

THESIS

IMPACT OF DIGITAL TABLETS ON THE WORK OF INTERIOR DESIGN  
PRACTITIONERS

Submitted by

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## ABSTRACT

### IMPACT OF DIGITAL TABLETS ON THE WORK OF INTERIOR DESIGN PRACTITIONERS

The purpose of this exploratory research study is to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest is if and how design practitioners are using the digital tablet when generating new ideas for the client within the schematic design phase. Understanding how interior designers use digital tablets during the design process will offer insights concerning their adoption process of a new technology. This phenomenological study was conducted with practicing interior designers in the state of Colorado with a wide range of practice experience. Participants completed a short demographic survey and answered open-ended questions regarding their personal experiences with the digital tablet in their work processes.

The findings of this study shed light on why interior designers use digital tablets in their work process, in addition to providing insight on why they don't use them for certain tasks. The category of participant's motivations for using the digital tablet in design projects included four themes: (1) communication, (2) information gathering, (3) document management and (4) business productivity. The communication theme had three sub-themes that emerged (1) electronic, (2) photographic and (3) visual presentation. The theme of information gathering includes two sub-themes of (1) collection of information and (2) idea generation. Within the category of participant experiences, there were two themes that emerged. They were (1) impact on work processes and (2) potential of digital tablet during design process. The theme, impact on the work processes, had two sub-themes that emerged: (1) advantages and (2) disadvantages.

While the use of digital tablets is on the rise, much is yet to be known about how and why digital tablets are used. This study provides an exploratory foundation, supported by innovation of behavior theory, providing initial insight into the use of digital tablets in the design process.

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## CHAPTER I

### INTRODUCTION

The world has witnessed many inventions that have changed how people work and communicate. Items such as typewriters, telephones, and personal computers have all greatly impacted the global marketplace (Steele, 2012). New technologies have offered interior designers the ability to transform a napkin sketch into a fully rendered 3-dimensional computer model; thereby altering the process of design and communications as we know it (Johnston, 2010).

Technology today has forever changed the way people conduct business and their everyday lives. In the 20<sup>th</sup> century alone, people lived through the birth of the automobile, television and personal computer, all of which greatly impacted their daily events (Lawson, 2006). Implications of such revolutionary inventions often went unnoticed as they progressively became the daily norm. Today, new technologies have become an expectation as useful inventions introduced by companies such as Apple, have become available on an annual basis (Lawson, 2006). An interior designer's job is no different than many others, in that it accepts and incorporates new technologies as they emerge. These technologies have impacted the way interior designers do business, communicate with clients, and even how they generate and communicate new ideas (Kalay, 2006).

At the heart of an interior designer's work is a series of decision-making steps known as the design process. These steps include: programming, schematic design, design development, contract documents and contract administration. Although the steps of the design process have remained the same, how a designer goes about the task has evolved (Young, 2012). As designers move throughout the design process, their distinctive thought processes provide them with the

ability to generate innovative design solutions while meeting clients' needs. This thought process, defined as design thinking, provides solution-focused, problem solving methods while affording innovative mindsets to explore and analyze design solutions (Adams, Daly, Mann, & Dall'Alba, 2011; Cross, 2006; Lande & Leifer, 2010; Lawson & Dorst, 2009).

Within the schematic phase of the design process, creative idea generation is paramount. An idea, defined by Jonson (2005) is a "basic element of thought that can be visual, concrete or abstract" (p. 613). The merging of idea generation with design thinking provides the means for creative idea generation and development to help solve design problems (Weisberg, 1999). With the interior designer's ability to create multiple innovative ideas, the purpose of design thinking is further solidified. Because idea generation is crucial in the design process, researchers have long sought to better understand why it plays such a major role in the design process (Ulrich & Eppinger, 2003).

Sketches are essential for refining and defining ideas and most often related to innovation and creativity in design (Plunket, 2009; Purcell & Gero, 1998). Whether it is reorganization of thought, exploration of possibilities or recognizing potential conflicts, a sketch is the most efficient means to record ideas (Plunkett, 2009). These drawings are critical in how an interior designer thinks about a design problem and develops design solutions (Purcell & Gero, 1998). Interior design practitioner heavily utilize sketching methods to work through design ideas and details along with helping record any "mental notes" that may arise (Pable, 2007).

Sketching for idea generation has been impacted by the introduction of computers into the design process. With the advent of computer technology, today's global marketplace has changed how designers work and deliver products, making many technological tools indispensable (Kalay, 2006; Young, 2012). Although computers have been used in office settings

since the early 1960's, the interior design field did not feel their influence until the 1970's. With the computer's ability to perform detailed tasks, interior designers were relieved of technical project components allowing greater time to be spent on creative design tasks (McLain-Kark, 2000).

As the popularity of technological devices is more readily accepted in the design process, users are becoming more dependent on such devices (Waxman & Zhang, 1995). One of the newest introductions in technology has been the digital tablet (e.g. Apple iPad). This revolutionary device took the world by storm offering a multi-touch display allowing the user to navigate applications via a stylus or finger. With the ability to design on the go, the digital tablet acts as a mental recording device to capture ideas whenever and wherever they strike. Just as a piece of paper allows the designer to record ideas, so does the digital tablet with its lightweight, mobile design (Bilda & Demirkan, 2003).

To date, no studies have been published that address the use of digital tablets in the design process; however several researchers have provided a foundation for this study. Meneely & Dakno (2007) explored the use of digital sketching in design education while McLain-Kark (2000) provided insight on how computer technology can improve end-user design. Additionally Kalay (2006) examines how technology has revolutionized the design profession by exploring the impact technology has had on how designers practice. Most recent, Geist (2011) explored the use of iPad's in higher education finding that students most benefited from increased information access while Brickley (2012) presented findings on using the iPad2 to develop students sketching, listening and observation skills. None of these studies directly explores practitioners' use of digital tablets (i.e. iPad) but do provide insight on how digital tablets are used to exchange information. With technology now taking a central role in how interior designers think, create



and act, identifying how digital tablets are used in the design process and idea generation is crucial to better understanding how the design process has evolved.

### Terms and Definitions

The following terms have been defined to frame the context for this study.

- *Design* is defined as “planning, decision-making and the management of activities which determine the function and characteristics of a finished product or process” (Trueman, 1991, p. 82)
  - *Design Process* is defined by Lawson (2006) as an orderly arrangement of steps that interior designers use to solve a design problem.
  - *Digital Tablets* are a mobile personal computer with a flat touch screen that takes direction via the user’s finger, stylus or virtual keyboard. The device is smaller than a laptop but larger than a smart phone that allows users flexibility and portability (Wieder, 2011).
  - *Idea Generation* is the creative thoughts and processes interior designers use to generate ideas in generating conceptual design ideas (Ulrich & Eppinger, 2003; Weisbeg, 1999).
  - *Interior Design Practitioners* are defined as those that meet the education, experience and examination set forth by the National Council for Interior Design Qualification (NCIDQ).
- Technology* is defined by Cleveland (2004) as the manifestation of physical devices that perform various tasks.

### Generating the Literature Review

Numerous databases were utilized in finding existing research on this subject matter. The core databases used were EBSCO, JSTOR, ScienceDirect, and ProQuest databases. Additionally,

Google Scholar and IIDA Knowledge Center were also utilized. Each of the aforementioned sources provided relevant information on building the foundation for this research study.

Searches of these databases and journals were conducted using the following words (individually and in various combinations):

- Creativity
- Design Process
- Design Thinking
- Digital Tablets
- Idea Generation
- Interior Design
- iPad
- Practitioners Workflow
- Sketching
- Technology in Design

Also, the indices of *The Journal of Interior Design*, *Design Studies* and *Design Intelligence* were searched for relevant articles with preference given to the newest publications on the topic. Current textbooks were used that the researcher had gathered throughout the course of her teaching experience along with conference proceedings attended. Websites for the National Council for Interior Design Accreditation (NCIDQ), American Society of Interior Designers (ASID), International Interior Design Association (IIDA) and the American Institute of Architects (AIA) were also searched for articles and relevant information. In addition to the databases and indices mentioned, several articles were found by reviewing other articles reference lists.

## CHAPTER II

### REVIEW OF LITERATURE

This Review of Literature will outline the importance of design thinking for an interior designer, the process of design used by practitioners and the impact of technology on the field of interior design. In addition, the use of digital tablets in professional practice will be discussed along with the purpose of the study and research questions posed.

#### Design as Process

##### *Design Thinking*

Tim Brown, CEO and President of IDEO, defines design thinking as a discipline that uses the designer's sensibility and methods to match a people's needs with what is technologically feasible and what is a viable business strategy. Lawson (2006) indicates that design thinking includes those "...thought processes which ... identify and understand ... design problems and create design solutions," (p. 9). The process of design thinking involves reflection about the design itself; encouraging creative thinking and analysis and developing new creative strategies. Innovation stemming from this thought process offers creative solutions to the problem at hand (Connell, 2010).

Brown (2009), states that when design thinking is used both as a creative and business management strategy it is comprised of a series of three main principles. These principles often overlap, similar to the design processes phases, without a clear beginning and end. The three principles are "*inspiration*, the problem or opportunity that motivates the search for solutions; *ideation*, the process of generating, developing and testing ideas; and *implementation*, the path that leads from the project room to the market" (Brown, 2009, p. 16). With inspiration and an

understanding of customer needs, these processes will produce more innovative ideas that can be implemented into product design and business management (Wattanasupachoke, 2012).

The iterative nature of the design thinking phases mimic the cyclical nature found in the design process supporting the idea that design thinking is an exploratory process. When accurately applied, this process reveals new information (Brown, 2009). Interior designers not only think creatively, they are practical, technologically driven, creative, aesthetically and culturally sensitive (Dohr & Portillo, 2011). “The ability to see what others have missed, to envision the possibilities others can’t imagine, and to show how out-of-the-box alternatives can work – this is design thinking” (Fisher, 2010, p. 65). Envisioning the future, even while knowing that what the future holds is uncertain and not yet in existence, demonstrates a primary characteristic of design thinking.

According to many well-respected design scholars, design thinking helps designers better understand how people interact within the interior environment. Because of this, researchers have long studied how interior designers approach and solve problems. Connell (2010) states design thinking in relation to the design process is best defined as “a method, a language, a protocol” (p. 67) where designer analyze “creative, practical, strategic, tactical, and pragmatic goals and objectives” (p. 68) that are presented by the design problem. This way of thinking indicates how designers go about the act of designing and the understanding they have about design (Adams, Daly, Mann, & Alba, 2011).

The ability of designers to think constructively while collaboratively solving problems are skills the global community is eager to acquire (Burdick & Willis, 2011). These core skills provide a foundation for much research into design thinking and its various applications within design processes. Research has proven the processes on how designers gather information to

make creative innovative decisions is of great interest within professional business sectors (Clark & Smith 2008; Dorst, 2011; Wylant, 2008). Dorst's (2011) study explored fundamental patterns of design thinking that can be used to help modern businesses to solve problems. Dorst states

Studying the way designers work and adopting some designerly practices could be interesting to these organizations because designers have been dealing with open, complex problems for many years, and the designing disciplines have developed elaborate professional practices to do this. The challenge of dealing with these open, complex problems leads to a particular interest in the ways designers create ... and the way design organizations deal with [problems] in their field of practice (p. 522).

The examination of multiple ideas simultaneously best explains how the designers understanding of what is known leads to creative design solutions (Fisher, 2010). The merging of knowledge and problem solving skills used in design thinking provides a platform for employees to generate creative ideas (Burdick & Willis, 2011). This understanding of how to identify client or consumer needs with creative problem solving is regarded as a competitive strategy by many entrepreneurs (Wattanasupachoke, 2012). The interweaving of design thinking characteristics provides the designer with a solid ability to critically assess strengths and weaknesses of ideas while generating innovative solutions to solve problems.

### *Process of Design*

Often described as “an orderly arrangement of phases or steps” (Piotrowski, 2011, p. 14), the design process is a systematic and coordinated methodology of research, analysis and knowledge integration (Kelly, 2013). The design process naturally enables the designer to explore of what they see, know and do not know when presented with complex projects (Poldma, 2009). These complex projects have caused a slight shift in how designers approach them;

however the five phases of the design process still remain constant. *Programming* includes gathering written and graphic information to use in research and analysis to best understand client needs. It is here project scope and limitations are defined to meet client's goals and objectives (ASID, 2007; Kelly, 2013; NCIDQ; Piotrowski, 2011; Poldma 2009). Just as the process of design thinking starts with understanding the client's needs, so does the design process (Wattanasupachoke, 2012). The *schematic design* stage includes formulation of preliminary ideas and plans shifting the focus from problem analysis to conceptual studies. Ideas generated are conveyed via bubble diagrams, matrixes and sketches creating some of the first visual documents for client review. *Design development* moves the project into decision making stages where ideas are further refined with added detail. The selection of materials, furniture and finishes are incorporated into the creation of detail drawings. From here *contract documents* are produced providing specifications and construction drawings based upon all previous decisions made. *Contract administration* is the final phase where the project is bid and construction starts (ASID, 2007; Kelly, 2013; NCIDQ; Piotrowski, 2011; Poldma 2009).

According to Lawson (2006), the process of design is complex and sophisticated. The complexity of the design process is reflective of the project intricacy an interior designer deals with when working with the built environment (ASID, 2007). Design is not a natural ability, but one that is learned with education and practice (Poldma, 2009). Aspects within the design process are both tangible and intangible (Poldma, 2009) dictating functional, technical and artistic knowledge required to successfully solve problems creatively. Part of the beauty of the design process is the iterative nature lending itself to many different approaches empowering the designer. The cyclical design process steps designers through design problem for successful resolution of problems related to design and allocation of specific interior spaces. Utilization of

such phase's helps keep the process moving forward while immersed in the project ensuring all steps have been taken and the problem is successfully solved (Piotrowski, 2011).

Many design disciplines (architecture, engineering, interior design, and so on) use the design process to guide the development of their design solutions. Ellen Shoshkes states "the design of the process must be as carefully considered as the design of the form" (Poldma, 2009, p. 8). Although each firm's practice structure may vary, the design process is the underlying theme binding the industries together.

### *Idea Generation in the Design Process*

Idea generation is commonly understood as the generation and development of ideas. According to Jonson (2005), an idea is defined as the fundamental element of a thought that is visual, concrete or abstract. All projects start with the generation of ideas that need to be defined and refined (Plunkett, 2009). Thoughts put on paper and ideas generated, rough and unrefined, lie at the heart of every design solution. These initial ideas set the tone for the project as it moves forward providing a foundation for the design approach (Rengel, 2007).

Idea generation, located in the schematic design phase, typically happens at the onset of the design problem when the designer starts exploring concepts and mentally visualizes potential solutions (Dorta, 2008). While design decisions are not made at this stage, the designer analyzes data making assumptions about ideas that need to be further analyzed (Dorta, 2008). It is here where multiple ideas are explored and analyzed based upon research findings and client needs. Due to its location within the design process, its critical interior designers understand the logistics from the start (Poldma, 2009). The techniques used to generate ideas are indispensable as they promote design creativity and innovation supporting design thinking processes (Smith, 1998). Plunkett (2009) stated the following regarding idea generation in design:

Good interior design does not begin with a drawing but with an idea, an ill-defined image that exists for a moment in the imagination and continues to flit, evasively, across the mind's eye. Designing is, in effect, the pursuit of that image: a succession of attempts to define it more precisely, to give it form, to examine it and assess its worth, to make progressively more objective decisions that finalize ideas and to communicate those ideas to clients in the form of drawings and to builders in the form of instructions ( p. 6).

Researchers such as Gero (2000), Shah, Kulkarni, & Vargas-Hernandez (2000) and Shah, Vargas-Hernandez and Smith (2003) have identified the need to better understand the idea generation process. Additionally, the creative thoughts and processes a designer uses to generate ideas has long been studied (Weisberg, 1999). Ulrich and Eppinger (2003) state that idea generation, often enclosed in the conceptual design process, is of special interest in design research as no other design phase has so big an influence on the future product. Even though all drawings are crucial in driving the projects direction, the collaborative early drawings of idea generation are thought to be the most creative. Using design thinking methods to stimulate create thought permits abstracted exploration of ideas to be further analyzed (van der Lugt, 2005).

### *Creativity in Idea Generation*

Creativity is directly linked to idea generation. Cox (2005) states that creativity directly produces new ideas, ways of looking at problems or ways of envisioning new opportunities. Creativity is a critical skill in a discipline where the ability to generate ideas is paramount (Pedersen & Burton, 2009; Piotrowski, 2011). A daily challenge to many interior designers, it is fundamental idea generation and the creative process is well understood.

Dohr's (1982) research discusses the three dimensions of creativity found in literature he defines as the creative person, the creative process, and the creative product. According to Lauer



& Pentak (2008), the creative process focuses on three simple acts, (a) thinking, (b) looking, and (c) doing. Both Dohr (1982) and Lauer & Pentak (2008) provide a solid foundation for the iterative steps that happen to stimulate creative thought processes. Creative thinking is part of the core of how interior designers function and create. When charged with a project, designers innately start the exploration of new methods to create space or objects, answers to problems or making modifications to existing items to improve upon (Piotrowski, 2011, p. 7).

As the interior designer is absorbed in thought processes and idea exploration they are continuously discovering new possibilities for the project (Plunkett, 2009). With the generation of numerous ideas, the interior designer must understand the majority of ideas developed will not come to fruition, but be filed away as part of the project process. Shortcomings will be found in current ideas and new ideas will spin off existing ones, all playing part in the final design solution (Plunkett, 2009) reminding the designer it's not necessarily the quality of the drawing that produces great design, but the content of the ideas within.

### Drawing Processes

Won's (2001) study on the relationship between drawing and visual thinking points out that the production of a drawing is the quickest and most effective means to visualize the thought processes of designers. The drawing the person generates lends itself structure to design thinking, idea generation and communication of those ideas.

#### *Sketching*

Sketching is a common means to generate, internalize or communicate ideas to a client or project team (Dorta, 2008; Jonson, 2005). A deeper understanding of sketching and its creative processes can help offer additional insight on the idea generation process. Meneely & Danko (2007) stated that generating drawings by hand is the most basic way to communicate creative

ideas. “When designers sketch it is usually a private function in which ... give[s] some shape to their first thoughts, but the freehand sketch is also an efficient way of communicating with other members of the design team” (Plunkett, 2009, p. 79).

Drawings take many forms, first more abstract then turning it into a feasible design idea. As the design process progresses, sketches become more structured giving way to greater detail essentially communicating more information about the project (Purcell & Gero, 1998). Initial drawings do not contain the detail drawings produced in later stages, such as construction drawings, need to (Plunkett, 2009).

The ability to construct an effective two- and three-dimensional sketch has been primary in architecture and interior design professions for centuries. The vagueness of a hand sketch can convey new insights and discoveries by the designer. Manipulation of the drawing tool (pen, pencil, etc.); can emphasize objects at the artist’s discretion. With focus being detracted from unwanted drawing details, the interior designer can selectively filter information to ensure understanding of specific areas (Pable, 2007).

### *Practitioners Use of Drawings*

Sketches are used by design professionals for many things in the design process – generation of an idea, floor plan, elevation, perspective or detail they are communicating. Just like different types of technical drawings (e.g. elevations and sections) are associated with later design phases, sketches are commonly associated with the schematic generation of ideas. Drawings used to generate ideas should be free flowing, spontaneous and somewhat abstract indicating the creative process happening (Plunkett, 2009). These unstructured drawings help capture ambiguous ideas that can only be developed with the looseness of a freehand sketch (Gross, Ervin, Anderson, & Fleisher, 1988).

A 2007 research survey conducted by Jill Pable from Florida State University sought to better understand design professionals perceptions of hand sketching. Of those surveyed, 76 percent of respondents felt that by using a quick 3D sketch designers are better be able to understand the big picture in developing a design solution while 86 percent felt sketches should be used to work through design details while developing design solutions.

Practitioners cite many benefits in using sketches in client communication. According to Pable's (2007) survey on practitioners perceptions and use of sketching, "sketches provide a necessary dialogue with a client to communicate intent and feel" while providing a way to "cognitively manage complex projects, support creative thought, and permit productive communication with colleagues and clients" (p. 11, 19). As a result, Pable (2007) suggests that this practice helps educate clients while clarifying any design confusion prompting immediate feedback.

## Technology in Design

### *Technology and Creativity*

Computer technologies have modified the traditional means of how people exchange ideas; revolutionizing how they work (Kalay, 2006). Technology has played a key role in how people within the design process think, create and act. Nelson (2010), states that technology and creativity are intertwined, with each outpacing each other at one time or another. Nelson (2010) cautions that within the last 20 years, technology has started to overshadow the creative process causing great concern.

Most designers can envision how the interior environment should look prior to it coming to life (Fisher, 2010) and are classified as holistic and visual thinkers. Meneely & Danko (2007) support the fact that technology allows the designer to still be a creative visionary but now utilize

artistic and technical means of thinking technology affords. This innate need to visualize the problem dimensionally helps better understand how technology enhances the design process. According to Nelson (2010), history indicates that new technology first becomes an enhancement to tasks and then a significant partner. Because technology is a key predictor of the future, the relationship between technology and creativity in interior design forecasts how interior designers work within design processes. With interior design practitioner's workflow being altered by technology, interior designers creative decision making processes can be allotted more time in turn producing better quality ideas.

### *Technologies Role in Design Process*

The profession of interior design is entering a new era with technology playing an essential role in the daily design processes (Dale, 2010). The speed at which tasks can be performed, ideas generated and morphed with technology is beyond initial expectations. The days of starting a new project with a clean desk and tracing paper are quickly fading and being replaced by a clean desk, and a blank computer screen (Brody 2010).

According to Johnston (2010), technology plays three critical roles in the design process: automating manual tasks while improving precision, enabling and enhancing ideation and improving communication. Tasks that once would take great spans of time, or may even be not possible, can now be efficiently produced thanks to technology in the design process. Workflow increased as a direct result of firms integrating groundbreaking technologies (Kalay, 2006; Young, 2012). In most aspects of the design process it is generally agreed upon interior designers have been "unshackled from the drudgery of production" (Johnston, 2010, p. 207). None the less, traditional methods of design such as hand drafting must first be mastered as the foundation of knowledge required to construct such drawings must be integrated into digital recreations.

### *Evolution of Practitioners Workflow*

Traditionally, the design team's workflow has not been collaborative, as typically one portion of the project is completed by a professional before another professional starts their portion (ASID, 2007). This workflow has led to the production of buildings that are readily accepted, but provide little innovation and creativity. According to the American Society of Interior Designers (2007), a collaborative, integrated design processes "recognizes the relation among building systems and among the team members that design and install those systems" (p. 5). Simultaneous integration by all professionals of technical, interpersonal, organizational, and managerial skills all are crucial when creating innovative built environments.

Due to multiple users being involved in the design process, the introduction and integration of building information modeling (BIM) technology in the late 1980's has helped to reinforce open communication and collaboration between all team members; especially early in the design process. According to the American Institute of Architects (2007), "BIM can combine, among other things, the design, fabrication information, erection instructions, and project management logistics in one database, it provides a platform for collaboration throughout the project's design and construction" (p. 10).

With design firms challenged to produce modern designs faster and more efficiently, the design industry is constantly adapting and evolving (Horst, 2012). Integrated Project Delivery (IPD), as defined by the American Institute of Architects (2007) "is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results" (p. i). Integrated project delivery resulted from the recognition of the collaborative nature of the design process and the integral role each professional plays from project start better reflecting the

role of technology in the design process. Two key players in the design profession; American Society of Interior Designers (ASID) and the International Interior Design Association (IIDA) have also acknowledged this change in design professionals' workflow in support of this project delivery approach.

Globally, IPD is implemented in firms helping design professionals focus on holistic project outcomes by including those professionals not previously involved in early design stages (AIA, 2007; ASID, 2007). With this shift in processes, emphasis is no longer on individual success and instead focused on overall project outcomes resulting from collaborative efforts. Business and professionals from around the globe can now participate in brainstorming sessions generating innovative, knowledgeable design solutions from the comfort of their office (Dale, 2010).

Regardless of the stage of the process, the interior designer works with professionals with varying levels of expertise (Mitton, 2008). The interaction between the design team, client and drawings allows immediate information and idea exchange. According to Johnston (2010), increased communication among all involved in the project; a designer, engineers, contractors, and clients, is one benefit of integrated project delivery that can't be argued. Projects today are complex, done on tight time frames and even tighter budgets making efficient communication vital.

### *Software Used in Design Practice*

Numerous software options are available for interior designers to use during the design processes. Brody (2010) identifies five basic types of software used by designers based on capabilities, costs and interoperability.

1. Microsoft Office Suite; office management tasks.

The Microsoft Office Suite includes a set of programs for word processing, creation of spreadsheets, data management and presentations. These programs have an easy to use platform which provides the user a clean interface to work within (Brody, 2010). Autodesk has now integrated similar interfaces to ensure easy interoperability.

## 2. Autodesk, Inc. AutoCAD; architectural drafting.

Tasks, such as the creation and modification of hand drawings, that took weeks or months are now reduced to hours or days thanks to the efficiency of computer aided-drafting (CAD) (Johnston, 2010). Computer-aided drafting is unarguably more precise than hand drafting allowing easy manipulation of the space designing. Changes are made quick and efficient with multiple copies being rapidly generated for distribution (McConnell & Waxman, 1999).

The inception of CAD can be traced back to the early 1960's but was not regularly utilized in architecture, engineering and interior design industries until the 1980's (McConnell & Waxman, 1999). At this time, it became main stream in firms due to reduced costs of software and supporting equipment. For decades, popular CAD programs such as Autodesk's AutoCAD have allowed designers to work within the design process without great impact on the processes structure (Taute, 2005). Once a cutting edge program more traditional designers feared is now widely used and readily accepted as a drafting standard.

## 3. Google SketchUp; three-dimensional sketches.

This software is "billed as an intuitive, easy-to-learn 3-D tool to be used during the conceptual phases of design" (Johnston, 2010, p. 208). Introduction of this

software filled the niche that AutoCAD could not by providing a quick and easy visualization tool (Johnston, 2010). It supports the mind to generate ideas freely, and has long been known for its easy to use multi-purpose three-dimensional modeling capabilities geared mainly towards conceptual drawings. The program does not focus on solid modeling, but instead on object faces. Due to this, drawing size is greatly reduced allowing the designer to quickly maneuver in the model without the longer regeneration time of BIM programs. Low costs (if any) associated with Google SketchUp have helped it quickly become one of the favorite modeling tools for architects and interior designers (Stine, 2012). SketchUp can be exported into AutoCAD for creation of construction drawings, or seamlessly integrated into Revit (Stine, 2012).

4. Autodesk, Inc. building information modeling (BIM) REVIT software; computer modeling.

Building information modeling (BIM) software, such as Revit, permits multiple disciplines to work simultaneously on a project detecting design conflicts prior to construction start (Dale, 2010; Johnston, 2010; Maresh, 2010). Interior designers, architects and engineers are now all part of the same drawing, making changes concurrently within one model (Dale, 2010; Maresh, 2010).

Building information modeling allows the design team to study multiple design options all at once. According to Rundell (2006)

The ability of BIM to capture and reflect design thinking enables interior architects and designers to evaluate, with their clients, multiple interior design schemes ... As a result, less time is needed to achieve consensus on a



particular design ... BIM as a tool for design thinking translates into competitive advantage for interior design businesses (p. 4).

Every part and piece of the building; building materials, finish materials, and furniture; are included three-dimensionally providing the project team with take-off information for ordering certain quantities and materials needed.

5. Adobe Photoshop; photograph and sketching manipulation.

The raster-based image processing software handles many image formats that allow production of high-quality images to be used for a variety of presentation drawings. Images can be manipulated so designers can clearly convey color, texture, scale and more to clients at the click of a button.

Research has proven that designers must carefully select what type of technology, if any, is the best for the project (Kalay, 2006; Plunkett, 2010). Plunkett (2009) stated “designers who use software creatively offer themselves and others, the chance to consider a richer, more accurate and informative representation of their ideas” (p. 10). The key to successful integration of technology is the ability of designers to avoid getting caught up in the two-dimensional floor plan, but instead create a holistic three-dimensional visual image of the interior environment (Taute, 2005).

In a 1991 study conducted by Trueman, the researcher argues that more attention must be paid to the use of technology for managing design projects. By identifying weak areas in the design process that could benefit from technology, a firm’s competitive edge could be sharpened. However, Trueman (1991) and other researchers state that not one single technology should be used throughout the entire design process; instead the technology used should fit the task at hand.

A narrative case study by McLain-Kark (2000), further explores the use of computer technology in the design process using software such as those referenced above. The EPA project by Hellmuth, Obata, and Kassabaum, (HOK) provides an example of optimal technology use in design projects by exploring how it was integrated to create a better design for users. McLain-Kark (2000) substantiates the important use of computers in interior design as technology is a primary tool bridging client and designer, creating interior environments. It is this technology that when used correctly, can positively impact the creative design process.

### Digital Tablets in Design

#### *History of Digital Tablet*

As of this writing, the newest technology on the market is the digital tablet (e.g. iPad), which is quickly superseding the laptop computer. Although the first tablet PC can be traced back to the 1960's the technology boom of the 1980's paved the way for the GRiDPad, manufactured by GRiD Systems, which weighed just less than 1.5 pounds. Compactness of this tablet provided users with a grayscale, backlit screen, internal floppy drive, fax/modem card, and a PCMCIA slot. As the 1990's approached, IBM introduced its ThinkPad offering a color screen. Shortly thereafter what technology enthusiasts defined as the "real tablet PC" faded away and the Palm Pilot took over (Schedeen, 2010).

In 2001, Bill Gates introduced the world to the Windows XP Tablet Edition that included a touch screen and compatibility with the desktop computer (Schedeen, 2010). From this point forward, other manufacturers offered similar products, but it was Steve Jobs that revolutionized the global market on tablet PCs. The unveiling of the Apple iPad in early 2010, provided the world with a device that bridged the laptop computer with the smartphone providing ultimate

user mobility and flexibility. Today, digital tablets have touched all areas of life forever changing the way people interact, far beyond what Steve Jobs envisioned.

### *Digital Tablet Uses*

A digital tablet can be used for almost every task a person needs to complete. From creating a grocery list, photography, business tasks, education and entertainment the digital tablet abilities have far surpassed initial expectations. Today, you will find digital tablets being used by medical professionals to read an x-ray or to pull up a patient chart. Parents are using digital tablets to help teach their children shapes and numbers long before they enter Pre-school. Educators in K-12 have integrated digital tablets into their classrooms in hopes to connect with today's tech savvy student; higher education is quickly following suit. The architecture and design industry is also feeling the impact of the digital tablet as doors are opening forever changing the way interior designers create and communicate.

Digital tablets, such as the iPad, are becoming increasingly popular for features such as a smaller, more portable size, touch screens and extended battery life. The ultimate flexibility and portability of such devices can allow an email to be quickly sent and the information accessed instantaneously. Collaboration around a laptop screen can pose many challenges, but the use of a digital tablet allows all users to actively participate in idea building discussions (Wieder, 2011).

As with the introduction of most new products, the new available digital tools bring forth growing pains causing people to shy away. Technology costs may exceed budgets, user friendliness may be lacking. Personal fears related to use of technology may exist (Nelson, 2010). Digital tablets are facing similar challenges. Many resemble laptops in form and function, but tend to cost more. User friendliness is still being resolved and purchase prices are being reduced.

### *Digital Tablets and the Drawing Process*

Over time, the production of drawings has evolved although modern perception of how sketches are produced lends mainly towards hand production. Digital tablets are causing this to be challenged. Drawings created by hand typically use a piece of paper and pen or pencil. Today, the digital tablet has the stylus meant to substitute the pen and screen in lieu of a piece of paper. Similar to how the piece of paper determines the designers hand movement across the page, so does the digital tablet. The tablet can be rotated, flipped and shifted to fit the thought process of the user. The stroke of the stylus on the screen can create straight and curved lines in both two- and three-dimensions allowing full immersion in the creative thinking process. To best understand how the digital tablet can substitute the designer's sketchbook, Jeff Bezos (2008) offers this insight regarding the creative development of Amazon Kindle's e-book.

We decided we were going to improve upon the book. And the first thing we did was try to determine the essential features of a physical book that we needed to replicate. The No. 1 feature is that it disappears. When you're in the middle of reading, you don't notice the ink or the glue or the stitching or the paper – all of that disappears, and you're in the author's world. Most electronic devices today do not disappear. Some of them are extraordinarily rude. Books get out of the way, and they leave you in that state of mental flow (p. 1).

### *Digital Sketching*

As interior designers are becoming more familiar and proficient in using digital tablets, early sketches will increasingly be generated using digital tablets as they have changed the way practitioners go about idea generation (Brandon & McLain-Kark, 2001). As of late, researchers have demonstrated increased interest in the exploration of idea generation using digital sketching

methods in design studios. To gain insight into the subject matter, one can look to education as current research reports are found here. The relationship between interior design education and practice is deeply intertwined, with a solid sequence of education, experience and examination found in the definition of the interior design profession (NCIDQ, 2012). Founding principles indicate the competencies an interior designer must have, defined by a common body of knowledge with a clear indication of the relationship between interior design practice and education (ASID, 2007; Guerin & Martin, 2004; Harwood, 1989).

Brickly (2012), presented her experiences on using iPad technology to increase interior design students understanding of traditional design skills such as sketching, listening, observation, writing and presentation in foundation studios finding increased levels of confidence in student sketching with the use of digital tablets. Additionally, Meneely (2007 & 2012), explored the benefits of digital technology in classroom sketching using the framework of motive, mind and media in evaluating student success. Motive focuses on the core philosophies and processes design student's value with the emphasis of mind being on the mindsets that govern the use of technology in design education. Media then provides exploration of how tools empower design students to achieve their goals. It was discovered that participant motives for learning had more to do with meeting the demands of technology than supporting their design processes making understanding of how participants view technology in early design stages crucial (Meneely & Danko, 2007). Media analysis shed additional insight on how technology impacted their design processes indicating digital sketching reduced certain technological barriers as it didn't require the activation of a command to execute a line, participants could just draw. Additional benefits, such as increased flexibility of idea generation and ability to adapt ideas quickly and easily, were also cited. However, some participants felt digital sketching was

better suited for conceptual drawing development and not production of presentation drawings. With the alignment of motive, mind, and media, Meneely & Danko (2007) find that technologies role in digital sketching is significant when meaningfully applied in the idea generation process.

For designers that have been trained using digital tablets, early stages of sketching are as likely to be created on screen as in a sketchbook. Drawing outputs can be created quickly and accurately clarifying details that may be unclear by hand (Plunkett, 2009). With the ability of computer programs to transfer early sketches into plans, elevations and other detailed drawings initial idea generation using this technology makes sense. Those that once struggled with generating hand sketches are now able to flourish utilizing available technology (Lawson, 2002).

Problem solving in interior design has been revolutionized by those who use digital sketching in the design process (Taute, 2005). Exploration of ideas happens rapidly, and interior designers can now explore more concepts with less risk thanks to digital tablets. Meneely & Danko's (2007) findings support the use of sketching using digital technology as it tends to reduce barriers to creative thinking because it does not rely on activating commands, like on a computer. The paperless environment a digital tablet creates increases flexibility for the user to generate ideas whenever and wherever inspiration strikes (Meneely, 2010). The savvy interior designer must be prepared to capture ideas swiftly ensuring ideas aren't forgotten, and the digital tablet acts as such a recording device. Hank (2003) states:

The fact that we live in the Information Age has been said too many times. But the fact that drawing is a powerful tool for this information age has rarely been said at all...What is needed are faster ways to get those images on paper, faster ways to get ideas across, and quicker ways to use drawings to get the results we need and want (p. 9, 11).

Due to the integration and acceptance of digital tablets interior designers have adapted, and mostly embraced, such tools have increased their design capabilities.

It is important to remember that designers new to any technology may fall victim to available tools and design features (Brandon & McLain-Kark, 2001). Generation of ideas can quickly be modified by selection of the tool button that can most quickly execute a version of the thought. The disruption this potentially causes to the creative thought processes of the designer may unintentionally steer them away from the core principles of the design thinking process (Dorta, 2008).

#### *Practitioners Use of Digital Tablet*

Little is known about how digital tablets are used in professional practice setting as at the time of this research as iPad technology is only four-years old. Due to lack of research that exists on digital tablets in professional design use for idea generation, we will once again look to education to offer insight and guidance providing a foundation to build upon.

Yazicioglu (2011) found that with the inception of digital technology into the architectural education system, it is possible to reshape the design process providing new approaches to traditional methods of design. Smith and Caruso (2010) cited a recent study by Educause examining the use of mobile technology by college-age students over the past five years. Findings indicated 1.2 percent of college-age students used mobile technology in 2005 with a dramatic increase to 62.7 percent in 2010. Similarly, the Pew Internet and American Life Project found similar trends between eighteen to twenty-nine year olds using mobile technology (Smith, 2010). It is these students that are emerging into the interior design profession that will be fluent with such technologies that are steadily becoming integrated into design practice. Studies such as this, indicate that “designers of today can no longer be trained to follow a set of

procedures since the rate of change of the world in which they must work would soon leave them behind” (Lawson, 2006, p. 6).

Digital tablets are rapidly becoming a common industry tool. It is not uncommon to see digital tablets in meetings and on job sites being used for information gathering, collaboration, or communication. Design firms are quickly establishing standards of use for digital tablets in various phases of the design process. A wide selection of tools, or applications (a.k.a. “apps”) are available allowing interior designers a variety of options based upon their area of design practice (residential, commercial, etc.), client needs, and phase in the design process (Pable, 2007).

Some designers embrace digital tablets quickly; however, it is not uncommon that the integration of this technology into design practice takes time. Even though opponents of digital technology have valid arguments against their integration, main stream society is responding more favorably.

### *Diffusion of Innovation Theory*

The phenomenon that occurs when a new technological change happens is multi-faceted. To best understand how interior designers adopt such technologies, as the digital tablet, the exploration of diffusion of innovation theory needs to be understood. Rogers (1995) defined diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Bender and Good (2003) cite innovation as “a creative idea, process, product or method” (p. 69) and communication as “the transmittal of information” (p. 69).

Adoption of new technology is not instantaneous. The rate of adoption of new technologies is based upon the individual designer’s perception of the innovation (Rogers, 1995); in this case the digital tablet. Bender and Good (2003) substantiated Rogers (1995) findings



stating that “every innovation has unique attributes perceived differently by each individual. These attributes include relative advantage, compatibility, trial-ability, complexity, and observability of the innovation....the greater the recognized advantages of the new innovation, the quicker the innovation will be adopted” (p. 69). According to Bender and Good (2003) the attributes of Rogers (1995) diffusion of innovation theory are defined as follows:

1. Relative Advantage: the degree to which an innovation is perceived to be better than the innovation it replaces.
2. Compatibility: the perception of the consistency between the innovation and the individuals values, experiences and needs.
3. Trial-ability: the degree to which a person experiments with the innovation on a low-risk, limited basis.
4. Complexity: the degree of difficulty in understanding the innovation.
5. Innovation: the degree to which the results of the innovation itself are visible and communicable to others.

The process of acceptance that takes place when a new innovation, digital tablets, is introduced into the marketplace takes time. Digital tablets can be feared and resisted by many as they pose uncertainties in the generation of ideas. With the creative idea generation process being unbound, it can be a challenge to interior designers to use technology that may put perceived limitations on these creative processes.

#### *Applications for Interior Design*

Today’s global market offers a wide variety of tools and applications available so ideas can be quickly recorded, analyzed, modified then shared. Professional organizations have taken notice of the increased demand for digital tablet applications that support the interior designer’s

job. McMullin's (2012) American Society of Interior Designers (ASID) ICON publication recently indicated applications for the most widely used digital tablet, Apple's iPad, offering increased working efficiency for the interior designer. Applications ICON recommended streamlined portfolio presentations, allowed users to conduct site surveys, take photographs and measurements of spaces, keep project task lists, record notes and observations while browsing latest design ideas. Other bloggers and organizations have also contributed their recommendations on applications that are best for interior design professionals and students.

It is important to remember that with the thousands of applications available, careful selection of the right application tool will weigh heavily on the finished product (Brandon & McLain-Kark, 2001). As Denise Guerin states "...the computer is only a tool...it doesn't do the thinking for you" (Taute, 2005, p. 25). It should not inhibit the interior designer from being creative but should, if used correctly, free the mind (Taute, 2005).

### Significance

To date, little research is published on how interior design practitioners utilize digital tablets during the design process. Kalay (2006) conducted an examination of the implications technology has on design methods, practices and products in relation to design professions. The assessment of the impact technology has had on design practice has been hard to define as it is constantly evolving. Geist (2011) finds that mobile technologies, such as iPads, are most beneficial to access information on the go. The abundant content digital tablets contain: apps, music, videos, news, reference materials, and much more (Rossing, 2012) provide numerous areas of focus for future research. Implications of such technology on the work environment are still relatively unknown as the mainstream phenomenon is just starting to be studied (Geist, 2011).

With such rapid technological advances being made, little published research has been produced on this topic making this area relatively unexplored. Because the technology being studied, digital tablets, are relatively new understanding how they impact the design process, especially idea generation needs to be better understood. Even though most of today's emerging practitioners are fluent in technology, it is how to best utilize such technologies that needs to be better explored. This opens the door for future research on the use of digital sketching means, such as the digital tablet, in the idea generation process (Meneely & Danko, 2007).

#### Limitations

Little published research exists on how the digital tablet is currently being used in interior design practitioners design processes let alone idea generation. It must be understood that the information gathered regarding practitioner use of digital tablets in the design process, focusing on idea generation, may be influenced by the firm's desired use of such technology and availability of such technology to practitioners. Because little published research exists, information gathered will shed light on how the tablet is currently being used providing a foundation for future research.

#### Purpose of the Study

The purpose of this research study is to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest is if and how design practitioners are using the digital tablet when generating new ideas for the client within the schematic design phase. Understanding how interior designers use digital tablets during the design process may offer insights concerning their adoption process of a new technology. In addition, the study may also offer information concerning the manner in which digital tablets may enhance or undermine creativity used for idea generation.

## Research Questions

The following research questions frame this study:

RQ1: How do interior design practitioners' utilize digital tablets during the design process?

RQ2: How do interior design practitioners' use digital tablets when generating new ideas for clients in the schematic design phase?

## CHAPTER III

### METHODOLOGY

This chapter will discuss the qualitative research methods used to gather data in the exploration of how interior design practitioners utilize digital tablets during the design process. In addition, sampling techniques, data analysis methods and study limitations will be discussed. Interpretive phenomenological research analysis will be reviewed as this method is the foundation for the exploratory study being conducted.

#### A Phenomenological Method

The purpose of this research study was to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest was if and how design practitioners were using the digital tablet when generating new ideas for the client within the schematic design phase. Understanding how interior designers use digital tablets during the design process offered insight concerning their adoption process of a new technology. In addition, the study also offered information concerning the manner in which digital tablets enhanced or undermined creativity used for idea generation.

This phenomenological study allowed the researcher to develop an understanding based on the experiences and perceptions of several individuals who have lived experiences with this phenomenon (Creswell, 2007). Phenomenology, which has its roots in philosophy, was proposed by Edmund Husserl as a method of scientific inquiry into the concept of consciousness or of human experience. Originally used to study philosophy and theology, it now spans into psychology emphasizing consciousness and human perception (MacDonald, 2001). Creswell (2007) describes phenomenological research as studying the meaning of experiences for “several individuals of their lived experiences” (p. 57). By analyzing similar experiences through multiple

users, a common experience, or phenomenon, was defined offering insight on the design questions posed (Creswell, 2007).

An Interpretive Phenomenological Approach (IPA), a version of the phenomenological method rooted in psychology, provided further insight into the research participants' experience with the digital tablet from their perspective. Jonathan Smith, the founder of interpretive phenomenological analysis defines IPA as

“An attempt to unravel the meanings contained in...accounts through a process of interpretive engagement with the texts and transcripts'. Such engagement is facilitated by a series of steps that allows the researcher to identify themes and integrate them into meaningful clusters, first within and then across cases” (Willig, 2001, p. 53).

This branch of phenomenology is concerned with capturing each individual participant's experiences with the subject at hand while trying to unravel the complex meaning within (Willig, 2001).

Interpretive phenomenological analysis focused on mainly open-ended, non-directive interview questions allowing the researcher to better understand the participant's world. With the participant being provided an opportunity to share their experiences with the subject matter, the researcher was then provided with an opportunity to gain deeper insight by encouraging participant elaboration on the subject matter (Willig, 2001). Due to the qualitative research design of this study, this method was appropriate as the researcher was looking to gain insight on how design practitioners use digital tablets in the design process and their experiences with the digital tablet. The purpose of a phenomenological study such as this was not only to describe the phenomenon in question, but to interpret the meanings behind it as well (Creswell, 2007).

Phenomenology allows researchers to distinguish between individuals' perceptions of a reality and the reality itself (Willis, 2007).

## Procedures and Research Questions

### *Participant Selection*

In-depth interviews were conducted with seven commercial and residential interior design practitioners from the State of Colorado. Identification of initial participants came through professional interior design organizations such as the American Society of Interior Designers (ASID) and the International Interior Design Association (IIDA) along with the researchers contacts in the commercial interior design field. Eligible participants were randomly selected based on if they were currently practicing commercial or residential interior design, using a digital tablet in the design process and willing to participate in a phone interview. A brief questionnaire was administered to the participants to gather basic demographic information such as gender, age, employment type, highest level of education achieved, length of years practicing, professional memberships and certifications (NCIDQ, LEED A.P., etc.) held (see Figure 1). Each prospective participant was assured of the anonymity of their answers. Once voluntary consent was given, each participant was contacted to arrange an interview time and received a consent form via email.

### *Interview Questions*

Interviews conducted using a qualitative research methodology are generally comprised of open-ended, in-depth, unstructured questions that prompt the participants experiences, opinions and views (Creswell, 2009). For the purpose of this study, thirty to forty-five minute interviews were conducted via the phone as participants were not located where the researcher could easily conduct face-to-face interviews. This procedure allowed the interviewer to control

the line of questioning, and allowed each participant opportunity to provide in-depth information (Creswell, 2009).

Participants were asked a series of questions to better understand their use of digital tablets in general work practices, the design process and in idea generation (see Figure 2). The first set of questions addressed topics such as why the interior design practitioner acquired the digital tablet, the percentage of time they used it for personal or work-related activities, how long they have used it, and what they used before acquiring the digital tablet to accomplish the same tasks.

The second set of questions addressed how the design practitioner used the digital tablet for work related activities. These included photo capture, contract documents, and business related activities such as developing meeting minutes, email/texting and related applications. The third set of questions addressed how the interior design practitioner currently used digital tablets in the design process, how it assisted them in daily design activities, their perceived benefits and hindrances, along user preferences. The final, fourth set of questions addressed topics such as practitioner's use of the digital tablet in idea generation in the design process.

### Sampling Techniques

Due to time and geographic constraints, a small sample of seven commercial and residential interior designers was used. A smaller participant sample was purposely selected for this qualitative and phenomenological study focusing on interpretive phenomenological analysis. Participants were selected for their ability to offer insight on the central research questions being studied due to their personal experiences with the phenomenon, digital tablets, being researched (Creswell, 2009). Participants were selected based upon their experience practicing interior design and current use of the digital tablet in the design process. Such purposeful sampling



helped ensure data collected resulted in a data set that can be analyzed to collect in-depth information and meanings. The intention of the subject selection within qualitative research was to select participants that are best suited to help the researcher gain a better understanding of the research questions posed (Creswell, 2009). To best ensure the suitability of the participants, each participant was selected based on his or her own personal experience with the phenomenon being studied.

Care was taken to ensure anonymity of each participant's response to protect participants from possible professional ramifications should any answers be offensive to or cause conflict with potential clients, employers or other professionals. With exception of the signed consent forms, no documentation created in this research contained participant's names or other clearly identifiable personal information. Additionally, questions asked during the interview process were designed to exclude identifying information, such as job titles or employer's names.

### Data Analysis

This research was considered an exploratory study, as the intention was to find themes that could potentially be studied in greater detail through future research on the subject matter. The motive of this study was to better understand how interior designers currently use digital tablets in the design process and for idea generation.

It was the intention of this researcher to use Interpretive Phenomenological Analysis (IPA) for data analysis. IPA works with participant interview transcripts wherein the four stages of IPA analysis help identify themes and commonalities among data gathered. In the first stage, the researcher read the interview transcripts individually and created notes reflecting initial thoughts and observations the researcher desired to record in response to each interview transcript. From there, the second stage required the researcher to identify, label and categorize

concepts and phrases from each individual interview transcript breaking down the sections of text within. Thirdly, the researcher integrated further structure into the individual interview analysis by listing the themes and analyzing them in relation to each other. These connections reflected the detail the participant's transcribed interview provided. Fourth, the final stage merged all participants' interview themes creating a summary table including those themes that help capture the participants experience with the phenomenon being studied (Willig, 2001).

Participant interviews were recorded, transcribed and coded in accordance with IPA. The end result lead the researcher to conclusions based upon relationships and themes formed from common participant responses.

#### Trustworthiness of the Study

The issues of reliability and validity were addressed in numerous ways. The following verification techniques were integrated into the study to ensure research validity.

#### *Perspective of Researcher*

The researcher acknowledged a bias towards the use of digital tablets and their use in the design process, as a commercial interior designer and interior design educator who currently uses digital tablets in most aspects of their personal and work life. However, the researcher did not wish to impose, directly or indirectly, her opinions onto research participants. Also, the researcher did not desire to influence research participants to answer interview questions in a way that may be false. Research participants interviewed were currently working primarily in commercial interior design and using a digital tablet both personally and professionally so it was assumed some participants had motivations similar to the researcher. However, there were some participants who used digital tablets for other reasons such as firm preference. The researcher identified additional reasons, not yet considered, may exist.

The researcher intended to pose questions in a manner that did not intentionally lead subjects to answer questions “correctly”, but honestly based upon their own experiences with digital tablets. Interview questions were open-ended, resulting in participant responses the researcher may not have anticipated. The researcher discovered, based upon each individual interviews, questions were asked the research did not initially consider. The researcher did not intend to use one set of answers to in-directly or directly elicit responses from the participant to respond in a similar or different manner.

Most importantly, during the interviews, the researcher did not discuss her own experiences, opinions, and motivations with subjects in order to avoid pressuring them to answer the questions with the “right” answer. Due to the potential for social desirability bias, individual interviews were conducted with each participant. In accordance with the tradition of phenomenology, the researcher attempted to suspend judgment regarding the reality of the phenomenon and refrained from drawing conclusions until data has been analyzed and such judgments and conclusions can be found on the certainty of data (Creswell, 2009).

#### *Reflective Journal*

The researcher maintained a reflective journal throughout the data collection process. Acting as a self-reflection tool, the journal allowed the researcher to record reactions to participants’ experiences and perceptions, the researcher’s questions regarding such speculations, as well as emerging trends, interpretations and conclusions (Creswell, 2007). Also, the contents of the reflective journal were used to cross reference data analysis and interpretations (Creswell, 2007).

## Limitations

This study was limited to interior design practitioners who primarily worked in the commercial interior design field as research has indicated commercial firms are most apt to adopt technologies first. Upon conclusion of one interview, one participant indicated they also practiced high-end residential design although they still work on small commercial jobs. The study did not include those practicing interior designers who did not use digital tablets in the design process. Not everyone who was invited to participate in the study had a digital tablet that was currently being used in the design process, but it helped determine which participants were best suited for the study. Participants were asked to refer other possible participants who might be interested in participating in this study if they meet the guidelines, potentially providing a broader scope of participants. It is acknowledged that firm work style preferences somewhat dictated how and when digital tablets were used, potentially skewing results.

## CHAPTER IV

### FINDINGS

The purpose of this research study was to explore how interior design practitioners utilized digital tablets during the design process. Of particular interest was if and how design practitioners used the digital tablet when generating new ideas for a client during the schematic design phase. Understanding how interior designers used digital tablets offered insights concerning the adoption process of this new technology. In addition, the study also offered information concerning the manner in which digital tablets enhanced or undermined a designer's creativity used to generate new ideas.

#### Process

Participants for this study were selected based on their current use of a digital tablet in their job, and for their knowledge and experience with a digital tablet during their work day. The phenomenon of how interior design practitioners used digital tablets in their work processes, design process and for idea generation was studied to ensure that participants would best be able to inform the central research questions due to their direct, personal experience with the phenomenon being studied (Creswell, 2007).

Initially, all potential participants were selected from the Colorado Chapter of the American Society of Interior Designers (ASID) practitioner member category. This category included professional, allied, and associate memberships, but excluded student and industry members. Each of the one-hundred and forty-four participants from this pool was contacted via email to request participation in this study. Follow-up emails and telephone calls were completed to this list as well. Of those contacted, seventeen respondents declined to participate due to either not having a digital tablet or their lack of availability due to their work schedule. The

remainder of those contacted did not respond. A total of five participants came from this initial participant pool.

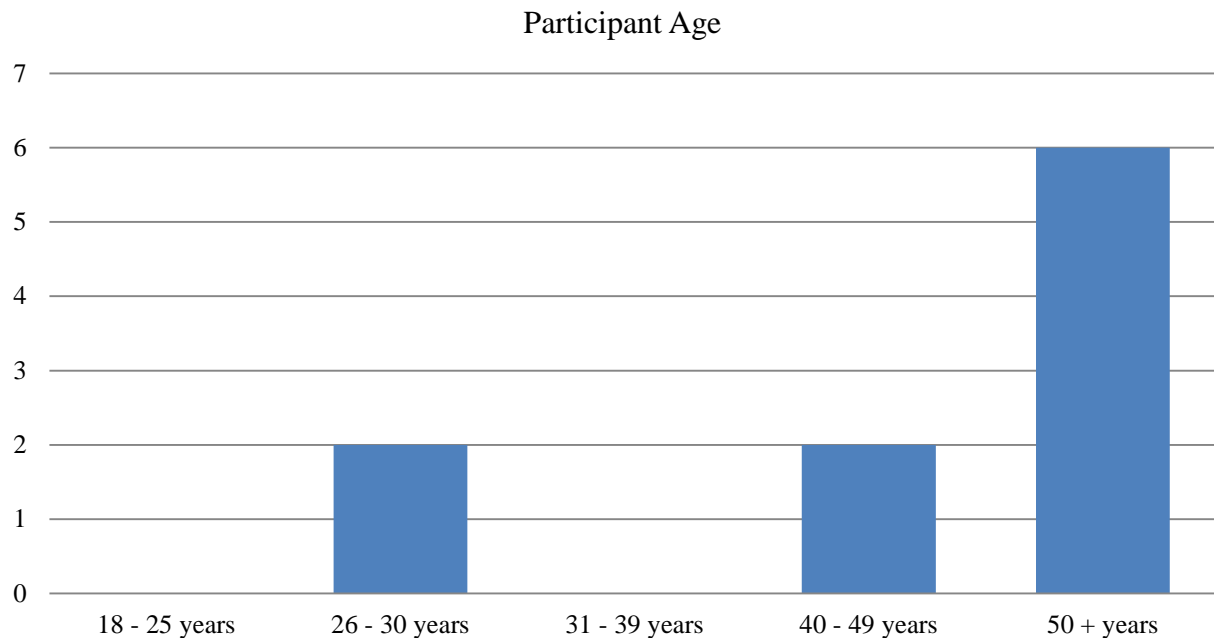
Due to low response rate after the first participant recruitment, the study was expanded to include the State of Colorado International Interior Design Association (IIDA) professional membership. An additional seventy-five potential research participants were contacted via email, taking care to avoid participant duplication from the previous sample set. Follow-up telephone calls and emails were conducted to all IIDA participants. Of those, ten potential participants responded stating they either did not currently use the digital tablet in the design process or currently had work schedules that did not permit them to participate in this study. Two participants agreed to partake in the study, while the remaining sixty-two did not respond. After each participant initially agreed to partake in the study, they were sent the informed consent form, a short demographic survey, and instructions to contact the investigator with times and dates convenient to the participant to schedule an interview. Each of the interviews was conducted on an individual basis to prevent social desirability bias that might occur. The questionnaire was completed and the consent form was signed and returned by participants prior to the study. At the conclusion of each interview, participants were asked to refer other possible participants, snowballing, to help aid in the gathering of qualified participants for this study. No additional study participants resulted from this request.

All seven of the interviews were conducted via telephone and during the work week of Monday through Friday between the times of eight in the morning and six at night at times convenient for the participant. All interviews lasted between thirty to forty-five minutes. They were audiotaped and transcribed. Participants were asked a series of open-ended questions

regarding 1) their experiences with using the digital tablet for general work activities, 2) their use of a digital tablet during the design process and 3) their use of a digital tablet for idea generation.

#### Context: Demographic Findings

All seven participants involved in this study were practicing interior designers who lived and worked in the state of Colorado and who specialized in both commercial and high-end residential design. The sample was all female and represented a range of ages from late twenties to above fifty years of age (see Figure 1).

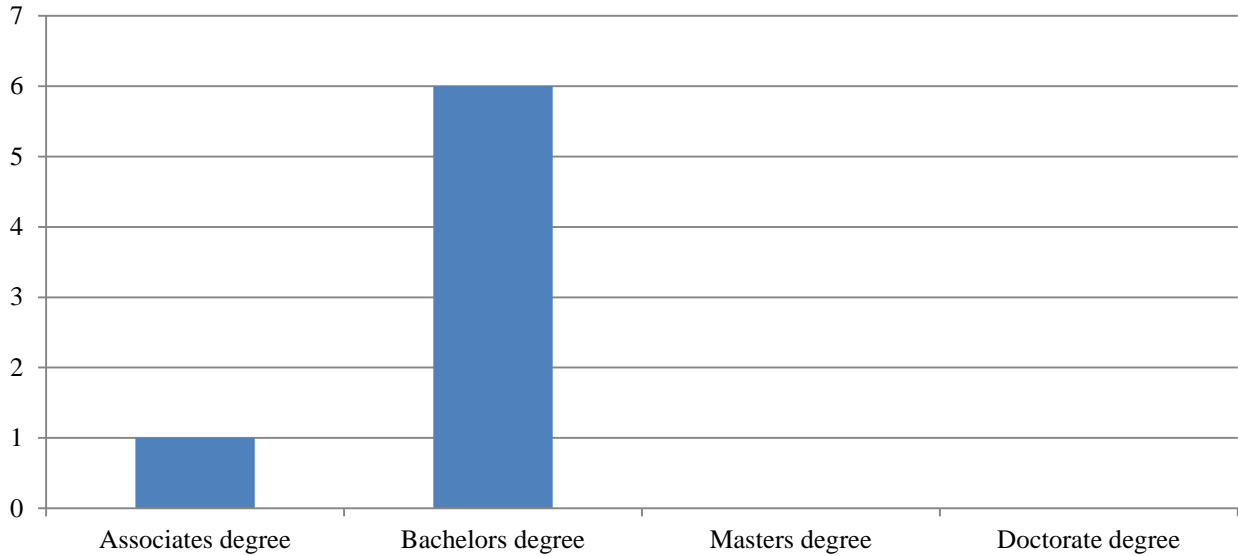


*Figure 1. Demographic Findings: Participants Age*

#### *Education, Employment and Experience*

Four of the participants held a bachelor's degree while one participant held an associates degree in interior design. One respondent indicated a dual bachelor's degree in interior design and business. None of the participants who responded held a graduate level degree, although one expressed interest in continuing their education (see Figure 2).

### Highest Level of Education Completed

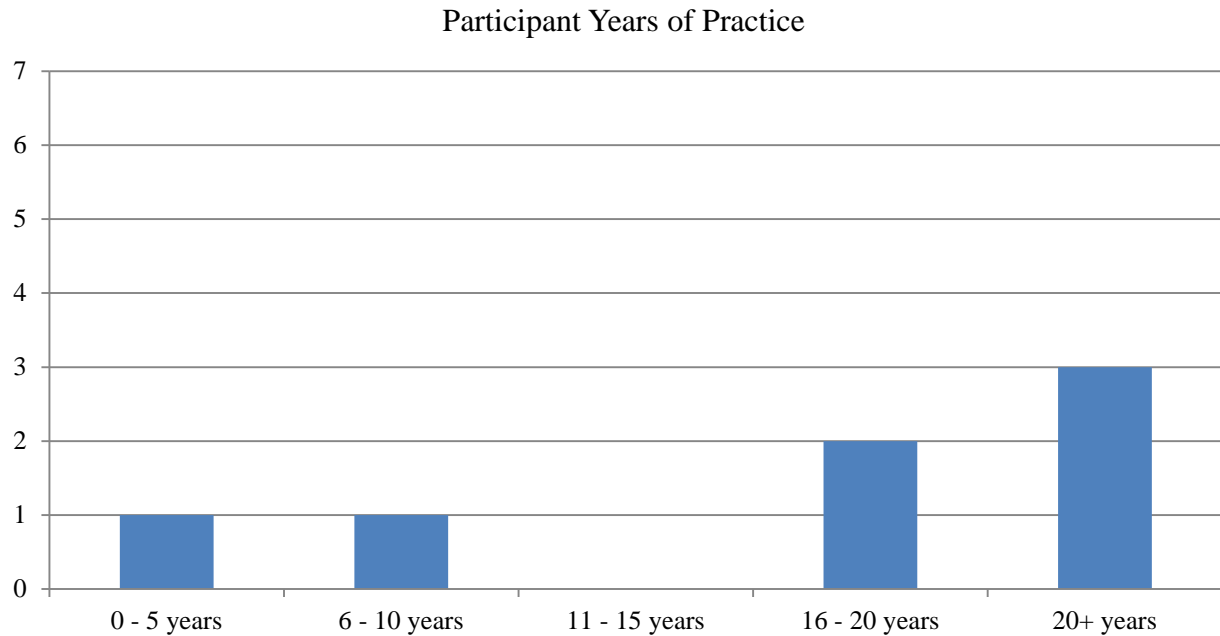


*Figure 2. Demographic Findings: Highest Education Completed*

Four of the participants held a bachelor’s degree from a CIDA (formerly known as FIDER) accredited program, while one participant is unsure.

At the time of the interviews, three of the participants had over twenty plus years of interior design practice, while one participant had been practicing six to ten years and the other participant had practiced zero to five years (see Figure 3).





*Figure 3. Demographic Findings: Participant Years of Practice*

One participant indicated in their interview they had pursued interior design as a second career option, so this could account for the variety of practice years versus age.

Participants represented a wide range of practice experience working on a variety of project types. The majority of participants were small business owners, with the minority currently working in design firms. One participant was an independent contractor/consultant, while the remaining four responding participants were principals/partners/owners in the company that employs them (see Figure 4).

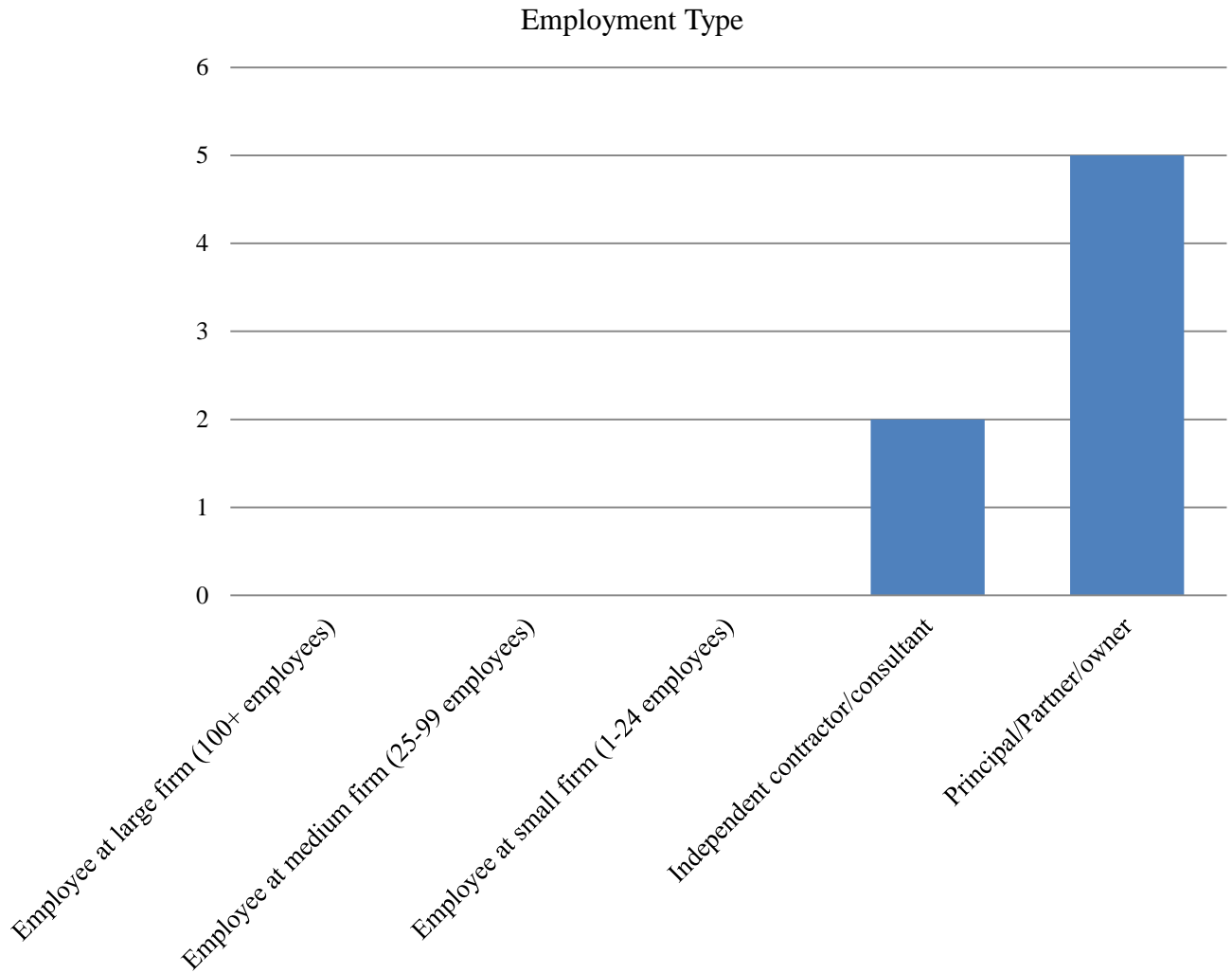


Figure 4. Demographic Findings: Employment Type

#### *Certifications, Licenses, and Professional Associations*

Three participants had passed the National Council for Interior Design Qualification (NCIDQ) exam. At the time of this study, the minimum level of experience among NCIDQ certified interior designers was four years plus the 3,520 hours of qualified interior design experience (NCIDQ, 2012). Three respondents were LEED Accredited Professionals (LEED AP) or LEED Green Associates (LEED GA) certified. One participant held the American Academy

of Healthcare Interior Design (AAHID) certification along with Evidence-Based Design Accreditation and Certification (EDAC) (see Figure 5).

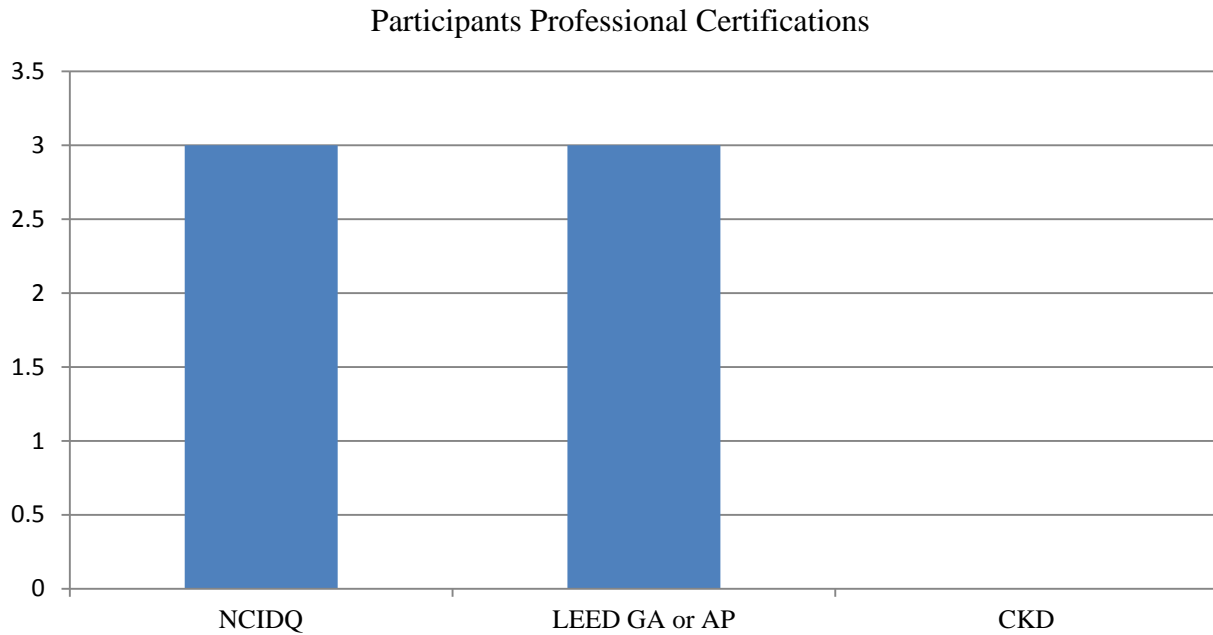
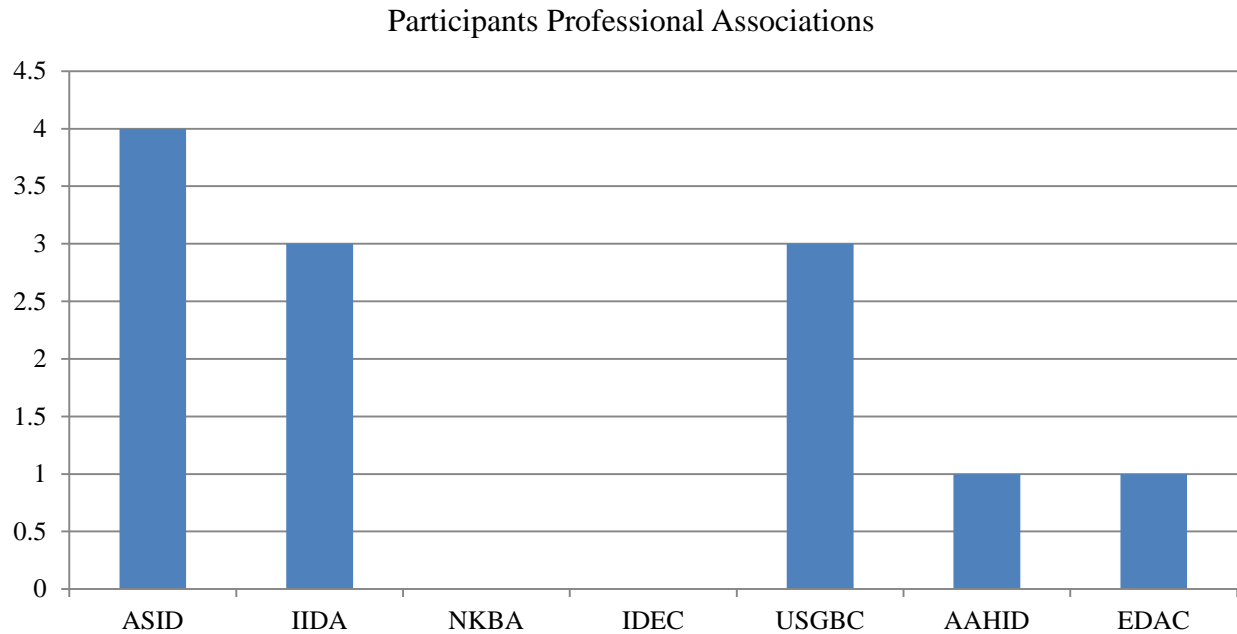


Figure 5. Demographic Findings: Participants Professional Certifications

Of the responding participants, four were members of the American Society of Interior Designers (ASID) and three were members of the International Interior Design Association (IIDA). Three participants were members of the US Green Building Council (USGBC) and one participant was a member of the American Academy of Healthcare Interior Designers (AAHID) and held the Evidence Based Design Accreditation and Certification (EDAC) credentials (see Figure 6).



*Figure 6. Demographic Findings: Participants Professional Associations*

### Coding and Analysis

Each interview was individually transcribed then imported into NVivo10 for coding and analysis. During review of the transcriptions, various themes emerged regarding the areas of interest this study explored. Interpretive Phenomenological Analysis (IPA) systematic nature of analysis was used to explore varied participant descriptions regarding use of digital tablets in interior design. Three distinct phases comprise the IPA method of coding and analysis which were used by the researcher to discover themes and motivations concerning this subject matter. Initially, interviews were individually read and notes created recording initial thoughts and observations the researcher had in response to each interview transcript. Secondly, the researcher identified labeled and categorized concepts and phrases from individual interview transcripts breaking down the sections of text within. Thirdly, the researcher integrated further coding structure into each individual interview analysis by further listing themes and continuing to

analyze them in relation to each other. In the fourth and final stage the researcher merged all participants' interview themes creating summary tables to better display all emerging themes helping capture the participants experience with the phenomenon being studied (Willig, 2001).

Participants discussed several diverse concepts and ideas related to their motivations, thereby providing answers that are coded into multiple segments. Numerous participants answered in great detail, providing responses that were more complex, whereas other participant responses were more direct in nature. Once all coding was analyzed, dominant themes were defined.

### Themes of Study

Two major categories shaped the findings of this study: participant motivations and participant experiences. Within each category, emergent themes and sub-themes were identified. The category of participant's motivations for using the digital tablet in design projects included four themes: (1) communication, (2) information gathering, (3) document management and (4) business productivity. The communication theme had three sub-themes that emerged (1) electronic, (2) photographic and (3) visual presentation. The theme of information gathering includes two sub-themes of (1) collection of information and (2) idea generation.

Within the category of participant experiences, there were two themes that emerged. They were (1) impact on work processes and (2) potential of digital tablet during design process. The theme, impact on the work processes, had two subthemes that emerged: (1) advantages and (2) disadvantages.

## *Participant Motivations*

### Participant Motivation Theme 1: Communication

Communication was one of the most common themes mentioned that related to interior designer's motivations for using digital tablets in their work activities. All seven participants discussed numerous characteristics of communication enhanced by digital tablets during individual interviews. Several sub-themes emerged from this including (1) electronic, (2) photographic, and (3) visual presentation to clients. By far, participants perceived the ability of the digital tablet to enhance project communication as the most important motivational factor for using the digital tablet in their work processes. Participant 3 stated,

You know, I think it helps being in communication all of the time with a client. Yeah, I think that is very beneficial. If I'm at a job site and they want to get ahold of me, I can see it either on my iPhone or my iPad; their request for communication."

### *Electronic*

To enhance communication, participants stated the most frequent use of digital tablets was email with clients, contractors and staff. Generally, they perceived the digital tablet provided an instantaneous method of maintaining contact with the project team. Participant 2 stated, "I can email everybody, the architect, the builder...you can do anything and email it out from where you are." Other participants echoed this statement stating they check their email regularly using their digital tablet, regardless of their location. The ability to email information including photographs, and document redlines, while located anywhere is a feature all participants greatly valued. The ability to exchange information instantaneously was felt by all participants to greatly improve project management and streamline communication.

To continue the cycle of communication, Participant 2 discussed the perceived value of sending staff an email to provide instantaneous project or client information. Requested information included project specifications, contract drawings, documents or other vital project details. The increased project support, through instant communication streamlined the project correspondence process and increased project efficiency. Participant 5 discussed the ability to use the digital tablet to store and organize emails, which in turn provided an on-site project record that could be easily referenced.

The ability to promptly respond to client request via email was discussed by two of the seven participants. However, one participant clearly distinguished between using the digital tablet for client questions that warranted a quick, immediate response versus those that required more thought and input upon return to the office. “Sometimes responses take time to research before you can respond,” stated Participant 3. By utilizing the digital tablet to streamline client communication and obtain pertinent information, such as project clarifications, that needed to be immediately conveyed, participants felt the digital tablet provided additional flexibility further increasing project communication.

### *Photographic*

Participants perceived that there were two important photographic communication capabilities available with digital tablets that made digital tablets valuable for their work. Participants discussed the ability to take a picture of a building site condition to photo-capture an on-screen image to use for future project needs along with the ability to add notes prior to sending to clients or team members. Participant 2 stated,

I do take a lot of photographs and I use the photographs [in my work]... If we are proposing furniture, a remodel or changes, or need to take [images to remember] finishes

or anything, I'll take [photos] with my iPad. And, then when I go in and do the proposal I scroll through the pictures and I can remember everything that I saw, which is fantastic - room by room.

Once a participant captured project details with the camera feature on the digital tablet, they were moved into a document where comments were added and then quickly communicated to clients, staff or contractors providing an instantaneous means of communication. Several other participants discussed the ability to take pictures using the digital tablet and the assistance they offered to recall certain aspects of a project, to create cost estimates, as-built plans or to use as a visual aid in working with other clients. Participant 6 stated,

I'm just visual, as most of us are, visual person; so the pictures tend to help me. I take pictures of areas. And then I use them. When I go in and do as-built drawings I take pictures.

Participant 3 stated, "I like my [digital tablet], especially for site photos, taking photos, categorizing them, sharing a situation with the rest of your team. It's really wonderful."

A majority of participants discussed the quality of images the digital tablet captures. Participant 4 stated "I print everything on photographic paper; there's terrific resolution." Additionally, clarity of image and image size were discussed by several participants as benefits of this technology tool. "It's a great way for me to have the images in a larger format," said Participant 6.

Several participants compared the differences in photographic quality between the digital tablet and their smart phone, the iPhone. Some participants preferred using the smaller iPhone to take pictures instead of the larger digital tablet due to size. Others preferred to take images with their smart phone and then download them to their digital tablet. The transferability and



compatibility between the digital tablet and smart phone was important. As Participant 6 stated, “I find it’s just too big – it’s too big to take pictures with [my digital tablet]. I can take pictures on my iPhone and through the Cloud; they come right onto my iPad.” Participants believed the quality of image and quick viewing ability that the digital tablet provided could not be matched by a smartphone or digital camera.

Another advantage to the photographic abilities of a digital tablet was the ability to add notes prior to forwarding it to peers, clients, or team members. Participants cited the ability to quickly take a picture, whether downloaded from a website or taken with the digital tablet, annotate it, then email it to the client, contractor or staff as a benefit to increase communication during the design process. Participant 6 stated, “I think it’s great with pictures, really great with design ideas.” This feature is particularly important in a predominantly visual profession, like interior design.

#### *Visual Presentation*

Another subtheme within communication was the designer’s ability to use the digital tablet for visual communication and presentation purposes. For example, participants stated the digital tablet was advantageous in increasing their ability to clearly communicate their design concept to the client or team member. Participant 2 stated,

It’s just a good visual. People respond well to visual communication...I can save an idea book from all over onto two different platforms [*Pinterest, Houzz*]. And, that way I can create an idea book...Then, I can open up those for clients. So that helps with the visual.

One participant mentioned their clients respond better to using this form of visual communication than more traditional methods previously used. Participant 5 stated, “When I

meet with the client on initial concepts I bring ideas up, right on my iPad.” Digital tablets were perceived to offer a fluid, portable, user-friendly format to enhance client communication.

The digital tablet was perceived to enhance visual communication if coupled with another output device: a projector or television. Participant 5 stated “sometimes we will even plug one into a TV so everyone can look at it at meetings, like in a conference room.” By using the digital tablet in conjunction with another output device, participants could not only view the image more clearly, but could interact more during presentation. In addition, as the designer fluidly navigated through drawings and documents client edits could be instantaneously incorporated as content was discussed.

Another benefit was identified by Participant 4. This designer discussed the flexibility and convenience her digital tablet provided when working with interior design interns. Interns find the tablet easy to navigate to generate ideas or selecting finishes. One participant stated,

I give it to my interns and whoever needs to use it for certain presentations...they like it a lot for presentations...presentations can be for like the beginning of the project when we are like still going through a lot of ideas and picking and choosing what is going to make it the next best. Or it can be in the end of the design process. For like final presentations and that kind of thing.

Lastly, Participant 5 identified another visual communication advantage with her digital tablet. Her goal is to use it as a marketing tool to develop and store her design portfolio. A design portfolio is used to illustrate design thinking and skills as well as finished client projects, to other clients.

## Participant Motivation Theme 2: Information Gathering

The majority of participants interviewed perceived the collection of information as any task that involves gathering data, ideas or materials to complete initial design proposals or to generate ideas. From here, two sub-themes emerged further defining the usage of digital tablets for information gathering, (1) collection of information and (2) idea generation. Participants discussed aspects of both information gathering and idea generation in detail. The original definition of idea generation, as defined in the literature review to focus on sketching of design ideas, differed from participants' interpretations. Participant 1 defined idea generation as "generating ideas, whether looking for images, doing research, reading up on a material or whatever it might be."

### *Collection of Information*

Participant discussions indicated the collection of information using digital tablets prior to project start was a significant way they used the digital tablet in the design process. Frequently, participants stated this gathering and documenting online information better facilitated their projects. Participant 1 stated,

I use [digital tablets] for doing research, logging that research into other sites such as either *Evernote* or *iCloud* or wherever we are using those materials... I do a lot of research on it; save all that information onto a cloud type format.

Additionally, Participant 5 stated she used the digital tablet for "product research in general." The ability to instantaneously access information participants needed to conduct business, was something all designers frequently discussed. Participant 1 stated,

The benefits [of the digital tablet] are making me more productive...What I find is that I will end up doing research. If I'm waiting for a plane, I will pull my iPad out first to do

work, whether that is looking for ideas or looking at emails much more quickly than I would actually pull out my PC.

The unlimited resources the internet affords to the information gathering process, was extremely quick, flexible and interactive. The majority of participants all agreed that this feature was an advantage to using digital tablets in the information gathering process.

Several participants discussed the benefits of looking up material specifications or being able to reference past clients' project while being on the job site, in a client meeting or traveling. Regarding the digital tablets use for the collection of information, Participant 3 discussed the "convenience and ease of access of getting the information very quickly [as it enables] interaction and sharing of information with clients." Additionally, Participant 5 states, "I research product... and anything I don't need to be doing on paper." The ability to research product and interior finish materials using the digital tablet was discussed by several participants as well. As Participant 6 stated,

We might have a finish or a piece of furniture we are looking at considering and want to make sure we have the right information...It's just a really efficient way to gather information and send it. I can be sitting on the floor in my office doing color schemes while I have my tablet out; I don't have to be going back and forth [between my desktop computer and library]...it's just very flexible. Flexible in terms of where I'm physically orientated, whether I'm by myself doing finishes, sitting at my computer doing drawings, or sometimes I'm in a coffee shop between clients or meetings. It's just really efficient... it's just flexible. The size of it, it is small, it is light yet it has a bigger screen than my iPhone. It has more flexibility.

In addition, all participants discussed how the exchange of information gathered was conducted using the digital tablet. Whether information was exchanged with clients, contractors or staff all felt by using a Cloud format, information exchange was enhanced. Participant 1 stated,

I ... save all that information onto a Cloud type format. I use it when I go to client meetings, take photographs, notes, show presentations...through [the] process of opening things on *DropBox*...whether it's the presentation, the specifications, the drawings, 2ds files, whatever it might be...I use it very heavily and take the [digital tablet] on all my project meetings whether that's a site meeting, client meeting, or contractor meeting.

The ease of saving information to a cloud-type format allowed designers to share project content with anyone desired. "You can put all of this on an *iCloud*, and people can go in and reach it and pull off the information. There is a lot of interaction and sharing of information with clients," stated Participant 3. The ability to share information interactively resounded through many participant interviews.

#### *Idea Generation*

In addition to using digital tablets for collecting information, participants also reported using the digital tablet for generating ideas. Throughout participant interviews, the means in which design practitioners' use the digital tablet for idea generation varied from the literature review definition of the act of sketching. Participant interviews revealed the digital tablet was being used for the generation of ideas, but participants generated those ideas by using online tools and applications to build ideas upon, rather than sketching. Participants indicated that between 50% - 75% of the time they used digital tablets to generate ideas instead of traditional methods used previously. Participant 1 stated "I use it I would say probably 60-75% of the time

in generating ideas, whether that is looking for images, doing research, reading up on a material or whatever it might be.” Additionally, digital tablets have “that flexibility to really reach out quickly and to surf the world from a standpoint looking for ideas,” Participant 1 stated. Statements such as these resonated with many participants’. With the vast resources the online environment provided, participants all felt the digital tablet greatly benefited their idea generation processes.

Online resources as blogs, manufacturers, magazines, and idea and concept generation applications all were discussed by participants as valuable tools to idea generation. Participant 3 stated, “I go to a lot of magazines for their resources.” As Participant 5 stated, “I have the *Interior Design* app, *Metropolis* magazine app, *Architectural Record*, and stuff like that I definitely use for idea generation...I also will look at some design blogs, like *Tree Hugger* or *Design Milk*.” Some participants felt they lagged at integrating digital blog and magazine features, like Participant 3 who stated, “I just started to change over some of my subscriptions from the hard copies to the digital.” Although some participants weren’t fully using digital tablets for this type resource, they were actively in the process of transitioning. Alternatively Participant 4 discussed using applications that gather information and images from many of these resources, like *Houzz* or *Architect*, in lieu of managing individual print subscriptions. She stated, “I’ll say...go to *Houzz* instead of getting magazines because it’s got so many photographs. Put your requirements in there and start building your own [ideas].” Similar applications to *Houzz* were primarily indicated as preferred applications as they provided access to a variety of design ideas acting as another vehicle to generate ideas from. *Pinterest* was also named as a favorite participant application as it offers a variety of pictures to view helping generate ideas.

One participant currently used the digital tablet for sketching purposes; although participants not currently using the digital tablets sketching capabilities expressed a future desire learn. The participant who sketched some using the digital tablet, did express concern over their comfort with the digital tablet at times, and articulated a pencil and paper was still preferred.

I do use the sketching app; the AutoCAD sketching app and the *Sketchbook* app. But...I still feel more comfortable on paper...I feel, it's like reading a book versus reading a book on the tablet... I like touching pencil or pens to paper and feeling it. It's therapeutic, you know what I mean?...It's not that I don't think it's real effective, it's just that if I'm going to do it I'd rather do it in a way that I feel better.

#### Participant Motivation Theme 3: Document Management

A majority of participants discussed how they use the digital tablet for the management of construction drawings and specifications. The ability to synchronize documents with a Cloud based organizational system, such as *iCloud*, *DropBox* or *Documents To Go* was reiterated frequently. Participant 1 stated,

From a standpoint of documentation management, I primarily use *DropBox* and/or *Evernote* for reminders. Those are the applications that I use pretty consistently... the cross reference between all the different sorts of Cloud sites is just great. As long as you save everything to either *Evernote* or *DropBox*, or whatever site it is that you are using, you can cross reference that whether on your PC, phone or your tablet...I just find that to be a godsend. It has really helped streamline the process which is I think for all of us is so important, and I love that.

Additionally, Participant 2 stated, "I put documents into *DropBox* and *Documents To Go* and I can open them up and work on them on my iPad." Participant 7 stated, "I can access our work

server so if I've forgotten a document or need to look up a contract or a budget or something I can access it from the job site." The ability to retrieve documents, drawings, and various materials via Cloud services and work on documents instantaneously was echoed by all participants. All participants repeatedly stated benefits of being able to utilize Cloud based document organization system was a feature all highly valued. Participant 2 stated,

I put a lot of things into *DropBox* so that anything that I save, files for example off of lighting , plumbing, furniture, whatever it might be and save those into different files then load those into *DropBox*. Then I can open those up for clients as well.

All users highlighted the digital tablets ability to increase the interconnectivity between project drawings and documentation. This important feature allowed participants to no longer carry large format construction drawings while on job. "I love that I don't have to take with me, schlep, all of the documents I used to," Participant 1 stated. Participant 2 states,

The ability to take the files along and work on them right now, with *DropBox*, *Documents To Go*....being able to have that [information available] and be able to access it and not have to carry even the laptop.

Furthermore, the digital tablets capabilities to act as a document viewer provided easy information access to several participants by permitting them to redline drawings or make field notes then email them to other contractors, staff or clients while in the field. Even though most participants' did not use the digital tablet to create construction drawings, all stated they do use it for viewing of such documents. Participant 5 stated, "Being able to look stuff up, like construction documents, is really nice....I don't use it [to create] construction documents, except to view them." Participant 6 stated,



I definitely use it as a viewer. Reviewing documents, viewing drawings if I'm going back and forth with a contractor or an architect or a structural engineer ...I do use it for document viewing as well.

The interconnectivity of documents and drawings is a feature the digital tablet all participants' greatly appreciated.

#### Participant Motivation Theme 4: Business Productivity

Three out of seven participants discussed the capabilities of the digital tablet for business purposes. All participants indicated the primary reason for purchasing the digital tablet was for business purposes, with leisure being secondary. "I did purchase it in relation to knowing I was going to use it for business," Participant 5 stated. Participant 2 stated, "I probably use it for 75% business and 25% personal use" with hopes of "betterment of the business." Statements such as this resounded from most participants.

Using the digital tablet for tasks such as online banking, organizing schedules for personal and construction use and general bookwork were discussed in a limited nature. "I do banking on it. So if I need to do something quickly or if I'm out and about, I can do banking on it, which is great," stated Participant 2. Participant 1 stated, "From a standpoint of business productivity, I'll do bills on it a little bit." However, concerns were expressed by all participants in regard to using the digital tablet exclusively for business purposes. Participant 4 stated,

I don't think I can use it exclusively [for business]. I still need my computer... to run my business, the actual business part of my business. I can do PO's and be in the Cloud with my computer, but ... when it comes down to [all the other information] ...I can't get all of that onto my tablet.

Additionally, the ability to verify payments, both payables and receivables, was discussed by two participants'. This feature some participants' valued especially if they were at a job site or with a client, unable to access the paperwork at the office. It was hoped by one participant that eventually the ability to pay while at the job site would be better developed as an increased service to her clients.

Generally participants indicated using digital tablets for basic business purposes, as discussed above, was one benefit of this technology. A majority of participants expressed great potential in eventually being able to use digital tablets for more detailed business tasks. However, design limitations of the digital tablet were expressed that currently hindered them from using the digital tablet for these tasks. Most significantly, were the digital tablets lacks a user-friendly keyboard along with more advanced document manipulation features, similar to that of a laptop computer. "I do have the keyboard, but I find that I just don't use it very often. It's just not as, good as I think as other keyboards," Participant 1 stated. Participant 4 stated, "The keyboard's ok, but it's much better to have a [larger] keyboard. So, that's another thing to carry, right?" When it comes to document manipulation, Participant 1 stated "I wish I could be more adept at actually you know creating the documents on the iPad, but I'm just not there yet," a sentiment echoed by many.

### *Participant Experiences*

Two themes regarding participants' experiences using digital tablets in the design process emerged from interview data. The two experience themes were (1) the impact on work processes and (2) potential of digital tablet during design process. Within the theme of impact on work processes, two subthemes emerged: (1) advantages and (2) disadvantages. All seven participants expressed diverse experiences and perceptions, some stronger than others, of their own abilities

to successfully use the digital tablet for interior design related tasks. Most expressed a strong desire to strengthen skills in using the digital tablet; however participants also indicated time limited them in doing so. Participants primarily indicated they were interested in participating in this particular study to gain additional knowledge and insight on how other interior design professionals are currently using digital tablets.

#### Participant Experience Theme 1: Impact on Work Processes

##### *Advantages*

Numerous benefits of the digital tablet were repeated frequently throughout participant interviews providing great insight on the digital tablets usefulness in the design process. Among the many advantages participants discussed about using digital tablets, they predominantly discussed the ability to access internet whenever needed. Whether on a job site, at a client meeting or personal commitment, the ability to have instant internet access increased participants' multi-tasking abilities. Participant 2 stated,

[Previously] I couldn't use my computer to access things on job sites because there was no internet [Wi-Fi]. And so with my iPad, I have that data plan so that I can access everything on job sites no matter where I am, which is a fantastic tool.

Participant 5 stated,

Even just using the internet on my iPad is really nice...it's nice to be able to flip from one thing to the next on a really clear, crisp tablet. It looks beautiful on here...It's also nice to have internet wherever you go, so you can be on a site and have internet.

Additionally, participants discuss the digital tablets sustainability features by allowing them to go paperless and further sustainable business practices. Participant 5 stated,

I think it's really nice because I can be paperless. I do work in other states as well as Colorado, so I can travel with my iPad and have everything, including digital boards and all of that in one spot, in one little place, than having to carry paper.

Participant 6 stated using her digital tablet "saves on paper; a huge save on paper." From the "standpoint of sustainability, because I am a LEED AP, and work mainly on LEEP projects and/or sustainable projects," Participant 1 perceived the digital tablet increased her ability to further sustainable design practices.

Another advantage four participants mentioned was the light weight design of the digital tablet. This design feature was much more user friendly for business travel, and less personal instead of their laptop computer. As one participant stated,

Rather than to have to carry my laptop, I just bring my iPad and put everything in *DropBox* and *Documents To Go* and have all my files and everything I need to communicate with very quickly.

Participant 4 stated, "It's easy to travel with and it's not as personal...so if I'm with a client and pulling out my laptop, it's more of a neutral backdrop than my life on my laptop. So, I really like it for that." Participant 7 discussed the benefit of "portability for traveling. I don't really lug my laptop with me anymore when I have to travel out of town." The majority of participants echoed these sentiments regarding why they prefer using the digital tablet for traveling instead of a laptop computer.

The ability to connect the digital tablet to a client's presentation system was discussed by two participants. Being able to look at drawings and documents or peruse the internet while in a client meeting were all features participants valued. Participant 5 stated, "Sometimes we will even plug one into a TV so everyone can look at [drawings] in meetings, like in a conference

room.” Additionally, a participant discussed the digital tablets ability to aid her teachings to other interior design professionals. Participant 1 said,

I use it a lot for [what] ... I think is a huge help is [to] teach my peers on behalf of USGBC and also ASID. So, I use it for my instructor notes, and it just is a great tool because I don't feel like I'm have to carry around a big notebook full of notes and details, things of that nature. So it really lightens my load, both in a physical sense and also the process stuff. I really, really like it from that standpoint.

The desire to stay current with industry technological trends was expressed by three participants. Participant 3 stated in regard to why she purchased the digital tablet for work purposes, “I wanted to stay current with technology....I think [I] was mostly trying to stay current with technology.” She also stated, “Everyone's excited about using the new technology together. There is a lot of interaction and sharing of information.” Participant 3 stated, “I can see this being a growing trend.” Adding to the conversation, Participant 4 stated, “I wanted to stay current with technology. And, it was a new little toy.” Participant 5 stated,

It's always interesting to see how other people are using new technology because it's so infinite, that even though you think you've heard of everything or ways that you can optimize it, you know someone else has done the same things, but even a little different so it's all fascinating to me.

She also added her future beliefs on how digital tablets will be used stating,

Well my general thought is that I just think it's going to be a requirement. It's just the way we are going to be working. Ours, and more and more companies have them [digital tablets]. Whatever industry it is, you know even non-profit organizations have them. It's

becoming a, it's just current technology now. And so I just think we will use it more and more.

Emerging as the final advantage was the ease of use the digital tablet provided in syncing all documents with participants smartphone, the iPhone. Participant 1 stated,

It's truly easy now to have all of this right on the iPad, and even if I didn't have my iPad I could still access it through my iPhone. So I love that you can cross reference from one device to another and also obviously to my computer...I can easily go grab the information either on my computer or on phone, or iPad.

Participant 3 stated, "If I'm at a jobsite and they [client, contractor, staff] want to get a hold of me, I can see that either on my iPhone or iPad, their request for communication."

Participant 6 stated, "It's a great way for me to be able to have the images in the larger format than just on my phone. You know I take them on my phone ... and through the cloud they come right onto my iPad."

### *Disadvantages*

Several limitations of using the digital tablet in the design process were discussed. The main reason participants' stated as to why they felt the digital tablet was limited their practice was time constraints. The majority of participants discussed the lack of time they had to sit down and find, then learn, new applications supporting their design activities while continuing to run their business. Participant 1 stated,

I wish I could be more adept at actually you know creating the documents on the iPad, but I'm just not there yet. I'm pretty sure it's because I'm a sole proprietor and I'm so busy that I tend to go back to what I'm really fast and know exactly how to use and as I have time explore how the iPad can serve me in ways to be more productive.

This sentiment was echoed by many participants. Participant 2 stated,

It's just more a matter of finding the time to learn the new apps, I think more than anything. And, um, you know that's with anything I think. It just takes time to learn and grow and figure out what the next best thing is for you to use and network with other designers to find out what they are using.

Predominantly, all participants strongly expressed a desire to learn more about how other interior designers used digital tablets in their process, to increasingly save time and learn from them.

Another limiting factor four participants discussed was the keyboard the digital tablet offered. Participants found it to be hard to use, small, and not very user friendly – even when they purchased the large format keyboard accessory for their tablet. Participant 1 indicated the digital tablet lacks “a keyboard that fits me well.” Some stated it took more time to use the keyboard on their digital tablet, so when certain tasks could not be easily completed with the digital tablet, they would instead work on a laptop computer. Participant 4 added, “It's [the keyboard] all concise, but it wasn't so terrific...the keyboards OK.” Due to this, some participants stated this as one reason why they do not use the digital tablet for creating documents such as specifications and construction drawings, but instead defaulted back to their personal computer.

Technical difficulties with the digital tablet were the last disadvantage participants discussed. Problems such as synchronizing their laptop computer with the digital tablet were mentioned by two participants as a limiting factor on their digital tablet use. Due to outdated technology on either a laptop or iPhone, these select participants did state they were restricted in how they currently used their digital tablet, but that once they get it all figured out; they would love to use the digital tablet more holistically. Participant 4 stated, “I have the original iPhone...I

have to get a new phone...we now know that technology all you do is update it.” Certain participants also mentioned the financial burden occurring for keeping technology updated. To use the digital tablet how participants’ desired, some found it was just not feasible to financially do so. As Participant 4 stated, “it’s just not feasible to update everything regularly when you are a small business owner.”

#### Participant Experience Theme 2: Potential of Digital Tablet During Design Process

The ability the digital tablet has to revolutionize practitioner work flow was discussed by all participants. In addition, practitioners discussed the digital tablets abilities to augment their job performance, supplementing their desire to advance their knowledge and skill with the digital tablet. The majority of participants agreed they are still learning the limitless possibilities the digital tablet has to continuously enhance design processes. When asked why they use the digital tablet in the design process, Participant 4 stated “well, because I found that I can.” Participants felt that because they could use the digital tablet in the design process that they should – there was no valid reason not to. Excitement was expressed by several participants regarding potential uses of the digital tablet in design processes. Participant 2 stated,

I think adding Google SketchUp, CAD things like that to [digital tablet], being able to draw, use the draw programs, the goal of taking a picture and being able to put measurements right on there and send it to the showroom for other designers to start working on; yardages, send back quotes, things like that, those are all things that I will use as time goes on.

Seamless integration of the digital tablet into design processes was discussed by three participants. Similar to building information modeling software, such as Revit, one participant expressed the desire to further increase this work style with usage of the digital tablet.



Applications such as *BlueBeam*, mentioned by Participant 3, have already taken integrated project delivery into account. She stated,

It's called *BlueBeam*... it's a pretty nice little program...almost like a dumbed down version of a Revit program or an AutoCAD. But you can do a number of different things into it...you can import a drawing, like a PDF, and then you can convert it back into a drawing... So, it's really nice to make notes, you can import pictures, you can take portions of specifications... right now what we've been using it for is punch lists. They have put a really nice program together regarding punch lists, abbreviations; you know like paint touch up, PT. They have all of these different codes you can just input, carry it [digital tablet] around the jobsite with all your drawings in the iPad, then just input all of the documentation. It is really nice versus... [having to] carry around... huge drawings...you'd have to put them on a cart they were so heavy. So, this really works out quite nicely. Then, you can also share those drawings with your other trade members, or consultants. So, your millworker can get the drawings. It's like real time data versus having to wait. You can put all of this on an *iCloud* and people can go in and reach it and pull off the information.

Currently in the software testing stage, *BlueBeam* developers are in the process of launching an application seamlessly creating a Cloud based application, managing projects digitally from the start. Additionally, Participant 4 mentioned the ability take a chair specification and plug it into a drawing, obtain quantity counts, then upload it to the manufacturer for ordering - all while swiping the client's credit card on site.

At each interviews close, participants were provided an opportunity to add further information they wanted to share regarding their use of digital tablets in the design process.

Participant 1 stated, “It has really streamlined the process, which I think for all of us is so important. I love that.” Participant 5 stated, “It’s all so interactive. You could pretty much design an entire space on an iPad, which is really phenomenal.” And, Participant 6 added,

I just think it [digital tablet]; it’s going to be a requirement. It’s just the way we are going to be working...more and more companies have them. Whatever industry it is, you know even non-profit organizations have them. It’s becoming a, it’s just current technology now. And so I just think we will use it more and more.

### Summary

The purpose of this research study was to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest was if and how design practitioners are using the digital tablet when generating new ideas for the client within the schematic design phase. All participants in this study perceived multiple benefits concerning the use of digital tablets in the design workplace and during the design process. Two major categories shaped the findings of this study: participant motivations and participant experiences. Within each category, emergent themes and sub-themes were identified. The category of participant’s motivations for using the digital tablet in design projects included four themes: (1) communication, (2) information gathering, (3) document management and (4) business productivity. The communication theme had three sub-themes that emerged (1) electronic, (2) photographic and (3) visual presentation. The theme of information gathering includes two sub-themes of (1) collection of information, and (2) idea generation. Within the category of participant experiences, there were two themes that emerged. They were (1) impact on work processes and (2) potential of digital tablet during design process. The theme, impact on the work processes, had two subthemes that emerged: (1) advantages and (2) disadvantages (see

Figure . Miscellaneous comments, not evident in themes, included such comments as the issue of being technologically challenged when using the digital tablet and personal preferences of digital tablet functions for work use. The majority of participants perceived that enhanced communication was the motivating factor for using a digital tablet for their interior design business.

Communication was one of the most common themes mentioned that related to interior designer's motivations for using digital tablets in their work activities. All seven participants discussed numerous characteristics of communication during individual interviews. To enhance communication, participants stated the most frequent use of digital tablets was email with clients, contractors and staff. Generally, they perceived the digital tablet provided an instantaneous method of maintaining contact with the project team. Continuing the communication cycle, participants discussed the perceived value of sending staff an email to provide instantaneous project or client information. The increased project support, through instant communication streamlined the project correspondence process and increased project efficiency.

Participants perceived that there were two important photographic communication capabilities available with digital tablets that made digital tablets valuable for their work. Participants discussed the ability to take a picture of a building site condition to photo-capture an on-screen image to use for future project needs along with the ability to add notes prior to sending to clients or team members. Once a participant captured project details with the camera feature on the digital tablet, they were moved into a document where comments were added and then quickly communicated to clients, staff or contractors providing an instantaneous means of communication. Another advantage to the photographic abilities of a digital tablet was the ability to add notes prior to forwarding it to peers, clients, or team members. Participants cited the

ability to quickly take a picture, whether downloaded from a website or taken with the digital tablet, annotate it, then email it to the client, contractor or staff as a benefit to increase communication during the design process.

The final subtheme within communication was the ability of the designer to use the digital tablet for visual communication and presentation purposes. For example, participants stated the digital tablet is advantageous in increasing their ability to clearly communicate their design concept to the client or team member. One participant mentioned that their clients respond better to using this form of visual communication than more traditional methods previously used. The digital tablet was perceived to enhance visual communication if coupled with another output device: a projector or television. In addition, as the designer fluidly navigated through drawings and documents client edits could be instantaneously incorporated as content was discussed.

The majority of participants interviewed perceived information gathering as any task that involves gathering data, ideas or materials to complete initial design proposals or to generate ideas. Participant discussions indicated that collection of information using digital tablets prior to project start was a significant use of the digital tablet in the design process. Frequently, participants stated that gathering and documenting online information better facilitated their projects. The ability to instantaneously access information participants needed to conduct business, was something all designers frequently discussed. Several participants discussed the benefits of looking up material specifications or being able to reference past clients' project while being on the job site, in a client meeting or traveling.

In addition to using digital tablets for collecting information, participants also reported using the digital tablet for generating ideas. Participant interviews revealed the digital tablet was

being used for the generation of ideas, but participants generated those ideas by using online tools and applications to build ideas upon, rather than sketching. One participant currently used the digital tablet for sketching purposes; although participants not currently using the digital tablets sketching capabilities expressed a future desire learn. Online resources as blogs, manufacturers, magazines, and idea and concept generation applications all were discussed by participants as valuable tools to idea generation.

A majority of participants discussed how they use the digital tablet for the management of construction drawings and specifications. The ability to sync documents with a cloud based organizational system, such as *iCloud*, *DropBox* or *Documents To Go* was reiterated frequently. The ability to retrieve documents, drawings, and various materials via Cloud services and work on documents instantaneously was echoed by all participants. All participants repeatedly stated benefits of being able to utilize Cloud based document organization system was a feature all highly valued. Furthermore, the digital tablets capabilities to act as a document viewer provided easy information access to several participants by permitting them to redline drawings or make field notes then email them to other contractors, staff or clients while in the field. Even though most participants' did not use the digital tablet to create construction drawings, all stated they do use it for viewing of such documents.

All participants indicated the primary reason for purchasing the digital tablet was for business purposes, with leisure being secondary. Using the digital tablet for tasks such as online banking, organizing schedules for personal and construction use and general bookwork were discussed in a limited nature. A majority of participants expressed great potential in eventually being able to use digital tablets for more detailed business tasks. However, design limitations of

the digital tablet were expressed that currently hindered them from using the digital tablet for these tasks.

All participants perceived the digital tablet as a benefit for the design practitioner when completing client projects. However, they felt the full capabilities of the digital tablet are yet to be realized. The majority of participants strongly agreed that digital tablets will, in the near future, face higher demand in the design marketplace. They also believed, with specific applications, that the digital tablet will be further integrated into the daily practices of an interior designer.

## CHAPTER V

### DISCUSSION

The purpose of this research study was to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest was if and how design practitioners are using the digital tablet when generating new ideas for the client within the schematic design phase. Two main categories emerged from this study, with underlying themes and sub-themes providing an exploratory foundation to enhance the limited knowledge that exists on this subject matter. This chapter is broken into three parts including (1) summary of findings, (2) discussion of findings and (3) future areas of research.

#### Summary of Findings

Two major categories shaped the findings of this study: participant motivations and participant experiences. Within each category, emergent themes and sub-themes were identified. Participant motivations for using the digital tablet during the design process revealed four emergent themes: (1) communication, (2) information gathering, (3) document management and (4) business productivity. The communication theme had three sub-themes that emerged (1) electronic, (2) photographic and (3) visual presentation. The theme of information gathering includes two sub-themes of (1) collection of information and (2) idea generation.

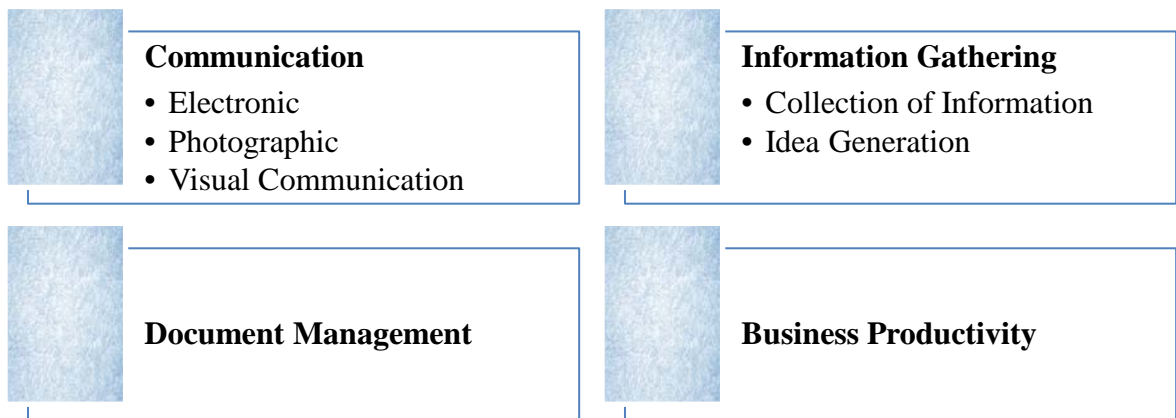
Within the category of participant experiences, there were two themes that emerged. They were (1) impact on work processes and (2) potential of digital tablet during design process. The theme, impact on the work processes, had two subthemes that emerged: (1) advantages and (2) disadvantages.

#### Participant Motivations

The category of participant's motivations for using the digital tablet in design projects included four themes: (1) communication, (2) information gathering, (3) document management

and (4) business productivity. The communication theme had three sub-themes that emerged (1) electronic, (2) photographic and (3) visual presentation. The theme of information gathering includes two sub-themes of (1) collection of information and (2) idea generation (see Figure 7).

#### Category 1: Participant Motivations



#### Category 2: Participant Experiences



*Figure 7.* Participant Motivation and Experience Using the Digital Tablet

All participants indicated that some form of communication -- electronic, photographic or visual --- was the primary motivation for using the digital tablet during the design process. Participants repeatedly discussed the ability to quickly and easily use the digital tablet to email clients, contractors, or staff whenever and wherever needed. Most felt that the digital tablet provided instantaneous client communication that was extremely important in maintaining



contact to facilitate decisions throughout the design process. Other examples of communication types were discussed. For example, two participants specifically mentioned applications (APPS) on the digital tablet that allowed them to audio record client meetings, thus helping them better focus on the client rather than note-taking.

The capability to capture photographic images of various project components, such as site elements or various finishes, was also discussed. The ability to instantaneously record interior design-related content onto the digital tablet was a feature all participants used a great deal. Increasing project communication between the client, contractor and designer was also discussed by participants, as they preferred the easy to use visual format the digital tablet provides. Unlike most clients, interior designers possess an innate ability to think and perceive visual spaces before they are constructed. Therefore, it is understandable that participants perceived that using the digital tablet to increase their ability to visually communicate designs to their clients was a real bonus of the digital tablet. In fact, numerous participants also discussed how the visual tools the digital tablet offered enabled them to be more productive.

Participants discussed in detail aspects of the digital tablet that offered both information gathering and idea generation. While a goal of this exploratory study was to better understand interior design practitioners' use of the digital tablets for idea generation, it became clear after data analysis of the findings that the phrase "idea generation" was defined differently by participants. The original definition of idea generation, as defined in the literature review, was to focus on the sketching of design ideas. Participants perceived sketching as a component of idea generation, but expanded the definition to include tasks such as gathering data, ideas or materials to complete the project. It was the perception of the participants that all of these tasks helped participants generate ideas that in turn solved design problems. In addition, data analysis

revealed that only one participant used the digital tablet for sketching and that none of the participants used the digital tablet for the creation of construction drawings or specifications.

While gathering online information and documentation to conduct project research, the digital tablet often provided greater opportunities of convenience than the traditional laptop or desktop computer. Using the digital tablet enabled instantaneous content gathering, due to Wi-Fi internet access. Participants also benefited through access to vital documents via Cloud services and applications (APPS) requiring Wi-Fi. Correspondingly, the digital tablet allowed easy project file organization with Cloud services permitting fluid information exchange. As an added benefit, all participants expressed the importance of wireless synchronization of documents on their laptop or desktop computer with their digital tablet. Cloud-based organizational systems, such as *iCloud*, *DropBox* or *Documents To Go*, were preferred by participants to provide immediate access to drawings, specifications or other desired materials.

Integrating the digital tablet into interior design business practices to complete tasks such as online banking, schedule organization and basic bookwork were discussed by three participants. Findings revealed that participants were not nearly as enthusiastic about using digital tablets for complex business tasks as they were for idea generation. Their hesitation related to the need for a full keyboard to quickly complete such tasks.

#### Participant Experiences

Within the category of participant experiences, there were two themes that emerged. They were (1) impact on work processes and (2) potential of digital tablet during design process. The theme, impact on the work processes, had two subthemes that emerged: (1) advantages and (2) disadvantages. The impact of the digital tablet and its potentials were prominently expressed by participants of this study. Participants repeatedly stated their desire to better understand how

other interior designers were using the digital tablet in hopes of gaining new knowledge from them.

Numerous benefits of the digital tablet were repeated frequently throughout participant interviews providing great insight on the digital tablets usefulness in the design process. Among the many advantages participants discussed was the access internet whenever needed. Whether on a job site, at a client meeting or personal commitment, the ability to have instant internet access increased participants' multi-tasking abilities.

Over half of participants discussed the benefits of size, flexibility and portability of using the digital tablet for work purposes. Whether on a job site or traveling, participants repeatedly stated their desire to use the digital tablet as an alternative to their laptop computer. It was felt the digital tablet provided a seamless tool that allowed an email to be sent quickly, a document to be viewed or edited, along with many other features easily utilized while sitting in an airport or at a construction site. The desire to maintain a competitive edge in today's global marketplace was discussed by three participants. They perceived that to stay abreast with the changing technology and interior design industry, it was best to become quickly available with the wide selection of tools and applications digital tablets offered.

In addition to increased benefits to their firm's workflow, participants also mentioned key limitations to effectively using the digital tablet in design processes. The foremost limitation participants stated was lack of time to learn all the available applications. Many expressed a great desire to integrate the digital tablet into the design process more effectively, but that time prohibited them from doing so. The "user-friendliness" of the keyboard was their primary concern. This inadequately designed component of the digital tablet was one reason participants did not use the digital tablet for the creation of construction drawings and specifications. Most

participants stated they would use the digital tablet for viewing these documents if this issue could be addressed.

There was overwhelming approval by the participants that the digital tablet can be used for almost every task needed in the design process. Although some tasks on the digital tablet were easier to complete than others, all participants felt the digital tablet had great potential to continue to revolutionize their workflow processes. Two participants expressed the ability to integrate design projects with other applications already being used by architecture and design firms, such as BlueBeam. The importance of Integrated Project Delivery and building information modeling is perceived to be a need that will be addressed in the near future.

Digital tablets are becoming increasingly popular within the architecture and design industry. Participants felt it was particularly important to be up-to-date with new technology for fear of being left behind. With most participants owning sole proprietorships and one working in an architectural firm, one would think this sentiment would first come from larger firms, as stated initially in the study limitations. However, this study revealed that that all participants, regardless of the firm size and type, were concerned with staying abreast with technologies. It was clear that participants felt the digital tablet is the future and they need to be on board with technological change, or their practice could be left behind.

## Discussion

In many ways, the findings of this study support findings from the existing body of knowledge. It must be noted that there are also findings that contradict existing research and/or represent research that has not been reported. Following is a discussion concerning how this study fits into the existing body of knowledge.

## Participant Motivations

### *Participant Motivation Theme 1: Communication*

All participants indicated some form of communication was a primary reason they use the digital tablet in the design process. Emerging from this study's findings were three sub-themes of communication, (1) electronic, (2) photographic and (3) visual presentation with each playing key roles in the design process. Participants all agreed whether communication is verbal or non-verbal, it takes shape in a variety of forms and through different media (see Figure 7).

Participants repeatedly discussed the abilities to quickly and easily use the digital tablet to email clients, contractors, staff or other vital project members whenever and wherever needed. Most felt it was extremely important to be able to use this tool to maintain constant contact to keep the project moving forward. As Brickley's (2012) study with higher education students finds, the ability to increase listening and observation skills using the digital tablet is an instrumental tool critical in increasing communication skills, as expanded on by this study in regard to interior design practitioners. With interior design programs, such as Brickley's, accredited by the Council for Interior Design Accreditation (CIDA), stringent standards are set forth under which both faculty and students must comply to ensure the highest level of interior design education is set. CIDA Standard 6: Communication, focuses on "a variety of communication techniques and technologies appropriate to a range and purpose of audiences" (CIDA, p. II-16). In turn, it is integral that communication skills are effective in clearly communicating content within the design process, in both education and practice. With interior design students being trained in CIDA programs to understand how to express ideas clearly and effectively, it is no surprise when a new technological tool comes on the market interior design practitioners are some of the first to adopt it.

Words are the most common means of human interaction, lending themselves to both face-to-face and computer generated interaction among people (Johnson, 2010). The American Institute of Architects (2007) Integrated Project Delivery (IPD) method clearly supports open, direct, and honest communication among project participants, additionally reinforcing the value digital tablets provide by supporting that same open, collaborative communication. With more firms embracing the IPD method of project management, project communication is increasingly evolving. It has been proven by integrating the IPD structure into the project process, an increase in positive overall project outcomes results. This format of project management was indicated by several participants as a primary means of project management. All participants worked on projects that utilized some form of this project delivery method. In general, there was a consensus of communication being a core feature of successful project completion for all parties involved. The increased communication among all involved in a project is one benefit of Integrated Project Delivery you cannot argue (Johnson, 2010).

Photographically capturing images using the digital tablet was also discussed by participants. The ability for participants to document items as needed then integrate them into their project, lends itself to the iterative nature of the design process, allowing for successful problem resolution (Piotrowski, 2011). Most participants expressed how they valued being able to take a photograph, annotate it, then either email or place it in a project file. It was felt this feature was a beneficial visual recording device allowing them to document project components as needed. This fundamental process of documentation enabled the designers to explore and utilize the built environment in many facets of the design process. Whether in the preliminary stages of information gathering to the final project walk-throughs, participants found the ability of the digital tablet to capture and exchange information was part of their successful use of the

digital tablet. As most participants were working in formats similar to Integrated Project Delivery, the collaborative nature in which they used the photographic qualities of the digital tablet increased the efficiency of information exchange. This in turn, further increased project communication (Johnston, 2010). Tasks as simple as taking a picture for communication purposes, allowed the interior designer to communicate with many design disciplines as needed to keep the project communication flowing smoothly, streamlining the flow of information.

Supporting the desire to maintain clear lines of project communication, interior design practitioners rely on the process of design thinking to further their intentions. As identified in current literature on design thinking, interior designers are practical, motivated individuals who desire to use new tools creatively and intuitively to discover alternative solutions to the problem at hand (Dohr & Portillo, 2011; Fisher, 2010). Supporting Tim Brown's definition of design thinking, is this study's findings that participants' in this study readily matched clients' needs with what is technological feasible and a solid business strategy. Participants eagerly integrated the digital tablet for communication purposes, prior to all other tasks in the design process, and indicated the primary reason for the integration is to further their business practices. The process of design thinking is a unique characteristic that embodies interior design practitioners' interviewed for this study.

The natural ability most interior designers have to think visually is another aspect of design thinking that relates to communication using the digital tablet. The fact participants are using the digital tablet to increase visual communication with their clients is not surprising. Even though the process of design itself is complex, interior designers are continuously searching for ways to enhance their core skills thinking constructively to solve various problems at hand (Burdick & Willis, 2011; Lawson, 2006). In fact, the majority of participants also discussed

their ability to be more productive with the visual tools the digital tablet has to offer rather than their traditional tools. From viewing images and searching the internet, to offering formal presentations, participants relied upon the digital tablet as a communication device (or tool) to demonstrate their innate creative ability to clients. By being able to obtain content on their digital tablet and stream the presentation to clients, participants' found clients responded more effectively than traditional methods used. This creative use of the digital tablet directly brings about new ways to look at problems and seeing new opportunities furthering the creative design process (Cox, 2005). In addition, it also augments how the viewing of multiple ideas simultaneously lead to create design solutions (Fischer, 2010).

Overall, the findings in this study are consistent in supporting previous research regarding communication within the design process. Every participant expressed numerous ways in which they continuously use the digital tablet to increase electronic, photographic and/or visual communication with clients and contractors. The ease of communication the digital tablet provided was the primary reason for starting to use the digital tablet in the design process, but it was soon discovered not the only benefit the digital tablet offers.

#### *Participant Motivation Theme 2: Information Gathering*

In addition to communication, all participants indicated they currently use the digital tablet for some form of information gathering in the design process. Emerging from this study's findings were two sub-themes of (1) collection of information, and (2) idea generation. Participants all agreed that idea generation not only included sketching, but the gathering and documenting of ideas as well.

The digital tablet is one of many tools interior design practitioners' uses to enhance their creativity during the idea generation process. However, after data analysis, it became clear that



idea generation was not defined as the act of sketching itself, but broadened to include the collection of information to generate ideas. Participants did state they viewed sketching as a valuable component of idea generation, but expanded the scope to include such tasks as gathering data, and ideas or materials to complete any portion of the project process. Only one participant of the study used the digital tablet for sketching; none used it for creating construction drawings or specifications.

The digital tablet proved to increase participants' ability to capture and record ideas even when they had a moment in between meetings or personal commitments, due to its lightweight and portable nature. Even though sketches were not the primary use for digital tablets in idea generation, the collection of content to generate ideas is still an integral part of design. Designers can still use this content to generate ideas, recognize potential conflicts or possibilities for ideas prior to them coming to fruition, better facilitating problem solving (Bilda & Demirkan, 2003). Participants in this study readily used the digital tablet for tasks of this nature. While each participant had a slightly different process to collect this content, the end result still provided a solid foundation for idea generation.

Concerning the creative process, idea generation can be viewed as "encompassing front-end preparation and back-end evaluation" making the idea generation process indispensable (Smith, 1998). Participants in this study repeatedly indicated that the process of information gathering not only took place in the initial stages of the design process, but instead happened holistically throughout. In addition, the portable, flexible nature of the digital tablet, it further lends itself to promoting creativity in design (Smith, 1998). Regarding what participants referred to as the gathering of online information using the digital tablet, participants often used the tablet to document and research any information pertinent to the project stage they were in. By having

increased information access with the digital tablet, participants greatly utilized this feature to continuously gather necessary information.

In 2011, Geist's study determined that students in higher education benefited from increased information access due to the use of digital tablets in their coursework. Just as Geist's students were encouraged to use the digital tablet in any means comfortable to them to compete a task, so do the participants' in this study. Each participant used their digital tablet in slightly different ways, but all found they were obtaining a similar end result. However, it must be noted that most participants asked to better understand how other interior designers were using their digital tablet in hopes of streamlining their processes. One theme in Geist's study was the convenience the Apple iPad offered students. Similarly, participants in this study repeatedly mentioned how the ease of use of the digital tablet allowed them to generate ideas and gather content regardless of where they were physically located. In addition, findings of this study also revealed that interior designers benefited from increased information access through the use of digital tablets.

Additionally Geist (2011) found that the use of the digital tablets for students to act as an e-reader or document viewer was a preferred methods of use, similar to the findings for interior design practitioners. Participants in this study indicated that even though most do not create documents on their digital tablet, they do heavily use it to view documents with clients and contractors. The interaction using the digital tablet as a viewer provides between all parties involved, was one Geist found increased learning. Similarly, this study found that participants preferred the more involved interaction they had with clients when they were able to use the digital tablet in a similar manner.

Overall, the findings of this study are consistent with previous research regarding idea generation and creativity in the design process. Every participant discussed some aspect of information gathering, whether collecting information or idea generation in their project process as an integral piece the design process. Participants were changing their work flow to better utilize the digital tablet to gather information to better facilitate a more streamlined design process.

### *Participant Motivation Theme 3: Document Management*

All participants indicate they currently use their digital tablet for some form of document management. Most commonly discussed were Cloud-based organizational program such as *DropBox* or *Documents To Go*. Participants in this study all expressed the importance of being able to wirelessly synchronize documents on their laptop or desktop computer with their digital tablet so they can access this information when needed. By being able to access documents and drawings instantaneously, it streamlined the project process for participants. This technological revolution has had a major impact on how interior designers manage their project documents. No longer do interior designers need to carry with them specification binders and large format construction drawings, but instead can easily download them to a Cloud system and then access them on their digital tablet wherever desired.

Trueman (1991), states that it is just as important to pay attention to technology for managing design projects as it is to the technology used to create the projects. In Trueman's (1991) study regarding the management of information technology in design practices, he found that one key issue is the successful access, integration and management of information on all levels of project management. He stated that firms would be at a disadvantage if they did not fully utilize technological advances in their design processes along with fully understand what

information is required at what project stage. Similarly, participants in this study all felt the great benefit of using Cloud-based organizational systems to be able to access and manage project information whenever and wherever they needed. Numerous times, participants discussed the ability the Cloud-based system via the digital tablet allowed them to retrieve and view a document when needed to increase project management. However, participants also indicated that there was not one best application to best manage documents, but instead utilized two or three applications to do so effectively. Supplementing this practice, Trueman (1991) and other researchers also support the ability to utilize multiple technologies to benefit the interior designers work process, instead of pinpointing one technology to try to complete all tasks.

Overall, the findings of this study are consistent with previous research findings regarding the management of documents in the design process. Although using the digital tablet to manage documents is relatively new in the design industry, participants all found that they greatly appreciated the digital tablets ability to do so fairly seamlessly. Participants appreciated how the digital tablet was simplifying document management for them further streamlining the design process.

#### *Participant Motivation Theme 4: Business Productivity*

Using the digital tablet for business purposes, such as online banking, schedule organization and basic bookwork were discussed by three participants. Limited participants expressed the desire to be able to pay bills or access budgets by using their digital tablet. This study's findings revealed there is still a hesitation to using digital tablets for business tasks among participants. Overall, the participants felt the digital tablet is not as user friendly as the traditional desktop or laptop computer for conducting these tasks as most required the use of a mouse and full keyboard.

Current computer technologies have modified the traditional means of how people exchange information (Kalay, 2006). Research has proven that interior designers must carefully select what type of technology is best for the project at hand to best increase their workflow (Kalay, 2006; Plunkett, 2010). Participants did express the need to select the applications they use carefully, as some provide different features than others in turn affecting their usability. Concern was expressed over not wanting to change the overall processes too much, but instead use technology to streamline and make certain processes more efficient. Most participants understood that utilizing the digital tablet in business meant certain tasks may change, however they were reluctant to yield too much on certain practices, such as scheduling, that they have found to rely on their desktop computer for. Kalay's (2006) study on the impact of technology on architectural business practices states that "more often, as traditional tools are transformed by new technology, it is the practices themselves that must adapt to the changing context" (p. 376). However, the participants in this study found themselves not using technology if they felt it didn't fully support their best interests in both their design and business processes.

In addition, participants still preferred the Microsoft software packages to create certain documents, a feature the Apple iPad does not currently offer. However, great potential for using the digital tablet in business was expressed by many participants once programs can be streamlined, although participants expressed no current desire to change their business processes of this nature.

Overall, the findings of this study somewhat contradict previous research findings regarding the use of digital tablets for business productivity. Although participants to desire to utilize technology as efficiently as possible in the design process, they do not currently feel that

the digital tablet provides this opportunity as fluidly as they desire. They cite some benefits, but at this time prefer to use a laptop or desktop computer to complete business orientated tasks.

## Participant Experiences

### *Participant Experience Theme 1: Impact on Work Processes*

Advantages of using the digital tablet in work processes were prominently expressed by participants in this study. While to date, no existing research has been located concerning interior designers' experiences using the digital tablet for work purposes, one can look to the educational sector for guidance. Technology is rapidly becoming a common industry tool, as pointed out by Pable (2007). The technological phenomenon is one that is occurring rapidly and forever changing how interior designers go about their job.

At the core of this technological change lies the diffusion of innovation theory. This theory states the adoption of new technology is not instantaneous, but one that takes place over time involving the perceptions of others (Rogers, 1995). This phenomenon is clearly evident in this study's findings as participants discussed (1) why they desired to use the digital tablet, (2) information gained from other digital tablet users and (3) how it affected their desire to use the digital tablet in project processes (see Figure 7).

Ultimately, when asked why participants purchased their digital tablet, they stated the intention to better their business practice and increase efficiency. Some even expressed their desire to have the latest technological gadget to work with. The relative advantage perceived by participants is one that led them to believe the digital tablet would be better than their current technology in hopes of increasing the workflow process. Participants all felt the digital tablet was a great advantage to their work processes. In addition, the compatibility of the digital tablet with participants other technology along with clients and staff, was perceived to be a great feature to

utilize in their practice. Participants all stated for the most part, the compatibility of the digital tablet with other technology and user interfaces was well worth the financial investment of the business. Over time, as participants explored their digital tablet the experimentation with the device lead them to be more comfortable, enabling them to integrate the digital tablet into certain work processes. Participants indicated they initially introduced the digital tablet into work processes they deemed low-risk and ones that would not cause a significant loss of time or money if it did not work as planned. Once the complexity of those tasks was mastered, then participants started to merge the digital tablet into what they perceived as more complex tasks, such as business productivity. Most also found the digital tablet also worked well to support their work-life balance as the flexibility of the tool enabled them to be mobile and at family functions while still maintaining contact with clients, staff and contractors.

Study participants repeatedly expressed the desire to better understand how other interior designers were using the digital tablet in hopes of learning from them. At the end of each interview, when asked if they had any more information to add the majority of participants expressed a desire to see what applications other practitioners' are using in hopes of gaining new information (see Table 3). Often, it was expressed that network would be created enabling interior designers to share experiences with applications and using the digital tablet in general to better facilitate learning. This desire is a common element of diffusion of innovation theory as a component of technological adoption has to do with other opinions and beliefs on the technology at hand.

Participants also mentioned key limitations that impacted their use of the digital tablet in work processes. The most prominent limitation that emerged from this study was perception of lack of time to learn applications for the digital tablet. Generally, participants in this study all

expressed a desire to have more time to learn all the features of the digital tablet to better integrate into work processes. Nelson (2010), cautions that it is not uncommon for practitioners' to get caught up in learning a new technology, and lose sight of the creative process. Participants in this study all were aware of the time constraints learning a new technology brought with it and were very conscious not to have it detract from their work processes. Due to this, most let learning the new technology fall to the sidelines for the sake of the design process, although frustration was still expressed. Participants wanted to have the time to better learn the new technology more adeptly as they perceived for the most part it would continue to further their work processes. Kalay's (2006), study finds the important role new technology plays on practitioner workflow needs to be carefully balanced, as the relationship between the two is not always beneficial. Participants of this study were seemingly aware of this detriment and integrated the technology of the digital tablet with caution throughout their work processes. Technical difficulties, such as getting the digital tablet and personal computer to synchronize completely, due to either outdated technology or user error, were discussed by limited participants. It was found that these instances were extremely limited in nature.

Johnston (2010) states, that while technology plays a key role in the design process automating manual tasks, it can also improve precision. For the most part this statement rings true for participants' of this study as mentioned in previous sections. However, certain components of the digital tablet; all used iPads, limited participants to create construction drawings, specifications and other similar documents. Most participants stated they would use the digital tablet for viewing these types of documents, but not for the creation of. It is here that this study refutes other research regarding using technology in the design process. Due to the format and lack of user-friendliness of the digital tablets keyboard, this study's findings does not



support Johnston's (2010) work. However, it must be mentioned that Johnston's (2010) study is broad based, where this exploratory study focuses on a specific type of technology, the digital tablet.

Overall, the findings of this study support and contradict previous research findings regarding the use of digital tablets for work processes. Although most participants discussed significant advantages to using the digital tablets for these purposes, a number of limitations emerged restricting practitioners' work processes. Diffusion of innovation theory fully supports the adoption and integration of the digital tablet into practitioner workflow, but Johnston's (2010) study does not fully support this study's findings.

#### *Participant Experience Theme 2: Perceived Potential of the Digital Tablet*

The idea that digital tablets can be used for almost every task a person needs to complete was widely reiterated by participants. Although some tasks were easier to complete than others using the digital tablet, all participants felt the digital tablet had great potential to continue to revolutionize their workflow processes. McLain-Kark (2002) states, using technology in the design process is a tool for bridging clients and designers together, positively impacting the design process. Their study on the bridging of technology in the design process provides evidence of how technology can be used in the future through evolving technology. Participants in this study all expressed their future intentions and wishes for the integration of the digital tablet into work processes. Confirming this, certain participants expressed the ability to integrate design projects with other applications already being used by architecture and design firms, such as BlueBeam. This validation further supported the importance of Integrated Project Delivery methods impacting the design industry.

Participants perceived digital tablets are becoming increasingly popular within the architecture and design industry, and all participants felt it was important to stay current with this new technology for fear of being left behind. Surprisingly, most of the participants were from sole proprietorships, with only one working in an architectural firm. One would think this sentiment would first come from larger firms, as stated initially in the study limitations. However, it was found that all participants, regardless of the firm size and type, were concerned with staying abreast with technologies. Generally, participants felt the digital tablet is the future and they needed to be on board or would shortly be left behind. This way the industry is going forever changing how designers go about the project process (Brandon & McLain-Kark, 2001).

Overall, the findings of this study support participants perceived potential for the digital tablet in the design process. All participants discussed with great excitement the future possibilities the digital tablet could have on their work practices. Even though most participants are not currently using the digital tablet to what they perceive as the utmost potential, they do express that in time they will be.

## Summary

Participant motivation and experience factors interior design practitioners expressed in this study create a clear link between this study's findings and that of Meneely & Danko's (2007) framework defining motive, mind, and media in evaluating student success in learning utilizing technology. Each facet of this framework specifically focuses on a specific theme that emerged from this exploratory study reflecting interior design practitioners' use of digital tablets in work processes. According to Meneely & Danko (2007), motive focuses on the core philosophies and processes design student's value, with the emphasis of mind being on the mindsets that govern

the use of technology in design education. Media then provides exploration of how tools empower design students to achieve their goals (see Figure 9).

## MOTIVE

What core philosophies and fundamental processes do design students value?

### Purpose

- To clarify the context that technology will serve.
- To establish the criteria governing our selection and use of a particular technology or tool.
- To provide the benchmark for assessing and justifying the use of technology.

### Clarifies

#### *SITUATIONAL KNOWLEDGE*

##### Design Domain

- Shared Ideologies/Beliefs/Values
- Domain Precedents
- Cultural Tenets

##### Context

- Contextual Criteria
- Justifications for using technology

##### Task

- Nature of the task to be completed
- Purpose, goals, and strategies

## MIND

How do mindsets govern the use of technology in design education?

### Purpose

- To monitor and regulate our actions with self-awareness.
- To link prior knowledge with new knowledge.
- To identify and test assumptions.

### Clarifies

#### *DISPOSITIONAL KNOWLEDGE*

##### Self-Awareness

- Personal Beliefs/Outlooks
- Habits and Preferences
- Personal Goals and Desires

##### Metacognition

- Tacit Assumptions
- Outcome Expectations
- Self-Observations
- Self-Evaluation

## MEDIA

How do tools empower design students to achieve their goals?

### Purpose

- To understand the capabilities and limits of digital tools and media.
- To assess the applicability of a specific tool or technique to a particular context.

### Clarifies

#### *TECHNICAL KNOWLEDGE*

##### Tools/Technology

- Capabilities/Limits of the tool
- Functions and Operations
- Commands

##### Technique

- New Ways of Working
- Methods and Procedures
- Application to Design Process

Figure 9. Motive, Mind and Media Framework (Meneely & Danko, 2007, p. 71)

Relating to Meneely & Danko's framework, the motive, or core philosophies and fundamental processes, behind practitioners' use of digital tablets were found to increase communication throughout all aspects of the design process. All participants strongly believed the main context for using the digital tablet was to help aid in increased communication in all facets of the project process. The nature of how the digital tablet helped streamline project communication was a feature all participants greatly desired. By having mobile, instant methods of communication participants were able to contact clients, staff or contractors as needed to maintain project flow. Additionally, participants cited the ability to use the digital tablet for information gathering, along with document management and business productivity. The capability of the digital tablet to drive the organization and sharing of information in each of these categories motivated each of the participants to continuously use the digital tablet in their daily work activities.

In addition to motive is the element of mind, which offers a better understanding how practitioners' mindsets drive their use of technology. A self-awareness of how the digital tablet can increase the ability to multi-task and obtain information wherever and whenever needed was expressed by all participants. Repeatedly, the ability of the digital tablet to complete tasks or obtain information on-the-go was discussed by participants. Features such as this were greatly desired, creating motive for participants to purchase the device. The final component of this framework focuses on media, which explores how the use of technological tools empowers the user to meet project goals. This component proved the strongest connection between Meneely & Dankos (2007) study and the exploratory information gathered from this study. The capabilities of the digital tablet provided numerous options for design professionals to work within the design process; however limitations of using the digital tablet for certain business productivity

purposes were discussed. Participants found that certain tasks are best completed by the use of a laptop or desktop computer, but never failed to stress the benefits the digital tablet provided. All participants greatly valued the flexibility digital tablets offered better helping them meet their project goals.

Overall, the findings of this exploratory study provided support for Meneely & Danko's (2007) work that provided an initial foundation for the exploration of interior design practitioners' use of the digital tablet in their work processes as their work with college students was similar in nature. The finding of this informational now provides additional information furthering the body of knowledge on this subject matter.

### Conclusions

The findings of this study offer a foundational understanding of interior designers' perceptions concerning the use of the digital tablet and how they utilize them in their workplace. Several themes emerged from this exploratory study bringing to light the many similarities among participant motivations and perceptions of using the digital tablet during the design process (see Figure 7).

This study indicates that all participants were highly motivated to incorporate the digital tablet into their work processes due to the tablet's ability to enhance the client-to-designer communication as well as information gathering, business productivity and document management. Participants were additionally motivated to continue with the integration of the digital tablet into the design process within the constraints of their resources: time, technological proficiencies and finances. Limitations to the additional adoption of the tablet were frustrating to participants; however they also recognized these as distinctive tradeoffs of technology integration.

All participants felt the digital tablet has immense potential for use in the design process to continue to enhance communication, idea generation, document production and workflow. With benefits of the digital tablet far outweighing the technical limitations, each participant repeatedly stated their desire to further their knowledge of the digital tablet and extend it into all aspects of their life. The participants believed that the profession was rapidly evolving, integrating digital tablets wherever possible. All stated they felt the need to stay current with technology to remain competitive in today's market and believed it was essential to continue to work towards integrating new applications into their practice. This resounding statement is one that is proven repeatedly by researchers, who in numerous areas have found that most professions must stay current with technology, or they will soon become obsolete.

Many of the findings in this study are both directly and indirectly supported in components of literature. While none of the findings in this study clearly disprove any existing research conclusions, one particular finding regarding business productivity somewhat contrasts with previous research conclusions. This researcher is lead to believe this is due to the detailed type of technology being studied, digital tablets, when the existing literature referred to the adoption of technology in general. However, since this is an exploratory study, this finding should not be surprising.

Prior to conducting this study, it was assumed that participants would likely discuss such topics as how they use the digital tablet in the design process and then more specifically for idea generation. These topic areas receive wide-ranging attention in existing literature; therefore it seemed reasonable that interior design practitioners may also use them regularly in practice. This assumption proved true for the most part. This study's participants revealed that interior design practitioners defined idea generation more broadly than that of the generation of initial drawings

and sketches, to include that of information gathering and research. The majority of participants expressed they currently do not use the digital tablet for sketching purposes nor to generate drawings, but do use the digital tablet for the gathering, viewing and sharing of documents.

It is felt that the findings of this exploratory study help provide great insight to how interior design practitioners currently utilize the digital tablet in the design process along with for idea generation. Participants shed light on a relatively unknown area of research, which is rapidly changing, due to fast paced technological advances. Even though there is much yet to be learned on this subject matter, it is believed a solid foundation for future research was provided on a topic that is ever-changing.

#### Future Research

This study was exploratory in nature. The sample was small, limited to one geographic area and included only those interior designers currently using a digital tablet in their work processes. For these reasons, there are several opportunities for future research.

- Expand the study to include nationwide participants, offering greater insight on how digital tablets are used in work processes. Extending this study nationwide would offer a greater participant pool and hopefully gain more in-depth information regarding how interior design practitioners use digital tablets. Since all study participants lived and worked within a narrowed geographic area, the findings cannot be assumed to be generalizable. Therefore, similar research expanding the participant base to other locations may help determine which findings might be consistent across a wider geographic and demographic range, and which findings might be consistent.
- Create focus groups with designers currently using the digital tablet in their work process.

It was mentioned by study participants that they wanted a way to be able to exchange



further information about how they use the digital tablet, so by creating focus group this would allow ideas to be exchanged and research to be conducted. By observing this interaction and exchange of information neutrally, additional motivations and themes may come to light of why and how designers use the digital tablet.

- Interview interior designers that do not currently use the digital tablet to better understand why they have yet to integrate it into their work processes. Because this study was limited to only current practicing interior designers who use a digital tablet, this portion of the population was excluded. With initial survey respondents expressing various reasons for not yet using a digital tablet, it was demonstrated that the reasons are vast, but yet almost all feel they should be moving towards integrating this technology into their work process. Researchers could then discover additional motivations and perceptions behind the use, or lack thereof, digital tablets.
- Further research could better define residential and commercial interior designers to better understand if there is a preference of digital tablet adoption and use depending on the area of practice. Because this study had a narrow participant pool, only one participant was primarily a residential designer with all others practicing commercial design. Additionally, a sample breaking down the various practice areas within commercial interior design, such as corporate, hospitality, government, etc. could be conducted, in order to determine what, if any, themes emerge.

In-depth studies could be conducted on the motivational themes discovered in this study to gain deeper insight on how the digital tablet is used exactly for each of the themes. While this study beings to provide an overall understanding of interior designers motives and perceptions of using the digital tablet for design purposes, much remains unknown about the great detail to which it is

used. For example, the overarching theme of communication could be studied more in-depth where participants were observed in their daily routines to better understand the extent of which the digital tablet is used.

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## APPENDIX

Table 1. Initial Survey Questionnaire

The purpose of this research study is to explore how interior design practitioners utilize digital tablets during the design process. Of particular interest is if and how design practitioners are using the digital tablet when generating new ideas for the client within the schematic design phase. This survey is demographic in nature. Its purpose is to gather initial data that will provide context to the subsequent interview data.

1. What is your gender?
  - a. Male
  - b. Female
  
2. What is your current age?
  - a. 18-25 years
  - b. 26-30 years
  - c. 31-39 years
  - d. 40-49 years
  - e. 50 +
  
3. What is your employment type?
  - a. Employee at a large firm (100+ employees)
  - b. Employee at a medium firm (25-99 employees)
  - c. Employee at a small firm (1-24 employees)
  - d. Independent contractor/consultant
  - e. Principal/Partner/Owner
  - f. Other
  
4. What is the highest level of education you have completed?
  - a. Associates degree
  - b. Bachelors degree
  - c. Masters degree
  - d. Doctorate degree
  - e. Other
  
5. If you hold a Bachelors degree, was your Interior Design program CIDA (formerly FIDER) accredited?

- a. Yes
  - b. No
  - c. Unsure
6. How many years have you been practicing interior design?
- a. 0-5 years
  - b. 6-10 years
  - c. 10-15 years
  - d. 15 – 20 years
  - e. 20 + years
7. Are you a member of any of the following professional organizations? Check all that apply:
- a. ASID
  - b. IIDA
  - c. NKBA
  - d. IDEC
  - e. USGBC
  - f. Other (please specify)
8. Do you hold any of the following professional certifications? Check all that apply:
- a. NCIDQ
  - b. LEED GA or AP
  - c. CKD
  - d. Other (please specify)

## Table 2. Interview Questions

The first set of questions will address topics such as why the interior design practitioner acquired the digital tablet, the percentage of time they use it for personal or work-related activities, how long they have used it, and what they used before acquiring the digital tablet to accomplish the same tasks.

1. How long have you used your digital tablet?
2. What amount of time do you use the digital tablet for work related activities?  
Personal activities?
3. How did you acquire your digital tablet? Does the firm you work for provide a digital tablet for you to use on your projects?
4. Did you decide to use the digital tablet in the design process based personal preference or at your firm's request?
5. What did you use prior to acquiring your digital tablet to accomplish the same tasks you currently use your digital tablet for?

The second set of questions will address how the design practitioner uses the digital tablet for work related activities. These may include:

- Photo capture
  - Contract documents
  - Business related activities such as developing Minutes of Client meetings
  - Email/texting
  - Related applications (apps)
1. Please describe your current use of the digital tablet for work related activities?
  2. Are there specific activities you find the digital tablet benefits or hinders?

3. What, if any, specific applications have you found to best assist you in work related activities?

The third set of questions will address how the interior design practitioner currently uses digital tablets in the design process, how it assist them in daily design activities, their perceived benefits and hindrances it has along user preferences.

1. Please describe your current activities with using the digital tablet in the design process?
2. Are there specific activities you find the digital tablet benefits or hinders?
3. What do you perceive to be the benefits of using digital tablets in the design process?
4. What are client's perceptions of your use of the digital tablet on their design project?
4. What, if any, specific applications have you found to best assist you in the design process?

The fourth set of questions will address topics such as practitioner's use of the digital tablet in idea generation in the design process. (A demonstration of types of idea generation will be encouraged if Skype is used.)

1. Do you use the digital tablet to aid in idea generation?
2. How do you use the digital tablet to aid in idea generation?
3. What specific benefits or hindrances have you found regarding the digital tablets use for idea generation?
4. What, if any, specific applications have you found to best assist you in idea generation?

The last set of questions will address the participant's future intentions toward digital tablet use in the idea generation process.

1. Do you believe you will use the digital tablet for idea generation in the future? Why or why not?
2. Based on your experience, what do you feel is the best use for digital tablets in the design process?
3. Do you have any additional thoughts you'd like to share regarding the use of digital tablets in the design process and idea generation?
4. What else would you like to share about how you use digital tablets in your personal or professional activities?

Table 3. Frequency of Use of Participant Application

<b>Application</b>	<b>Frequency Count</b>	<b>Application</b>	<b>Frequency Count</b>
Houzz	22	Notes	1
Mail/Email	20	Pantone Color Finder	1
Dropbox	18	GPS	1
Photos/Camera	13	Green Source	1
Internet (Safari, Google)	12	ASID Mobile	1
Pinterest	6	Architecture	1
AutoCAD WS	5	Teknion	1
Documents To Go	5	Mohawk	1
Bluebeam	5	WebEx	1
iCloud	4	Yammer	1
Evernote	3	Architizer	1
Specify	3	Architonic	1
AutoCAD Sketchbook	3	Doodle	1
Architectural Record	3	Green Builder Magazine	1
Pages	3	GBIG	1
Magic Plan	2	Green Building Design	1
Slide Shark	2	Notes	1
Facebook	2	Pantone Color Finder	1
Benjamin Moore Color Capture	2	GPS	1
iHandy Level	2	FLOR	1
SketchPad	2	Interface	1
Archinect	2	Prezi	1
Metropolis Magazine	2	Interior Design Magazine	1
Palette App	2	AudioNotes	1
Skype	1	Vento	1
Go To Meeting	1	Calculator	1
WebEx	1	Quick Office	1
Yammer	1	Neu.annotate	1
Architizer	1	File Browser	1
Architonic	1	Save2PDF	1
Doodle	1	Sherwin William Color Snap	1
Green Builder Magazine	1	PhotoPad	1
GBIG	1	Penultimate	1
Green Building Design	1		

Note: All applications are based upon the Apple iPad.