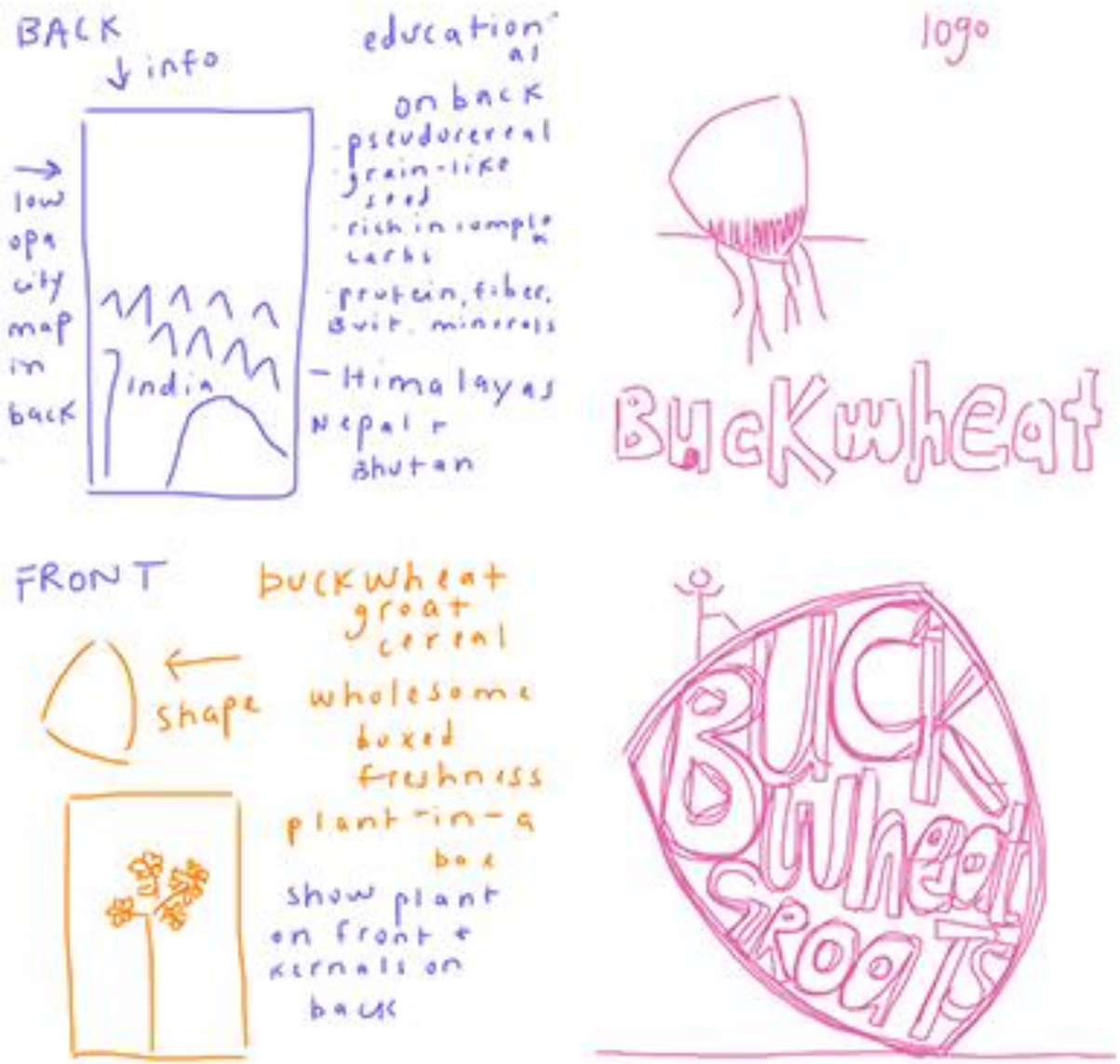
Carrie’s iPad Sketch



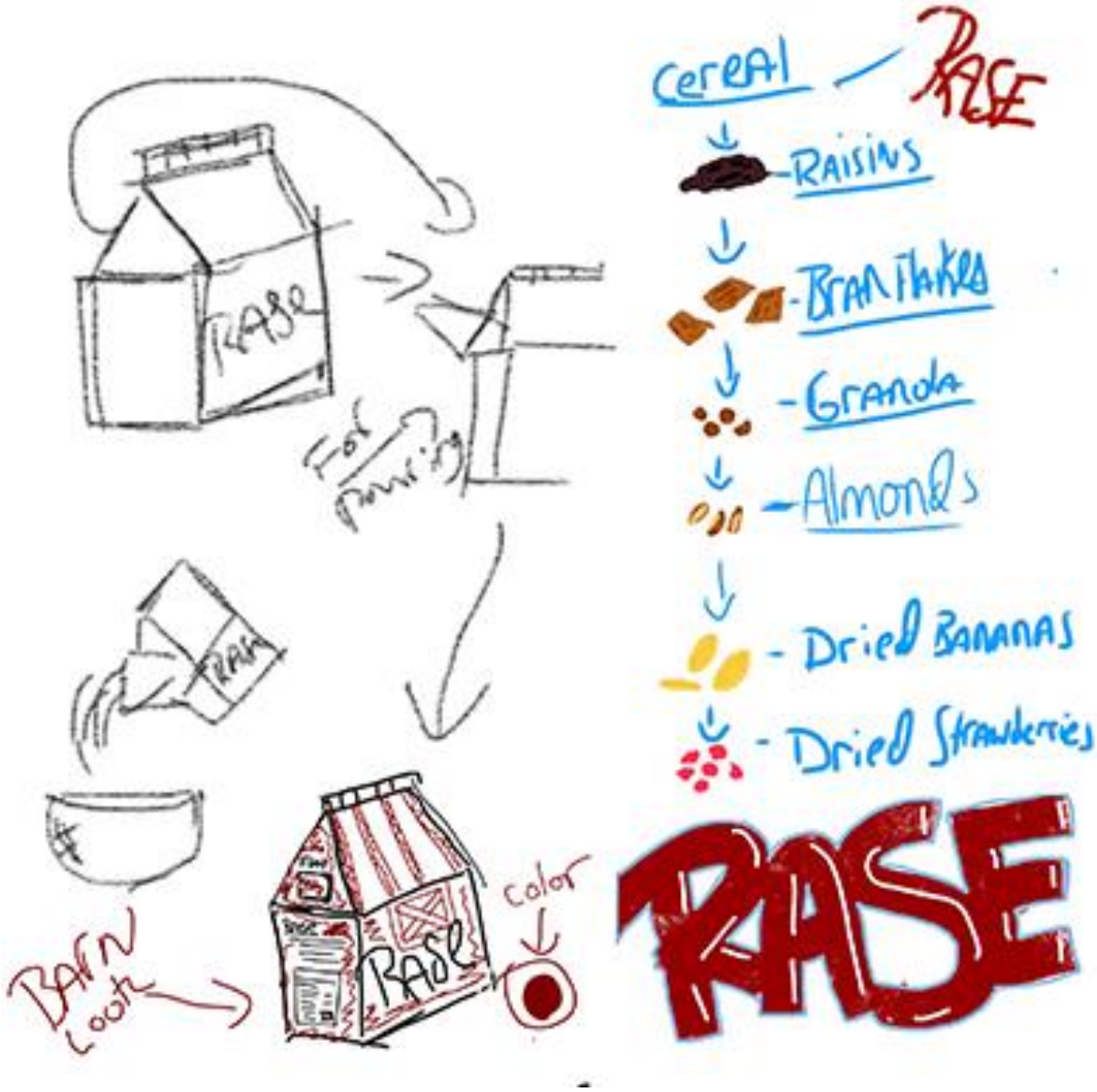
Natalie's iPad sketches



Maria's iPad sketches

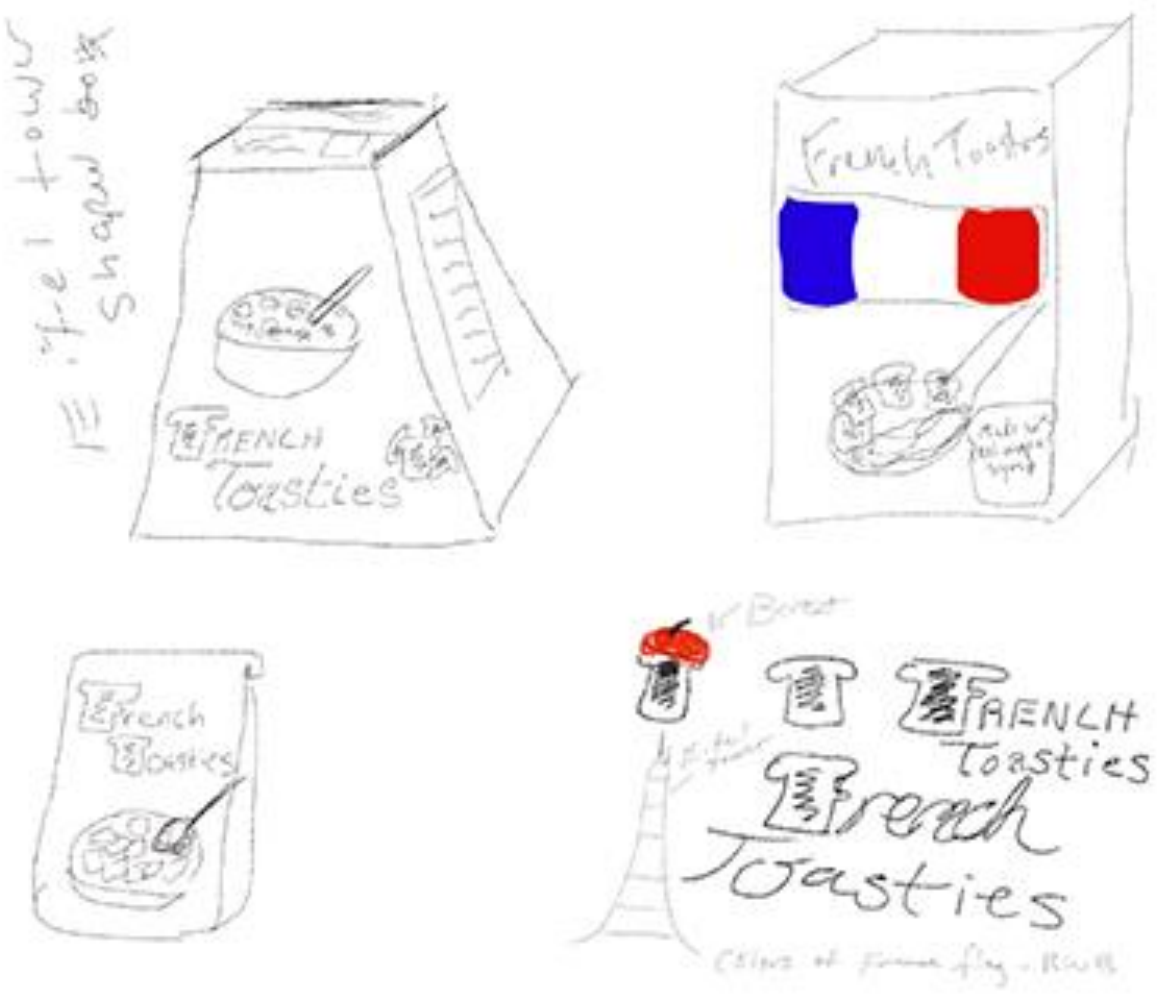


Emily's iPad sketches



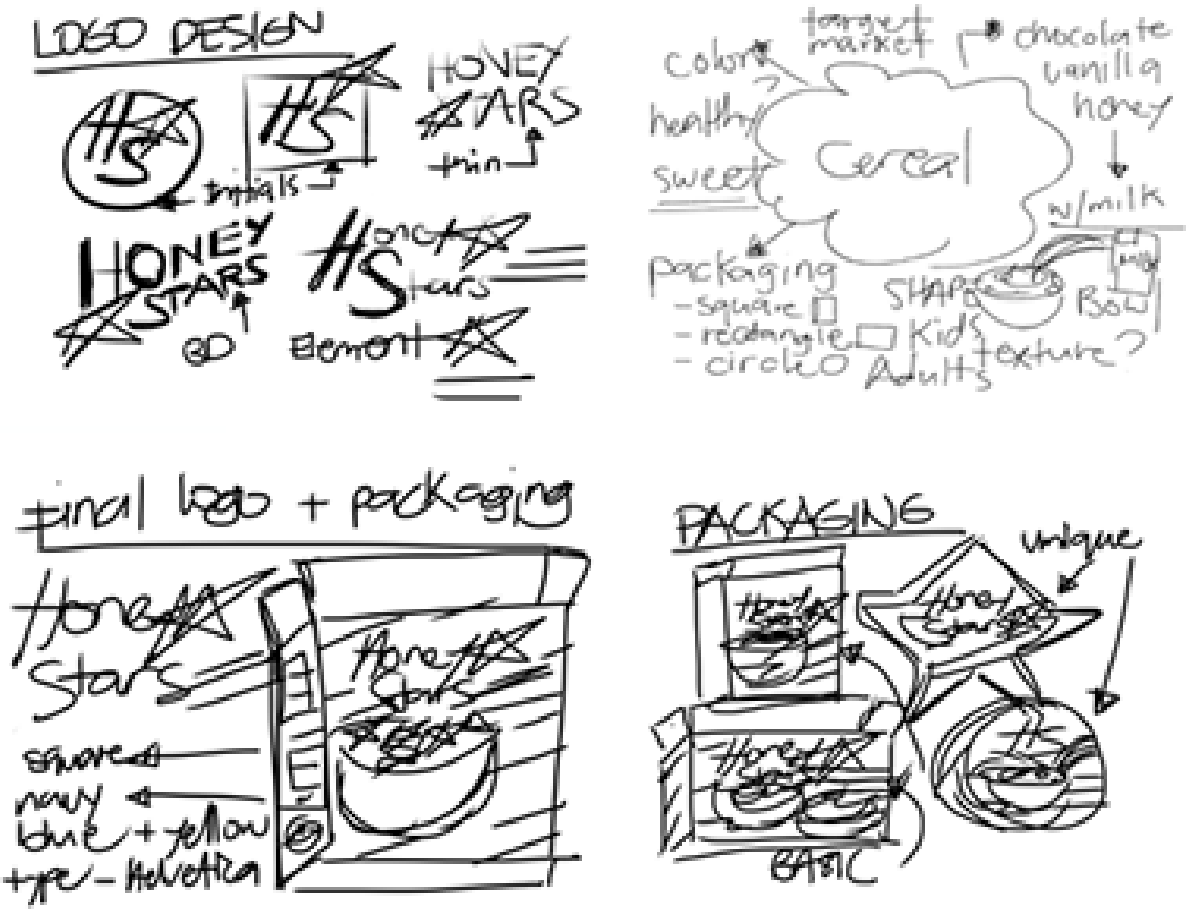
Benjamin's iPad sketches

Michael's iPad sketches



David's iPad sketches

Austin's iPad sketches



Sarah's iPad sketches

APPENDIX J

STUDENT SKETCH RUBRICS

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Proficient:** Box has some nice perspective – can tell it is a box. Can tell where info will go. Not sure what type of cereal it is though.	**Proficient:** Gets the point across that he is marketing something contained within a box, however you are not exactly sure what the product is.	**Proficient:** There were several logo ideas sketched, two with color, as well as box shapes in 3D and 2D with logo placement; unsure what the cereal is
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Needs work:** Would have liked to see some variety to the sketches.	**Needs work:** This is par for the amount of time, brainstorming and energy the student places in the majority of his work. He is quick to go with the first idea that comes to mind.	**Needs** Work: 5 different logo ideas that were expanded from 2 basic ideas; not original or creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Needs work:** not a lot of detail added.	**Needs work:** Definitely needs more detail to communicate what the product is.	**Needs Work:** Sketches include various lines, only one color other than black, and some text; Unsure what the cereal is

Sketch rubric for Kevin

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Exemplary:** Despite not following activity it is clear that her sketch is of Mickey Mouse	**Exemplary:** The sketch is definitely recognizable of what the intended image was to be.	**Exemplary:** Sketch communicates Mickey Mouse, however, this student did not follow the instructions to sketch ideas for a cereal
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Needs work:** Mickey is a very recognizable figure. Nothing real creative about the sketch.	**Needs work:** This student is able to be creative, however it is not shown here since I know she has an instructional booklet of how to sketch these Disney characters.	**Needs work:** Nothing creative about the sketch
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Needs work:** not a lot of detail added.	**Needs work:** Hard to tell since she excels only in areas she is extremely interested in.	**Needs work:** Lines and one color other than black used, otherwise lack of detail; demonstrates novice skill level

Sketch rubric for Carrie

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Exemplary:** Idea for cereal and packaging was clearly communicated through the use of details, shapes, and color.	**Exemplary:** Although you may not be instantly sure why the product is called "Astro Puffs", you are sure to know they are a cereal. I do see the red top to the "A" as if it is a rocket, although the shape could be a bit cleaner, it still reads overall.	**Needs work:** This appears more like a "rough" rather than sketching ideas; there is only one idea, not several sketches to generate many ideas; the one idea is communicated clearly
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Exemplary:** The design was creative and original..	**Proficient:** I would have liked to see the shape of the "puff" to know if it helps to push the concept of a rocket or gastro type of items.	**Proficient:** Name of cereal is creative as is dotted background on cereal box; bowl/spoon with cereal is common, not original
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Exemplary:** Sketches had great detail. Participant had great use of shading and details like the "splashes" of milk coming out of the bowl to make the design pop.	**Exemplary:** The student seems to have a good grasp on the various tools and options available.	**Exemplary:** "Rough" is detailed with lines, shapes, type, color, shading

Sketch rubric for Natalie

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Proficient:** Idea was somewhat clear. Package was labeled but not sure what type of cereal it is.	**Proficient:** Gets the point across that she is marketing something contained within a box, however you are not exactly sure what the product is other than it is usually served in a bowl and is crunchy..	**Needs work:** This appears more like a "rough" rather than sketching ideas; there are 2 logo ideas, not several sketches to generate many ideas; not clear what type of cereal it is
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Needs work:** Lots of crunchy type cereal out there. Doesn't seem very original.	**Needs work:** More brainstorming should have been done ahead of time to come up with something more interesting and different.	**Needs work:** Not enough logo ideas and the 2 generated are not creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Box shows good perspective but doesn't have a lot of detail. Nice that participant came up with different logo ideas.	**Proficient:** For a rough sketch this is what typically can be expected from an average student considering the limited amount of drawing/sketching training they get in there in the introductory level courses.	**Proficient:** Logos and box includes lines, type, shapes, perspective, but otherwise not enough details

Sketch rubric for Maria

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External GD Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Proficient:** Idea was somewhat clear. Shape of cereal was depicted and front and pack were identified and described. Would have liked to see more of what the actual box would look like.	**Needs work:** Where sketches should be more image heavy, these are still very text heavy to communication the concept. With that stated, without the text you would have no idea this is a box, cereal or buckwheat from the shapes presented.	**Needs work:** Lack of ideas generated; limited sketching completed, looks like a "rough" with a lot of text to communicate idea; clear what the cereal will be
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Exemplary:** Never heard of a Buckwheat cereal before so thought the idea was creative.	**Proficient:** Most of her work has a similar theme of healthy and geographical location heavy. These concepts may not be overly diverse to her, yet are compared to her peers overall.	**Needs work:** Her idea to communicate "buckwheat" was common, the plant/seed, so was not original or creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Sketches combine color, text, and some images. Could have added more details – would have liked to see shape of box.	**Proficient:** Rough, but depending on interpretation of what you were asking for, these images could have been pushed further. It takes her a few evaluations to know what the expectations are from the one who has requested such a project.	**Needs work:** Used lines and color, but no shaping, 3D dimensions, etc.

Sketch rubric for Emily

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Exemplary:** Very clear idea of what will be in this cereal as well as how the package will look and function.	**Proficient:** The only concept that is not communicated well is the reason behind his choice of using a barn.	**Needs work:** The idea for this cereal was communicated clearly, but mostly through words, not sketches; there was only one logo idea (type logo) that could be misinterpreted
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Exemplary:** Creative shaped box and name for a cereal.	**Exemplary:** Depending on the reasoning behind using a barn as the packaging, I think it is not only an interesting concept but also very original and creative.	**Needs work:** Creative shape of cereal box (barn) but cereal name could be misinterpreted as "race" rather than the intended raisin (rase) meaning; more thought and sketches needed to generate more creative ideas
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Exemplary:** Great level of detail, especially on the fruits and grains that are in the cereal.	**Exemplary:** Interesting how he is using blue and black for most of the text, yet does have some more color for the individual ingredients, then the basic sketches are almost all in black.	**Proficient:** Used lines, color, shapes and perspective to communicate idea, but no shading or other details

Sketch rubric for Benjamin

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Needs work:** Get that it is a baseball theme but not real clear as to what type of cereal it is or what the package looks like.	**Needs work:** The viewer knows what the product is for since he spells it out with text instead of the visual sketch, however this is the format he usually falls into.	**Needs work:** Although he generated 3 different logo ideas and included one of the logo ideas onto a cereal box, it was not clear what type of cereal it was
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Proficient:** Several cereal use athletes on the box but don't know of one named after a particular sport.	**Proficient:** Most of his work has a sports theme. These concepts may not be overly diverse for him, yet are always quite different than what his peers usually produce.	**Needs work:** Ideas were directly related to baseball: diamond, glove, bat; all are common, not original/creative baseball ideas. However, the idea to create a cereal based on baseball is original
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Use some color, lines, text. But could use more detail as to what the cereal is.	**Needs work:** He is not the strongest student, although he always places a ton of effort into all his work.	**Needs work:** Used lines, shape, dimension, color, but lacks effective details

Sketch rubric for Michael

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Exemplary:** Student sketched several different types of boxes as well as the shape of the cereal. Colors and little beret communicate the French theme.	**Proficient:** Gets the point across that he cereal has different possible packaging concepts, however not exactly sure what the product is other than it tastes like French toast.	**Proficient:** French theme (flag colors, Eifel tower shape of package) is somewhat clear, but not all buyers would relate to these subtleties
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Proficient:** The French theme is unique but there are a lot of French toast flavored cereals	**Proficient:** The shape of the individual cereal bites and the general cereal concept of French toast has already been done before. The two of the three packaging options is the only thing that is different or unique..	**Needs work:** Ideas were directly related to France/French: Eifel tower, flag & colors; all are common, not original ideas. However, the idea to create a package in the shape of the Eifel tower is creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Use some color, lines, text. But could use more detail as to what the cereal is.	**Proficient:** Rough, but depending on his interpretation of what you were asking for, these images could have been pushed much further than this.	**Needs work:** Used lines, shape, dimension, color, but lacks effective details

Sketch rubric for David

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Needs work:** Had to rely on the words to know what the sketch was.	**Proficient:** Although rough, definitely gets the main point across.	**Needs work:** Never would have known it was a light fixture except for the accompanying text; this student did not follow the instructions to sketch ideas for a cereal
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Needs work:** Seemed liked a fairly common lamp idea.	**Needs work:** This is not a new concept overall	**Needs work:** Common idea; not original or creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Use some color and words	**Proficient:** For what was required of sketching for this instructor, this meets expectations.	**Needs work:** Used lines and color; lacks many details

Sketch rubric for Austin

Criteria	Levels of Achievement					
	Exemplary	Proficient	Needs Work	Researcher Comments	Instructor Comments	External Graphic Design Educator Comments
Ability to communicate idea through sketch	Idea was clear and well thought out	The idea was somewhat clear. Some thought went into the idea.	The idea was not clear or not well thought out.	**Needs work:** Had to rely on the words to know what the sketch was.	**Exemplary:** Excellent job providing an in-depth view of her thought process and the reasoning behind what she ended up desiring to be the polished concept..	**Exemplary:** Several variations of "Honey Stars" logo ideas and packaging ideas sketched; visual mind mapping also accomplished
Originality & Creativity	Sketches were extremely original and creative	Originality and creativity were shown in some areas	Little or no original thought was shown in the sketches	**Proficient:** Existing cereal brand but creative packaging ideas	**Exemplary:** She is showing that the tool is not limiting her ability to be creative.	**Needs work:** Literal interpretation of "star" generated; not original or creative
Skill Technique level of detail	Sketches are detailed – making use of color, shading, text, etc.	The sketches have some detail	Sketches lack detail	**Proficient:** Good use of text and lines to communicate idea.	**Proficient:** Depending on how much time she allowed herself dictates the skill level shown. When she has more time, the sketches typically are more polished, although rarely contain color.	**Needs work:** Used lines, shapes, dimension, but no color or shading or other effective details required to communicate ideas

Sketch rubric for Sarah

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