CREATIVITY AND IMAGERY IN INTERIOR DESIGN STUDENTS: 
EXPLORING RELATIONSHIPS AMONG CREATIVE PERSONALITY, PERFORMANCE, 
AND VIVIDNESS OF VISUAL IMAGERY

By

SIRIPORN KOBNITHIKULWONG

A THESIS PRESENTED TO THE GRADUATE SCHOOL 
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT 
OF THE REQUIREMENTS FOR THE DEGREE OF 
MASTER OF INTERIOR DESIGN 

UNIVERSITY OF FLORIDA

2007
© 2007 Siriporn Kobnithikulwong
To my family and those who have contributed their support to me.
ACKNOWLEDGMENTS

This thesis would not have been possible without the dedication and support of many people. First, I wish to thank my supervisory committee chair, Dr. Margaret Portillo, for her patience and open-minded attitude toward my work and scholarship. She gave me support, encouragement, and beneficial criticism that helped bring this thesis to completion. My other committee member, Jason Meneely, gave helpful comments and answered my questions any time I needed. Candy Carmel-Gilfilen and Dr. Maruja Torres contributed their time and thoughtful assistance to the data collection of this research. Dr. Jo Hasell introduced the world of research to me and provided knowledge and support for me to live in that world.

Also, the dedicated help of Stephen Flocks, who edited my drafts, was invaluable. Juanita Melchior always informed me of helpful information and assisted me with graduate school forms and paperwork. Anne Baumstarck and Jennifer Bassett helped improve my writing and speaking skills and made a hard semester more delightful for me. I also would like to thank juniors, seniors, and other graduates who participated in this thesis study. Without their contributions to the data collection, this research could not have been possible.

Furthermore, I would like to thank my boyfriend and friends who supported me throughout this process in their many ways. Wuthichai Leelavoravong gave me the best support and made me feel better any time I was down. Donruethai Laphasradakul, Prapaporn Rattanatamrong, and Panoat Chuchaisri encouraged me to pass several tough periods, made me smile when I almost cried, and helped feed me when I was too tired to cook. Finally, I wish to thank my family in Thailand; without them, I doubt I would have even come to graduate school and had the determination to finish a degree.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>4</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>8</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>9</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>10</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>12</td>
</tr>
<tr>
<td>Background</td>
<td>12</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>15</td>
</tr>
<tr>
<td>- Research Purposes</td>
<td>15</td>
</tr>
<tr>
<td>- Primary Variables</td>
<td>16</td>
</tr>
<tr>
<td>- Conceptual Framework</td>
<td>17</td>
</tr>
<tr>
<td>- Research Questions</td>
<td>17</td>
</tr>
<tr>
<td>Summary</td>
<td>18</td>
</tr>
<tr>
<td>2 REVIEW OF LITERATURE</td>
<td>21</td>
</tr>
<tr>
<td>Introduction</td>
<td>21</td>
</tr>
<tr>
<td>- What Is Creativity?</td>
<td>21</td>
</tr>
<tr>
<td>- Historical Overview of Creativity Research</td>
<td>22</td>
</tr>
<tr>
<td>- How Is Creativity Defined?</td>
<td>22</td>
</tr>
<tr>
<td>- Mooney’s framework</td>
<td>23</td>
</tr>
<tr>
<td>- The novelty and appropriateness consensus</td>
<td>24</td>
</tr>
<tr>
<td>- How Is Creativity Investigated?</td>
<td>24</td>
</tr>
<tr>
<td>- Relational Models to the Study of Creativity</td>
<td>26</td>
</tr>
<tr>
<td>Creativity in Persons and Products</td>
<td>27</td>
</tr>
<tr>
<td>- Who Are Creative People?</td>
<td>27</td>
</tr>
<tr>
<td>- Theoretical and Empirical Foundations</td>
<td>28</td>
</tr>
<tr>
<td>Assessing Creativity in Persons</td>
<td>29</td>
</tr>
<tr>
<td>The Psychometric Approach as a Current Applicable Model</td>
<td>30</td>
</tr>
<tr>
<td>- Biographical inventories</td>
<td>30</td>
</tr>
<tr>
<td>- Personality traits</td>
<td>31</td>
</tr>
<tr>
<td>What Are Creative Products?</td>
<td>32</td>
</tr>
<tr>
<td>Assessing Creativity in Products</td>
<td>33</td>
</tr>
<tr>
<td>Amabile’s Consensual Assessment Technique (CAT)</td>
<td>33</td>
</tr>
<tr>
<td>Creativity in the Design Domain</td>
<td>36</td>
</tr>
<tr>
<td>- Creativity as a Combined Characteristic of Domain Generality and Specificity</td>
<td>36</td>
</tr>
<tr>
<td>Current Applicable Theories</td>
<td>36</td>
</tr>
</tbody>
</table>
Question 3: Do Differences in Creative Performance Vary by Level of Creative Personality?..............................71
Question 4: What, if Any, Relationships Exist among Overall Creativity, Elaboration, and Planning Evident in Creative Performance?..................................................71
Summary.................................................................................................................................................73

5 DISCUSSION........................................................................................................................................88
Summary of the Research Background and Purposes .............................................................88
Interpretation........................................................................................................................................88
Interpreting Findings from the Preliminary Analysis.......................................................88
Interpreting Findings from the Correlation Analysis.......................................................89
Question 1: Do differences in vividness of visual imagery vary by level of creative personality? .................................................................90
Question 2: Do differences in vividness of visual imagery vary by level of creative performance?..................................................................................91
Question 3: Do differences in creative performance vary by level of creative personality?.......................................................................................93
Question 4: What, if any, relationships exist among overall creativity, elaboration, and planning evident in creative performance?.................................95
Enhancing Creativity and Visual Imagery in Interior Design Education.................................96
Limitations........................................................................................................................................98
Directions for Future Research...............................................................................................99

APPENDIX
A UFIRB APPROVAL ................................................................................................................................102
B DESCRIPTION OF THE SKETCH PROBLEM.........................................................................................105
C THE SKETCH PROBLEM ASSESSMENT..............................................................................................106
D SOLUTIONS OF THE SKETCH PROBLEM........................................................................................107
LIST OF REFERENCES..........................................................................................................................112
BIOGRAPHICAL SKETCH .......................................................................................................................121
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1</td>
<td>Most frequently selected adjectives</td>
<td>74</td>
</tr>
<tr>
<td>4-2</td>
<td>Descriptive statistics on primary variables</td>
<td>74</td>
</tr>
<tr>
<td>4-3</td>
<td>Visual imagery vividness scores by creative personality scores</td>
<td>74</td>
</tr>
<tr>
<td>4-4</td>
<td>Visual imagery vividness and creative personality correlations</td>
<td>75</td>
</tr>
<tr>
<td>4-5</td>
<td>Visual imagery vividness scores by creative performance scores</td>
<td>75</td>
</tr>
<tr>
<td>4-6</td>
<td>Creative performance scores by creative personality scores</td>
<td>75</td>
</tr>
<tr>
<td>4-7</td>
<td>Creativity, elaboration, and planning evident correlations</td>
<td>75</td>
</tr>
<tr>
<td>4-8</td>
<td>Correlations between primary variables</td>
<td>76</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>Key variables diagram</td>
<td>19</td>
</tr>
<tr>
<td>1-2</td>
<td>Conceptual framework</td>
<td>20</td>
</tr>
<tr>
<td>3-1</td>
<td>Methodology framework</td>
<td>61</td>
</tr>
<tr>
<td>3-2</td>
<td>Arrangement for creative performance assessment</td>
<td>62</td>
</tr>
<tr>
<td>3-3</td>
<td>Examples of creative performance. A) Representative low creative performance. B) Representative high creative performance</td>
<td>62</td>
</tr>
<tr>
<td>4-1</td>
<td>Visual imagery vividness scores with eyes closed by creative personality scores</td>
<td>77</td>
</tr>
<tr>
<td>4-4</td>
<td>Narrative elaboration comparison. A) Low creative performance. B) High creative performance</td>
<td>80</td>
</tr>
<tr>
<td>4-5</td>
<td>Literally solution. A) Low creative performance 1. B) Low creative performance 2.</td>
<td>81</td>
</tr>
<tr>
<td>4-6</td>
<td>Metaphorical solution. A) High creative performance 1. B) High creative performance 2.</td>
<td>82</td>
</tr>
<tr>
<td>4-7</td>
<td>Graphic comparison. A) Low creative performance. B) High creative performance</td>
<td>83</td>
</tr>
<tr>
<td>4-8</td>
<td>Quality of perspective comparison. A) Low creative performance. B) High creative performance</td>
<td>84</td>
</tr>
<tr>
<td>4-9</td>
<td>Legibility quality comparison. A) Low creative performance. B) High creative performance</td>
<td>85</td>
</tr>
<tr>
<td>4-10</td>
<td>Elaboration scores by creativity scores</td>
<td>86</td>
</tr>
<tr>
<td>4-11</td>
<td>Planning evident scores by creativity scores</td>
<td>86</td>
</tr>
<tr>
<td>4-12</td>
<td>Elaboration scores by planning evident scores</td>
<td>87</td>
</tr>
<tr>
<td>5-1</td>
<td>Visualization in design creativity</td>
<td>101</td>
</tr>
</tbody>
</table>
By definition, creativity assumes a central role in the field of interior design. Creativity relates to the ability to visualize information; however, only a few studies have focused on this potential connection in design. The purpose of this study is to explore the role of visual imagery in creative persons and design performance.

Fifty-six advanced interior design students were profiled on their creative personality traits and visual imagery vividness through Domino's creativity (Cr) scale on the Adjective Check List (ACL) and Vividness of Visual Imagery Questionnaire (VVIQ). To profile creative performance, participating students completed a locally developed sketch problem that was assessed by a panel of four expert judges using Amabile’s Consensual Assessment Technique (CAT) on overall creativity, elaboration, and planning evident.

The sample, as a whole, reported intelligent, artistic, and imaginative as the top three adjectives describing their personality. The statistical findings indicated that the ACL-Cr did not significantly associate with the overall VVIQ; however, it showed a significant inverse relationship with the VVIQ for eyes closed. No significant correlations appeared between either the ACL-Cr or VVIQ and creative performance. In creative performance, significant
relationships were revealed among creativity, elaboration, and planning evident. The qualitative analysis of creative performance indicated differences in quality of visual imagery vividness, elaboration, and planning evident between representative low and high creative performances. Representative low creative performance lacked detail both in writing and drawing, suggesting unclear visualization in participants who produced them; whereas, the high creative examples showed elaborated narratives and more fully designed drawings, indicating stronger visualization.

Results suggest that creativity in design performance can be enhanced by promoting visual imagery vividness. Closing eyes may help students with lower creative personality traits visualize better than without such intervention. Vividness of visual imagery positively relates to student ability to plan and develop a design, which also seems to raise creativity in design performance. To increase creativity in interior design, it is recommended that educators should consider and encourage the importance of visual imagery in the design curriculum.
CHAPTER 1
INTRODUCTION

Background

Doctoral students drop out of universities before graduation not because they cannot pass exams or get good grades in courses, but because they cannot come up with an original idea for a dissertation. …One hears the same story in industry and the business world, in civil service and scientific research. Technical knowledge and expertise might abound, but originality and innovation are scarce. Yet the way our species has been developing, creativity has become increasingly important. In the Renaissance creativity might have been a luxury for the few, but by now it is a necessity for all. (Csikszentmihalyi, 2006, p. xviii)

In *Developing Creativity in Higher Education: An Imaginative Curriculum* (2006), Csikszentmihalyi states how essential creativity is in learning a discipline, and it will be increasingly important across fields in the future. Particularly, in design disciplines, creativity appears fundamental to the field (Dineen, 2006; Lawson, 2005). Regarding a recent study of instructors’ and students’ perspectives on creativity in art and design (Dineen, 2006), “The development of learner creativity was considered by all of the lecturers to be the primary goal of art and design education” (p. 110). Therefore, a number of instructors, educators, and researchers in the design field have explored correlations between creativity and several aspects of design in order to gain insight into and enhance design abilities and skills (Goldschmidt & Tatsa, 2005; Kokotovich & Purcell, 2000; Lawson, 2005; Lawson & Menezes, 2006). This underlines the strong and extended relationship between creativity and the design realm.

Almost 2 decades ago, Fowles (1991) predicted, “The interior designer’s work [would] become more technical, complex, and specialized and also more valued and creative. These changes should result in major alterations in design education” (p. 21). So far, several studies have supported his prediction by revealing the essence of creativity in both educational and professional facets of the field (Miller, 2005; Portillo, 1996, 2000, 2002; Vithayathawornwong &
Furthermore, creativity appears integral in a recent definition of the interior design profession:

Interior design is a multi-faceted profession in which creative and technical solutions are applied within a structure to achieve a built interior environment. … The interior design process follows a systematic and coordinated methodology, including research, analysis and integration of knowledge into the creative process, whereby the needs and resources of the client are satisfied to produce an interior space that fulfills the project goals. (National Council for Interior Design Qualification, 2004)

Presently, the Council for Interior Design Accreditation (2006), whose mission is to ensure a high level of quality in interior design education, identifies creative thinking as a core requirement in the educational program standards. Regarding the professional standards, due to the responsibility of the interior designer, which covers all spaces within environments built for human habitation, “educational philosophies and goals should be applied in the development of a creative professional who can synthesize information and analyze problems from many different perspectives” (Council for Interior Design Accreditation, 2006, ¶ 1).

Based on the prediction, studies, and standards described above, the interior design curriculum should encourage researchers, educators, and students to explicitly think to achieve increasingly creative work in the field. How can the curriculum be developed to promote creativity? Various factors affect this issue. However, the creativity of the interior design student, who will be expected to produce highly creative processes and performance, is fundamentally important. Heightening creativity in interior design students will enable them to become more effective and successful in their occupation (Portillo, 1996).

By reviewing studies in related fields (Daniels-McGhee & Davis, 1994; Davis, 1999; Kunzendorf and Reynolds, 2004-2005), we see an interesting relationship between creativity and imagination being delineated. Imagination is defined as “the act or power of forming a mental image of something not present to the senses or never before wholly perceived in
reality” (Mish, 1999, p. 578). As seen in the definition, mental imagery is an important part of imagination, and it has been also connected to creativity in psychology and education research for at least 200 years. A number of studies have revealed that mental imagery is a crucial aspect of thinking, problem-solving, learning, and generating creativity (Daniels, 1995; Drake, 1996; Khatena, 1984; Morrison & Wallace, 2001; Paivio, 1969). Basically, mental imagery can be assessed through seven modalities: visual, auditory, tactile, kinesthetic, taste, smell, and bodily sensations (Robertson, 2003). Visual imagery, the ability to visualize, is the most frequently identified modality in research on mental imagery (Daniels-McGhee & Davis, 1994; Marks, n.d.; McKelvie, 1995).

For instance, Daniels (1995) examined creativity and visual imagery in art and science specialty-school students. She discovered an important correlation between creativity and vividness of visual imagery in the students through How Do You Think personality inventory, Torrance Picture Completion Test, and Vividness of Visual Imagery Questionnaire. Moreover, qualitative data gathered from the students’ image response journal revealed that highly creative students expressed more vividness of visual imagery through longer, more informative, and elaborate descriptions about their visual imagery than those with lower creativity. LeBoutillier and Marks (2003) explored creative individuals in areas of art, film, and sculpture; such as Breton, Ernst, and Moore. They found that those creative people use mental imagery, especially the visual modality, to achieve creativity in their work. Besides, many findings from art and design studies have supported the important role of visual imagery in fostering creativity; as a result, the correlation between creativity and visual imagery should be deeply examined.

In the design realm, visual imagery acts as the internal visualization of designers which appears to play a crucial role in the design process, such as developing concepts, designs, and
communication skills. Designers across disciplines think and communicate visually, so visualization takes an essential part in supporting their creativity and design problem-solving skills (Goldschmidt & Smolkov, 2006). However, to date, only a few studies in allied fields of design, such as architecture, interior design, landscape architecture, industrial design, and graphic design, have explored the correlation between creativity and visual imagery. For instance, Liddament (2000) examined a concept of visual imagery used in design by referring to multi-disciplined perspectives. He suggested that if the concept of visual imagery could be clearly elucidated, it would help to develop creativity in design as well as provided useful implications for design pedagogy.

Many studies in cognitive and design thinking have shown that the internal visualization, visual imagery, and the external representation, such as drawings, are instrumental in design problem solving. Casakin and Goldschmidt (2000) examined effects of visual analogy and imagery on the designer problem-solving skill. One of their conclusions stated that visual imagery can be employed by designers to manipulate shapes and forms as well as reorganize them in consequential and creative ways. In addition, Kokotovich and Purcell (2000) investigated design issues of creativity, mental synthesis and visual imagery, and drawing. They compared and contrasted 3D-designers (industrial designers), 2D-designers (graphic designers), and non-designers by asking them to generate creative forms from provided shapes. The findings indicated that the designers, who often use visualization in the design process, achieved much higher scores on generating creative forms than did the non-designer.

**Problem Statement**

**Research Purposes**

As stated in the background, the correlation between creativity and visual imagery appears essential to the design realm, but a few efforts have investigated this issue. Thus, this thesis study
aims to explore whether the relationship exist and is beneficial to design areas. The main purpose of this thesis study is to examine relationships among features of creativity and visual imagery in interior design students. The study especially emphasizes the role of visual imagery in creative persons and performance in interior design. Results of this thesis study will be meaningful for the body of knowledge in the interior design field by contributing to better understanding of creativity and visualization in interior design students and their performance. In addition, findings will provide recommendations to educators to enhance creativity and visualization in the interior design curriculum.

**Primary Variables**

Before conducting the current research, it is important to clarify definitions of primary variables and specify the scope of the investigation. Figure 1-1 identifies primary variables, their definitions, and the relationship among the variables. Beginning with creativity, a majority of creativity researchers relatively agree that creativity can take place in a characteristic of personality, process, quality of a product, and an outcome of an environment, referred to as the four P’s of creativity: Person, Process, Product, and Press (Mayer, 1999; Mooney, 1963; Taylor, 1988). Only creativity in the person and product are focused in this thesis study.

As mentioned above, mental imagery involves seven modalities: visual, auditory, tactile, kinesthetic, taste, smell, and bodily sensations (Robertson, 2003). Only visual imagery is emphasized in this thesis study. In addition, according to Block (1981) and Kosslyn, Thompson, and Ganis (2006), one side of the mental imagery researchers, known as pictorialists, agrees that “mental images are in fact images and hence often compared visual mental images to pictures” (Kosslyn, Thompson, & Ganis, 2006, p. 6). The other side, called the descriptionalists, argues that “we should think of mental images as representing in the manner of some non-imagistic representations – namely, in the manner of language rather than pictures” (Block, 1981, p. 3). In
this present study, both pictorialist and descriptionalist approaches are employed to be guidance for assessing visual imagery in interior design students.

**Conceptual Framework**

After defining the primary variables, the scope of the thesis investigation is necessary to be overviewed. In the design process, a designer has to visualize something that has not been created while solving a design problem. Then, in order to communicate a design to others, the internal visualization is developed through external representations or design performance, such as drawing or 3-D modeling. The conceptual framework of this study is developed to support the investigation in design process.

Figure 1-2 illustrates the framework, which is divided into three parts: the person, process, and product. First, focusing on interior design students, as the person in this study, their creative personality is examined whether it relates to their self-reported vividness of visual imagery, which is considered as the internal visualization. Second, the study explores the process while the student visualizing and how they represent their visualization through an external representation, which is the product in this study. Correlations between the generating process of the internal visualization and external representation are also investigated. Third, focusing on the other primary variable, creativity in the product or creative performance is examined. Finally, this thesis study explores whether relationships exist among these three parts of the framework.

**Research Questions**

- **Question 1:** Do differences in vividness of visual imagery vary by level of creative personality?

- **Question 2:** Do differences in vividness of visual imagery vary by level of creative performance?

- **Question 3:** Do differences in creative performance vary by creative personality?
Question 4: What, if any, relationships exist among overall creativity, elaboration, and planning evident in creative performance?

These questions require rationales from the literature cited in Chapter Two. Chapter Three describes the methodology: the study participants, instruments, pilot study, and procedure, utilized while conducting this thesis study. Chapter Four addresses the research questions by presenting results of the study, both in terms of quantitative and qualitative analyses. Finally, Chapter Five interprets and discusses the study, interpretation of the results, implications to the interior design curriculum, limitations in this research, and suggestions for future studies.

Summary

Creativity has increasingly become important in learning a discipline. Particularly, in interior design, creativity has been considered as an essential characteristic within the designer, design process, and performance. Thus, it is necessary to develop the interior design curriculum, including teaching, learning, practicing, and conducting research, to promote creativity.

Reviewing the literature shows that mental imagery plays a significant role in fostering creativity. Especially, visual imagery primarily affects creativity and problem solving skills in design. A number of studies in the psychological and educational areas have supported this correlation; however, only a few efforts of designers have explored this issue. Thus, this thesis study aims to investigate this connection by emphasizing the role of visual imagery in the person and performance in interior design.
Figure 1-1. Key variables diagram

Creativity
Creativity is “the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints)” (Sternberg & Lubart, 1999, p. 3).

Mental Imagery
Imagery is “the mental invention or recreation of an experience that in at least some respects resemble the experience of actual perceiving an object or an event, either in conjunction with, or in absence of, direct sensory stimulation” (Finke, 1989, p. 2).

Person
A creative person is “someone who possesses particular traits that influence his or her creativeness” (Davis, 1999, p. 41).

Process

Product
A creative product “must be new and must be given value according to some external criteria” (Gruber & Wallace, 1999, p. 94).

Press
(Environment)

Auditory

Tactile

Visual
Visual imagery “refers to the ability to visualize, that is, the ability to form mental pictures, or to see in the mind’s eye” (Marks, n.d., ¶ 1).

Pictorialist’s Perspective

Descriptiveist’s Perspective

Kinesthetic

Smell

Taste

Bodily Sensation
Figure 1-2. Conceptual framework
CHAPTER 2
REVIEW OF LITERATURE

Introduction

This chapter reviews the most relevant literature on creativity and visual imagery that offers the background for answering the research questions raised in this thesis. The primary thrust of this review focuses on the definition and measurement of creativity in the person and products. The review also emphasizes the relation between creativity and imagery with particular attention to the design fields. The review is divided into four sections. Section one introduces an historical overview of creativity research, definitions, as well as recent theories and approaches. Section two outlines applicable theoretical and empirical foundations that focused on creative traits and products. Section three discusses major theories associated with domain-specific creativity and outlines research from a design perspective. Lastly, section four establishes theoretical and empirical foundations emphasizing the relationship between creativity and imagery both in general and in the design realm.

What Is Creativity?

As I write, in July 2005, there is a renewed burst of interest by policy-makers in creativity. To give a few examples, Paul Roberts has just begun to review creativity in English schools; the Cultural Commission in Scotland has recently produced a sizeable and far-reaching report on Scotland’s creativity needs; the new Creativity Industries Minister in England, James Purnell, has outlined his vision for the creative industries; George Cox is reviewing how small and medium-sized enterprises can make better use of “creative specialists”. These projects, covering different spheres of endeavour, form a good starting point for why creativity is considered a valuable attribute for society, and how, within a policy-making community increasingly focused on delivery, the “c”-word is of interest. (Smith-Bingham, 2006, p. 10)

As mentioned in the previous chapter and above quotation from the Head of Policy and Research at the National Endowment for Science Technology and the Arts in the UK, creativity has gradually been accepted as a significant quality enhancing success and efficiency in every discipline. It is not surprising that a number of researchers across fields have employed various
approaches to examine creativity. Furthermore, due to its multi-facets and the complexity of creativity’s nature, research on creativity is extremely diverse and represents a range of research perspectives (Baer & Kaufman, 2006; Daniels, 1995; Kaufman & Baer, 2005; Mayer, 1999; Sternberg, 2003, 2006b).

**Historical Overview of Creativity Research**

Before 1950, research in creativity emphasized the role of intelligence research (Albert & Runco, 1999; Sternberg, 1988a) with little research focusing exclusively on creativity. Some experts, such as Guilford, included creativity as a subset under the area of intelligence; whereas, others, such as Getzels, argued that creativity was psychologically distinct from intelligence (Albert & Runco, 1999).

However, interest in creativity research began to grow in 1950 when Guilford, in his APA Presidential Address, brought the potential of creativity research back into the forefront (Sternberg & Lubart, 1999). During the 1950s to 1970s, work in creativity had developed in different fields with different perspectives, but results from those studies did not provide a clear focus. Since the 1970s, creativity research has become clear and noticeable with definitions, approaches, and theories developed by creativity pioneers, such as Guilford, Torrance, Sternberg, Lubart, Csikszentmihalyi, Amabile, and Gardner (Baer & Kaufman, 2006; Mayer, 1999; Sternberg, 2003, 2006a). Although research on creativity is still considered a minor subject in the field of psychology, it has generated significant progress as results of the pioneering efforts and gradually grown across disciplines (Feldman & Gardner, 2003; Kaufman & Baer, 2005; Sternberg & Lubart, 1999).

**How Is Creativity Defined?**

What is creativity? In general, it seems to be easy to describe this term and find examples of creative people, things, or situations; however, there are challenges in empirically defining
A diversity of theoretical and methodological perspectives indicates multiple approaches to researching creativity, contributing in part to lack of consistent definitions of this term (Amabile, 1983, 1996; Davis, 1999; Guilford, 1950; Mayer, 1999; Simonton, 1999; Sternberg, 1985, 1988b, 2006a, 2006b; Sternberg & Lubart, 1999; Taylor, 1988; Torrance, 1984). Even though Sternberg’s (1985, 1988b) classic study involving implicit theories shows that people agree on the same viewpoint about main characteristics of creative individuals, or Amabile’s (1983, 1996) research reveals a high internal consistency among expert judges in their assessment of creative products, there is still no definite meaning to define creativity. In *Fifty Years of Creativity Research*, Mayer (1999) argues for a clearer and more practical definition of creativity in the field.

**Mooney’s framework**

Mooney (1963) facilitated organization of research on creativity by proposing four foci for scrutinizing creativity; they comprise the creative environment or press, the creative product, the creative process, and the creative person. Mooney states that although previous creativity research employed different ways to study and focused on different aspects of creativity, those ways and aspects were one or a combination of the four foci.

Besides providing a rational panel of categories to the creativity research organization, Mooney’s framework also responded to a disciplinary disintegration among different approaches in social, psychological, and behavioral research. Based on this framework, various approaches and theories in those areas have been categorized into the four channels. Recently, according to Baer and Kaufman (2006), Sternberg (2003), Sternberg and Lubart (1999), and Taylor (1988), the disintegrated nature of creativity research has gradually waned because more combined approaches and theories occur. The integration among many previous definitions and theories as
subcomponents of a surrounding and unified construct is currently introduced by emerging systems theories.

Since the four foci are expansive and practicable to be employed for study in most aspects of the creativity research appearing in the literature, Mooney’s framework has widely been recognized and utilized by many researchers (Davis, 1999; Plucker & Renzulli, 1999; Sawyer, 2003; Sternberg, 1988b; Taylor, 1988). Torrance (1988), whose research has focused on the creative process, makes an excellent connection among the creative process, person, press, and product within his research definition:

I chose a process definition of creativity for research purpose. I thought that if I chose a process as a focus, I could then ask what kind of person one must be to engage in the process successfully, what kinds of environments will facilitate it, and what kinds of products will result from successful operation of the processes. (p. 47)

**The novelty and appropriateness consensus**

Even though an exact definition of creativity has not been collectively accepted, a majority of creativity researchers generally endorse the notion that creativity involves the creation of an original and useful or novel and appropriate product (Averill, 2005; Baer & Kaufman, 2006; Amabile, 1983, 1996; Davis, 1999; Gruber & Wallace, 1999; Leman, 2005; Mayer, 1999; Sternberg, 2006a). Mayer (1999) defines novelty and appropriateness as follows:

The overarching definition of creativity seems to favor the idea that creativity involves the creation of new and useful products, including ideas as well as concrete objects; however, from this definition, it follows that creative people are those who create new and useful products, and creative cognitive processes occur whenever a new and useful product is created. (p. 450)

**How Is Creativity Investigated?**

Not only is defining what creativity complex, but also describing how it is studied proves challenging (Baer & Kaufman, 2006; Mayer, 1999). By analyzing and summarizing previous and
current research on creativity, Mayer (1999) highlights a representative sampling of creativity research approaches:

**Psychometric methodologies:** In these approaches, creativity is best described as a quantifiable human factor, and quantitative measurement is the most important characteristic of these methodologies.

**Experimental methodologies:** Experimental researchers view creativity as a cognitive process of the human and seek to analyze the cognitive processes involved in solving creativity problems.

**Biographical methodologies:** Biographical approaches focus on analyzing case studies of the eminent creative people’s history. They believe that events in the life of a creative person can address his or her creativity.

**Biological methodologies:** Biological or cognitive neuroscience researchers consider creativity as a measurable physiological characteristics and examine the physiological relationship of creative problem solving.

**Computational methodologies:** The main notion of these approaches is that a computer program can represent a person’s creative thinking; therefore, techniques of artificial intelligence are examined to find correlations with creativity in the human.

**Contextual methodologies:** In these approaches, creativity is viewed as a context-based activity; creativity is in its social, cultural, or evolutionary context.

In addition, each of those six approaches may address each of three research paradigms, including describing the nature of creativity, comparing creativity and non-creativity, and relating factors to creativity. According to Sawyer (2003), the psychometric approach is most widely employed and developed in creativity research, especially creative personality traits. It is
important to note that this thesis study follows this approach, considering creativity as a measurable mental trait of individuals and employing quantitative measurement to study creativity. Particularly, this current research focuses on two types of the research paradigms: comparing interior students who score high and low in creativity and relating creativity measures to vividness of visual imagery measures.

Relational Models to the Study of Creativity

One relatively recent subject regarding the integration tendency is relational models, or also known as confluence models (Baer & Kaufman, 2006; Sternberg, 2003; Sternberg & Lubart, 1999). Relational models are “multifactor models that posit several separate but interacting components that must come together to yield original and productive outcomes” (Baer & Kaufman, 2006, p. 20). Each theory is briefly presented here, but Amabile’s and Csikszentmihalyi’s theories, which are more relevant to content in following sections, will then be amplified.

Amabile (1983, 1996) introduces a three-factor model or a componential framework and defines creativity as the confluences of intrinsic motivation, domain-relevant skills, and creativity-relevant skills. The creativity-relevant skills comprise a cognitive style, knowledge of heuristics, and a work style. Gruber and his colleagues (Gruber & Davis, 1988; Gruber & Wallace, 1999) posit a developmental evolving-systems model for understanding creativity that emphasizes the unique ways that a creator’s purpose, idea, knowledge, and affect grow over time. Gruber studied individuals, such as Charles Darwin, in documented records to trace the development of ideas over time. His studies also showed the tenacity and complexity of creative progress leading to successful creative products. Gardner (1993) also conducts case studies suggesting that creative products can be developed from an irregularity within a system, such as tension between competing critics, or moderate asynchronies between the individual, domain,
and field. Csikszentmihalyi (1988, 2006) proposes a different systems approach but emphasizes the interaction of the individual, domain, and field.

Sternberg and Lubart (1991, 1999; Sternberg, 2003, 2006a) present an investment theory of creativity, which was expanded from Sternberg’s three-facet model of creativity (1988b). Based on this theory, they state that a creative person is one who buys low and sells high in ideas. They also posit six main interrelated aspects that are relevant to this process; they include intellectual abilities, knowledge, thinking styles, personality, motivation, and environment.

More recently, Sternberg and colleagues (Sternberg, 1999, 2003, 2006a; Sternberg, Kaufman, & Pretz, 2004) introduce a propulsion model stating that “creativity can be different kinds, depending on how it propels existing ideas forward” (Sternberg, 2003, p. 99). This theory addresses eight different kinds of creative contributions that are categorized based on their correlation to the domain. The eight contributions consist of replication, redefinition, forward incrementation, advance forward incrementation, redirection, reconstruction, reinitiation, and integration.

Researchers in different fields have investigated characters of creativity in order to promote human ability to contribute creativity to a domain. However, due to its complexity and multi-facet nature, we have not been able to precisely define creativity yet. So far, one primary point we found from reviewing the literature is that we cannot establish any laboratory settings to explore creativity characters; only way for exploring creativity is to investigate it in context.

**Creativity in Persons and Products**

**Who Are Creative People?**

Since the 1950s, the creative person personality has been the first focus of research on creativity (Chávez-Eakle, Lara, & Cruz-Fuentes, 2006; Sawyer, 2003). Most of the studies have investigated personality correlates of highly creative behaviors and/or individuals and determine
their traits. In order to gain insight into personality, researchers have utilized different approaches based upon their perspective on creativity definitions. As a result, various definitions of creativity include the following: “A creative person is someone who possesses particular traits that influence his or her creativeness” (Davis, 1999, p. 41), “The creative person is not conveniently ‘far out’ along some well-charted path: She or he is unique in unexpected ways” (Gruber & Wallace, 1999, p. 93), and “… within their domain of interest, all creative individuals love the task that engages their whole energy” (Csikszentmihalyi, 2006, p. xix).

**Theoretical and Empirical Foundations**

Literature on early writings linked creativity and intelligence in which the concept of the creative person was shrouded in the concept of the intelligent genius (Sternberg, 1888a; Sternberg & Lubart, 1999). According to Albert and Runco (1999), in the pre-Christian period, the idea of genius was related to mystical powers of protection and good fortune, until the Greeks shifted their thinking to individual abilities and desires. During the Middle Ages, views on genius and creativeness related to creation or genesis from God. It was not until the Renaissance that this attitude shifted to understanding genius (including creativity) as a human-based competence. In the late of 1800’s, while the idea of creativity as an identifiable and inherent intellectual construct was seriously being critiqued, empirical studies were taking place to test this assumption by investigators (Albert and Runco, 1999).

Galton took his efforts on studying the diverse traits of eminently creative individuals. Galton considered diversity as a measurement problem. To solve that problem, diversity was operationalized as individual dissimilarities within a setting of known factors that could be measurable. “Thus, one of Galton’s significant contributions directly to psychological research and indirectly to creativity was the operational definition of broad evolutionary diversity as manifested in specific individual differences that could be measured” (Albert & Runco, 1999, p. 28).
In addition to this, by employing measurement methods to investigate diverse aspects, he also posited a paradigm that is now known as the psychometric approach. Based on his earlier study of eminence-achieving families, Galton also suggested that creativity was significantly related to intelligence, and they were abilities in every human without any supernatural powers.

In the early period of the empirical creativity research, intelligence research dominated creativity in intelligence; studies in the topic had no unified direction. However, Guilford stimulated creativity investigations in the early 1950s. Based upon his earlier intelligence work, Guilford correlated divergent production to creativity. He developed the three-dimensional “Structures of Intellect model” to describe the processes that a highly creative person’s brain could perform (Baer & Kaufman, 2006). Furthermore, this model emphasizes creative thought and defines divergent production as a set of creative thinking functions, including generation of a quantity of ideas, the number of possibilities into which ideas can be placed, the uniqueness of ideas, and the embellishment of ideas. These functions are well known as fluency, flexibility, originality, and elaboration (Guilford, 1967). Besides this renowned model, Guilford technically is recognized as an original one who introduced the psychometric approach to the realm of creativity.

Assessing Creativity in Persons

After the contribution of Guilford, most efforts in the field have been dedicated to examining creative people. As a result, current diverse approaches in the subject have been heavily developed and applied to study creative persons. According to Mayer’s (1999) representative sampling of creativity research approaches, of the six current approaches, the top three most broadly employed approaches in assessing creative individuals comprise:

**The psychometric approach:** This is Guilford’s original approach and considers creativity as a mental characteristic that can be measured by appropriate tools. In other words,
creativity is best described as a quantifiable human trait. This approach employs quantitative measurement and ability-based analyses to examine creativity in people.

**The experimental approach:** It is considered as the significant tried-and-true method of cognitive psychological research. It emphasizes the cognitive processes that are involved in solving creativity problems. Three primary components of this approach are controlled environments, quantitative measurement, and cognitive task analysis. In the experimental approach, creativity is best described by analyzing the cognitive processes of humans since they engage in creative thinking.

**The biographical or cognitive neuroscience approach:** This approach includes both qualitative analyses, such as the case study method (Gruber & Wallace, 1999), and quantitative analyses, such as the historiometric perspective (Simonton, 1999). The biological approach considers creativity as a measurable physiological characteristic. In other words, creativity can be best described as physiological changes of a human that relate to creative problem solving.

**The Psychometric Approach as a Current Applicable Model**

As described previously, the psychometric methodology is the most relevant approach for this thesis study; therefore, the psychometric evidence is mainly highlighted in this review as well. Since the 1950s, psychometric instruments have been heavily designed and developed across domains to explore creativity (Sawyer, 2003). Regarding Plucker and Renzulli (1999), this approach suggests that a person’s creativity consists of various facets that can be quantified by appropriate quantitative instruments. Basically, there are two main characteristics of such instruments: biographical inventories and personality traits.

**Biographical inventories**

“The best predictor of future creative behavior may be past creative behavior” (Colangelo et al., 1992, p. 158). In addition to this, Amabile (1983) suggests that people’ creativity may be a
result from their past. Based on this assumption, biographical inventories have been developed by many researchers (Plucker & Renzulli, 1999). By employing the instruments, past behaviors of creative individuals are examined to indicate whether those experiences have any correlations with their creative outcomes. In general, biographical inventories require respondents to report their past accomplishments and/or experiences; however, many instruments contain an item-check list that associates either with current activities or with both past and current activities.

**Personality traits**

This kind of psychometric instrument focuses on measuring diverse characteristics of people. Fundamentally, the instruments have been designed to assess personality relating to creative behavior and indicate highly creative individuals’ common personality traits. Then, these traits have been utilized in comparison with other individuals. The instruments are widely developed and employed in creativity research (Chávez-Eakle, Lara, & Cruz-Fuentes, 2006; Plucker & Renzulli, 1999); examples of these measures include the Group Inventory for Finding Talent, Group Inventory for Finding Interests, Sixteen Personality Factor Questionnaire, and Adjective Check List.

The following is an example of empirical creativity studies employing the personality traits to explore creativity in a specific domain. Domino and Giuliani (1997) employed the ACL-Cr to assess three samples of photographers: photography students, novice professionals, and experienced professionals. In the student group, there was no significant correlation among the ACL-Cr, creativity ratings, and technical expertise ratings. On the contrary, in the novice professional group, scores on the ACL-Cr significantly correlated with all dimensions: portfolio rated scores, grades, creativity ratings, technical expertise ratings, and self-ratings. Like the novice professionals, in the experienced photographer group, significantly relationships were revealed among the ACL-Cr, portfolio ratings, creativity self-ratings, and creativity peer-ratings.
By comparing the ACL-Cr scores, the progression of ACL-Cr means across the three samples was found, with the students scoring lowest and the experienced professionals scoring highest.

By reviewing the literature on the creative person, first, we found that theories and research surrounding this topic agree well that the personality traits can enhance creativity (Sawyer, 2003; Sternberg, 2003). In addition, Helson (1996) makes an interesting suggestion that creative personality investigations should return to explore whether highly creative people have common traits across domains and discover the significant differences among highly creative persons.

Second, we also see the major direction of future research that aims to understand the complex phenomenon of creativity among different variables rather than define those various variables (Baer & Kaufman, 2006; Plucker, 2005; Sternberg, 2003).

**What Are Creative Products?**

MacKinnon (1978) claims that the basis of creativity studies should be investigating creative products in order to identify what differentiates them from others. This idea has been increasingly accepted by a number of researchers who study creativity across different fields. Prominent researchers offer definitions of a creative product in a way to clarify dimensions of creative performance.

For example, Amabile (1982) suggests that “a product or response is creative to the extent that appropriate observers independently agree it is creative” (p. 1001). Gruber and Wallace (1999) describe that “the creative product must be new and must be given value according to some external criteria” (p. 94). Averill (2005) defines that “a creativity response is (typically) different from what is standard for the individual or group, and it is of some value (e.g., aesthetically as in art, theoretically as in science, or practically as in business)” (p. 231). Based on reviewing the literature, it is important to note that most definitions of creative performance emphasize the important role of novelty and appropriateness. Basically, novelty is easier to be
identified than appropriateness; one can depict immediately what is new or different from others, whereas only one cannot decide easily what is useful or appropriate to its context. Some of the definitions obviously stressed that criteria in a domain are necessary for assessing creative products.

Assessing Creativity in Products

Research into creative products was primarily addressed to establish validity in creativity research and help create external criteria that could be compared with other creativity measurements (Plucker & Renzulli, 1999). However, it is difficult and complex to find an appropriate approach to assess creative products. Even though the psychometric approach has been successful in the study of creative people, especially in the study of personality traits, it has been surprisingly limited in the study of creative products.

So far, the most accepted method for assessing creative products has been the rating of external judges, including educators, parents, and experts in a domain (Plucker & Renzulli, 1999). According to Balchin (2006), the views of experts in a domain support this method to be more reliable than many others. In the area of product ratings by domain-expert judges, two slightly different methods have been developed. First, refined by Amabile (1983) and widely known as the Consensual Assessment Technique (CAT), is the rating without or with little guidance. This method addresses the significant role of specific criteria within disparate domains, and it has been more widely recognized by all most all fields, even the “hard” sciences (Baer, Kaufman, & Gentile, 2004). The other one is the rating with fully provided categories that serve as guides for experts to assess products.

Amabile’s Consensual Assessment Technique (CAT)

Amabile (1983, 1996) refined and developed the Consensual Assessment Technique (CAT) in order to investigate levels of creativity embodied by a product. The CAT requires
expert judges to assess creativity mainly with their own concept of creativity based upon the only theory of the CAT suggesting that experts in a given domain readily identify creativity when they see it (Ambile, 1983, 1996; Baer, Kaufman, & Gentile, 2004). Administration of the CAT is relatively simple and straightforward. However, at the same time, it adheres to some requirements as Hennessey and Amabile (1988) describe:

Subjects are asked to complete some task in a specific domain (such as poetry), and then experts in that domain (such as poets) independently rate the creativity of the products. The level of interjudge agreement is assessed, and if it is acceptable (generally above .70), the mean across-judge creativity ratings are used as our dependent measures of creativity. (p. 15)

A number of studies have proved that the CAT can be validly and reliably employed in evaluating creativity in products, mostly in visual arts and writings. In order to expand the scope of its validity, Auh and Johnston (2001) originally utilized the CAT in assessing creativity in music. In their study, a product sample included 19 musical compositions and 14 invented stories produced by three- to five-year-old children. A panel of three experts was utilized to evaluate the products using the CAT. As a final result, they found that the CAT was a reliable method to assess creativity in musical compositions by the children with inter-judge reliabilities of .86 for the music compositions and .70 for the invented stories. In addition, they concluded that the CAT contained some advantages for the judges to see the products from a more holistic view.

Even though the CAT has been both widely employed and well validated across disciplines, its validation has been limited to evaluating only products under strictly experimental conditions with specific requirements for creating the products. According to this limitation, Baer, Kaufman, and Gentile (2004) conducted research to explore if the CAT can be expansively used in assessing a broader and more diverse product sample gathered for non-specific experimental requirements. For this study, a large panel of 13 expert judges was employed to assess creativity in students’ stories, personal narratives, and poems that had been already
collected in another research study. The results proved that the CAT had a potential to be broadly used in evaluating creativity in diverse products, with a high degree of inter-judge reliabilities (.94 for the stories, .96 for the narratives, and .87 for the poems). Furthermore, the results allowed researchers to gain benefits from already-gathered creative products to assess different correlations that may lead to greater levels of creative performance.

In the educational area, teacher rating has been the most popular tests for apparent reasons. The instruments require teachers to rate specific dimensions of students’ products. One of the most recent teacher-rating tests is a creativity feedback package (CFP) developed by Tom Balchin (2006). The CFP includes seven criteria for products to be rated in a 12-point Likert scale; the criteria consist of uniqueness, associations of ideas, risk-taking, potential, operability, well-craftedness, and attractiveness. Four of them describe the creative concept and the other three describe the quality of build. Concise definitions, as a guideline to evaluate students’ products, are also provided for educator judges.

The person and product are involved in creativity production as stated in Mooney’s framework. A creative person is someone who possesses specific traits that affect his or her ability to produce creative process or ideas. The most widely employed approach to study the creative person is the psychometric methodology. In particular, research on creative personality traits has been the first focus on studying creativity in people.

A creative product or idea has to consist of novelty and usefulness regarding the consensus of novelty and appropriateness. Contrast to the research on the creative person, research on the creative product has not found a precise approach to assess creativity yet. So far, the most frequently employed approach to evaluate creative performance is the consensual assessment technique, which is based upon opinions and comments from expert judges in each domain.
Creativity in the Design Domain

One primary issue at the heart of creativity research is whether creativity is domain specific, and this conflict has lead to a split in thinking. The first camp, employing a domain-general approach, considers that creative processes are universal. The other camp, employing a domain-specific approach, believes that creativity is unique and focuses only on creativity within specific fields such as art and science.

Creativity as a Combined Characteristic of Domain Generality and Specificity

Based on the current direction of unified theories in creativity research, the fragmentation of those two approaches has been welded. Some researchers who support the domain-general approach have recognized an important role of domain-specific thinking skills in creative thinking. Some experts in specific domains have tried to correlate the personality traits of creative individuals in their domain with those in others (Baer & Kaufman, 2005). However, in assessing creativity in products or performance, a domain still obviously plays a strong and important role. Recently, Kaufman and Baer (2005a) articulate the importance of domain specificity in creativity as

The field of creativity is a natural one in which to explore issues of content and domain specificity. Although one can think of creativity as a construct in abstract, domain-transcending ways, all creative products come into being in some domain or field of endeavor (and they are ultimately judged by the current standards of the relevant field or domain). Creativity also has a much wider purview than it once did; no longer confined to just a few areas in the arts and sciences, creativity is now considered important in performances and products of all kinds. (p. xiv)

Current Applicable Theories

By reviewing the literature in the topic of creativity in the design domain, three recent applicable models are presented here. The first two theories represent the unified approach and the last one is a recently proposed theory of Baer and Kaufman, who relatively see creativity as a domain-specific character.
Amabile’s componential framework

Amabile (1983, 1996) posits a componential framework or a three-factor model of creativity productivity. She views creativity as the confluences of three components: intrinsic motivation, domain-relevant skills, and creativity-relevant skills.

Intrinsic motivation or task motivation: It is defined as one’s attitude toward the task, one’s perception to starting the task, one’s first level of internal motivation toward the task, and the ability to mentally minimize external restraints (Davis, 1999). According to Amabile (1996), the simple internal motivation can lead to higher levels of creativity than external motivation; in addition to this, increasing extrinsic motivation, such as offering of rewards, might decrease intrinsic creativity. She also notes that “rewards that convey competence information to subjects may not undermine intrinsic motivation” (p. 160).

Domain-relevant skills: They consist of knowledge and skills that influence creative performance in a given domain but not creative performance in other domains, such as drawing or writing.

Creativity-relevant skills: These skills include (a) a cognitive style that engages in complexities and mental processes that occur during solving creative problem, (b) knowledge of heuristics for creating new and different ideas, and (c) a work style typified by concentrated effort, an ability to break free from problems, and high energy.

Csikszentmihalyi’s three-part theory

Csikszentmihalyi (1988, Nakamura & Csikszentmihalyi, 2003) proposes a theory highlighting the interaction among three components of creativity: the individual, field, and domain.

The individual: A person utilizes knowledge in a domain and expands or converts it through personality characteristics, cognitive processes, and motivation. Everyone has potentials
to be creative. Fresh perceptions, novel creations, and valuable ideas can be caught by anyone. However, persons who actually change the ways we see and do things are only few.

**The field:** This component includes experts or people who manipulate a domain and judge or select creative outcomes. Members of a field can either enhance or hinder creativity in the domain. By admitting too many novel ideas or being too strict, new creative outcomes can be harmed and limited.

**The domain:** A domain protects and transmits creative outcomes to other people both in present and future. Domains are relatively stable, and through learning, they can transmit valuable ideas without change from one generation to the next.

**Current Applicable Studies in Design**

**Creativity in the design person**

Dohr (1982) examined planning program-development approaches focusing on changes in participants’ creativity. The first one was called the linear approach, which provided the experiment with explicit and traditional education experience. The other was the exploratory approach, which provided multi-dimensional and integrative education experience. A sample of 85 women was divided into two groups for participating in each approach. Domino’s creativity scale (ACL-Cr), a divergent thinking exercise, and personal interviews were employed for this study. The results presented that, after the experiment, a mean ACL-Cr score of the exploratory-approached participants ($M = 47, SD = 10.16$) was significantly higher than of those in the linear approach ($M = 39.4, SD = 12.1$). In conclusion, providing flexibility in the planning process appeared to support participants’ creativity.

According to the literature on creativity based on the domain-specific approach, besides understanding the influences of educational approaches on learner creativity, understanding the nature of people in specific fields has been mainly focused on. According to Sternberg’s (1985)
Implicit Theories of Intelligence, Creativity, and Wisdom, professors of art, business, philosophy, and physics were asked to portray characteristics of highly intelligent, creative, or wise persons in their correlated fields. The results revealed that the creative person was defined as someone who was unorthodox, perspicacious, appreciative of the arts and imaginative, intelligent and able to connect ideas in new ways, reflective and flexible, and energetic and goal directed. Furthermore, the art professors relatively highlighted originality, imagination, and experimentation as their creative characteristics, while those in business emphasize the ability to create and develop new ideas.

Portillo (2002) also employed implicit theories of creativity to examine creativity conceptions of professors in allied design fields, including interior design, architecture, landscape architecture, and engineering. The Adjective Check List (ACL) and Domino’s creativity scale (ACL-Cr) were utilized to collect the data. Exploratory analyses of individual ACL-Cr items indicated at least 75 percent of the respondents in each field agreed that imaginative, inventive, and adventurous were items for best describing the creative individual in their respective fields. In addition, the creative individual in interior design was recognized as significantly more individualistic and original than those reported in the other three disciplines.

Creativity in the design product

McCoy and Evans (2002) explored the role of specific interior design elements on creativity. Two studies were undertaken. In the first study, they utilized a photographic structured Q sort to examine which kinds of interior space participants would feel most creative and least creative. Based on results from the first study, two settings were created in order to be environments for conducting creativity tests in study two; one was reported as a low creativity-fostering environment and the other one was reported as a high creativity-fostering environment.
In the second study, a sample of twenty pre-college students was randomly divided into two groups that completed two creativity tests in both settings in counterbalanced order. The creative tests included the Torrance Test of Creative Thinking (TTCT) and creating collages that were then evaluated by Amabile’s Consensual Assessment Technique (CAT) on three dimensions of creativity: fluency, flexibility, and originality. A panel of six expert raters was employed, and inter-rater reliability of .78 exceeded the acceptable level. The results indicated that participants who completed the tests in the high creativity-fostering environment scored significantly higher both in the TTCT and collage than those in the low creativity-fostering setting.

Meneely and Portillo (2005) conducted research examining domain-specific correlations among creative personality traits, cognitive styles, and creative performance. A sample of 39 design majors was employed and administered the Adjective Check List (ACL) and the Herrmann Brain Dominance Instrument (HBDI). In addition, a design task was given to each participant and results of the task were then assessed for creativity using the CAT. According to the results, creative personality traits that were most frequently checked by the sample included imaginative, artistic, independent, curious, ambitious, adventurous, humorous, sensitive, intelligent, and energetic. A majority of the sample showed high-flexibility in their thinking process. A significant correlation between creative personality scores on the ACL-Cr and cognitive flexibility scores on the HBDI was found, and the creative personality scores predicted creative performance.

Recently, Van der Lugt (2005) investigated a relationship between sketching and creativity in design. According to previous published research, sketching mainly served as three functions: (a) supporting the individual thinking process, (b) supporting re-interpretation of each other’s
ideas in group action, and (c) increasing access to earlier ideas. Van der Lugt categorized three kinds of sketching for investigating in this study based on those functions: the thinking sketch, talking sketch, and storing sketch. Four experimental meetings were set up; each meeting consisted of five experienced product design majors. During meetings, the participants were asked to use a brainsketching technique to represent their idea generation. The results of each type of sketching were finalized by using the link systems, which “reflect structurally different interactions that the designers can have with their earlier ideas” (p. 11). Finally, the results of the thinking and storing sketches strongly supported that sketching could enhance the creative process and ideas in group meetings. Furthermore, sketches could motivate creativity, particularly in the immediate idea generating process. It is interesting to note that the results of Van der Lugt’s study and Lawson’s (2005) research, discussing how people could enhance creative design process and ideas, supported each other. Both of them emphasized the essential role of sketching in creative design process.

As seen in the previous review of the literature, many features, such as intelligence, imagination, and originality, are involved in creativity production. Particularly, in the design fields, one of those features which is frequently reported by highly creative design individuals and mentioned in creative personality traits is imagination or visual imagery. To gain insight into visual imagery, section four provides an overview of mental imagery research and highlights the role of visual imagery in creativity in design.

The important role of a domain is highlighted by many theoretical and empirical studies on creativity. Creative people in each specific domain possess some different traits from others in different domains. Creative individuals in the art and design fields are described as more original, imaginative, and individualistic than creative people in other fields.
Furthermore, one domain provides different criteria from other ones to assess creative performance or products in that domain. In the art and design areas, besides creative-relevant skills, designers still need domain-relevant skills, such as sketching or using computer-aided programs, to accomplish creative performance in art and design. In addition, as a part of criteria in the design fields, comments and opinions from educators, professionals, and experts are very essential to assess creative performance in design areas.

**Creativity and Visual Imagery**

We are immersed in imagery. We have images of ourselves and images that we portray to the world. We rehearse future action and decision by imagining how things would be if we did this or that. We reflect on and evaluate the past through weighing up and sifting through our memories, just as with a set of old photographs. …In all these human activities …., we create and are influenced by the power of our inner imagery. Though we regularly translate some of that perceived imagery into conceptual thought and subsequent action, the use of our imaginative senses could be more extensively used across the full range of social science research. (Edgar, 2004, p. 1)

Mental imagery is one of the most associated topics with creativity (LeBoutillier & Marks, 2003; Pylyshyn, 2003). Basically, mental imagery can be assessed through seven modalities: visual, auditory, tactile, kinesthetic, taste, smell, and bodily sensations (Robertson, 2003). Visual imagery, the ability to visualize, is the most frequently identified modality in research on mental imagery (Daniels-McGhee & Davis, 1994; Marks, n.d.; McKelvie, 1995). A concept of visual imagery is usually delineated in creativity definitions, personality traits, theories, and empirical studies. Many philosophers, psychologists, behaviorists, educationists, even scientists and artists, have spent their efforts to explore this relationship and taken its potential to develop the body of knowledge in their fields (Daniels-McGhee & Davis, 1994).

**Historical Overview of Imagery Research**

In accordance with a thoughtful literature review of Daniels-McGhee and Davis (1994), a role of imagery was evidenced in the history by early philosophers many centuries ago. Visual
imagery was also highlighted by Aristotle that “the soul, never thinks without a mental picture” (Yates, 1966, p. 32). In the Renaissance, many changes and new notions of cognition occurred, and imagination was tied to a divine and magical power. It was not until the Protestant Reformation that the idea of magical imagination was declined and substituted by verbal strategies. Ramus, a notable philosopher of the 1600s, opposed Aristotelian conceptions of images and the use of imagery. He emphasized an imageless mind in memory system and learning process (Daniels-McGhee & Davis, 1994).

During the second half of the 1900s, the field of psychology was established and the potential of imagery was reborn. Wundt was the first psychologist, who gave birth to imagery again (Daniels-McGhee & Davis, 1994). He proposed a periodic table of the mind listing elementary sensations. One of his colleagues argued the point against the imageless mind; if one had an “imaginal mind”, even abstract ideas could be represented in imagery. However, the imagery-supportive investigation was limited by the development of behaviorism, especially by the research of Watson, who attacked the existence of images. Imagery was ignored until cognitive psychologists and behaviorists needed to explore beyond verbal responses in investigating the Stimulus-Response formula. Imagery was re-emerged as a potential subject of the investigation.

**Exploring Connections between Creativity and Imagery**

**Early psychological perspectives**

In the early psychology era, although many behaviorists put no effort into imagery research, clinical researchers and psychologists well recognized the importance of imagery (Daniels-McGhee & Davis, 1994). Freud states that emergence of images derives from the unconscious in primary thinking process, including dreams, reveries, free associations, and fantasies. In addition, fantasies and imagery are forms of creativity that are adapted to be more
socially accepted. Furthermore, Kris follows Freud’s track but emphasizes preconscious and conscious mental process on motivating creativity and fantasies. Jung introduces “archetypal images”, part of the collective unconscious, emerging in dreams and shaping visionary creativity or active imagination. The main idea of Jung’s clarification is that humans contain a common and universal storehouse of psychic contents that are called archetypes.

**Cognitive psychological perspectives**

After being re-emerged by cognitive psychologists, imagery is classified by Holt (1964) into nine categories: the thought image, eidetic image, synesthesia, hallucination, paranormal hallucination, pseudo-hallucination, dream image, hypnagogic image, and hypnopompic image. Based on these nine types of imagery, highly creative individuals have frequently referred to dream images, hypnagogic and hypnopompic images, and thought images.

Paivio (1971) proposes a dual-coding theory stating that two coding systems of human cognitive process include imaginal and verbal systems. Paivio posits that learning will be more effective, and recall will be greater when the two systems become involved. Thus, images should influence a higher level of recall than words because images can be coded both imaginally and verbally. In his studies comparing the processing of words and pictorial stimuli, he also indicates that people recall more of the images, but had greater precision in recall of the order when stimuli are words.

Shepard (1978) and Kosslyn (1985, 1994; Kosslyn, Thompson, & Ganis, 2006) consider mental imagery as pictures in the mind rather than words. By conducting a number of studies to explore the transformation process associated with mental rotation of visual stimuli in memory, Shepard suggests that an image in our mental imagery is similar to the perception of an object in reality. Kosslyn has extended Shepard’s track of the imagery investigation. He posits that people
are different in the quality and kind of imagery that they can employ; furthermore, they differ in the manner in which they utilize their imaginal ability.

**Current Applicable Theories**

**Cognitive characteristics and processes of creative people**

Tardif and Sternberg (1988) surveyed literature on creativity across multi-perspectives and provided meaningful descriptions of the creative person associated with features of imagery. Their explanation of the creative individual is based on the following perspective; “although it is generally agreed that creative individuals are creative within limited domains, various explanations have been offered for why individuals differ in their propensities toward and abilities in their domains of specialty” (pp. 433-434). They created a list of cognitive characteristics that are shared by creative people across domains. The characteristics can be basically categorized into three groups: traits, abilities, and processing styles belonging to the creative person.

Considering creative features on the list, many of them obviously relate to imagery. Focusing on traits of the creative person, good imagination implies an important role of visual imagery in creativity production. Within cognitive abilities of the creative individual, thinking metaphorically and using wide categories and images also support the significant role of imagery. Moreover, in processing styles of the creative person, the connection between creativity and imagery is found in preferring nonverbal communication and creating internal visualizations.

**A cognitive model of perception, imagery, and creativity**

Flowers and Garbin (1989) suggest that a combination of involuntary and executively controlled processes generates creative behavior. The involuntary processes are information-reducing procedures serving to increase stability and organization of percepts for normal people; furthermore, these processes resist the formation of new representations of ideas. The
executively controlled processes include the selective attention, manipulation of mental images, and controlled cross-modal representation. According to their analysis, the creative person is likely to be affected by a “looseness” of perception in the involuntary processes; this lack of perceptual rigidity allows his or her to develop information from environment and recalled or reconstructed images in new ways. Nonetheless, the creative person may have more superior control of the executive processes than normal people; as a result, the anomalous or unusual image is consciously exposed to construction and modification to encourage new ideas.

Current Applicable Approaches

Since imagery has been differently investigated among diverse fields, a number of approaches have been presented (Kosslyn, 1980). However, this review aims to explore imagery only in facets that are most relevant to the design field. A novel method of imagination-based qualitative research and a classic approach relating to visual imagery are considered beneficial to the current research; therefore, they are highlighted here.

Imagework

Recently, imagework is introduced as a new methodology for social sciences research, using imaginative and experiential practices. It has been developed based on Jung’s active imagination concept and is also called “active imagination”, “visualization”, and “guided fantasy”. According to Edgar (2004), imagework is defined that:

The imagework method is an active process in which the person “actively imagining” lets go of the mind’s normal train of thoughts and images and goes with a sequence of imagery that arises spontaneously from the unconscious. It is the quality of spontaneity and unexpectedness that are the hallmarks of this process. (p. 7)

Since imagework establishes a new way of research, providing more opportunities to gain insight into the personal experience, it has been increasingly grown mostly in the fields of qualitative research, such as visual anthropology, art-based research, and transpersonal research.
(Edgar, 2004). To organize a variety use of imagework, it has been categorized into three characteristics: the introductory imagework, memory imagework, and spontaneous imagework.

**Introductory imagework:** This type of imagework is designed to facilitate investigating participants’ feeling about a specific circumstance. The method is simply to ask participants to imagine an image reflecting the situation being focused on at that time. This method can be employed as apart of group interviews and focus groups.

**Memory imagework:** This aspect is designed to awaken images of participants’ childhood experiences that are forgotten or little considered. The method consists of directing participants through their early biographical memories. This can be a part of an oral history approach as well as a written narrative approach.

**Spontaneous imagework:** The method is to ask a group of participants to visualize and direct them on an imaginary journey together. This procedure can reveal and work on important personal and social issues of participants.

It is worth noting that imagework is not only used for gathering research data, but it is widely utilized in therapeutic methods and education programs as well. In addition to this, it can be applied to enhance creativity in some ways. As creativity can be taught, practicing imagination and elaboration abilities tend to be one option to cultivate creativity (Robertson, 2003).

**Marks’s vividness of visual imagery questionnaire (VVIQ)**

Although imagery comprises the mental sights, sounds, smells, tastes, touch, and other bodily sensations, the most widely referred and emphasized aspect has been visual imagery (Kaufmann, 1979; Robertson, 2003). Focusing on the visual aspect, vividness has been at the top of the research approaches (LeBoutillier and Marks, 2003).
Marks (1972) developed the Vividness of Visual Imagery Questionnaire (VVIQ), which is a brief 16-item questionnaire with a five-point rating scale of vividness of visual imagery. In the VVIQ, vividness is defined as clarity and liveliness of a picture that comes before the mind’s eye (Marks, 1973, n.d.; Robertson, 2003). Reliability and validity of the test are well acceptable, approved by a large number of studies in education and psychology that have employed this instrument (McKelvie, 1995).

For example, Isaac and David (1994) conducted an experiment, consisting of five studies to explore individuals’ developmental changes and differences in visual and movement imagery as well as to examine if systematic differences in imagery vividness can be quantified in specialist groups. In the five studies, a diversity of participations, such as students in age groups from 7 to 50+ years of age, across-major college students, air traffic controllers, and pilots, was utilized to find the differences among individuals. The researchers employed the VVIQ and the Vividness of Movement Imagery Questionnaire (VMIQ) to collect data from the samples in all five studies.

Based on study one, the findings indicated that the VVIQ and VMIQ are reliable instruments for measuring imagery vividness even when a subjects are young children. The results of study three found that students in differing areas of study contained significantly different imagery ability; however, highly similar imagery profiles among the different groups of influential athletes were revealed in study four. As a conclusion of all studies, the results strongly suggested that imagery aptitude provides a strong influence on the development and control of movement skills.

Kunzendorf and Reynolds (2004-2005) used the VVIQ1, VVIQ2, and Prevalence of Visual Imagery Test (PVIT) for their study connecting the ability to imagine with the ability to develop
rules of perceptual equivalence. Also, the researchers created drawings, consisting of three figures, two of which were topologically equivalent to each other, and use them to assess the ability to develop the rules. Scores on the ability to develop the rules were analyzed by performing a median-spite analysis of the VVIQ scores. The overall findings indicated that participants who achieved greater vividness of visual imagery significantly succeeded at visual problem solving than those with lower vividness of visual imagery.

**Current Applicable Empirical Studies on Creativity and Visual Imagery**

The correlation between creativity and imagery in high school students was discovered by Daniels (1995). Creativity and vividness of visual imagery profiles were collected from students in art- and science-specialty schools, using four instruments: How Do You Think inventory (HDYT), Torrance’s Test of Creative Thinking (TTCT), VVIQ, and the image response journal. The statistical findings disclosed that high creative students reported more images and vividness of their visual imagery than students with low creativity. The most interesting point of differences between the reports of high and low creative students was in the length, detail, and level of elaboration shown in their narrative journals. Furthermore, creativity and domain effects and an interaction for vividness of imagery were indicated.

By reviewing a number of empirical studies focusing on the role of imagery in the creative process, LeBoutillier and Marks (2003) suggests that there are two standard approaches employed in the topic: the individual differences and image generation approaches. Then, they chose the first approach to be the theme of their study. A content analysis and meta-analytic procedure were performed, and nine studies, out of 58 papers associated with imagery and creativity, were statistically analyzed. The VVIQ was the most employed instrument for assessing self-reported imagery, while the TTCT was the most employed instrument for assessing creative thinking performance. The overall results indicated that self-report imagery
associated with creative thinking; however, the association was very weak. Therefore, the findings established only slight support for the claim that imagery was a significant associate of creativity.

Then, moving into allied fields of design, Kokotovich and Purcell (2000) examined design issues of creativity, mental synthesis, and drawing. Visual imagery was one aspect in the heart of the mental synthesis. Two experiments were conducted; they compared and contrasted three-dimension designers, two-dimension designers, and non-designers. In the first experiment, the sample was asked to produce creative forms based upon assigned information. As expected, the designers achieved almost twice the number of creative forms than the non-designers. In the second experiment, the same procedure as in the first experiment was repeated, but the participants were allowed to draw during the process; this aimed to test whether drawing can enhance the ability of creative mental synthesis. Similar to previous research in the topic, the findings revealed that drawing did not enhance the creative mental synthesis output at all.

Currently, Goldschmidt and Smolkov (2006) conducted another study associated with a part of mental synthesis that involved visual imagery. They expanded the idea recognizing visual imagery and sketching as primary internal and external components in creative design problem solving. However, their research relatively emphasized on visual stimuli and effects the participants had on design performance. A sample of architecture and industrial design majors was asked to solve two tasks of design problem solving in different settings. The participants were separated into three groups based on three setting conditions: with no visual stimuli, with diverse and full visual stimuli, and with a modest number of visual stimuli. Participants’ solutions were evaluated by three judges on three dimensions of creativity, including originality, practicality, and general quality. The overall results showed that visual stimuli significantly
influenced the mental synthesis and design problem solving. The best solutions were obtained from participants in the setting with a modest number of visual stimuli. Full visual stimuli effected better results than did no visual stimuli. In addition, visual stimuli significantly enhanced originality in design solutions, whereas practicality was negatively affected by visual stimuli.

The role of visual imagery has been mentioned in creativity theories and introduced by a number of creativity researchers. Studies in psychological and educational areas have revealed findings to strengthen the association between creativity and visual imagery. However, some researchers argue that creativity and visual imagery strongly connect to each other only in some aspects. For example, the analysis of self-reported creativity and visual imagery instruments indicates a slight relationship between those two measures. In the design realm, visual imagery or the ability to visualize plays a significant role in design problem solving, whereas only a few studies have focused on this subject.
CHAPTER 3
METHODOLOGY

Introduction

In order to investigate relationships among creative personality, performance, and vividness of visual imagery in design, this thesis study employed multiple measures testing creative personality, design performance, and vividness of visual imagery. Creative personality traits and vividness of visual imagery profiles were collected from a sample of experienced interior design students with two standardized self-reported instruments. A measure of creative performance was also gathered from the participants by employing a design-based sketch problem designed by the researcher to gauge creativity, elaboration, and planning evident; this problem directly related to domain-specific and design problem-solving skills. This approach supported a multi-dimensional profiling of relationships among the person, performance, and process of visualization in design. Based on the conceptual framework, Figure 3-1 illustrates the instruments and types of data employed to investigate each primary variable of this current thesis study.

Participants

The participants were 56 upper division design students enrolled in an accredited department of interior design at a large private university in the southeast United States. Since this thesis study aimed to explore the relationship between creativity and imagery in interior design, experienced students were assumed to have a more developed skill set and provide more useful and relevant data than beginning students.

The sample consisted of junior, senior, and graduate interior design students. Their ages ranged from 20 to 35 with a mean of 22.6 ($SD = 2.6$). Only two or 3.6% of the participants were male; this sample is a sign of the female dominance in the interior design academic field.
Meneely and Portillo (2005) found a major gender-composition issue in interior design education from their 2003 personal communication with Kayem Dunn, the Former Executive Director of Foundation of Interior Design Education and Research (FIDER), now known as CIDA. At that time, the 142 accredited interior design programs across North America enrolled an estimated 10% males and 90% females.

The sample, which was selected by the convenient sampling method, included a junior-and graduate-student class and senior-student class in the interior design program. All involved students volunteered and completed a written consent statement to participate in the study. A data-collecting process, conducted in April 2007, consisted of two class sessions. Due to absences that occurred during the second data-collecting session, the creative personality traits and vividness of visual imagery profiles reported in this study are based on a sample size of 56, but levels of the overall creativity, elaboration, and planning evident in design solutions that were gathered in the second session are based on 49 participants.

Instruments

Adjective Check List (ACL)

This thesis study utilized the Adjective Check List (ACL) to assess the creative personality traits profile from the sample. The ACL was designed by Gough at the Berkeley Institute of Personality Assessment and Research in 1949 and developed by Gough and Heilbrun in 1980. According to the reviews by Teeter and Zarske (Buros, 1985), the ACL was initially created for observers to use in describing others; however, it has been effectively employed in self-reported investigations.

The ACL form has three pages and requires fifteen to twenty minutes to complete. The test is in a 300-item format formulated into 37 separate scales for interpretation. Raw scores can be converted to standard t-scores. Considering wide variation (.34 to .95) of the ACL’s reliability,
median values in the mid 70s confirm generally sufficient reliabilities. Correlations between ACL scales and several other tests, such as the scales of the California Psychological Inventory and the Minnesota Multiphasis Personality Inventory, basically prove validity of the ACL.

To collect a creative personality traits profile in this study, the ACL was scored with Domino’s (1970) Creativity Scale (ACL-Cr) in stead of the ACL-Cps suggested in the ACL manual because the ACL-Cr provides more relevant results to art- and design-based research than the ACL-Cps. Domino (1970) studied creative achievement in students over a three-year period. By using the ACL, he found a Cr scale of 59 items was reported most frequently to creative students. Moreover, in his cross-validation study of 800 science, art, and literature students, the ACL-Cr significantly differentiated creative students from the control groups. Domino’s study also showed high internal consistency reliability and good validity in predicting the rated creativity of students’ art and writing projects (Davis, 1999). To convert the ACL’s raw scores to the ACL-Cr’s t-scores, the researcher referred to Creativity is Forever (Davis, 1999), which includes the 59-item scale and scoring guide of the ACL-Cr.

Furthermore, Domino’s Creativity Scale was empirically compared with three other creativity scales developed from the ACL: the Smith and Schaefer Scale, Yarnell Composite Scale, and Gough’s Creativity Personality Scale (Domino, 1994). A science-specific and an art-specific samples were administered the ACL and asked to rate themselves and their peers on dimensions of creativity, intellectual competence, personal competence, leadership, sociability, communicative skills, and punctuality. Results revealed that all of the four scales indicated sufficient internal consistency reliability in both samples with the highest of .86 for the Domino’s scale and the lowest of .74 for the Gough’s scale. In the science-specific sample, scores on all four scales significantly related to both self-ratings and peer ratings of creativity. In
the art-specific sample, all four scales also significantly related to both self-ratings and faculty ratings of creativity (Domino, 1994). Therefore, all four scales can be well used to predict creativity rated by others, such as peers or professors.

**Vividness of Visual Imagery Questionnaire (VVIQ)**

The vividness of visual imagery questionnaire (VVIQ) was employed to profile the vividness of visual imagery of the student participants. The VVIQ, introduced by Marks in 1972, is a 16-item questionnaire with a five-point rating scale of vividness of visual imagery (Isaac & Marks, 1994; Marks, 1973; McKelvie, 1995). Marks (1972, 1973) defined vividness as clarity and liveliness of a picture that comes before the mind’s eye. Test takers are required to call for a variety of images based on the items and rate those various images according to the five-point scale, with 1 as the most completely vivid image and 5 as no image at all. It is important to note that, to facilitate investigating relationships among visual imagery vividness and features of creativity in this present study, the VVIQ rating scores were reversed: 1 = no image at all, 2 = vague and dim, 3 = moderately clear and vivid, 4 = clear and reasonably vivid, and 5 = perfectly clear as normal vision. This reversal is commonly performed in the comparison between the VVIQ and another measure (McKelvie, 1995; Walczyk and Hall, 1988).

The VVIQ shows a test-retest reliability coefficient of .74, a split-half reliability coefficient of .88, and an alpha reliability coefficient of .89 (McKelvie, 1995). Validity information is provided in terms of correlations between the VVIQ and other instruments of picture recall and self-rating (Marks, 1972, 1973). Furthermore, McKelvie (1995) found the VVIQ validity coefficient across all criterion tasks of .269 (95% confidence interval .25 to .31) that was accepted as evidence of a relationship. The VVIQ, in general, is a useful predictor, particularly for some interesting relationships between vividness of visual imagery and a variety of performance measures.
Sketch Problem

A sketch problem was locally developed for this thesis study to determine overall levels of three dimensions, including creativity, elaboration, and planning evident in design solutions produced by interior design students. Regarding Goldschmidt and Smolkov (2006), visual imagery and sketching are the two influential dimensions in design problem solving. In the design problem-solving process, visual imagery, an internal representation of visualization, is developed and represented through sketching, an external representation. As a result, drawing was a primary element for solving this sketch problem; this encouraged the participants to employ an external representation to support their internal visualization. Additionally, a written narrative was employed as the other primary element for solving the problem; this encouraged the participants to elaborate on their imagination more completely and effectively.

The sketch problem consisted of two sections. The first section involved sketching, while the second section involved writing about ideas presented in the drawing (Appendix B). The task began by having the students consider four words as primary clues or idea generators. The descriptors were carefully selected by the researcher and two qualified experts in interior design education in order to prevent any limitations that might hinder or mislead the participants’ creativity and imagination. These words (time, contrast, repetition, and change) stimulated a concept as the students visualize an interior transitional space fully and sketch their visualized space. After completing the sketch, they wrote about their drawing of the interior space describing the situation, feelings, or other details. The drawings and narratives were coded to protect the identity of the student participants.

To measure an overall creativity, elaboration, and planning evident in design performance, both sketching and narrative parts gathered from the sample were evaluated by following Amabile’s (1996) Consensual Assessment Technique (CAT). The researcher asked a panel of
four expert judges, consisting of interior design faculty, to assess the design solutions. The judges were given an instruction document (Appendix D) and verbally instructed to rate the design solutions on a 1.0 to 5.0 scale relative to one another solely based on their subjective evaluations of the three dimensions: creativity, elaboration, and planning evident, presented in each performance (Baer, Kaufman, & Gentile, 2004). The four judges rated design performance independently in different periods. Figure 3-2 shows the arranged design solutions for the assessment process. Calculated for this thesis study, inter-rater reliabilities of .80 for creativity, .80 for elaboration, and .77 for planning evident, were above the acceptable levels recognized by Amabile (1996).

Finally, the top five and bottom five of judged creative performance were thoroughly analyzed. Figure 3-3 illustrates examples of the representative low and high creative performances. The researcher, the only judge in this procedure, analyzed the chosen performances based on main criteria identified in the sketch problem directions (Appendix B): presenting four key terms (time, contrast, repetition, and change) through a solution and describing situations and/or feelings within a visualized space. To get more insight into visual imagery vividness, elaboration, and planning evident within creative performance, the representative low and high creative groups were compared using following criteria that are relevant to design performance: quality of narrative elaboration, translation styles, design graphics, quality of perspective, and quality of legibility.

**Pilot Study**

A primary objective of the pilot test was to determine the sketch problem’s quality and how it should be developed for employing in the data collecting process. Because the ACL and VVIQ are standardized instruments that have been widely utilized in psychological and educational research, they do not need pre-testing.
Three graduate students in architecture and interior design were asked to participate in the pilot study. The researcher informed them of the purposes of the study and pilot test. The pre-testing participants volunteered and were not paid any compensation for participating. Each student was given a letter-size sheet, 11” x 17” white sheet, two 11” x 17” trace sheets, and two pencils. The researcher also gave a one-page document of directions (Appendix C) and verbally instructed each participant to fully visualize a transitional area inside a building by using four key words: time, contrast, repetition, and change. Afterward, the student participants were required to sketch their visualization on the 11” x 17” white sheet. Also, they were able to use the trace sheets to create a drawing if they would like to. Then, they were asked to write a description of the drawing. Finally the recorded periods and pre-tested results of the sketch problem were evaluated and analyzed to improve the problem and plan the data collecting process.

Recorded time spent by the participants ranged from 20 to 35 minutes for sketching and three to ten minutes for writing; as a result, the researcher decided to provide thirty minutes for the sketching part and ten minutes for the narrative part of the sketch problem. Two of the pre-testing participants used a trace sheet to sketch their preliminary ideas and drew their final drawing on the white sheet as required, while the other one used only the white sheet. However, the researcher still provided the same set of supplies when undertaking the data collecting process. There was no evidence of unclear directions of the sketch problem; on the one hand, every participant easily created a sketch and narrative based on the instruction. However, it is important to note that there was a limitation for a participant who is not a native English speaker to describe his idea clearly in English. Compared with the other two narratives, the description
written by the non-native English speaker provided less information and details to support the drawing; this represents a limitation in the study.

**Procedure**

The data collecting process was separated into three stages. In the first phase, the participant groups were given the university informed consent statement (Appendix A), two instruments, and a pencil. Then, they were asked to complete the Adjective Check List (ACL). They selected adjectives that they considered as best describing their own personality from a 300-item list. After finishing the ACL, the participants were asked to rate a 16-item form of the Vividness of Visual Imagery Questionnaire (VVIQ) according to the clarity and liveliness of their visual imagery twice, the first time with their eyes open and the other with their eyes closed. The first phase took a total of thirty minutes to complete.

In the second phase, which was conducted in the next 50-minute class period, the student participants were requested to solve the sketch problem. Each participant was given one letter-size sheet, one 11”x 17” white sheet, two 11”x 17” trace sheets, and two pencils. After providing those supplies to all participants, the researcher also gave them directions and descriptions of the problem (Appendix B). Afterward, the researcher verbally instructed the students to fully visualize or design a transitional space. The participants were asked to sketch their final visual image on the 11”x 17” white sheet. They were able to use the trace sheets to create one or more drawings and require extra sheets from the researcher as well. The participants were told to complete a drawing in thirty minutes. And then, the researcher asked the participants to narrate a situation, feelings, or other details appearing in their imagined space that they could not present through the drawing. They wrote a narrative part of one page on the letter-size sheet. This narrative section took ten minutes to finish.
Finally, the third phase of the data collection involved the evaluation of each participant’s final design performance from the second stage using the Consensual Assessment Technique (CAT). Before the assessment process, the drawings and narratives were coded to protect the identity of the student participants. The researcher reproduced each narrative by typing and attached it to a drawing coded in the same number in order to facilitate the evaluation. All of the solutions were consecutively arranged in relation to the coding numbers on tables. Each judge was asked to assess design performance individually. They were supplied with an instruction document (Appendix C) and evaluation forms to record their responses. Each judge was required to review all solutions first and then assigned a different starting point around the tables to evaluate the levels of creativity, elaboration, and planning evident pertaining to each performance on a five-point scale (Amabile, 1996). The judges were also asked to rate the solutions relative to one another rather than in accordance with some absolute standards.

**Summary**

In conclusion, the methodology profiled creative personality traits and vividness of visual imagery by administering two standardized measures to the sample of 56 experienced interior design students. These profiles were developed from Domino’s creativity scale (Cr) scores on the Adjective Check List (ACL) and visual imagery vividness scores on the Vividness of Visual Imagery Questionnaire (VVIQ). Additionally, a locally developed sketch problem was pre tested and then given to 49 student participants to measure their creative performance in design. The last stage of the data collection was the assessment of an overall quality of creativity, elaboration, and planning evident in the design solutions, employing the Consensual Assessment Technique (CAT).
Figure 3-1. Methodology framework
Figure 3-2. Arrangement for creative performance assessment

Figure 3-3. Examples of creative performance. A) Representative low creative performance. B) Representative high creative performance.
CHAPTER 4
RESULTS

Creative personality profiles of the sample were based on scores from Domino’s creativity scale (ACL-Cr). Visual imagery vividness profiles of the sample were derived from the Vividness of Visual Imagery Questionnaire (VVIQ) scores, and creative performance profiles of the sample were based on average rated scores from the entire panel of expert judges. To fully present findings from the study, this chapter is divided into two sections. The first section describes primary results of each administered instrument. The second section, which is organized by four primary research questions, presents results from each question and compares them to findings from previous pertinent research.

**Preliminary Analysis**

**Creative Personality**

The Adjective Checklist (ACL) was administered and scored using Domino’s (1970) creativity scale (ACL-Cr) to evaluate creative personality characteristics. Calculated from the sample’s self-described personality data, Cronbach’s alphas identified a high degree of internal consistency with reliabilities of .97 for the total ACL instrument and .87 for the creativity scale (ACL-Cr); this is consistent with Meneely and Portillo’s (2005) study using a design majors sample with reliabilities of .97 for the total ACL instrument and .89 for the creativity scale. Out of 300 items on the ACL, the number of adjectives checked per participant ranged from 24 to 228 with a mean of 97.3 ($SD = 36.4$). This result is consistent with the average number of items checked by a normative women sample ($M = 97.4$, $SD = 34.6$) stated in the ACL scoring manual (Gough & Heilbrun, 1983).

To control for the total number of adjectives checked, the ACL-Cr scores were converted from the ACL raw scores using $t$-tables (Davis, 1999). The final scores indicated that the
sample’s ACL-Cr scores ranged from 34 to 68 with a mean of 50.0 (SD = 8.0), which is somewhat but not significantly higher than scores found in previously published studies using a design majors sample (M = 48.5, SD = 9.2; Meneely & Portillo, 2005) and using a range of majors from across disciplines sample (M = 45.2, SD = 11.5; Davis & Bull, 1978). The most common ACL-Cr self-described adjectives within the participants were revealed by a frequency analysis; they included intelligent, artistic, imaginative, capable, enthusiastic, ambitious, sensitive, curious, humorous, independent, adaptable, interest-wide, and confident. Table 4-1 shows rank of the adjectives ordered by numbers and percentages of participants selecting each adjective.

**Vividness of Visual Imagery**

The Vividness of Visual Imagery Questionnaire (VVIQ) was administered and scored to profile visual imagery vividness within the sample. According to the rating scale indicated by Marks (1972), the author of the VVIQ, the lower score means the higher vividness and clarity of visual imagery within each person. However, to facilitate investigating relationships among visual imagery vividness and features of creativity in this present study, the VVIQ ratings were reversed: 1 = no image at all, 2 = vague and dim, 3 = moderately clear and vivid, 4 = clear and reasonably vivid, and 5 = perfectly clear as normal vision. VVIQ analyses typically reverse the scores to facilitate comparisons between the VVIQ and other measures (McKelvie, 1995; Walczyk & Hall 1988). Also, other VVIQ statistical data referred from previous studies was applied in the same direction to correctly compare with the data from this study.

Calculated from the VVIQ data, reliability of .92 showed a high degree of internal consistency, achieving the acceptable level of .89 recognized by Marks (1995). In addition, reliability of .82 for eyes open and closed correlation was also above the acceptable level of .75 (McKelvie, 1995). Based on 16 total items of the VVIQ, a mean of each item’s scores collected
from the sample was 3.7 ($SD = 1.10$). This result is consistent with a mean of Isaac and Marks’s (1994) research using a range of majors across four disciplines: Physical Education, English, Physics, and Surveying ($M = 3.81$, $SD = .48$) and a mean of all 38 means collected from previous published studies using college students as their main samples ($M = 3.69$, $SD = .21$; McKelvie, 1995).

The final overall VVIQ scores indicated that the sample ranged in vividness of visual imagery from 63 to 150 with a mean of 119.39 ($SD = 19.19$). On the one hand, this result is higher than previous published research using a psychology majors sample ($M = 61.30$, $SD = 8.10$; Kunzendorf & Reynolds, 2004-2005). On the other hand, it is lower than a mean from Riquelme’s (2002) published research using a sample of Spanish psychology and Chinese business college students ($M = 158.43$, $SD = 10.13$). To gain further insight into the difference between eyes open and closed scores, the researcher also calculated mean scores for both parts. A mean of 58.20 ($SD = 10.70$) for the scores with eyes open was slightly lower than the mean of 61.20 ($SD = 14.00$) for the scores with eyes closed; however, this difference was not significant with $t$ (56) = -1.389, $p = .170$. This finding is strengthened by studies of McKelvie (1995), which reveals an overlapped effect size for eyes open and closed is very close to zero, and Isaac and Marks (1994), who find no significant difference between eyes open and closed scores in the majority of their study cases.

**Sketch Problem**

**Judged evaluation of the design performance**

Overall levels of creativity, elaboration, and planning evident indicated by the final design performance were assessed using the Consensual Assessment Technique (CAT). Inter-rater reliabilities for the four expert judges were above the acceptable level of .70 recognized by
Amabile (1983 & 1996) and Barnard (1992). Reliabilities reached .80 on the dimension of creativity, .80 on the dimension of elaboration, and .77 on the dimension of planning evident.

**Rated scores of the design performance**

Rated scores from the entire panel of judges were averaged for each participant’s design solution. The final results indicated average creativity scores ranged from a low of 1.00 to a high of 4.75, with an overall sample mean of 2.67 ($SD = .88$). The sample’s average elaboration scores ranged from a low of 1.25 to a high of 5.00, with an overall mean of 2.85 ($SD = .84$); and average scores from planning evident ranged from a low of 1.00 to a high of 4.75, with an overall mean of 3.02 ($SD = .86$).

**Correlation Analysis**

To further test relationships among creative personality, vividness of visual imagery, and creative performance, the researcher performed a median split on the ACL-Cr, VVIQ, and the three dimensions of creative performance in order to indicate low and high groups for data collected through each instrument. Table 4-2 illustrates numbers of participants, average scores, and standard deviations belonging to low and high groups based on the data collected through each instrument.

**Question 1: Do Differences in Vividness of Visual Imagery Vary by Level of Creative Personality?**

As stated in the previous chapter, vividness of visual imagery or internal visualization was measured using the VVIQ and creative personality was assessed using the ACL-Cr. Thus, correlations between the VVIQ and ACL-Cr were used to examine differences in vividness of visual imagery reported among the participants of differing levels of creative personality. The reported ACL-Cr and overall VVIQ scores revealed no significant relationship between visual imagery vividness and creative personality ($r = .26, p = .058, t = -1.934$). A linear regression
analysis between the ACL-Cr and VVIQ eyes open scores found no significance either \((r = .05, p = .709, t = -.375)\). However, a significant relationship was revealed between the ACL-Cr and VVIQ eyes closed scores with \(r = .31, p = .019, t = -2.411\). A scatter plot of this correlation is shown in Figure 4-1. To further test this relationship, the researcher employed a median split on the ACL-Cr to define a low ACL-Cr group \((n = 27)\) and a high ACL-Cr group \((n = 29)\). Table 4-3 illustrates mean VVIQ scores of the low and high ACL-Cr groups. An Independent-Samples \(t\) test confirmed that the low ACL-Cr group accomplished significantly higher VVIQ eyes closed scores than did the high ACL-Cr group, \(t (40.90) = 2.918, p = .006\).

A Pearson-Correlation analysis was also performed to test the relationship between the VVIQ and ACL-Cr within the low and high VVIQ and ACL-Cr groups. As shown in Table 4-4, a statistically significant relationship between the VVIQ and ACL-Cr scores was found only within the low VVIQ group. According to the findings described previously, it is interesting to note that participants within the low level of creative personality were likely to achieve higher scores on the VVIQ with eyes closed than those in the high level.

**Question 2: Do Differences in Vividness of Visual Imagery Vary by Level of Creative Performance?**

**Quantitative findings**

Vividness of visual imagery was measured using the VVIQ and creative performance was assessed using the sketch problem and CAT. Thus, correlations between the VVIQ scores and average rated scores on the sketch problem’s creativity dimension (SP-Cr) were used to examine differences in vividness of visual imagery reported among the participants who performed differing levels of judged creative performance. A linear regression analysis was utilized to examine relationships between the VVIQ and SP-Cr scores. This analysis found no significant correlation \((r = .09, p = .555, t = .595)\). To gain more information about relationships among the
low and high VVIQ and SP-Cr groups, the research also employed a Pearson-Correlation analysis to examine whether there were correlations existing between the VVIQ and SP-Cr scores within the low and high groups. Mean VVIQ scores of the low and high SP-Cr groups are illustrated in Table 4-5. This analysis indicated no significant correlation either.

**Qualitative findings**

Qualitative data collected from both sketching and writing components of the sketch problem revealed differences between those judged low and high on creativity. Ten design solutions were chosen from a total of 49 sketch problems (Appendix D). As presented in Figure 4-2 and Figure 4-3, the five examples with the lowest level of the SP-Cr scores were compared to the top five solutions achieving the highest SP-Cr scores.

The researcher thoroughly analyzed this data set based on the criteria identified in the sketch problem directions (Appendix B). The students were asked to present four key terms (time, contrast, repetition, and change) in their solutions and write about their visualized space. The analysis indicated that the representative low creative solutions missed at least one criterion whereas the highly rated ones contained all primary criteria in the drawings and narratives.

To get more insight into visual imagery vividness, elaboration, and planning evident within creative performance, the representative low and high creative groups were compared on the quality of narrative elaboration, literal and metaphorical translation styles, design graphics, perspective, and legibility. Figure 4-4 to 4-9 illustrate these comparisons between the representative low and high sketch problems on the rating criteria.

Visual imagery vividness also was represented through quality of elaboration. The representative high creative performance group, as a whole, wrote longer narratives than did the low group. An average length of narratives from the high group was 133 words whereas an average length of narratives from the low group was 73 words. Figure 4-4 shows examples of
narrative elaboration comparing these groups. The following is an example from the low creative group:

The space is modern, open, and airy. The light coming from the unsheltered windows [is changed] with seasons and the hours of the day. There is ample seating ranging from hard benches, cushiony benches to comfort side chairs. The tall dark columns add height and drama to the space while playing of the windows. There is no focal point; each piece is an item to look at in and of itself. (70 word count)

In contrast, the narrative represents elaboration and is from the high creative group:

When I look at the space that I have drawn, I see it more as spatial and volumetric ideas that can be translated further. Time, contrast, repetition, and change occur simultaneously through large movements, such as the distinct transition from light to dark, positive to negative space as well as consistency in distances from one object to another. Though many principles remain stagnant, graphically it keeps the eye moving around the perspective view. I wanted to keep it strictly spatial because honing in on small details is more a part of the final design process. In translation, I see this space turning into a gallery space that can readily display something in an interesting fashion, or even certain aspects of a retail space (fitting rooms or display casing). (128 word count)

As a whole, narratives of the low group explained elements on a drawing and did not represent visualization of students who produced them, while those of the high group described feelings and visualization of the participants. In addition, the number of trace sheets in the planning process differed between groups. On average, the representative low creative students employed at least one trace sheet to create a final solution; whereas, the representative high creative group used none. Perhaps the participants who performed high creative solutions did not need any trace sheets because they visualized their design more vividly than those with low creative solutions who needed trace sheets to help clarify their visualization. Another explanation is that the high creative group had better sketching skills.

To solve the sketch problem, the low group literally translated the key terms in their designs, while the high group employed more metaphorical thinking in representing the key terms in their designs. For example, a low creative solution in Figure 4-5 A used a clock to represent a quality of time and flowers to show a meaning of change. Similarly, in Figure 4-5 B,
time was represented through a dining set, and change was illustrated through a doorway. A high creative solution in Figure 4-6 A interpreted time as a sense pulling a viewer into the drawing and considered change as different spaces between walls and ceilings. Another metaphorical solution in Figure 4-6 B represented time through differences between inside and outside and considered change as movement from the front to end of the space. Interestingly, only low creative solutions contained pieces of furniture in their drawings and connected meanings of the key words to the furniture. It is possible to hypothesize that the students who produced those low creative solutions focused on elements within the space (furniture) not on shaping the space itself whereas their peers in the high group thought with more complexity in designing a space with metaphorical qualities.

In terms of design graphics, as seen in Figure 4-7, the low creatives contained linear and rectangular forms that influenced the static look of their design; whereas, the high creatives generated a stronger dynamic movement in their designs by using curve and free-form elements (Ching, 1996). Furthermore, solutions in the high group employed movement from such curves to create perspective pulling a viewer into their spaces, while the low creative solutions did not make a connection between their drawings and a viewer.

Quality of perspective also affects a viewer’s perception of dimensions, proportions, and scale of elements within a design (Ching, 1996). Using accurate proportions and scale of design elements, the high group, as a whole, showed better quality perspective technique than did the low group (Figure 4-8). Additionally, designed spaces of the high group were open on one side or end, which identified presence of adjacent areas beyond that space. In contrast, designed spaces of the low group mostly were enclosed, with a more limited perspective.
Considering quality of legibility, the two groups differed on the level of contrast and line weight in their solutions. Drawings from the high group showed high contrast and clear line weight, while the other group’s drawings appeared less legible with low contrast and poorly defined line weight (Figure 4-9). Based on the results described above, the qualitative analysis indicated that judged creative performance, as an external representation of visualization, positively related to vividness of visual imagery or internal visualization. Furthermore, these two features associated with elaboration, and planning evident, as dimensions of creativity in design performance.

**Question 3: Do Differences in Creative Performance Vary by Level of Creative Personality?**

In order to explore how well creative personality predicted judged creative performance, correlations between the ACL-Cr and SP-Cr scores were examined. A linear regression analysis was performed to find relationships between overall levels of the creative personality and performance. This analysis found no statistically significant correlation \( r = .17, p = .245, t = -1.177 \). This finding was unexpected and inconsistent with a previous study using a design majors sample \( r = .33, p = .046; \) Meneely & Portillo, 2005). To gain more information, average SP-Cr scores were calculated based on a median split that was performed on the ACL-Cr to produce low and high ACL-Cr groups. Although mean SP-Cr scores of the low and high ACL-Cr groups, as presented in Table 4-6, seemed different, an Independent-Samples \( t \) test indicated no significant relationship with \( t (47) = 1.891, p = .065 \). As a final result, creative personality did not predict judged creative performance for this study.

**Question 4: What, if Any, Relationships Exist among Overall Creativity, Elaboration, and Planning Evident in Creative Performance?**

The qualitative findings from research question two indicated that creativity associated with an overall quality of elaboration and planning evident in design performance. For
quantitative results, a reliability of .92 revealed a very high degree of internal consistency for the rated scores among the dimensions of the sketch problem, including creativity, elaboration, and planning evident. Regression analyses were performed and indicated significant linear trends among those three dimensions. Scatter plots of those trends are depicted in Figure 4-10 to 4-12. A Pearson-Correlations analysis, shown in Table 4-7, also revealed very strongly significant relationships within those three dimensions.

In addition, to gain more insight into how well overall levels of creativity, elaboration, and planning evident in design performance predicted vividness of visual imagery, linear regression analyses were performed to find correlations between average rated scores on elaboration (SP-El) and planning evident (SP-Pl) and the VVIQ scores. (The relationship between average rated scores on creativity (SP-Cr) and the VVIQ was performed and described for research question two already.) Like the SP-Cr, the analyses found significant relationship neither between the SP-El and VVIQ \( (r = .024, p = .873, t = .161) \) nor between the SP-Pl and VVIQ \( (r = .024, p = .871, t = .164) \).

To examine how well creative personality predicted judged scores on elaboration and planning evident in design performance, linear regression analyses were performed to find correlations between the SP-El and SP-Pl and ACL-Cr scores. (The relationship between the SP-Cr and ACL-Cr was performed and described for research question three already.) The analyses found statistically significant relationship neither between the SP-El and ACL-Cr \( (r = .094, p = .518, t = -.651) \) nor between the SP-Pl and ACL-Cr \( (r = .093, p = .527, t = -.638) \). Finally, as shown in Table 4-8, Pearson Correlation analysis was performed to summarize the correlations among creative personality, visual imagery vividness, and judged creativity, elaboration, and planning evident.
Summary

First, the data revealed that the sample was characterized by a range of creative personality traits. Most frequently, the participants reported intelligent, artistic, imaginative, capable, enthusiastic, ambitious, sensitive, curious, humorous, independent, adaptable, interest-wide, and confident as adjectives that best described themselves. Second, vividness of visual imagery scores only for eyes closed significantly correlated with creative personality scores. A negative correlation appeared; participants with lower levels of creative personality visualized more vividly when they closed their eyes than those with higher levels of creative personality. Third, strong correlations were found among judged creativity, elaboration, and planning evident within design performance.

Fourth, vividness of visual imagery scores did not significantly correlate with judged scores on creativity, elaboration, and planning evident in design performance. In the other words, scores on the internal visualization did not statistically predict scores on the external representation of visualization in this study. However, the qualitative analysis indicated differences in vividness of visual imagery, quality of elaboration, and planning evident between the low- and high-level groups. The groups differed on their sketch problem in terms of the quality of narrative elaboration, literal and metaphorical translation styles, design graphics, perspective, and legibility. Fifth, no significant correlations were found between creative personality scores and judged scores on creativity, elaboration, or planning evident within design performance. Finally, within design performance itself, correlations emerged among creative personality, visual imagery vividness, and judged creativity, elaboration, and planning evident.
Table 4-1. Most frequently selected adjectives

<table>
<thead>
<tr>
<th>Adjective</th>
<th>n</th>
<th>% N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent</td>
<td>51</td>
<td>91.1</td>
</tr>
<tr>
<td>Artistic</td>
<td>49</td>
<td>87.5</td>
</tr>
<tr>
<td>Imaginative</td>
<td>48</td>
<td>85.7</td>
</tr>
<tr>
<td>Capable</td>
<td>47</td>
<td>83.9</td>
</tr>
<tr>
<td>Enthusiastic</td>
<td>44</td>
<td>78.6</td>
</tr>
<tr>
<td>Ambitious</td>
<td>43</td>
<td>76.8</td>
</tr>
<tr>
<td>Sensitive</td>
<td>43</td>
<td>76.8</td>
</tr>
<tr>
<td>Curious</td>
<td>43</td>
<td>76.8</td>
</tr>
<tr>
<td>Humorous</td>
<td>42</td>
<td>45.0</td>
</tr>
<tr>
<td>Independent</td>
<td>42</td>
<td>75.0</td>
</tr>
<tr>
<td>Adaptable</td>
<td>41</td>
<td>73.2</td>
</tr>
<tr>
<td>Interest-wide</td>
<td>41</td>
<td>73.2</td>
</tr>
<tr>
<td>Confident</td>
<td>40</td>
<td>71.4</td>
</tr>
</tbody>
</table>

Note: N = 56

Table 4-2. Descriptive statistics on primary variables

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>m</th>
<th>SD</th>
<th>t-test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low ACL-Cr</td>
<td>27</td>
<td>43.63</td>
<td>4.46</td>
<td>t (54) = 9.049, p = .000</td>
</tr>
<tr>
<td>High ACL-Cr</td>
<td>29</td>
<td>55.86</td>
<td>5.55</td>
<td></td>
</tr>
<tr>
<td>Low VVIQ</td>
<td>28</td>
<td>104.07</td>
<td>13.74</td>
<td>t (54) = 9.995, p = .000</td>
</tr>
<tr>
<td>High VVIQ</td>
<td>28</td>
<td>134.71</td>
<td>8.62</td>
<td></td>
</tr>
<tr>
<td>Low SP-Cr</td>
<td>24</td>
<td>1.96</td>
<td>0.43</td>
<td>t (42.427) = 9.122, p = .000</td>
</tr>
<tr>
<td>High SP-Cr</td>
<td>25</td>
<td>3.36</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Low SP-El</td>
<td>26</td>
<td>2.21</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>High SP-El</td>
<td>23</td>
<td>3.57</td>
<td>0.54</td>
<td>t (47) = 9.413, p = .000</td>
</tr>
<tr>
<td>Low SP-P1</td>
<td>26</td>
<td>2.38</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>High SP-P1</td>
<td>23</td>
<td>3.73</td>
<td>0.49</td>
<td>t (47) = 8.752, p = .000</td>
</tr>
</tbody>
</table>

Table 4-3. Visual imagery vividness scores by creative personality scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean VVIQ score for eyes closed</th>
<th>Mean VVIQ score for eyes open</th>
<th>Mean overall VVIQ score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low ACL-Cr (n = 27)</td>
<td>66.33 (SD = 7.93)</td>
<td>57.96 (SD = 10.56)</td>
<td>124.30 (SD = 14.96)</td>
</tr>
<tr>
<td>High ACL-Cr (n = 29)</td>
<td>56.34 (SD = 16.50)</td>
<td>58.48 (SD = 11.05)</td>
<td>114.83 (SD = 21.70)</td>
</tr>
<tr>
<td>Total (n = 56)</td>
<td>61.16 (SD = 13.92)</td>
<td>58.23 (SD = 10.72)</td>
<td>119.39 (SD = 19.19)</td>
</tr>
</tbody>
</table>
Table 4-4. Visual imagery vividness and creative personality correlations

<table>
<thead>
<tr>
<th></th>
<th>VVIQ scores within the low ACL-Cr group</th>
<th>VVIQ scores within the high ACL-Cr group</th>
<th>ACL-Cr scores within the low VVIQ group</th>
<th>ACL-Cr scores within the high VVIQ group</th>
</tr>
</thead>
<tbody>
<tr>
<td>VVIQ within</td>
<td>Pearson correlation: 1 20</td>
<td>Pearson correlation: 33 25</td>
<td>Pearson correlation: .00 02</td>
<td>Pearson correlation: .03 03</td>
</tr>
<tr>
<td>the low ACL-Cr</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
<tr>
<td>VVIQ within</td>
<td>Pearson correlation: 1 21</td>
<td>Pearson correlation: .00 21</td>
<td>Pearson correlation: 1 -04</td>
<td>Pearson correlation: .00 86</td>
</tr>
<tr>
<td>the high ACL-Cr</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
<tr>
<td>ACL-Cr within</td>
<td>Pearson correlation: 1 21</td>
<td>Pearson correlation: .00 21</td>
<td>Pearson correlation: 1 -04</td>
<td>Pearson correlation: .00 86</td>
</tr>
<tr>
<td>the low VVIQ</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
<tr>
<td>ACL-Cr within</td>
<td>Pearson correlation: 1 21</td>
<td>Pearson correlation: .00 21</td>
<td>Pearson correlation: 1 -04</td>
<td>Pearson correlation: .00 86</td>
</tr>
<tr>
<td>the high VVIQ</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
</tbody>
</table>

** Significant correlation at the 0.01 level (2-tailed)

Table 4-5. Visual imagery vividness scores by creative performance scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean VVIQ score for eyes closed (SD)</th>
<th>Mean VVIQ score for eyes open (SD)</th>
<th>Mean overall VVIQ score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SP-Cr (n = 24)</td>
<td>59.88 (SD = 15.22)</td>
<td>58.17 (SD = 10.45)</td>
<td>118.04 (SD = 20.89)</td>
</tr>
<tr>
<td>High SP-Cr (n = 25)</td>
<td>63.12 (SD = 10.09)</td>
<td>56.00 (SD = 11.06)</td>
<td>119.12 (SD = 17.59)</td>
</tr>
<tr>
<td>Total (n = 49)</td>
<td>61.53 (SD = 12.83)</td>
<td>57.06 (SD = 10.71)</td>
<td>118.59 (SD = 19.08)</td>
</tr>
</tbody>
</table>

Table 4-6. Creative performance scores by creative personality scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean SP-Cr score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low ACL-Cr (n = 23)</td>
<td>2.92 (SD = 0.81)</td>
</tr>
<tr>
<td>High ACL-Cr (n = 26)</td>
<td>2.45 (SD = 0.91)</td>
</tr>
<tr>
<td>Total (n = 49)</td>
<td>2.67 (SD = 0.88)</td>
</tr>
</tbody>
</table>

Table 4-7. Creativity, elaboration, and planning evident correlations

<table>
<thead>
<tr>
<th></th>
<th>Average scores on creativity</th>
<th>Average scores on elaboration</th>
<th>Average scores on planning evident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average scores on</td>
<td>Pearson correlation: 1 81</td>
<td>Pearson correlation: 1 88</td>
<td>Pearson correlation: 1 72</td>
</tr>
<tr>
<td>creativity</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
<tr>
<td>Average scores on</td>
<td>Pearson correlation: 1 00</td>
<td>Pearson correlation: 1 00</td>
<td>Pearson correlation: 1 00</td>
</tr>
<tr>
<td>elaboration</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
<tr>
<td>Average scores on</td>
<td>Pearson correlation: 1 00</td>
<td>Pearson correlation: 1 00</td>
<td>Pearson correlation: 1 00</td>
</tr>
<tr>
<td>planning evident</td>
<td>Significance</td>
<td>Significance</td>
<td>Significance</td>
</tr>
</tbody>
</table>

** Significant correlation at the 0.01 level (2-tailed)
Table 4-8. Correlations between primary variables

<table>
<thead>
<tr>
<th></th>
<th>ACL-Cr scores</th>
<th>VVIQ scores</th>
<th>SP-Cr scores</th>
<th>SP-El scores</th>
<th>SP-PI scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL-Cr</td>
<td>Pearson correlation</td>
<td>.00</td>
<td>-.26</td>
<td>-.17</td>
<td>-.09</td>
</tr>
<tr>
<td>scores</td>
<td>Significance</td>
<td>.03</td>
<td>.12</td>
<td>.26</td>
<td>.26</td>
</tr>
<tr>
<td>VVIQ</td>
<td>Pearson correlation</td>
<td>.00</td>
<td>.09</td>
<td>.02</td>
<td>.02</td>
</tr>
<tr>
<td>scores</td>
<td>Significance</td>
<td>.28</td>
<td>.44</td>
<td>.44</td>
<td></td>
</tr>
<tr>
<td>SP-Cr</td>
<td>Pearson correlation</td>
<td>1</td>
<td>.81**</td>
<td>.72**</td>
<td></td>
</tr>
<tr>
<td>scores</td>
<td>Significance</td>
<td>.00</td>
<td>.00</td>
<td>.00**</td>
<td></td>
</tr>
<tr>
<td>SP-El</td>
<td>Pearson correlation</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>scores</td>
<td>Significance</td>
<td>1</td>
<td>.38**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP-PI</td>
<td>Pearson correlation</td>
<td>.00</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>scores</td>
<td>Significance</td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Significant correlation at the 0.01 level (2-tailed)
Figure 4-1. Visual imagery vividness scores with eyes closed by creative personality scores
Figure 4-4. Narrative elaboration comparison. A) Low creative performance. B) High creative performance.
Figure 4-5. Literally solution. A) Low creative performance 1. B) Low creative performance 2.
Figure 4-6. Metaphorical solution. A) High creative performance 1. B) High creative performance 2.
Figure 4-7. Graphic comparison. A) Low creative performance. B) High creative performance.
Figure 4-8. Quality of perspective comparison. A) Low creative performance. B) High creative performance.
Figure 4-9. Legibility quality comparison. A) Low creative performance. B) High creative performance.
Average Elaboration Scores = 0.79 + 0.77 * spcr
R-Square = 0.65

Figure 4-10. Elaboration scores by creativity scores

Average Planning Evident Scores = 1.15 + 0.70 * spcr
R-Square = 0.51

Figure 4-11. Planning evident scores by creativity scores
Figure 4-12. Elaboration scores by planning evident scores

Average Elaboration Scores = 0.23 + 0.87 * sppl
R-Square = 0.78
CHAPTER 5
DISCUSSION

Summary of the Research Background and Purposes

This thesis study aimed to examine relationships existing between creativity and visual imagery within the field of interior design. Creativity has been widely accepted in interior design as valuable leading to innovative ideas and performance, yet little research has been conducted in this area. This thesis study addressed this challenge by studying the role of visual imagery in creative interior design students through their internal visualization and through their design performance. By reviewing pertinent literature on the subject, we find that visual imagery appears central to creativity; many studies in psychological and educational areas have found this association. Finally, results from the current study offer recommendations to design educators on strengthening opportunities for visualization and creativity in the interior design curriculum.

Interpretation

This discussion is separated into sections organized by the preliminary analysis and correlation analysis of four main research questions. Each section summarizes importance and findings, as well as discusses relevant theories, empirical studies, supporting data, and implications. Afterward, an implication precise to the interior design curriculum is introduced. At the end of the chapter, limitations of this study and directions for future studies are provided.

Interpreting Findings from the Preliminary Analysis

According to Csikszentmihalyi’s (1988) dynamic model of creativity, the person, one of the three primary components of creativity, is a starting point of the creative process. To develop the curriculum or even make change in individual courses, it is imperative that we must consider and understand the interior design student, whom we are trying to educate. By preliminarily analyzing data collected through instruments, findings revealed information about the student’s
personality traits and ability to visualize, which could enhance educators’ understanding of the student’s characteristics.

Regarding the preliminary analysis of data collected through instruments, the data from the ACL-Cr revealed that the sample, as a whole, achieved a somewhat but not significantly higher average creative personality score than did samples of previous published studies (Davis & Bull, 1978; Meneely & Portillo, 2005). The data from the VVIQ indicated that a mean VVIQ score of the sample is consistent with college-students samples in previous studies (Isaac & Marks, 1994; McKelvie, 1995). Gaining insight into characteristics of the student, the ACL-Cr data also revealed most frequently selected adjectives that best described the sample. Within those chosen adjectives, characteristics that are consistent with previous research on the personality traits of highly creative art and design individuals consisted of imaginative, intelligent, and humorous (Davis, 1999; Portillo, 2002, Tardif & Sternberg, 1988).

Csikszentmihalyi (1988) suggests that creativity involves the interaction of the individual, domain, and field. Based upon findings mentioned above, it is possible to interpret that the sample, as a whole, posses characteristics that could enhance their ability to generate creative process and performance. Besides the person, the other two components of the creativity interaction also play an important role in creativity production. This could imply that the curriculum and educators, as components of the domain and field, should take part in encouraging the student to contribute creativity to the interior design domain.

**Interpreting Findings from the Correlation Analysis**

This section responds to the main research objective, aiming to examine relationships between creativity and visual imagery, by discussing correlations among creativity features and vividness of visual imagery. It also extends the interpretation from the previous section by providing implications to people in the domain, particularly educators, to encourage creativity
and ability to visualize in the interior design curriculum that could increase creativity within the student and their design performance.

**Question 1: Do differences in vividness of visual imagery vary by level of creative personality?**

Research question one was developed to investigate potential correlations between creative personality and vividness of visual imagery within the interior design student. According to the literature review, the use of visual imagery, as a part of imagination, has been reported by highly creative persons. Personality traits of creative art and design individuals commonly include imaginative (Davis, 1999; Sternberg, 1985). Thus, results from this question were assumed to reveal relationships existing between these two features.

By examining correlations between the ACL-Cr and VVIQ scores, findings indicated a significant relationship in a reverse direction between creative personality and visual imagery vividness with eyes closed. The finding is unexpected and inconsistent with previous research (Kunzendorf & Reynolds, 2004-2005; McKelvie, 1995; Riquelme, 2002). This could result from inconvenient timing at the end of semester; some participants may be worried about their final exams and/or projects and did not take the tests seriously. A time constraint while administering the instruments could also affect the result; some students may rush to complete the tasks and were not cautious to clearly understand directions of the instruments. Another reason could be ambiguity in defining vividness on the VVIQ. Different persons identify degrees of their visual imagery vividness differently. In addition to the VVIQ, items that are used to measure the vividness of visual imagery on this test may be not sensitive enough to measure visualization within design students.

Another significant result was found by performing a median split and an Independent-Samples $t$ test. Students in the low level of creative personality achieved significantly higher
scores on their visual imagery vividness with eyes closed than their peers in the high level of creative personality. This result strengthens the previous negative correlation between the ACL-Cr and VVIQ for eyes closed. This could imply that students with low creative personality see pictures in their mind more clearly than their peers when they close their eyes. In the other words, closing eyes could help design students who possess low creative personality visualize better and more vividly. This finding provides an implication to educators or even design students to develop visualizing with eyes closed to their teaching or learning process in order to promote the ability to effectively visualize.

**Question 2: Do differences in vividness of visual imagery vary by level of creative performance?**

Precedent research suggests that designers need both internal and external representations of ideas for design problem solving. Based on this notion, visual imagery (internal visualization) and design performance (external representation of visualization) were assumed to associate with each other and potentially enhance design problem solving skills. Research question two was developed to examine this assumption.

In the quantitative analysis, no significant correlation was found between the VVIQ and SP-Cr scores. Since a paucity of research in design has mentioned the VVIQ, no pertinent previous studies can be compared with this finding. However, in general, this finding relatively supports the previous research of LeBoutillier and Marks (2003) suggesting that self-reported imagery is weakly associated with performance on creativity measures.

Considering the assumption, the result is unexpected but could be attributed to several factors. First, as mentioned previously, the VVIQ may be not relevant enough to assess vividness of internal visualization within students in design disciplines. Second, different levels of participants’ hand-sketching skills could influence this finding. This study did not pretest to
determine a baseline of participants’ sketching skill. It may be that participants with lower sketching skills may have more difficulty drawing what they visualized than those with better skill sets. For example, seven participants complained that their solutions could have been better if they had been allowed to use a computer-aided program to represent their visualization. One participant even noted on her solution that she could not effectively present her visual imagery through hand sketching. Nowadays computer-aided design programs and information technology play an important role in design process and performance (Lawson, 2005). A number of design professionals and students prefer to employ those technologies to represent their design ideas rather rely on their own sketching. However, sketching is still considered a core fundamental design skill for all designers (Council for Interior Design Accreditation, 2006). Another explanation for the inconsistent findings between this study and previous research might be the impact of data collection. As mentioned previously, collecting the data at the end of a semester may be negatively influenced by student fatigue. In addition, the data collection occurred in late afternoon sessions when participants may be tired from other courses and not as motivated to perform at their highest level.

While the quantitative results did not find a statistical relationship between the VVIQ and judged creativity, results from the qualitative analysis did support the association between vividness of visual imagery and creative performance. Differences in vividness of the internal visualization between students who produced the representative low and high creative performances showed clear differences in quality of elaboration and planning evident. This result is consistent with previous research that employed qualitative methodology to investigate a role of visualization in creativity within design contexts (Casakin & Goldschmidt, 2000; Goldschmidt & Smolkov, 2006; Goldschmidt & Tatsa, 2005). Ability to think and communicate visually is
recognized as a hallmark of creative designers. A person who produces creative process and performance is someone who sees pictures in his or her mind’s eye more easily and vividly than others (Flowers & Garbin, 1989).

Based on the qualitative findings, the sketch problem, as an external representation of visualization, may be affected by vividness of the internal visualization within the student. In the design problem solving process, if a student clearly visualizes his or her designed space, this may be beneficial for design problem solving and the development of design solutions.

**Question 3: Do differences in creative performance vary by level of creative personality?**

Creative performance successfully incorporates novelty and appropriateness (Amabile, 1996). To understand creative performance, many researchers have focused on the role of creative personality in production of creative products or processes (Davis, 1999; Domino & Giuliani, 1997; Meneely & Portillo, 2005; Sawyer, 2003). Research question three aims to examine whether correlations existed between those two components of creativity in interior design. Based on this literature, results from this research question were assumed to reveal correlations between creativity in the student and their design performance.

Statistical analyses of the ACL-Cr and SP-Cr scores showed that creative personality did not predict judged creativity in design performance. This result was not expected and contradicts other published findings. Previous studies using the ACL-Cr have found a relationship between creative personality and judged creative performance (Domino & Giuliani, 1997; Meneely & Portillo, 2005). However, it is worth noting that Domino and Giuliani’s (1997) research uncovered a significant relationship between creative personality and judged creative performance in professional photographers, but they did not find a significant association between ACL-Cr scores and creativity-judged scores in photography students. Creative performance in students may be more erratic than that of professionals.
Furthermore, this result could be attributed to limitations of this thesis study. Although the sample size employed in this study was large enough for the qualitative analysis of the sketch problem, it may be too small for the quantitative analysis of the ACL-Cr. According to Amabile (1983, 1996), creativity productivity involves task motivation, domain-relevant skills, and creativity-relevant skills. Lack of any one of these components causes unsuccessful creativity production. Undertaking the sketch problem session in late afternoon could negatively affect the student’s motivation to complete the task. Moreover, a limitation of hand-sketching skill in design performance could impact a component of domain-relevant skills in producing creative performance. Another possible reason to explain the unexpected finding is derived from the reviewed theoretical and empirical research suggesting that, besides creative personality, there still are numerous factors taking part in creative performance. Although creative personality traits support one to be potentially creative, it is not enough for that one to contribute anything creative to a domain if the society that one lives in does not accept his or her idea (Nakamura & Csikszentmihalyi, 2003). Amabile (1996) also articulates a role of personality traits in creativity in the following statement:

Particular clusters of personality traits are found fairly consistently among individuals exhibiting high levels of creativity…but, again, they are not sufficient in and of themselves. Certainly, any given individual – even one exhibiting a particular ‘creative’ personality-trait constellation – is not creative at all times or in all domains. (p. 83)

However, in the interior design education, it is still important to promote creativity in students as they are a fundamental component to produce creativity to the domain. Furthermore, opinions and judgments of the educator, professional, and expert are really noteworthy and cannot be forgotten in the teaching and learning process. Accordingly, a student who can contribute creative performance to the interior design domain is someone who does not only have potential to be creative but has potential to realize criteria in the domain as well.
Question 4: What, if any, relationships exist among overall creativity, elaboration, and planning evident in creative performance?

Even though it is universally endorsed that novelty and appropriateness are two major characteristics of the creative artifact, other dimensions in each domain also influence creativity production (Amabile, 1996). To raise creativity in the interior design curriculum, we need to know influencing features in our domain that could promote an overall quality of creative design performance. Based on dimensions employed to assess design performance in this thesis study, research question four was developed to explore if there were connections existing among judged dimensions: creativity, elaboration, and planning evident. It was assumed that these three dimensions related to each other and could increase creativity in design performance.

Results from this research question clearly support the assumption. Besides the qualitative finding described in research question two, by employing the statistical analysis, internal consistency reliabilities indicated a very high degree of associations among the three dimensions. This result implies that elaboration and planning evident are dimensions that could define and enhance creativity in design performance. This finding, especially elaboration, is consistent with previous research exploring features fostering creativity. Regarding Guilford (1967), fluency, flexibility, originality, and elaboration are defined as four eminent functions in creative performance generated from creative thinking. Either each or a combination of these four functions is always employed in evaluating creative performance (Amabile, 1996).

Considering the qualitative findings, the representative high creative performance appeared better planned and contained more details both in drawing and narrative parts than did the low group. It is reasonable to suggest that one way to define and enhance creativity in design performance is to promote the student’s ability to well elaborate and plan their design and emphasize the role of elaboration and planning evident in the curriculum. In addition to
elaboration and planning evident, it is also important to note the high group also represented better quality in perspective, contrast, and line weight, as well as employed curve and free-form design elements to generate dynamic movement in their design. These findings could be helpful for the educator to emphasize them in the design teaching process, or even for the design student to use them as guidance to develop creative design performance.

**Enhancing Creativity and Visual Imagery in Interior Design Education**

Imagery is important, but in Western culture, language is king. In school we steadily wrap our children’s brains in the “cool web of language”—it would be terrible if we didn’t, but there is a cost to everything. By neglecting imagery we risk the withering of a whole set of quite remarkable mental capacities. (Robertson, 2003, p. 3)

We have been taught to learn and think logically from the earliest grade levels. Less emphasis is traditionally placed on the role of mental imagery in enhancing creativity and learning ability; these skills are not well promoted in school or college curricula (Ahsen, 1996; Robertson, 2003; Shaw, 1984; Tracy, Fricano, & Greco, 2000-2001). Ironically, in art and design disciplines, the essential role of imagination and even creativity leading to the development of visual imagery has not yet been stressed in the art and design curricula (Dineen, 2006).

In the design process, a designer has to visualize something that has not been created while solving a design problem. In the other words, a designer needs to see a future design in his or her mind’s eye. Then, the design is developed through external representations, such as a drawing or model, in order to communicate the designer’s visualization to others. However, considering design curricula, the role of external representations of visualization, such as sketching, rendering, and using computer-aided design program, is principally emphasized rather than the importance role of the internal visualization.

Considering the implications from the creativity and visual imagery literature and this thesis study, we see that visual imagery or the internal visualization relates to external
representations and plays an important role in fostering creativity in design performance. As a result, to enhance student design problem solving skill and creative design performance, the importance of visual imagery should be seriously considered in the interior design curriculum. As seen in Figure 5-1, the implication precise to the interior design curriculum is represented based on the conceptual framework, which focuses on the person and product in interior design.

In order to achieve creative performance, a person is supposed to have high quality of creativity-relevant skills, motivation, and domain-relevant skills (Amabile, 1983, 1996). Based upon the present study, creative personality and the ability to vividly visualize are involved in creativity-relevant skills supporting creativity in design performance. Previous published research has indicated that creative personality takes a part in creative performance. Although this study could not completely support that idea, it indicated a correlation between creative personality and the internal visualization, which encourages creativity in design performance. This connection suggests that by closing eyes while visualizing, students with low creative personality could create better and clearer visualization than their peers with high creative personality. Therefore, visualizing with eyes closed is possibly helpful for students in the low level of creative personality to develop their creative design performance. Focusing on design performance, the results from this present study outlines that creative design performance depends on the student’s ability to well organize and fully elaborate a design. Finally, this study also posits that a student’s task motivation and appropriate skill set increase his or her ability to perform creatively.

Based on the findings and implications from this current study, it is beneficial for educators to encourage visual imagery vividness in the interior design curriculum in order to promote creative performance in the domain. Besides focusing on only external representations,
educators should employ and enhance the ability to creative vivid internal visualization in their teaching process. This may possibly enhance student skills to develop external representations as well as creatively solve design problems. One technique, easily incorporated into the curriculum, is to encourage visualization of design problems with eyes closed; this could well help students who are less creative than their peers to more effectively solve a creative design problem.

**Limitations**

Some limitations of this current thesis study should be acknowledged. Although the sample size employed in this study was sensible to collect the qualitative data through design performance, it may be considered too small to detect relationships between visual imagery and creativity through standardized instruments (ACL-Cr and VVIQ). This may have produced results that were inconsistent with previous studies that employed a larger sample size.

Another limitation probably relates to the VVIQ. Since it was originally developed and has been mostly employed in psychological and educational applications, the VVIQ may be not sensitive enough to measure visual imagery in interior design. Another concern surfaced in the administration of the test where test directions appeared somewhat ambiguous. After collecting the VVIQ data, some participants complained that the rating scale was unclear, and they were not certain if they rated degrees of visual imagery vividness correctly on the scale.

Further, the timing of data collection also appeared to be a limitation of the current study. Data collection occurred at the end of a semester; additionally, testing sessions occurred at the end of the day. Student participants may have been less motivated to accomplish the tasks given because of the semester demands, distractions, and fatigue. According to Amabile (1983, 1996), task motivation strongly influences creativity; motivation consists of two elements: a person’s baseline attitude to the task and a person’s perceptions of his or her reasons for commencing the
task. Also, collecting data late in the day, participants may rush to complete the tasks in time, regardless of the quality of performance.

Finally, a limitation may relate to hand sketching skills. Sketching is generally assumed as a basic skill in the design field (Lawson & Menezes, 2006; Van der Lugt, 2005), so this present study did not conduct a pretest to determine a baseline of drawing ability. Since drawing quality was not controlled, there may be differences in visualization, sketching ability, or motivation that may have impacted the findings.

**Directions for Future Research**

Based upon the findings from this current study, we see that internal visualization plays a role in creative design performance. In addition, visual imagery also positively relates to quality of elaboration and planning evident which supports creativity in the external representation of visualization. This establishes a path for future studies on the role of visual imagery in creativity within design.

Starting with sampling, the limitation mentioned in the previous section may be addressed by selecting a sample size that is appropriate to the research questions posed. If the study employs qualitative methodology, a sample size could be smaller and still produce valid results; whereas, quantitative methodology will require a larger sample size. In the present study, the qualitative data appeared insightful in better understanding creativity and visual imagery in design. It is recommended that future studies should consider qualitative methodologies, such as protocol analyses, interviews, and focus-groups, to gain more information on this subject. To prevent negative effects of task motivation on the sample, conducting research at the beginning or middle of a semester is recommended to lessen distractions in student participants. Gathering data across the semester would yield more insights into design progress. Finally, it would be
interesting to conduct an interdisciplinary extension of this study to see how interior design
students compare to those in art, architecture, and other allied fields of design.

To address the sketch problem limitation, it is recommended to perform a pretest to
determine a baseline of participants’ sketching skill to control for bias. Instead of drawing,
researchers may also consider testing visualization with three-dimension modeling to measure
creative design performance. Modeling also is a core skill for interior designers who visualize in
three dimensions.
Figure 5-1. Visualization in design creativity
APPENDIX A
UFIRB APPROVAL

Institutional Review Board
UNIVERSITY of FLORIDA

DATE: April 17, 2007

TO: Siriporn Kobnithikulwong
336 Architecture Building
Campus

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

SUBJECT: Approval of Protocol #2007-U-0352

TITLE: Creativity and Imagery in Interior Design Students: Exploring Relationships among Creative Personality, Design Product, and Vividness of Visual Imagery

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants. Given your protocol, it is essential that you obtain signed documentation of informed consent from each participant. Enclosed is the dated, IRB-approved informed consent to be used when recruiting participants for the research.

It is essential that each of your participants sign a copy of your approved informed consent that bears the IRB approval stamp and expiration date.

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

If you have not completed this protocol by April 11, 2008, please telephone our office (392-0433), and we will discuss the renewal process with you. It is important that you keep your Department Chair informed about the status of this research protocol.

ISF: d1

An Equal Opportunity Institution
Informed Consent Statement

Protocol Title: Creativity and Imagery in Interior Design Students: Exploring Relationships Creative Personality, Design Product, and Vividness of Visual Imagery

Please read this consent document carefully before you decide to participate in this procedure.

Purpose of the research:
The main objective of this research is to examine relationships between creativity and imagery in interior design students. The study emphasizes the role of visual imagery in creative personality and product in interior design. Results of the study will be meaningful for the body of knowledge in the interior design field by providing useful information with recommendations for interior design curricula that enhance creativity in students and projects.

What you will be asked to do in the study:
During the first class period, you will be asked to complete two standardized instruments that measure your personality and style of visualizing. In the Adjective Check List, you will select adjectives that you consider self-descriptive. Afterward, you will complete the Vividness of Visual Imagery Questionnaire by rating a 16-item form on the way you visualize information. You will take this questionnaire twice, the first time with your eyes open and the second time with your eyes closed.

During the next class period, you will be requested to complete a sketch. You will be given supplies, including a pencil, letter-size sheet, 11"x 17" white sheet, and two 11"x 17" trace sheets. The researcher will give you directions and what to sketch on a screen in front of your classroom. Afterward, the researcher will ask you to write a description of your sketch.

Time required:
The first phase: a total of thirty minutes (fifteen minutes for completing each test)
The second phase: about forty minutes

Risks and benefits:
On the one hand, there are benefits to your practicing visualization and sketch skills. On the other hand, there are no anticipated risks in this procedure.

Approved by
University of Florida
Institutional Review Board 02
Protocol # 2007-U-0352
For Use Through 04/11/2008
Compensation:
You will not be paid any compensation for participating in this study.

Confidentiality:
Your identity will be kept confidential to the extent provided by law. Your information and data will be assigned a code number. The key to this code will be kept in a file that is accessible only by the researcher and your identity will not be revealed in the final manuscript.

Voluntary participation:
Your participation in this procedure is completely voluntary. There is no penalty for not participating.

Right to withdraw from the study:
You are free to withdraw your consent to participate and may discontinue your participation in this study at any time without consequence.

Whom to contact if you have questions about the study:
Dr. Margaret Portillo
Interior Design Department
Email address: mportill@ufl.edu
Phone number: (352) 392-0252 # 334

Siriporn Kobnithikulwong
Master’s candidate
Interior Design Department
Email address: siriporn@ufl.edu
Phone number: (352) 562-2340

Whom to contact about your rights as a research participant in the study:
UFIRB Office, Box 112250, University of Florida
Gainesville, FL 32611-2259
Phone number (352) 392-0433

Agreement:
I have read the procedure described above. I voluntarily agree to participate in the procedure and I have received a copy of this description.

Participant: ___________________________ Date: ________________
Investigator: __________________________ Date: ________________
APPENDIX B
DESCRIPTION OF THE SKETCH PROBLEM

Department of Interior Design
College of Design, Construction, and Planning
336 Architecture Building, University of Florida
Gainesville, FL 32611

Creativity and Imagery in Interior Design Students: Exploring Relationships among Creative Personality, Performance, and Vividness of Visual Imagery

Directions and Descriptions of the Sketch Problem

For this task, you will complete a drawing and discuss your ideas about the design in writing. You will be given a set of supplies to work with and will complete your drawing in thirty minutes and your written description in ten minutes.

Drawing

Consider the meanings of time, contrast, repetition, and change, and visualize a transitional space within a building that connects these qualities. Imagine this space fully, and then, sketch a transitional interior space within a building according to your imagination on the provided 11” x 17” white sheet. Also, you are able to use the trace sheets and request extra sheets to create your drawings.

Writing

Describe the experience of being in the space, including the setting, feelings, or other details based on your imagination. Using the letter-size sheet, write no more than one page.
APPENDIX C
THE SKETCH PROBLEM ASSESSMENT

Department of Interior Design
College of Design, Construction, and Planning
336 Architecture Building, University of Florida
Gainesville, FL 32611

Creativity and Imagery in Interior Design Students: Exploring Relationships among Creative Personality, Performance, and Vividness of Visual Imagery

Description of the Sketch Problem

A sketch problem was designed for this thesis study to determine the level of creativity in design product. To research imagery and creativity, the student participants were asked to complete a drawing and narrative that would be evaluated for creativity by three expert judges.

The participants were given a set of supplies to work with and then asked to consider the meanings of time, contrast, repetition, and change, and visualize a transitional space within a building that connects these qualities. They were also asked to describe the experience of being in the space, including the setting, feelings, or other details based on their imagination.

Instructions of the Sketch Problem Assessment

Please rate the drawings on a 1.0-to-5.0 scale solely based on your considerate, but subjective opinions of their three dimensions provided on the following pages. Start with the first dimension and rate all drawings in relation to one another. After you finish rating the first dimension of the drawings, please rate the second and then third dimensions with the same method. Criteria employed to rate the drawings are only your definitions of the given three dimensions and your opinions. Since you are the expert in interior design, feel free to rate these drawings on the basis of your own expert sense.
APPENDIX D
SOLUTIONS OF THE SKETCH PROBLEM
LIST OF REFERENCES


BIOGRAPHICAL SKETCH

Kobnithikulwong, S. received her Bachelor of Architecture (major in interior architecture) with honors from Chulalongkorn University, Thailand, in 2003. After that, she was an instructor in the Department of Interior Architecture at Thammasat University for 2 years. She currently is a graduate student in the Interior Design Department, University of Florida. Her research interests are creativity in interior design and the design of learning and educational environments. At the University of Florida, she has been accepted into the Ph.D. program in the College of Design, Construction and Planning and been a teaching assistant for interior design graphic communications. After receiving her doctoral degree, she plans to return to her country and work as a professor at Thammasat University.