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Exploring Relationships Between Thinking Style and Sex, Age, Academic Major, Occupation, and Levels of Arts Engagement Among Professionals Working in Museums

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

EXPLORING RELATIONSHIPS BETWEEN THINKING STYLE AND SEX, AGE,
ACADEMIC MAJOR, OCCUPATION, AND LEVELS OF ARTS ENGAGEMENT
AMONG PROFESSIONALS WORKING IN MUSEUMS

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF EDUCATION

in

CCURRICULUM & INSTRUCTION

by

Mark David Osterman

2015

To: Dean Delia C. Garcia
College of Education

This dissertation, written by Mark David Osterman, and entitled Exploring Relationships between Thinking Style and Sex, Age, Academic Major, Occupation, and Levels of Arts Engagement among Professionals Working in Museums, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Date of Defense: November 9, 2015

The dissertation of Mark David Osterman is approved.

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Dean Lakshmi N. Reddi
University Graduate School

Florida International University, 2015

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DEDICATION

To my daughter, Olivia Osterman

Always continue to explore, learn, and create.

ACKNOWLEDGMENTS

I owe special gratitude to my major professor and dissertation chair Dr. Thomas G. Reio, Jr. for his guidance, mentorship, and support in this research project. Additionally, I want to thank the support and efforts of Dr. Linda Spears-Bunton, Dr. Sarah Mathews, and Dr. Kyle Perkins who agreed to serve on my committee and provide invaluable insights. Lastly, I want to thank Dr. Linda Bliss for her sustained contributions that gave direction and clarity to my work throughout my tenure at Florida International University.

To my family, thank you for always encouraging my curiosity and supporting my desires to continuously explore, learn, and create.

ABSTRACT OF THE DISSERTATION

EXPLORING RELATIONSHIPS BETWEEN THINKING STYLE AND SEX, AGE,
ACADEMIC MAJOR, OCCUPATION, AND LEVELS OF ARTS ENGAGEMENT
AMONG PROFESSIONALS WORKING IN MUSEUMS

by

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With evidence that arts engagement and nonlinear thinking style both utilize insight, intuition, and emotion in the decision making process, the literature has driven an investigation of the relationship between levels of arts engagement and thinking style preference. This nonexperimental correlational study ($N = 101$) explored (a) the prevalence of linear, nonlinear, or balanced linear/nonlinear thinking style of professionals working in museums. (b) Whether thinking style has a relationship with (i) age; (ii) sex; (iii) academic major; (iv) occupation; (v) levels of arts engagement. Two theoretical frameworks underpinned this study: (a) new literacies and (b) cognitive styles.

A Web-based self-report survey instrument was used to investigate the relation among the variables of interest. Existing literature was used to provide a foundation for the study and guide the research. Correlational, means, and hierarchical regression analysis were used to test the hypothesized model and examine the hypotheses. The means analyses at the descriptive level revealed that females, those in the 60 or older age group, Humanities majors, and those who worked in education demonstrated more

balanced linear/nonlinear thinking styles. The correlations results indicated that there was a statistically significant relationship between thinking style and sex and thinking styles and academic major. The hierarchical regression results suggested that after controlling for select demographic variables, only being a Humanities major uniquely predicted significant variance in thinking style. The lack of significant findings of a relationship between thinking style and age did not correspond to existing research that supports a correlation. Additionally, a significant relationship between thinking style and levels of arts engagement was not found during correlational and hierarchical regression analysis.

A limitation of this research study was that the Web-based self-report survey version of the Linear/Nonlinear Thinking Style Profile (LNTSP) instrument did not transfer well to online use because the participants had some problem understanding how to score their answers properly. This issue could be handled readily and recommendations are made to revise the Web-base self-report version of the survey for future research use.

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CHAPTER I INTRODUCTION TO THE STUDY

In July of 1945, Dr. Vannevar Bush published an article for *The Atlantic Monthly* titled “As We May Think.” In this article, Bush expressed concern that the vast amounts of information and knowledge being obtained and stored by humanity was set to a linear construct or what he called “the artificiality of systems of indexing” (p. 11). Bush (1945) defined this system as artificial because it went against the natural associative/nonlinear process of the human mind for accessing information. Bush envisioned a system that mimicked the human mind and made selections by association, rather than by indexing. The invention of the World Wide Web provides the information system Bush so much desired. It is a system of networked computers that turned the Internet from a data-transfer system used by specialists into a mass-adopted technology used by hundreds of millions of people across the globe to synthesize, store, and access vast amounts of information in an associative/nonlinear manner.

The incredible growth of the World Wide Web has led it to become one of the defining technologies for literacy and learning of our time (Lambert & Cuper, 2008; Leu et al., 2011). With this growth the need to be literate and successfully accomplish tasks through this technology has become relevant. Regardless of age, sex, or socioeconomic background it is now necessary to have some degree of digital literacy and use online tools to communicate with the outside world and perform certain personal, administrative, creative, and educative tasks (Fox & Rainie, 2014). After 25 years of existence, researchers continue to take stock of the impact of the Web on society. For

purposes of this dissertation, the researcher has chosen to focus on the impact the Web is having on literacy and comprehension in the 21st century.

Literacy and Comprehension

Why does literacy matter? Literacy leads to participation in cultural and social activities through the acquisition of knowledge (Freire, 1987). Literacy offers empowerment by allowing people to make decisions economically, socially and politically (Stromquist, 1995). UNESCO (2006) has stated that literacy can benefit individuals and societies through engagement and lifelong learning that affect decisions. Bown (1990) claimed that with the acquisition of literacy, masses become more confident and courageous and can contribute to broader socio-economic processes. In addition, literacy influences culture as it brings on cultural changes and at the same time makes people aware of the need for the preservation of certain cultural norms and values (Freire, 1987). The importance of literacy cannot be understated for individuals and societies as a whole. Its benefits are vast, but literacy is something that is evolving with technology and being redefined.

Definitions of literacy today are multiple, complex and shifting. Since the mid-twentieth century, scholars have devoted considerable attention to defining literacy. When looked at closely, literacy as a concept has proved to be complex and dynamic, interpreted and defined in many different ways and highly contested in terms of how it is related to broader notions of education and knowledge. Ongoing academic research, institutional agendas, national context, cultural values, and our personal experiences continue to define and redefine what it means to be literate. Literacy has been defined as a simple process of acquiring basic cognitive skills, to using these skills in ways that

contribute to the development of society through social awareness and critical reflection (Gee, 1996; Knobel, 1999). Paulo Freire brought about a broader understanding of the term literacy, one that moves from a strict decoding and reproducing of language into issues of economics, health, and sustainable development (Freire, 1970a, 1970b, 1973). In addition, literacy's meaning has expanded to include the ability to identify, understand, interpret, create, and communicate through language, numbers, images, symbols, and technology (Coiro et al., 2008; Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011). The list of competencies expected of today's literate individual is expanding and as a result many new forms of literacy are being identified. Such new literacies include, but are not limited to: media literacy, visual literacy, environmental literacy, and digital literacy (Coiro et al., 2008; Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011; Leu et al. 2009; Merchant, 2007; Quesada, 2000; Yenawine, 1997). As society and technology change, so does literacy. Because technology has increased the intensity and complexity of literate environments, the 21st century demands that a literate person have a wide range of literacies. In 2008, The National Council of Teachers of English (NCTE) Executive Committee adopted the following skills to define literacy: develop proficiency and fluency with the tools of technology; build intentional cross-cultural connections and relationships with others so to pose and solve problems collaboratively and strengthen independent thought; design and share information for global communities to meet a variety of purposes; manage, analyze, and synthesize multiple streams of simultaneous information; create, critique, analyze, and evaluate multimedia texts; and attend to the ethical responsibilities required by these complex environments. The National Curriculum Board's (2009) definition of

literacy has expanded to refer to a flexible, sustainable mastery of a set of capabilities in the use and production of traditional texts and new communications technologies using spoken language, print and multimedia. The expansion of skills necessary to be literate has challenged learners and educators to find new ways to respond to the world and meet new contextual demands in varying literacy situations.

Similar to literacy, it was once assumed that reading comprehension could be defined simply. For a time, comprehension was looked at as a combination of decoding and oral comprehension skills (Hoover & Gough, 1990). Essentially, it was thought that if readers could decode the words on a page, they would be able to reflect on what was being read and understand what they were reading. Contemporary research in reading comprehension suggests that readers who comprehend are active processors of text, connect texts to their experiences and prior knowledge, set expectations or goals for their reading, and ask questions of the text as they read amongst other qualities (Duke & Pearson, 2002; Pearson & Anderson, 1984; Pearson & Fielding, 1999; Pressley, 1999, 2000; Pressley et al., 2002). As individuals use active critical analysis to connect texts to their experiences and prior knowledge their comprehension is affected by socio-cultural factors similar to the way literacy is affected by such variables. As a result, researchers have begun to look at the impact that socio-cultural contexts play in the acts of both literacy and comprehension. This requires a shift from a psycholinguistic perspective to a socio-psycholinguistic perspective (Gee, 1992).

One of the many challenges to literacy and comprehension is that students reading competencies have only been practiced with a limited range of texts and in a limited range of circumstances (Biancarosa & Snow 2006; Pearson & Fielding, 1991). Students

often do not have the fluency and comprehension to understand texts as they move from one place or discipline to another. Shanahan (2004) has found that the approach to reading and getting information from text can be different based on discipline and context. These contemporary and complex views of literacy and comprehension affected by socio-cultural, discipline-based, media-based, and personal contexts amongst other factors helped clarify the researcher's understanding of cognitive styles and new literacies for this study and aided the researcher in identifying some of the literacy and comprehension challenges readers face in 21st century.

Problem

The growth of technology and the Web has created a new form of literacy known as digital literacy (Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011; North Central Regional Educational Laboratory, & Metiri Group, 2003;). Digital literacy is the assortment of cognitive-thinking styles, abilities, and dispositions that consumers of digital information utilize (Eshet-Alkalai & Chajut, 2009). Digital literacy has necessitated a number of important shifts of emphasis in literacy over the past two decades. One of the most important has been the shift from fixed to fluid texts where reading and writing paths have become nonlinear in contrast to linear historical texts (Merchant, 2007). As a result, nonlinear thinking style has become a necessary skill set within the larger theoretical framework of digital literacy (Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011).

Brown and Adler (2008) described the resulting shifts in literacy from a “push” approach of learning, where directed learning is the norm, to a “pull” approach of social learning, where new technologies attempt to enable people to actively participate and

shape the learning experience. These shifts pose new challenges for individuals in evaluating and understanding information (Buckingham, 2007) and necessitate the use of both linear and nonlinear thinking style for effective information and communication processing (Coiro, Knobel, Lankshear, & Leu, 2008; Eshet-Alkalai & Chajut, 2009; Lambert & Cuper, 2008; Leu et al., 2011). Moreover, these shifts offer evidence that online reading comprehension is not isomorphic with offline reading comprehension (Leu et al., 2011). In light of this, policy makers and educators must begin to recognize the pervasive growth of the World Wide Web as posing more than just a techno-procedural (basic utilization of computer software and hardware) difference. Challenges to successful literacy on the Web also include cognitive (the ability to locate, analyze, validate, evaluate, critique, integrate, and synthesize information including text, images, video, and audio through a range of modalities), and socio-emotional (the effective use of and communication through synchronous and asynchronous social media on the web, and ethical understanding of such digital behavior) challenges. These challenges require new skills and strategies for successful comprehension in the digital realm (Eshet-Alkalai, 2004).

These changes have ramifications for our educational system. The nation's present approach to learning in schools and training for the labor force are mismatched to the demands of new technology (Davidson, 2011). Educational environments have been and are still primarily designed to reinforce our attention to regular, systematic tasks that are approached in a purely linear fashion (Davidson, 2011). Curriculum in the United States has been restricted to what can be tested, encouraging schools to separate the cognitive from the affective, defining thought as being either qualitative or quantitative as

opposed to both, and denying the important role of the senses in concept formation (Dorn, 1999). This leaves little room for creative and nonlinear thinking style within curriculum development and robs students and teachers of the opportunity to enhance such skills.

The nation's educational system should adapt to the ever-increasing demand for highly creative output in the workplace (Carlson & Kaiser, 1999; Gupta & Govindarajan, 2002; Hitt, Keats, & DeMarie, 1998). Pink (2005) has advised that we are "moving from the Information Age to the Conceptual Age" (p. 33). This "conceptual age" requires new skill sets with an emphasis on non-routine cognitive skills, such as abstract reasoning, problem solving, creativity, nonlinear thinking, communication, and collaboration on all levels of employment (Karoly & Constantijn, 2004). Effective planning, thinking, and problem solving in today's business world requires these skills to generate unique ideas and novel solutions to problems (Buenger, Daft, Conlon, & Austin, 1996; Davidson, 2011; Pink, 2005; Robinson, 2011; Sternberg, 2002; Vance, Groves, Paik, & Kindler, 2007b; Zaccaro, 2002).

To meet the new demands for nonlinear thinking style in the home, learning environments, and the workplace educators, researchers, and policy makers must improve their understanding of what nonlinear thinking style is, what factors affect nonlinear thinking style, whether nonlinear thinking style is mutable, and how to best assess an individual's thinking style.

Currently, there is a limited amount of research in the literature concerning what variables have a relationship with nonlinear thinking style preference (Vance et al., 2007b). Furthermore, there is a limited amount of research in the literature concerning

how engagement in the arts offers methods of inquiry, representation, and comprehension that may be mutually synergistic with nonlinear thinking style.

Purpose

With evidence that arts engagement and nonlinear thinking style both utilize insight, intuition, and emotion in the decision making process (Dorn, 1999; Eisner, 2002; Vance et al., 2007b; Groves, Vance, Choi, & Mendez, 2008), analysis of the literature led the researcher to investigate if there is a relationship between levels of arts engagement and thinking style preference.

The overall objectives of this research were to: (a) Explore the prevalence of linear, nonlinear, or balanced linear/nonlinear thinking style for professionals working in museums. (b) Whether thinking style has a relationship with (i) age; (ii) sex; (iii) academic major; (iv) occupation; (v) levels of arts engagement. Two theoretical frameworks underpinned this study: (a) new literacies (Coiro et al., 2008; Leu, Kinzer, Coiro, & Cammack, 2004), and (b) cognitive styles (Gardner, Holzman, Klein, Linton, & Spencer, 1959; Gardner, Jackson, & Messick, 1960; Groves et al., 2008; Messick & Ross, 1962; Vance et al., 2007b; Witkin, Moore, Goodenough, & Cox, 1977).

Research Questions

1. What is the relationship between sex and thinking style for professionals working in museums?
2. What is the relationship between age and thinking style for professionals working in museums?
3. What is the relationship between academic major and thinking style for professionals working in museums?
4. What is the relationship between occupation and thinking style for professionals working in museums?

5. What is the relationship between levels of arts engagement and thinking style for professionals working in museums?

Operational Definitions

Arts Engagement

For purposes of this research project arts engagement was broadly defined as either observing, reading, or directly participating in any of the following art forms: the performing, visual, and fine arts, as well as applied arts including architecture and graphic design; crafts; film, digital media and video; humanities and historic preservation; literature; and other creative activities; as well as community/cultural festivals, fairs and events. Arts Engagement was measured by the Levels of Arts Engagement Survey.

Professionals Working In Museums

For purposes of this research project professionals working in museums were identified as any person working in a museum setting. The fields of work included, but were not limited to: accounting/finance, administrative/clerical, curator, assistant/deputy/associate director, chief operating officer, conservation, development/membership, directors/administrators, education, exhibitions, facility/operations, internships/fellowships, public relations/marketing, publications, registrar/collections management, security, and visitor services/customer service. Participants self-identified their field of profession in each survey.

Cognitive Styles

Cognitive styles are defined as stable, but mutable attitudes, preferences, or habitual strategies that determine individuals' modes of perceiving, thinking, problem

solving, and remembering (Gardner et al., 1959; Gardner et al., 1960; Groves et al., 2008; Messick & Ross, 1962; Vance, Groves, Paik, & Kindler, 2007b; Witkin et al., 1977).

Linear thinking style. As measured by the Linear Nonlinear Thinking Style Profile (LNTSP) instrument employed in this study, linear thinking involves rationality, logic, and analytical thinking concentrating on external factors for comprehension and communication (Vance et al., 2007b).

Nonlinear thinking style. As measured by the LNTSP instrument, nonlinear thinking is related to intuition, insight, creativity, and emotions, concentrating on internal factors for comprehension and communication (Vance et al., 2007b).

Balanced linear/nonlinear thinking style. As measured by the LNTSP instrument, balanced linear/nonlinear thinking style are represented by the ability to utilize both modes of thinking style preference dependent upon the context of the problem to be solved.

Literacy

The National Curriculum Board (2009) has defined literacy as a flexible, sustainable mastery of a set of capabilities in the use and production of traditional texts and new communications technologies using spoken language, print, and multimedia.

Comprehension

Comprehension is the ability to read information, process it and understand its meaning. An individual's ability to comprehend text is influenced by their traits, personal experiences and skills. Comprehension is a creative and multifaceted process (Tompkins, 2011).

New Literacies

New Literacies include the new skills, strategies, dispositions, and social practices that are required by new technologies for information and communication; are central to full participation in a global community; regularly change as their defining technologies change; are multifaceted; and our understanding of them benefits from multiple points of view (Coiro et al., 2008).

Digital literacy. Digital literacy is the assortment of cognitive-thinking styles, abilities, and dispositions that consumers of digital information utilize. Digital literacy incorporates and is measured by six types of literacy skills: photo-visual literacy, reproduction literacy, information literacy, branching (lateral non-linear) literacy, socio-emotional literacy, and real time thinking (Eshet-Alkalai & Chajut, 2009). This framework is composed of three strands: technical-procedural, cognitive, and emotional-social.

Assumptions

Assumptions are statements by the researcher that certain elements of the research are understood to be true. The assumptions made for this study include:

1. The World Wide Web is a defining technology for literacy and learning of our time.
2. The World Wide Web requires additional skills and strategies for successful online reading comprehension known as digital literacy.
3. Nonlinear thinking style is a skill set within the theoretical framework of digital literacy.

4. It is assumed that the results of the study will be relevant to educators and other stakeholders.

Scope

This study investigated thinking style preference of professionals working in Museums. Professionals were chosen from state, municipal, and private museums throughout the United States. The museums were classified into five basic types—general, natural history and natural science, science and technology, history, and art. General museums hold collections in more than one subject and are therefore sometimes known as multidisciplinary or interdisciplinary museums. Museums of natural history and natural science are concerned with the natural world; their collections may contain specimens of birds, mammals, insects, plants, rocks, minerals, and fossils. Museums of science and technology are concerned with the development and application of scientific ideas and instrumentation. The term history museum is often used for a wide variety of museums where collections are amassed and, in most cases, are presented to give a chronological perspective. The art museum is concerned primarily with the object as a means of unaided communication with its visitors. Traditionally these collections have comprised paintings, sculpture, and the decorative arts.

Professions represented in museums and coded for this study include: education, public relations/publications, curators, CEOs/directors/admin/development/membership, admin/support/clerical/intern/fellow, registrars, and exhibitions. Education professionals included museum educators and those working primarily in education and interpretation. Public relations professionals include individuals working in marketing museum programs. Curators are professionals conducting research, conceptualizing, and

producing exhibitions in collaboration with staff. The CEO typically has the title of executive director and leads the museum, Directors/admin/development/membership are various mid-level to high level supervisors working in the development and membership initiatives for the museum that include identifying and cultivating donors.

Admin/support/clerical are mostly entry level administrators that work as support staff while interns/fellows work at museums conducting research and other tasks to assist the museum in its endeavors and offer the individual practical experience in the museum field. Registrars work with archivists to help catalogue and maintain a museum's collection. Exhibitions staff consists of engineers, designers, architects, and builders who help conceptualize, design, and construct spaces for exhibits.

The study utilized a Web-based self-report survey that was distributed to museum professionals across the United States. The data collection took place over the course of three weeks.

Significance of the Study

The researcher added to the body of knowledge regarding the relationship between thinking style and personal characteristics. Additionally, the researcher identified gaps in the literature concerning a relationship between nonlinear thinking style and arts engagement. A deeper understanding of the relationship between thinking styles and levels of arts engagement can lead towards the development of programs that encourage the use of specific thinking styles, spur further research in the field, and promote advocacy for arts engagement experiences over the course of a lifetime by professionals working in museums.

The researcher developed a new instrument to measure arts engagement over a lifetime that can be used in the field for other applications. In addition, the researcher developed a Web-based self-report survey version of the Linear/Nonlinear Thinking Style Profile (LNTSP) instrument. The Web-based self-report survey version of the LNTSP instrument did not transfer well and allowed for many respondents to not follow the proper 3-point allocation rule. This greatly reduced the validity of the findings for the study and the validity of the instrument used by the researcher. The use of this new instrument did help identify some of the complexities of using a Web-based self-report survey and those limitations offer valuable lessons to improve sample and instrument design for future studies. Recommendations for instrument refinement are offered in Chapter V.

CHAPTER II

LITERATURE REVIEW

This literature review investigates (a) literacy and new literacies with a focus in the theory of digital literacy and its origins, existing definitions and theoretical models, and a summary and synthesis of the literature (b) the theory of cognitive styles and its origins, cognitive styles testing and measurement, and a summary and synthesis of the literature.

Nonlinear thinking style falls within the theoretical framework of cognitive styles (Allinson & Hayes, 1996; Guilford, 1967; Kolb, 1984; Messick, 1984; Sternberg, 2002; Vance et al., 2007b) and is also considered an essential skill within the theoretical framework of digital literacy (Eshet-Alkalai & Chajut, 2009). This fact creates a relationship between digital literacy and cognitive styles. With this in mind the researcher viewed this study as focused on cognitive styles with implications for digital literacy. Logically, it was necessary to include the theoretical framework of digital literacy within this literature review because this was the particular context in which the need/demand for nonlinear thinking style was researched. The fact that there is an increasing need for people to develop digital literacy skills (Eshet-Alkalai & Chajut, 2009) is the “so what” aspect of why the application of nonlinear thinking style matters in the 21st century.

To conduct the literature review key search terms were identified that took into account how different authors refer to these theories and their dimensions using diverse terminology. This was done in order to ensure complete coverage of the broad, multidisciplinary literature on cognitive styles and digital literacy. The review took strongest consideration of peer-reviewed journal papers on the basis that they represent

scientifically validated knowledge and have the highest impact on the field. Books, book chapters, and other non-peer reviewed publications were included in the review.

Numerous databases including ERIC, ProQuest, EBSCOhost, FirstSearch, and Google Scholar using the terms: literacy, comprehension, cognitive styles, thinking styles, learning styles, linear-nonlinear thinking style, new literacies, 21st century literacies, World Wide Web literacies, digital literacies, new media literacies, information literacy, ICT literacies, computer literacy, and ORC (online reading comprehension).

Bibliographies of relevant articles served as a source of content for the review as well.

The author expanded his search to include information literacy mission statements from colleges and universities across the nation.

Literacy and New Literacies

The Internet and other forms of information and communication technologies (ICTs) are redefining the nature of literacy and bringing about a discussion and debate concerning new literacies (Coiro, Knobel, Lankshear, & Leu, 2008). New literacies generally refers to new forms of literacy made possible by digital technology developments, although new literacies do not have to involve use of digital technologies. The term new literacies is relatively new within the field of literacy studies, first mentioned by David Buckingham (1993) in an article titled; “Towards New Literacies, Information Technology, English and Media Education.” Since then its definition has continued to evolve and these changes in literacy have been noted and researched by many in the field (Coiro et al., 2008; Lankshear & Knobel, 2003; Leu, 2007; McKenna, Labbo, Kieffer, & Reinking, 2006). The resulting research leads to the conclusion that traditional definitions and approaches to literacy must adapt to 21st century demands

(Jolls, 2008; Merchant, 2008). As literacy definitions change the field should examine the implications of these changes for research and development. Such implications include identifying instructional strategies essential for supporting successful digital literacy performance for different information and communication technologies.

Digital Literacy

This section reviews research and literature concerning digital literacy. The first subsection articulates existing definitions, the second subsection focuses on theoretical frameworks, and the third subsection is a summary and synthesis of the literature. Recommendations for definitions and frameworks that include three strands in their structure: techno-procedural, cognitive, and socio-emotional are offered. The researcher defines techno-procedural as basic utilization of computer software and hardware; cognitive as the ability to locate, analyze, validate, evaluate, critique, integrate, and synthesize information including text, images, video, and audio through a range of modalities; and socio-emotional as the effective use of and communication through synchronous and asynchronous social media on the web, and ethical understanding of such digital behavior. These strands create an integrated holistic framework for digital literacy. The recommendations are made with the awareness that a settled definition and framework may not be possible in an area of study whose foundation, technology is rapidly changing (Leu et al., 2007).

Digital Literacy Definitions

The term digital literacy was popularized by Gilster (1997) who defined it broadly as the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers. Digital media tools and digital literacy have

evolved since 1997 becoming more complex and pervasive in our everyday lives. Researchers have been grappling with this growth and attempting to define digital literacy in the modern age. What follows are a series of definitions considered and critiqued for the purposes of the study.

Ba, Tally, and Tsikalas (2002) describe digital literacy as a “set of habits through which youngsters use information technologies for learning, work, and fun” (p. 5). This definition is general, but sheds light on a discord in contemporary education. As Beavis, Apperly, Bradfor, O’Mara, and Walsh (2009) suggest, “the skills demanded for an increasingly technological and changing workplace are not being learned in schools; rather they are being learned through youth’s ‘engagement’ in virtual worlds” (p. 164). Currently, schools still tend to promote print-based literacies in instruction, curriculum content, and assessment. The discord between the digital literacies youths are confronted with at school and the ones they use at home needs to be addressed by educators. As the World Wide Web has become one of this generation’s defining technology for literacy and learning, the field of education should take up World Wide Web integration into the curriculum and begin instruction in the new literacy skills the World Wide Web requires (Leu et al., 2007).

Eshet-Alkalai (2004) suggests that digital literacy refers to the assortment of cognitive-thinking strategies that consumers of digital information utilize. Eshet-Alkalai and Amichai-Hamburger (2004) elaborate on this concept suggesting that “having digital literacy requires more than just the ability to use software or to operate a digital device; it includes a large variety of complex skills such as cognitive, motoric, sociological, and emotional that users need to have in order to use digital environments effectively” (p.

421). This definition is holistic and gets to specifics that Ba et al. (2002) do not cover. Specifically, that digital literacy involves technical, cognitive, and social skills. Leu et al. (2004) define digital literacy as the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies. The inclusion of dispositions along with skills and strategies is unique to this definition and prompts questions concerning the role dispositions or what might be called thinking styles play in digital literacy in comparison to skills and strategies. Martin (2006) defines digital literacy as:

the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze, and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process. (p. 4)

This definition is holistic in the manner of Ba et al. (2002), but also inclusive of synthesis and creative output. Two emerging and important aspects of digital literacy as the researcher will make evident later on. O'Brien and Schraber (2008) define digital literacy as "socially situated practices supported by skills, strategies, and stances that enable the representation and understanding of ideas using a range of modalities enabled by digital tools" (p. 67). This definition also illustrates the importance of creative outputs through the representation of ideas. Moreover, O'Brien and Schraber (2008) make mention of digital literacy as a socially situated practice. The socio-emotional is another emerging quality of digital literacy whose prominence continues to grow. Calvani, Fini, and Ranieri (2009) describe digital literacy as being able to explore new technological situations in an

adaptable manner, to analyze, select, and validate data and information, to be able to build shared and or collaborative knowledge, and to be able to synthesize ideas through technology. Calavani et al. (2009) illustrate the collaborative aspect of digital literacy, a result of the socio-emotional strand of the field whose importance is continuing to grow through the pervasive use of social media and real-time communicating tools over the World Wide Web. Eshet-Alkalai and Amichai-Hamburger (2004), Martin (2006), O'Brien and Schraber (2008), and Calvani et al. (2009) have all expanded the theory of digital literacy from Gilster to not only include the techno-procedural, but also cognitive, and social aspects of the field. These expanded perspectives take into consideration the evolution of technology as a tool that incorporates and demands all three strands at all times from the user/learner. It is no longer particularly useful to think of digital literacy merely in terms of information technology (Buckingham, 2007). Definitions for digital literacy must now consider the inclusion of techno-procedural, cognitive, and socio-emotional strands that offer a range of significant knowledge, thinking styles, skills, and understandings for the user. Considering the varied definitions offered in this section the researcher defines digital literacy as the assortment of cognitive-thinking styles, abilities, and dispositions that consumers of digital information utilize. The researcher agrees with Eshet-Alkalai and Chajut (2009) that digital literacy incorporates six types of literacy skills: photo-visual literacy, reproduction literacy, information literacy, branching (lateral non-linear) literacy, socio-emotional literacy, and real time thinking. In the next subsection, recommendations concerning this framework will be presented.

Theoretical Models

Up until recently primary, secondary, and post-secondary schools arrived at theoretical models for digital literacy using their information literacy models developed through their library systems. As a result, most institutions developed digital literacy theoretical models that focused on research skills such as posing a question, identifying appropriate sources, finding, evaluating, or synthesizing information (American Association of School Librarians, 2011). Currently, models are expanding to include multiple literacies and integrating the techno-procedural, cognitive, and socio-emotional. What follows are a series of existing information literacy and digital literacy frameworks, some that separate the technical and cognitive, some that integrate the two, and others that expand the framework to include a techno-procedural, cognitive, and socio-emotional strands.

The Florida Department of Education (FDOE, 2011) developed the FINDS research process model as a framework for its information literacy curriculum standards for media specialists. The framework consists of five dimensions: (a) focus, (b) investigate, (c) note, (d) develop, (e) score. Below is a more detailed interpretation of each dimension:

1. Focus on information need
2. Investigate resources to search for answer
3. Note and evaluate facts and ideas to answer the question
4. Develop information into knowledge for presentation
5. Score presentation and search process

The Florida Department of Education (FDOE) has divided the research process model up into five overarching themes that are important skills, but are limited to the finding, retrieval, and synthesis of information in a research context. The Hunter College Libraries (2015) information literacy mission statement expands a bit from the FDOE by stating:

Information literacy enhances the pursuit of knowledge by preparing students to think critically and use information for their academic, professional and personal lives. The information literate individual can recognize the need for information, can locate it using a variety of media and technologies, and can evaluate information in order to use it effectively. Information literate students have the flexibility to take these skills from their formal education and use them throughout life as citizens and professionals and as a means toward continued learning. (para. 2)

This framework has a research-based focus, but it is more expansive because it begins to address the socio-emotional strand by alluding to the ethical use of technology as citizens and professionals. Traditionally, libraries have been leaders in defining digital literacy at schools because their environments have been in the forefront of the transition from printed text to digital text. Unfortunately, a focus on research competencies as a core framework does not encompass the full set of skills that can make a student fully successful in a digital environment today. Following are theoretical models for digital literacy that encompass not just techno-procedural but, attempt to include the cognitive and sometimes socio-emotional strands as well.

The Association of Colleges & Research Libraries (ACRA, 2011) states that:

Information literacy is a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information. In addition, information is available through multiple media, including graphical, aural, and textual, and these pose new challenges for individuals in evaluating and understanding it. (para. 3)

The inclusion of graphical, aural, and textual elements that pose new challenges for individuals in evaluating and understanding information addresses the multi-modal cognitive skills that are necessary for digital literacy and alludes to the challenges of being visually literate. The University Library at the University of Illinois at Urbana-Champaign (2011) uses a broad framework for defining of digital literacy stating that digital literacy is:

(a) the ability to use digital technology, communication tools or networks to locate, evaluate, use and create information; (b) the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers; and (c) a person's ability to perform tasks effectively in a digital environment. (para. 1)

This framework goes beyond the finding, retrieval, and synthesis of information.

The emphasis on reproduction and manipulation take into account that digital environments are places where the user/learner must synthesize (i.e., creative outputs) and communicate their ideas through multi-modal presentations. With an ever increasing focus on creative output, an argument can be made that to be digitally literate one must also be visually literate (Jones-Kavalier & Flannigan, 2006). Visual literacy is defined as

a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media. A visually literate individual is both a critical consumer of visual media and a competent contributor to a body of shared knowledge and culture (ACRA, 2011). Digital media represents cultural forms that are inextricably connected with other visual and audio-visual media (Buckingham, 2007). The continued use of computers and other digital media places a strong emphasis on not only visual literacy, but media literacy skills as outlined by the University of Illinois' framework.

Florida International University's (2015) Library Instruction Program has the following mission statement: "To educate students to recognize the need for information, understand the organization of knowledge, gather data using a variety of media and technologies and evaluate the relevance and authority of information in all its forms" (para 1).

FIU's information literacy goals are:

1. To educate students to recognize the need for information, understand the organization of knowledge, gather data using a variety of media and technologies and evaluate the relevance and authority of information in all its forms.
2. To prepare students to think critically as they seek and use information.
3. To encourage and enhance collaborative relationships between classroom and library faculty.

FIU's Library instruction program's student outcomes are:

1. Engages in regular inquiry and seeks new information for lifelong learning.
2. Applies creative and flexible information seeking strategies in order to navigate the unfamiliar, take action or solve a problem.
3. Identifies appropriate sources in order to access relevant information.
4. Uses most appropriate media, technologies and organizational tools in order to access and manipulate information.
5. Evaluates information in order to determine quality, relevance, or perspective.
6. Synthesizes new information with current understanding and experience in order to create something new, acquire insight, transform values, or expand knowledge base.
7. Examines and uses legal and ethical standards in order to use information appropriately and responsibly.
8. To prepare students to think critically as they seek and use information.
9. To encourage and enhance collaborative relationships between classroom and library faculty.

The goals and outcomes put forth by FIU are the beginnings of a complex approach to information/digital literacy. The university includes the critical analysis skills, synthesis, and new forms of collaboration and socialization skills necessary in the digital world, but the approach still does not include a visual literacy aspect. With the amount of information delivered through images it would seem necessary to address visual literacy as well.

Buckingham (2007) has developed a digital literacy framework using a media literacy framework as a foundation with a focus on visual literacy and creative synthesis. Media literacy focuses on analysis, understanding, synthesis, and communication of digital content. Buckingham's framework has four dimensions (a) representation (b) language (c) production and (d) audience. These dimensions are further defined below:

Representation

1. How websites claim to 'tell the truth', and establish their authenticity and authority.
2. The presence or absence of particular viewpoints or aspects of experience.
3. The reliability, veracity and bias of online sources.
4. The implicit values or ideologies of web content, and the discourses it employs.

Language

1. The use of visual and verbal 'rhetorics' in the design of websites (for example, graphic design principles, the combination of visuals and text, the use of sound).
2. How the hyper textual (linked) structure of websites encourages users to navigate in particular ways.
3. How users are addressed: for example, in terms of formality and 'user-friendliness'.
4. The kinds of "interactivity" that are on offer, and the degrees of control and feedback they afford to the user.

Production

1. The nature of web authorship, and the use of the World Wide Web by companies, individuals or interest groups as a means of persuasion and influence.
2. The technologies and software that are used to generate and disseminate material on the Web, and the professional practices of web “authors”.
3. The significance of commercial influences, and the role of advertising, promotion and sponsorship.
4. The commercial relationships between the Web and other media such as television and computer games.

Audience

1. The ways in which users can be targeted by commercial appeals, both visibly and invisibly.
2. The nature of online “participation”, from web polls to bulletin boards to “user-generated content.”
3. How the Web is used to gather information about consumers.
4. How different groups of people use the World Wide Web in their daily lives, and for what purposes.
5. How individuals or groups use and interpret particular sites, and the pleasures they gain from using them.
6. Public debates about the “effects” of the World Wide Web, for example, in relation to online safety and “addiction.”

Buckingham's inclusion of representation, language, production, and audience spans the techno-procedural, cognitive, and socio-emotional strands with a focus on the need for people to not only become digital consumers, but also producers of shared knowledge. What follows are a series of theoretical frameworks that also use media literacy as a foundation for the development of a digital literacy framework.

The iSkills assessment framework was developed by the Educational Testing Service (ETS iSkills, 2015). The framework is divided into seven levels of proficiency:

1. Define
2. Access
3. Manage
4. Integrate
5. Evaluate
6. Create
7. Communicate

This model is clearly focused on the cognitive aspects of media literacy, but pays less attention to the socio-emotional strand. The Society of College National University Libraries (2012) created the SCONUL Seven Pillars of Information Literacy: Core Model with a framework of six dimensions:

1. Identify: Able to identify a personal need for information.
2. Scope: Can assess current knowledge and identify gaps.
3. Plan: Can construct strategies for locating information and data.
4. Gather: Can locate and access the information and data they need.

5. Evaluate: Can review the research process and compare and evaluate information and data
6. Manage: Can organize information professionally and ethically.

In a similar vein Leu et al. (2011) suggest five processing practices that people engage in while reading online.

1. Identifying important questions
2. Locating information
3. Critically evaluating information
4. Synthesizing information
5. Communicating information

Castek, Zawilinski, McVerry, O'Byrne, and Leu (2011) developed an online reading comprehension framework consisting of five dimensions that appears inspired by media literacy framework foundations, they include:

1. Reading online to generate a problem or question from one's social context.
2. Reading to locate information online.
3. Reading to critically evaluate information online.
4. Reading to synthesize information online from multiple sources.
5. Reading to communicate and exchange information online with others.

These frameworks incorporate many of the skills, strategies, and dispositions that are distinctive to media literacy and digital literacy, but the focus remains more on direct skills leaning towards the techno-procedural and cognitive with a focus on media literacy while lacking attention towards the socio-emotional. Though Castek et al. (2011) does

include a dimension that focuses on communication and exchange between people online alluding to the collaborative nature of the World Wide Web.

Using a more integrative approach the International Society for Technology in Education (NETS, 2007) created a digital literacy framework that has six dimensions. This framework focuses on the creating and communicative dimensions, but also gives space for social dimensions through digital citizenship. The dimensions are listed below:

1. Creativity and Innovation: students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration: students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
3. Research and Information Fluency: students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making: students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship: students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
6. Technology Operations and Concepts: students demonstrate a sound understanding of technology concepts, systems, and operations.

In another framework that considers all three strands Martin (2003) suggest a framework that acts on the following three dimensions:

1. Operative: representing the level of technique or mastery of basic digital competences.
2. Thoughtful usage: the contextually-appropriate application of digital tools.
3. Critical reflection: the understanding of the transformative human and social impact of digital actions.

Calvani et al. (2009) also developed an integrative model. The model includes three dimensions of digital competence based on individuals' (1) ethical, (2) cognitive, and (3) technological levels. These dimensions cut across the techno-procedural, cognitive and social strands. Gardner et al. (2011) suggest a six point holistic and integrative framework where participants of online communities exercise the following new critical new media literacies:

1. Performance: The ability to adopt alternative identities for the purpose of improvisation and or discovery.
2. Simulation: The ability to interpret and construct dynamic models of real world processes.
3. Judgment: The ability to evaluate the reliability and credibility of different information sources (including friends and peers).
4. Negotiation: The ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms. Networking—the ability to search for, synthesize, and disseminate

information; in other words, networking creates opportunities to share with others.

5. Collective intelligence: When participants pool knowledge and compare notes with others toward a common goal.
6. Appropriation: The ability to meaningfully sample and remix media content.

O’Byrne and McVerry (2009) developed a digital literacy framework based on dispositions rather than skills and or thinking styles. Dispositions can be considered patterns of behavior, situated in the context of a particular environment. As opposed to cognitive styles dispositions are rarely mutable. The framework consists of five dispositions:

1. Persistence
2. Flexibility
3. Collaboration
4. Reflection
5. Critical stance

O’Byrne and McVerry (2008) state that when dispositions are recognized and “developed by those who can manipulate the environment, it may lead to gains in the acquisition of knowledge, skills, and understandings. Thus while online reading comprehension involves specific skills and strategies there are also likely to be affective factors that determine how these skills and strategies are used (p. 364).” O’Byrne and McVerry (2008) have created a unique framework that focuses on dispositions rather than thinking styles or abilities/skills. Dispositions brings up the question of whether digital literacy skills reflect personality characteristics, that are perhaps innate, not easily acquired by

everybody, and certainly not to the same extent. For instance, the gaps that currently exist between students are often associated with dispositions and or practices used by young people in their homes (Henderson & Honan, 2008). When designing a framework and technology plan educators and policy makers must take these considerations into account.

In response to these trends in research, Eshet-Alkalai (2004) created a five-skill holistic theoretical framework for digital literacy. It is this framework that inspired the researcher to further investigate the relationship between digital literacy and nonlinear thinking skills. This framework, expanded in 2009 to include six skills, offers a useful way to begin creating assessment tools that can be used to increase research and better understand what core skills are representative of effective digital literacy. Eshet-Alkalai and Chajut's (2009) framework consists of the following dimensions:

1. Photo visual literacy is the ability to work effectively with digital environments, such as user interfaces, that employ graphical communication.
2. Reproduction literacy is the ability to create authentic, meaningful written and artwork by reproducing and manipulating preexisting digital text, visuals, and audio pieces.
3. Branching literacy is the ability to construct knowledge by a nonlinear navigation through knowledge domains, such as in the World Wide Web and other hypermedia environments.
4. Information literacy is the ability to consume information critically and sort out false and biased information.
5. Socio emotional literacy is the ability to communicate effectively in online communication platforms such as discussion groups and chat rooms.

6. Real-time thinking skill is the ability to process and evaluate large volumes of information in real time, such as in computer games and chat rooms.

The definition for photo-visual literacy created by Eshet-Alkalai (2004) is limited and should be expanded to include a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media (ACRA, 2011). This broadened definition addresses the role images play in the conveyance of information in the digital age and the need to synthesize that information visually as stated in the reproduction literacy definition above.

Branching literacy requires nonlinear thinking style and is defined as the ability to construct knowledge by a nonlinear navigation through knowledge domains, such as in the World Wide Web and other hypermedia environments. Eshet-Alkalai and Amichai-Hamburger (2004) state that:

branching literacy requires that scholars who have good spatial-multidimensional sense of orientation stay oriented and avoid getting lost in the hyperspace while navigating through complex knowledge domains, despite the intricate navigation paths they may take. They must also have good metaphoric thinking and the ability to create mental models, concept maps, and other forms of abstract representation of the web's structure, which help branching-literate scholars to overcome disorientation problems in hypermedia environments. (p. 422)

The inclusion of branching literacy takes into consideration that nonlinear thinking style are demanded by today's nonlinear multimedia tools of the World Wide Web. The framework developed by Eshet-Alkalai (2004) includes a large variety of complex cognitive, motor, sociological, and emotional skills. The framework also

includes media literacy and visual literacy concepts. This holistic view of digital literacy recognizes that the use of technology, specifically the World Wide Web, is a reading comprehension issue, not just a techno-procedural one. Eshet-Alkalai (2004) proposes to use this theoretical framework as a diagnostic and evaluative tool for use in creating precise, user-directed products. Furthermore, Eshet-Alkalai contrasts the traditional industrial linear literacy skill sets, against more contemporary lateral nonlinear literacy skill sets (Covello, 2010).

These newly emerging frameworks for digital literacy should be carefully considered and some consensus should be identified. This way, researchers may use a validated and agreed upon model to measure the quality of learners' work in digital environments and provide teachers, scholars, developers, and policy makers with more effective means of designing curricula that is effective at enhancing digital literacies.

Summary

New perspectives on literacy and the learning processes through which literacy is acquired, have been emerging (Hiebert, 1991). While there is agreement that a new set of 21st-century skills involving technologies are needed for literacy, there is still no clear consensus about precisely what knowledge and abilities are necessary for people to be digitally literate (Ba et al., 2002). Other terms used alongside or sometimes synonymously with digital literacy include: 21st century literacies, World Wide Web literacies, multiliteracies, information literacy, information communication technologies (ICT) literacies, computer literacy, and online reading comprehension (ORC). Each of these terms has particular definitions, but commonalities can be identified helping to bring them together under the same theoretical umbrella of new literacies.

Coiro et al. (2008) conclude that most new literacies including digital literacy share four assumptions: (a) new literacies include the new skills, strategies, dispositions, and social practices that are required by new technologies for information and communication; (b) new literacies are central to full participation in a global community; (c) new literacies regularly change as their defining technologies change; and (d) new literacies are multifaceted and our understanding of them benefits from multiple points of view. Leu et al. (2009) suggest that new literacies theory functions on two levels: upper case (New Literacies) and lower case (new literacies). Digital literacy acts as a lower case dimension to the broader more inclusive concept of upper case New Literacies.

In a sign of growth in the field of education, technology, and engineering literacy has now been mandated and become a formal part of the National Assessment of Educational Progress (NAEP), also known as the 'Nation's Report Card,' which gauges the educational progress of elementary and secondary students. The National Assessment Governing Board (2014) defines technology and engineering literacy as "the capacity to use, understand, and evaluate technology as well as to understand technological principles and strategies needed to develop solutions and achieve goals" (p. 3). This definition is limited and relates to other definitions the researcher has discussed that cover the techno-procedural strand, some of the cognitive strand, and very little to none of the socio-emotional strand.

Instruments for secondary education are also becoming common and are in use. Some of the most recognized include: ETS iSkills, the iSkills assessment measures information literacy through seven task types representing a range of ways that students handle information through digital technology; iCritical Thinking, this is an online exam

with simulated situations; Project SAILS, this is a 45 “forced answer” multiple-choice items exam; and iDCA (Digital Competence Assessment), this is a multiple-choice, situated response, and simulation, administered online through Moodle. Katz (2005) suggests four imperatives for integrating digital literacy assessment into the educational framework: (a) to support institutional ICT literacy initiatives, (b) to guide curricula innovations and evaluate curricula changes, (c) to guide individual learning, (d) to establish a clear definition of skills and knowledge. These imperatives offer objectives that should be considered by researchers as they continue to develop assessment tools for digital literacy.

Synthesis

Digital Literacy is an umbrella framework for a number of complex literacies comprised of skill, knowledge, ethics, and creative outputs (Calvani, Cartelli, Fini, & Ranieri, 2008). As a result of this complexity digital literacy lacks an agreed upon definition and a sound integrative theoretical framework. The difficulties and challenges concerning digital literacy include a series of overlapping constructs (Ba et al., 2002), a limited body of research, limited tools of measurement, and few scholars who study the issue. Moreover, the continuously changing nature of technology opens up the field to even newer literacies that will appear in the near future.

Questions that exist for the field of digital literacy include: If comprehension is different on the World Wide Web, what implications do these differences have for instruction, assessment, and professional development? What is the full range of skills essential for effective digital literacy? What are the gaps between informal uses of digital literacy and current classroom literacy routines? Could different literacies reflect different

learning styles or intelligences or personality types? Could these skills reflect personality characteristics or dispositions, that are perhaps innate, not easily acquired by everybody, and certainly not to the same extent?

Cognitive Styles

This section reviews research and literature concerning cognitive styles theory. The first subsection focuses on cognitive styles theory and its origins; the second subsection focuses on cognitive styles testing and measurement, including the LNTSP instrument used in this study; and lastly, the third subsection is a summary and synthesis of the literature. The researcher concluded that cognitive styles are stable, but mutable attitudes, preferences, or habitual strategies that determine individuals' modes of perceiving, thinking, problem solving, and remembering. Moreover cognitive styles are not considered abilities but rather preferred ways of using the abilities one has across a wide variety of cognitive tasks. Cognitive styles are concerned with the form rather than the content of cognitive activity. Thus, cognitive styles are defined by process.

Cognitive Styles Theory and Origins

Cognitive styles represent a bridge between two distinct areas of psychological investigation: cognition and personality (Sternberg & Grigorenko, 1997). Cognition is viewed as the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses. Personality is viewed as the combination of characteristics or qualities that form an individual's distinctive character. Origins of cognitive styles research are traceable to Jung's (1923) theory of psychological types. Jung observed that people seemed fundamentally different in terms of whether they were more extraverted, oriented to the external world of people and experiences, or

introverted, oriented to the internal worlds of thoughts, ideas, feelings, and memories. With further observation Jung noticed that people practiced consistent behavior or what are now called cognitive styles based on whether they were more extraverted or introverted. These cognitive styles represent Jung's eight psychological types. The types are: extraverted sensation, introverted sensation, extraverted intuition, introverted intuition, extraverted thinking, introverted thinking, extraverted feeling, and introverted feeling. Jung's typology has become one of the most widely used to identify cognitive styles. It can be seen in modified form in the Myers-Briggs Type Inventory (MBTI) (Myers & McCaulley, 1985; Myers & Myers, 1980), an assessment tool designed to measure thinking styles.

The first major systematic study of cognitive styles did not occur until the 1940s when Witkin and colleagues developed the theory of field dependence–field independence (FDI) (Witkin, 1949, 1950, 1952, 1962; Witkin, Oltman, Raskin, & Karp, 1971). This study identified individual differences in how people performed perceptual tasks, noticing that these differences were stable over time and across various types of tasks. Some researchers/theorists who were early to the field of cognitive styles include Gardner, Messick, and Jackson (R. W. Gardner et al., 1959; R. W. Gardner et al., 1960; Messick & Ross, 1962); Wallach and Kogan (1965); Pettigrew (1958); and many others whose main contribution was to identify individual differences in how people performed simple cognitive tasks and to demonstrate that there were varying degrees of success in how people perceived and solved those tasks. Following this early research influential cognitive style theories were developed. Some of these include Guilford's (1967) convergent and divergent thinking, De Bono's (1970) lateral thinking, Torrence's (1979)

creative thinking processes, Gardner's (1993) multiple intelligences, Kolb's (1984) learning styles inventory, Sternberg's (1985) triarchic theory of intelligence, and Vance et al. (2007b) and Groves et al.'s (2008) linear and nonlinear thinking style balance.

Following is a brief description of each of these theories.

Convergent and divergent thinking. Guilford (1967) developed his theory of convergent and divergent thinking through his work researching creativity. Guilford suggests that convergent thinking involves obtaining a single, correct solution to a problem, while divergent thinking involves creative pathways where multiple answers are generated to a set problem with a reliance on ideas from across disciplines to reach a deeper understanding of a concept. Moreover, Guilford theorized that divergent thinking was a major factor in manifesting creativity. He observed that most individuals display a preference for either convergent or divergent thinking. Guilford identified four main attributes to divergent thinking: (1) fluency, the ability to produce many ideas or solutions; (2) flexibility, the capacity to evaluate many approaches to a single problem; (3) originality, the capacity to produce novel and unique ideas that are different from the majority of other people; and (4) elaboration, the capacity to identify the details that make up an idea as well as synthesize those ideas. Guilford (1967) and Torrance (1963) observed that creative thinking abilities could be developed through direct instruction, theorizing that these thinking styles were mutable.

Lateral think theory. De Bono used the work of Guilford to develop his lateral thinking theory describing divergent thinking as containing elements of both vertical and lateral thinking. De Bono's (1970) lateral thinking theory suggests that lateral thinking approaches a problem from unique and novel perspectives, using unconnected inputs to

open up new lines of thinking. This differentiates from vertical thinking, described as rational and logical thought striving for the most reasonable solution to a problem with a course of least resistance. De Bono views lateral and vertical thinking styles as diametric yet, complimentary to each other and existing on a spectrum of equal weight. The use of both thinking styles increases the learner's potential for success and increases each styles overall effectiveness (De Bono, 1970). De Bono's lateral thinking theory has been criticized for having little concern for testing the validity of his ideas through empirical research (Sternberg, 1998). This is confirmed by the scant existing empirical evidence to validate his theories.

Creative thinking. Torrence's (1979) theory of creative thinking framework was built out of Guilford's (1967) theory of convergent and divergent thinking as well. According to Torrence (1979) there are four aspects that describe creative thinking: (1) fluency, which refers to the production of a great number of ideas or alternate solutions; (2) flexibility, which refers to the production of ideas that show a variety of possibilities or different points of view; (3) elaboration, which is the process of enhancing ideas by providing more details; and (4) originality, which involves the production of ideas that are unique or unusual. Torrence's theory of creative thinking styles lead to the development of the Torrance Tests of Creative Thinking (TTCT). In its original form the TTCT involved simple tests of divergent thinking and other problem-solving skills utilizing Guilford's four attributes of divergent thinking (fluency, flexibility, originality, and elaboration). The TTCT provided a physical measure and groundwork for the idea that creative levels can be scaled and then increased through practice. The TTCT has

become highly recommended in the educational field and is also used in the corporate world.

Multiple intelligences. Gardner's (1993) theory of multiple intelligences suggests that humans have multiple yet distinct units of intellectual functioning labeled intelligences, each with its own observable and measurable abilities. There are nine intelligences identified by Gardner (1993): logical-mathematical, linguistic, musical, spatial, bodily kinesthetic, interpersonal, intrapersonal and existentialist. The degree to which each of these intelligences is possessed by an individual represents their preferred cognitive style. The most common criticism of Gardner's theory centers on the seemingly subjective criteria he employs to identify intelligences and his specific choice of intelligences (Eysenck, 1994; Scarr, 1985; Sternberg, 1983). For example, his use of musical intelligence and bodily-kinesthetic intelligence are often looked at as talents rather than specific intelligences. Criticism is also lodged against his theory because of a lack of comprehensive empirical research. Regardless, Gardner's (1993) theory has had wide ranging influence on educators and researchers and continues to drive people to better understand cognitive styles.

Learning styles. Kolb's (1984) theory of learning styles is designed to help individuals identify the way they learn from experience. Kolb theorized that learning preferences use two continuums: (a) active experimentation-reflective observation and (b) abstract conceptualization-concrete experience. Using this model Kolb suggests that there are four types of learners:

1. Diverging: the Diverging style's dominant learning abilities are Concrete Experience (CE) and Reflective Observation (RO). People with this learning

style are best at viewing concrete situations from many different points of view

2. Assimilating. The Assimilating style's dominant learning abilities are Abstract Conceptualization (AC) and Reflective Observation (RO). People with this learning style are best at understanding a wide range of information and putting into concise, logical form.
3. Converging. The Converging style's dominant learning abilities are Abstract Conceptualization (AC) and Active Experimentation (AE). People with this learning style are best at finding practical uses for ideas and theories.
4. Accommodating. The Accommodating style's dominant learning abilities are Concrete Experience (CE) and Active Experimentation (AE). People with this learning style have the ability to learn from primarily "hand-on" experience.

According to Kolb et al. (2000), learning requires abilities that are diametric and the learner must continually choose which set of learning abilities they will use in a specific learning situation to best adapt to it. Kolb et al. (2000) suggest that people with balanced learning profiles in both dimensions (active experimentation & abstract conceptualization) are more sophisticated (adaptively flexible) learners. De Bono (1970), Sternberg (1985), and Vance et al. (2007b) all agree that a balance of diametric thinking styles leads towards a more sophisticated learner.

Triarchic theory of intelligence. Sternberg's (1985) triarchic theory of intelligence categorizes intelligence into three parts: (a) creative or synthetic intelligence, the ability to deal with new and unfamiliar situations by drawing upon existing knowledge and skills. Creative intelligence is associated with creativity, intuition, and the

arts; (b) analytical intelligence, the ability to complete problems in a quick, logical manner. Analytical intelligence is associated with being able to take a problem apart and see new solutions, though not unique solutions. (c) Practical or contextual, the ability for adaptation, shaping, and selection all based on particular context of the surrounding environment. This type of intelligence is often referred to as “street smarts.” Sternberg believed that the ability to balance all three thinking styles through adaptation was important to attaining success in any concept formation (Sternberg, 1999). Sternberg’s theory is connected to the work of Guilford (1967) with creative intelligence matching Guilford’s divergent thinking model and analytical intelligence matching the Guilford’s convergent thinking model. Sternberg expands the theory with the addition of the practical or contextual intelligence.

Linear and nonlinear thinking style. Linear and nonlinear thinking style theory developed by Vance et al. (2007b) proposes that linear thinking styles are a “preference for attending to external data and facts and processing this information through conscious logic and rational thinking to form knowledge, understanding, or a decision for guiding subsequent action” (p. 5). Vance et al. (2007b) defines nonlinear thinking style as a preference for attending to internal feelings, impressions, and sensations when comprehending and communicating information. These definitions are based on two fundamental dimensions creating a theoretical framework. The linear dimension involves rationality, logic, and analytical thinking concentrating on external factors for comprehension and communication. The second, a nonlinear dimension is related to intuition, insight, creativity, and emotions, concentrating on internal factors for comprehension and communication. Vance et al. (2007b) believe there should be a

greater balance in education and professional practice between nonlinear thought (using creativity, insight, intuition, holistic thinking, etc.) and the linear thought of logic and reason.

There is a consistent approach between Guilford's (1967) theory of convergent and divergent thinking styles, De Bono's (1970) lateral and vertical thinking styles, Kolb's (1984) learning style inventory, Sternberg's (1985) triarchic theory of intelligence, and Vance et al. (2007b) linear and nonlinear thinking style. Each of these theories views thinking styles as diametric and diverging between the rational, logic, analytical, and the intuitive, insightful, creative, and emotional (Sternberg and Kolb expand their theories to include other detailed dimensions). Each theory also places these styles on a spectrum that values both ends of each extreme and accepts that a balance of thinking styles is of most advantage to the learner (Tiedemann, 1989; Witkin et al., 1977). These theories suggest that cognitive styles, although relatively stable, are malleable, can be adapted to changing demands, and can be modified by experiences.

Testing and Measurement

Research in the field of cognitive styles has shown evidence through testing and measurement that several variables can be related to cognitive style preferences. Tamir (1985), in a meta-analysis of fifty-four research publications on styles has shown that, among high school and college students, cognitive styles are related to cultural background, grade level, learning discipline, career goals, and achievements (Smith & Dalton, 2005). Reading-Brown and Hayden (1989) showed that technical education students were more characterized by passive observation and reflection than were liberal arts students, who adopted a more active-experimental approach. Canfield (1980) showed

that, at college level there were identifiable learning style preferences amongst groups based on programs of study, specifically education, business, and art history majors. These preferences offer evidence of a person's learning and acquisition style and have important implications for predicting learning and career choices (Dunn, Beaudry, & Klavas, 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997). Holland (1973) has suggested that career choices can be predicted by learning and knowledge acquisition preferences such as: realistic, investigative, artistic, social, enterprising, and conventional. Researchers continue to provide evidence that cognitive styles have predictive power for academic achievement beyond general abilities (Dunn et al., 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997; Sternberg & Zhang, 2001).

There have been various instruments developed and implemented for the measurement of cognitive styles. Moreover, the majority of these instruments have been developed for the business and management environment. Over the course of four decades researchers have identified a multitude of cognitive styles allowing for the often repeated criticism that cognitive styles theory has a vast and ever growing amount of dimensions, but no unifying theoretical framework. Some of the better known cognitive styles identified in the field include: field- dependent and field-independent (Witkin, 1962); reflective and impulsive (Kagan, 1965); verbalizer and visualizer (Paivio, 1971); convergent, divergent (Torrence, 1979); diverging, assimilating, converging, accommodating (Kolb, 1984); creative, analytical, practical (Sternberg, 2002); analysis and intuition (Allinson & Hayes, 1996); knowing, planning, and creating (Cools & Van den Broeck, 2007); rational, avoidant, dependent, intuitive (Scott & Bruce, 1995); adaptive and innovative (Kirton, 2003); and linear, nonlinear, balanced linear/nonlinear

(Brătianu & Vasilache, 2009; Vance et al., 2007b) to name a few. What follows is a brief description of some widely used methods of assessment/measurement of cognitive styles.

Emedded figure test. Witkin's Embedded Figure Test (EFT) was developed to measure field dependence–independence (Witkin et al., 1977). The EFT is a perceptual test which requires the subject to locate a previously seen figure within a larger complex figure. This simple assessment yields information about field dependence-independence. Field-independent people quickly find the hidden figures, while field-dependent people have trouble locating the figures embedded within the surroundings. The EFT, which is comprised of 18 complex figures, can be administered in 20 minutes and can be quickly scored using answer templates. The test has become a recognized tool for exploring analytical ability, social behavior, body concept, preferred defense mechanism and problem solving style as well as other areas.

Matching familiar figures. The Matching Familiar Figures (MFFT) was developed to measure the bipolar trait of reflection-impulsivity dimension (Kagan, Rosman, Day, Albert, & Phillips, 1965). The MFFT tests a preference for making responses quickly versus pausing to decrease the number of errors in problem-solving situations. The test involves selecting a figure from among six similar variants that is identical to an original figure. Response times and error rates are measured, and a median split criterion is used to classify individuals as reflective, if they make few errors and exhibit long response times, and impulsive, if they make more errors but respond faster. Consistent with findings on field dependence–independence, the impulsivity–reflectivity dimension was moderately stable over time and across different contexts (Kozhevnikov, 2007).

Myers-Briggs type. The Myers-Briggs Type Indicator (MBTI) is a psychometric questionnaire developed by Katharine Cook Briggs and her daughter, Isabel Briggs Myers, and first published in 1962. The instrument is designed to measure psychological preferences in how people perceive the world and make decisions. These preferences were modified from the eight personality types first identified by Jung (1923). The four dimensional dichotomies investigated with the MBTI include:

- Extraversion (E) – (I) Introversion
- Sensing (S) – (N) Intuition
- Thinking (T) – (F) Feeling
- Judging (J) – (P) Perception

The current North American English version of the MBTI Step I includes 93 forced-choice questions that explore these dichotomies to identify cognitive style preferences. The statistical validity of the MBTI as a psychometric instrument has been the subject of criticism (Pittenger, 1993). Reasons for such criticism include: a lack of critical scrutiny (Coffield, Hall, & Ecclestone, 2004), a dependency on honest self-reporting by the person tested without the use of validity scales to assess exaggerated or socially desirable responses and vague terminology allowing behaviors to fit into many personality types. The test is also known to have low test-retest reliability (Pittenger, 1993). This measure is more complex than most cognitive style assessments that often utilize one or two dimensional conceptualizations. The indicator is frequently used in the areas of pedagogy, career counseling, professional development, leadership training, and many other areas.

Torrance test of creative thinking. Torrance developed the Torrance Tests of Creative Thinking (TTCT) in 1979 to test creativity. Originally the test was scored on four scales: fluency, flexibility, originality, and elaboration. The current incarnation of the test has two batteries of paper-and-pencil test objects, a figural and verbal test. TTCT is designed to be used for all populations from kindergarten to graduate school. The figural test scores on following five scales: fluency, resistance to premature closure, elaboration, abstractness of titles, and originality. Scoring of the figural test gives scores for the mental characteristics listed above as well as for the following creative strengths: emotional expressiveness, internal visualization, storytelling articulateness, extending or breaking boundaries, movement or action, humor, expressiveness of titles, richness of imagery, synthesis of incomplete figures, colorfulness of imagery, synthesis of lines or circles, fantasy, unusual visualization. The verbal test uses six word-based exercises to assess creativity. The verbal test is scored on the following three scales: fluency, flexibility, and originality. Aside from school settings, these tests are also used in institutional and clinical settings to assess creativity in adult subjects.

Cognitive style indicator. Cognitive Style Indicator (CoSI) developed by Cools and Van den Broeck (2007) differentiates between three dimensions of cognition known as: knowing, planning, and creating. People with a knowing style are characterized by a preference for facts and details, people with a planning style prefer structure and order, and people with a creating style tend to generate ideas and alternative ways of doing things through experimentation (Cools & Van den Broeck, 2008). Cognitive style researchers have traditionally focused on the distinction between analytical and intuitive thinking (Hodgkinson & Sadler-Smith, 2003). However, results of empirical research

suggest that cognitive styles might be more complex and contain multiple dimensions (e.g., Beyler & Schmeck, 1992; Leonard, Scholl, & Kowalski, 1999). The CoSI attempts to measure three of these dimensions.

Cognitive style index. Cognitive Style Index (CSI) developed by Allinson and Hayes (1996) is designed for managerial and professional use. This instrument utilizes a bi-polar scale for analysis and intuition. This type of scale is based on the idea that the absence of one dichotomy implies the presence of the other. This uni-dimensional approach is common to cognitive style measures. The CSI contains thirty-eight statements in a self-report format with 'true-uncertain-false' choice of answers. Allinson and Hayes (1996) developed this assessment of cognitive style for administering in large-scale organizational studies.

General decision making style. The General Decision Making Style (GDMS) (Scott & Bruce, 1995) was designed to assess how individuals approach decision situations. It distinguishes between 5 decision styles: (1) rational style that emphasizes a search for logical alternatives, (2) avoidant style that emphasizes postponing and avoiding decisions, (3) dependent style that emphasizes a need for direction from others, (4) intuitive style that emphasizes a reliance on hunches and feelings, (5) spontaneous style that emphasizes a desire to get through the decision-making process as soon as possible. The GDMS is a 25 item survey that uses a Likert type 5-point ratings system (1 = strongly disagree to 5 = strongly agree). The scores on each scale may range from 5 to 25 with the highest score representing the respondent's primary decision-making style. The second highest score represents the respondent's backup decision-making style. The

test attempts to typify individual differences in decision-making habits and practices, in the domain of career development and career behavior studies.

Kirton adaption-innovation. The Kirton Adaption–Innovation (KAI) Inventory developed by Kirton (1976, 2003) is used to identify and measure adaptability and innovativeness of individuals by placing them on a continuum ranging from high adaptation to high innovation. A 32-item questionnaire it is used to measure an individual’s problem-solving style on a scale from 32 to 160. The mid-point of the scale is 96. Those with scores higher are considered innovators. Lower scores indicate one is an adaptor. The scoring as mentioned is not hierarchical, but rather exists on a continuum as most cognitive style measures are designed. KAI is used in the training of managers, groups, and individuals for the enhancement of group cohesion and effectiveness, leadership techniques, and for problem-solving team building.

Linear nonlinear instrument. The linear nonlinear instrument developed by Brătianu and Vasilache (2009) uses a 50-item questionnaire with answers evaluated on a Likert-type scale comprising five topics:

proportionality bias, the predisposition towards thinking that outputs are always a k times inputs; sequential bias, thinking that processes and activities are successive, rather than simultaneous; superposition bias, thinking that effects of interrelated processes will add following arithmetic rules; deterministic bias, thinking that between processes there is, normally, a cause effect linkage; and structure bias, thinking that in the world there is, always, an underlying structure. (p. 7)

The instrument was developed to better predict knowledge management and business decision making process.

The Linear Nonlinear Thinking Style Profile (LNTSP) was developed by Vance et al. (2007b). The LNTSP is based on 2 dimensions: a linear dimension which involves rationality, logic and analytical thinking and a non-linear dimension which is related to intuition, insight and creativity. The LNTSP was developed to accurately identify a person's propensity to rely on linear and nonlinear sources of information and processes to guide subsequent action (Vance et al., 2007b). The LNTSP contains a 5-item Linear/Nonlinear scale and an 8-item External/Internal scale, each consisting of pairs of stimuli containing one Linear (or external) option and one Nonlinear (or internal) option. Respondents distribute three points across each pair of items. According to Vance et al. (2007b), this instrument is supported by factor analyses and multiple-sample comparison results. Validation study results across multiple populations reveal a 4-factor model of linear and nonlinear thinking style involving the manner in which individuals attend to a particular kind of information source (internal vs. external) and subsequent linear versus nonlinear processing of that information. The results also indicate that the LNTSP has acceptable convergent validity through two commonly used and conceptually related instruments, the Myers-Briggs Type Indicator (MBTI) and Cognitive Style Index, as well as external validity and face validity across students from different academic major programs, individuals from distinctly different professional careers, and managerial and professional workshop participants (Vance et al., 2007b). When scoring the LNTSP a scoring sheet using two columns is used. Column 1 represents deals linear choices and column 2 nonlinear choices. The more negative the total score, the more nonlinear, and

the more positive the total score, the more linear a person's thinking style is. A balanced linear/nonlinear thinking style would be between around -3 to +3.

Summary

As a result of the varying cognitive styles theorized and tested over the past 40 years there have been many attempts to organize them under a unifying structure. Allinson and Hayes (1996) and Hayes and Allinson (1994) developed a unified structure based on an analytical – holistic (or analytical–intuitive) style. The analytical style is often described in the literature as convergent, differentiated, sequential, reflective, and deductive, while the holistic style has been described as divergent, global, impulsive, intuitive, inductive, and creative (Kozhevnikov, 2007). Leonard et al. (1999) identified three cognitive style dimensions: (a) cognitive style, which relates to the way individuals process information; (b) decision-making style, which indicates individual preferences for decision making processes; (c) decision making behavior style, which reflects the ways individuals make decisions depending upon external factors. Grigorenko and Sternberg (1997) classify cognitive styles falling into three major categories: (a) cognition-centered, (b) personality-centered, and (c) activity-centered approaches. Vance et al. (2007b) suggests that linear and nonlinear thinking style fall under two fundamental dimensions creating a theoretical framework. The linear dimension involves rationality, logic, and analytical thinking concentrating on external factors for comprehension and communication. The nonlinear dimension is related to intuition, insight, creativity, and emotions, concentrating on internal factors for comprehension and communication. The theory developed by Vance et al. (2007b) is not only an extension of Guilford's (1967) theory of convergent and divergent thinking styles, De Bono's (1970) lateral and vertical

thinking styles, Kolb's (1984) learning style inventory theory, and Sternberg's (2003) triarchic theory of intelligence, but also Allinson and Hayes' (1996) and Hayes and Allinson's (1994) unified structure based on an analytical – holistic (or analytical–intuitive) style.

The researcher has chosen to utilize the LNTSP because it attempts to operationalize the converging versus diverging variable that Allinson and Hayes (1996), Grigorenko and Sternberg (1995), Kozhevnikov (2007), Leonard et al. (1999), and Messick (1984) theorized by assessing preferences for one or the other thinking activity. Convergence versus divergence defined as the diametric systems of rationality, analysis, and logic opposed to creativity, intuition, emotion, and insight. The LNTSP attempts to measure this distinction and or balance. Moreover the LNTSP instrument adds complexity to the bipolar characteristics of cognitive styles by using a measure that has degrees of preference with the possibility of three categories of measure: linear, nonlinear, and a balanced linear/nonlinear thinking style. Such a type of framework helps add to the reliability and validity of the learning style inventories mentioned (Pittapantazi & Christou, 2008).

The instruments and the theories that support them illustrated in this section converge on the conclusion that cognitive styles, although relatively stable, are malleable, can be adapted to changing demands, and can be modified by experiences. The augmented instrument the researcher utilized for this study attempted to add a significant contribution to the body of research by correlating external factors that affect the formation of nonlinear thinking style.

Synthesis

Throughout the literature there is inconsistency in the definition and usage of the various terms surrounding cognitive styles. For purposes of this study the researcher defines cognitive styles as stable, but mutable attitudes, preferences, or habitual strategies that determine individuals' modes of perceiving, thinking, problem solving, and remembering (Gardner, 1959; Gardner et al., 1960; Groves et al., 2008; Messick & Ross, 1962; Vance et al., 2007b; Witkin et al. 1977). Cognitive styles are not considered abilities but rather preferred ways of using the abilities one has (Sternberg, 1988, 1990, 1994, 1997). Messick (1984) distinguished cognitive styles from abilities by referring to abilities as dealing with the context and the questions of What? and How much? In contrast, cognitive styles refer to the manner or mode of cognition- to the question of How? Furthermore, abilities are seen as unipolar whereas cognitive styles are often theorized as bipolar (Tiedeman, 1989). Another major way in which cognitive styles differ from abilities is in their coverage and pervasiveness. Abilities are specific to particular domains while styles run across many domains and are transferrable (Messick, 1984; Tiedeman, 1989). Cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences or styles in how we perceive, think, solve problems, and synthesize ideas (Witkin et al., 1977). Thus, cognitive styles are defined by process.

During the last four decades researchers have been trying to examine which characteristics of people affect their learning style the most. Concentration has been on: personality types, early educational specialization, professional career, current job role, and adaptive competencies. The present research adds to the body of knowledge in this

field by attempting to correlate personal characteristics to thinking style preferences. The purpose of such research helps the field better understand if it can accurately measure thinking styles, augment thinking styles through designed experiences, and use thinking styles as predictors for academic achievement, academic majors, and career choices.

Herein it is argued that cognitive styles are stable, but mutable attitudes, preferences, or habitual strategies that determine individuals' modes of perceiving, thinking, problem solving, and remembering. Moreover cognitive styles are not considered abilities but rather preferred ways of using the abilities one has across a wide variety of cognitive tasks. Linear/nonlinear thinking styles are examples of such preferences. Cognitive styles are concerned with the form rather than the content of cognitive activity. Thus, cognitive styles are defined by process.

Theoretical Framework Conceptualization

The key theoretical frameworks that best support my conceptualization of digital literacy are new literacies and cognitive styles. Leu, O'Byren, Zawilinski, McVerry, and Everett-Cocapardo (2009) suggest that new literacies function on two levels: upper case (New Literacies) and lower case (digital literacies). Digital literacy acts as a lower case dimension to the broader more inclusive concept of upper case New Literacies.

Nonlinear thinking style falls within the theoretical framework of cognitive styles (Allinson & Hayes 1996; Guilford, 1967; Kolb, 1984; Mesick, 1984; Sternberg, 2003; Vance et al., 2007a, 2007b) and is also considered an essential skill within the theoretical framework of digital literacy (Eshet-Alkalai & Chajut, 2009). Taken together the two theoretical frameworks of cognitive styles and new literacies thus support my conceptualization of digital literacy (see Figure 1).

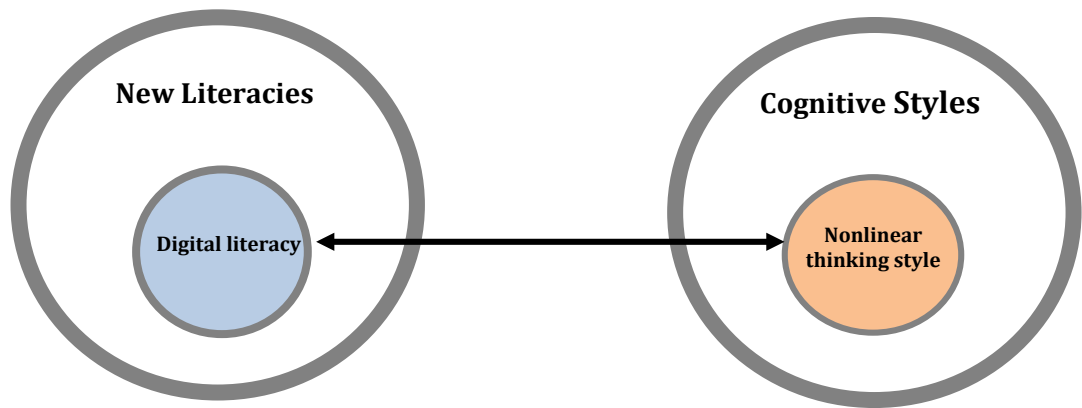


Figure 1: Conceptual theoretical framework.

Gaps in the Literature

Gaps in the literature focus on a lack of research concerning a relationship between nonlinear thinking style styles and levels of arts engagement with implications for digital literacy. Traditionally, there has been much less research concentration and attention given to the discipline of the arts in comparison to other prominent curriculum areas such as language arts, science, and mathematics. Despite this, the learning sciences could benefit from further understanding of how the arts offer methods of inquiry, representation, and comprehension that are mutually synergistic with other fields of study such as nonlinear thinking style. To date, there is a limited amount of research in the literature concerning levels of arts engagement and its effects on thinking styles.

More and more research is coming out that supports the impact of the arts on learning for all students. The research suggests that arts education develops a set of skills and capacities closely aligned with those that policymakers and education leaders believe are necessary for success in the 21st Century such as: creativity, innovation, adaptability,

observation skills, evidential reasoning, speculative abilities, and the ability to find multiple solutions to complex problems (Hetland & Winner 2004; Korn, 2010; Lichtenberg, Woock, & Wright, 2008; Yenawine 1997). Studies conducted by Catteral (2009) and Deasy (2002) show that rich art experiences in pre-k through 12th grade, whether integrated in the core curriculum or taught as separate subject areas can lead to increased academic, social, and functional skill development and knowledge. Visual art studio classes were found to help students develop habits of mind for sustained focus, imagination, close observation, and articulation of their decision-making process (Hetland & Winner, 2004). Through arts study, middle school students improved in their ability to turn barriers into opportunities and persist in completing challenging tasks (DeMoss & Morris, 2002), and mastery of arts skills at the high school level was found to encourage further motivation for higher achievement (Rostan, 2010). The arts equip students to be creative (Lichtenberg et al., 2008), and strengthen problem solving abilities and other critical thinking skills. Students who study the arts, for example, score higher than their peers on tests measuring the ability to analyze information and solve complex problems, and are more likely to approach problems with patience and persistence (Korn, 2010).

In the state of Florida, a Cohort Study of Arts Participation and Academic Performance conducted by the Center for Fine Arts Education 2010-2011 and using 197,932 12th grade seniors' data demonstrated a strong relationship between individuals participation in school arts experiences and higher academic success as demonstrated by grade point averages, scores on the Florida Comprehensive Assessment Test (FCAT), and math and verbal portions of the SAT exam. The results showed a positive correlation

from participation in fine arts and music classes on students from varying races, ethnicities, socioeconomic levels, and disabilities.

In a comparison of cohort data from 2007-2008 to 2010-2011 of Arts Participation and Academic performance, Kelly (2012) found data supporting that K-12 arts education experiences contribute to the overall academic success of Florida public school students. Students perform higher in academic areas such as math, reading and writing; and students' reduced dropout rates demonstrated by a decrease from greater than 30% to less than 6% when earning fine arts credits. For the general population, the more music and arts classes taken, the higher the student achievement in all measures. The data also found that overall, there are more 12th grade students enrolled in arts-related classes taking the SAT. When analyzing free/ reduced lunch and race data, for most arts-related classes, students enrolling in four or more credit hours scored higher on math and verbal portions of the SAT than students receiving no arts instruction.

These findings corroborate a similar study of 25,000 students in a study entitled: *Involvement in the Arts and Human Development* (Catteral, Chapleau, & Iwanagae, 1999) which followed high school students for 10 years and found involvement in the arts was positively related to academic success. Moreover, the results are also supported by a similar analysis from the West Virginia Music Educators Association (Whisman & Hixson, 2012). This analysis of cohort data from the 2006-2007 academic year showed that public school students with more arts credits outperformed their peers in nearly every indicator. Furthermore, these findings are supported by the research findings by Caroni, Donato, and Muller (2012).

Arts advocates and researchers have often attempted to strengthen the role of the arts in education through claims that levels of arts engagement can lead to “transfer” effects to other academic subjects (e.g., Adams, Foutz, Luke, & Stein, 2007; Catterall, Dumais, & Hampden-Thompson, 2012; Deasy, 2002; Hetland & Winner, 2001). A concern with this work from many arts advocates is that art is looked at as a subject taught to enhance other subjects rather than taught for its own inherent benefits. A further concern expressed by researchers is the lack of research that isolates the causal influence of arts engagement. The RAND Corporation concluded that many of the existing studies on the benefits of arts engagement “do no more than establish correlations between arts involvement and the presence of certain effects in the study subjects. They do not demonstrate that arts experiences caused the effects” (McCarthy, Ondaatje, Zakaras, & Brooks, 2004, p. xiv). Some existing studies that have attempted to find a causal relationship between arts engagement and cognition include: Luftig’s (1994) creativity measures study; Burton, Horowitz, and Abeles’ (2000) student expressiveness and elaboration study; Lampert’s (2006) critical thinking skills study; Korn’s (2007) quasi-experimental evaluation of the Solomon R. Guggenheim’s Literacy Through Art program; Adams, Foutz, Luke, and Stein’s (2007) School Partnership Program (SPP) study at the Isabella Stewart Gardner Museum (ISGM) in Boston; and Bowen, Greene, and Kisida’s (2013) Learning to Think Critically: A Visual Art Experiment study conducted at the Crystal Bridges Art Museum in Arkansas. The researcher hopes to add to this growing body of research by using the levels of arts engagement and LNSTP instruments.

With much of today's media delivered in visual form, students need engagement with the arts to understand, interpret, and create information (Lambert & Cuper, 2008). The World Wide Web demands users to be visually literate to advance critical thinking, decision making, communication, creativity, and learning on the web. Engagement with the arts increases one's visual literacy (Yenawine, 1997). As youths take advantage of a digital world by utilizing the multitude of images, sounds, videos, and text to synthesize new creations, they are given opportunities to critically reflect, evaluate, deconstruct, and interpret meaning of original source material and their newly augmented creations (Buckingham & Burn, 2007; Peppler & Kafai, 2007). Learning how to appropriately remix and rework popular media develops both creative and analytical skills.

We are in the process of shifting from a culture that passively received information from the Web to one that is asked and encouraged to actively participate by augmenting or generating new content (Bonk, 2009). Information now integrates images, video, sequences, design, form, symbols, color, 3D, and graphic representations. Users need to know how to interpret visual messages and obtain deeper meanings from those images on a constant basis (Lambert & Cuper, 2008). The graphic user interface of the World Wide Web is only part of the visual world people must navigate. Moreover, it is no longer the province of advanced professionals to use visualization tools to represent information. Dropping costs and improved technologies have placed powerful multi-media tools in the hands of many. People are now expected to interpret and communicate in multi-modal fashion. Visual literacy has become a necessary skill for the 21st century. Visual literacy increases observation skills, evidential reasoning, speculative abilities, and the ability to find multiple solutions to complex problems (Yenawine, 1997). Visual

literacy can be defined as a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media (ACRL, 2011).

Non-linear thinking and intuitive artistic processes common to the visual arts and visual literacy may be useful to the development of digital literacy skills. Eisner (2002) states, “Standardization of solution and uniformity of response is no virtue in the arts. While the teacher of spelling is not particularly interested in promoting the student’s ingenuity, the art teacher seeks it” (p. 1). Eisner (2002) goes on to suggest the arts teach us qualitative relationships, complex forms of problem solving, how to celebrate multiple perspectives, that the limits of our language do not define the limits of our cognition, and that small differences can have large effects, all ideas that are linked to nonlinear thinking style. A diversity of solutions and the space that is afforded for creative solutions to problems is what it means to engage in learning in the arts (Peppler, 2013). Furthermore, Eisner (2005) suggests that the arts teach us to act and judge in the absence of rule, to rely on feel, to pay attention to nuance, to act and appraise the consequences of one’s choices, and to revise and then make other choices. Vance et al. (2007b) and Groves et al. (2008) consider intuition, insight, creativity, and emotion as four cognate but distinct approaches that are interrelated forms of nonlinear thinking style. Eisner’s concepts of what art can teach relates to the approaches of interrelated forms of nonlinear thinking proposed by Vance et al. (2007b). To rely on feel is a form of intuition and emotion; to pay attention to nuance and appraise the consequences of one’s choices is a form of insight. Creativity is foundational to the arts and nonlinear thinking style.

The interrelation of these theoretical concepts leads to the possibility that engagement in the arts could promote particular nonlinear thinking style and therefore digital literacy skills (See Figures 2 & 3).

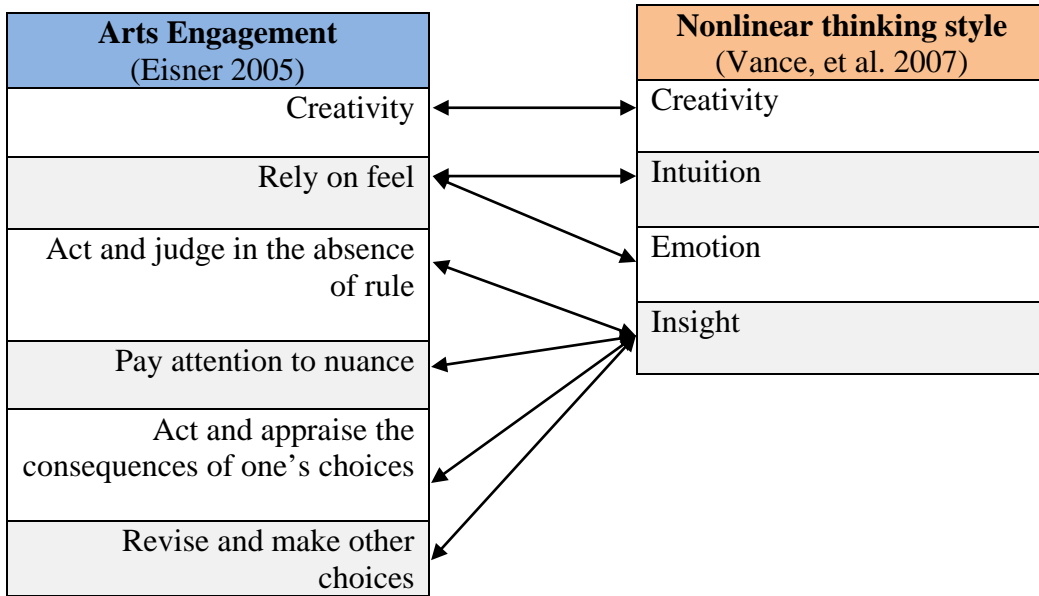


Figure 2. Relationship between arts engagement skills and nonlinear thinking style.

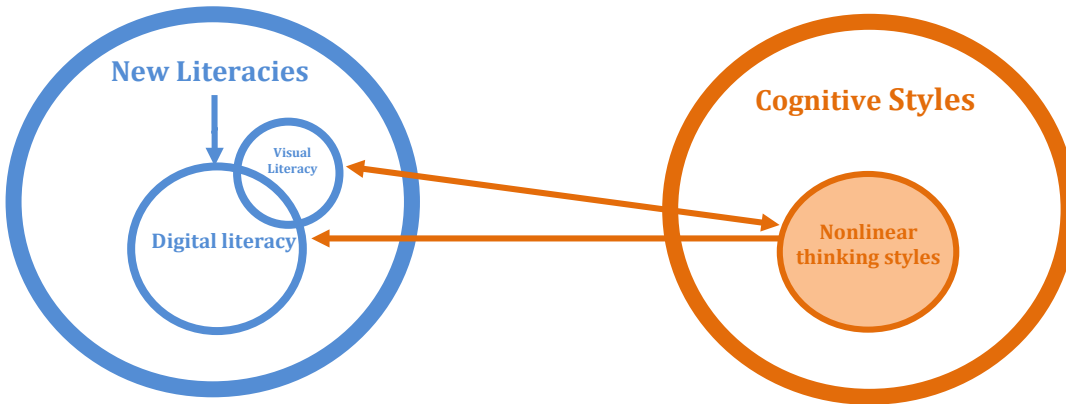


Figure 3. Conceptual theoretical framework connecting cognitive style dimension of nonlinear thinking style with visual and digital literacy.

Introduction of the Instruments

The LNTSP was developed by Vance et. al (2007b). The LNTSP was developed to test a comprehensive thinking style model that accurately reflects a person's propensity to rely on linear and nonlinear sources of information and processes to guide subsequent action (Vance et al., 2007b). The LNTSP contains a 5-item Linear/Nonlinear sub-scale and an 8-item External/Internal sub-scale, each consisting of pairs of stimuli containing one Linear (or external) option and one Nonlinear (or internal) option. The more negative the total score, the more nonlinear, and the more positive the total score, the more linear the thinking style. A quite balanced total score would likely be between around -3 to +3.

The Levels of Arts Engagement instrument measures levels of arts engagement based on participants' level of active engagement with the arts over the course of their lifetime. Levels of arts engagement was measured by a modified instrument developed by the researcher. The development of the arts engagement survey was informed by three existing surveys (1) Levels of Engagement with Art by Randi Korn & Associates (2005), (2) The 2008 Survey of Public Participation in the Arts conducted by the NEA (2012), (3) The 2012 Houston Arts Survey, Participation, Perceptions, and Prospects (Klineberg, Wu, & Aldape, 2012). The arts engagement survey contains 11 statements/questions that describe exposure to arts experiences. A score of 0-11 = passive participant, 12-22 = participant, 22-33= committed participant and enthusiast on the arts engagement survey. The demographic survey was constructed to explore if differences in cognitive or thinking styles have a relationship with (a) age; (b) sex; (c) academic major (d) occupation.

Summary

Cognitive style research has gained momentum as a result of newer theories differentiating cognitive styles from abilities and personality traits, and the attempt to make formal connections with other mainstream literature in psychology (Armstrong, Coll, & Sadler-Smith, 2011). Cognitive style theory also continues to gain popularity because of an interest in the role of intuition and creativity in managerial decision making and because it is theorized to be useful as a selection or placement tool for learning and vocations (Grigorenko & Sternberg, 1997; Sternberg & Zhang, 2001; Vance 2007b). The research discussed in this section has revealed that individuals use different approaches to solve cognitive tasks and an individuals' preferences for these approaches are quite stable over time and are related to intelligence and personality (Sternberg & Grigorenko, 1997; Witkin et al., 1977).

Concurrently, technology growth has brought about a number of important shifts of emphasis in terms of literacy over the past two decades. One of the most critical and obvious is a move from fixed to fluid texts where reading and writing paths have become non-linear in contrast to linear historical texts (Merchant, 2007). Other shifts include the development of interwoven texts through the use of such devices as textual hyperlink, reading and writing paths that are becoming non-linear, and text that has become more densely multimodal (Merchant, 2007). These shifts pose new challenges for individuals in evaluating and understanding information and necessitate additional skills for effective digital literacy such as: nonlinear thinking style for effective information and communication processing, visual literacy, socio-emotional literacy, and information literacy, and reproduction literacy (Eshet-Alkali, 2004). The demand of these skills offers

evidence that digital literacy must be considered a new form of literacy with its own set of demands and skills that are techno-procedural, cognitive, and socio-emotional in nature.

CHAPTER III

METHODS

This chapter begins by listing the research questions and hypotheses. Second, the section discusses research design, population and sampling, variables and instrumentation, data management, and lastly, data analysis. This chapter concludes with a summary of relative points.

Research Questions

1. What is the relationship between sex and thinking style for professionals working in museums?
2. What is the relationship between age and thinking style for professionals working in museums?
3. What is the relationship between academic major and thinking style for professionals working in museums?
4. What is the relationship between occupation and thinking style for professionals working in museums?
5. What is the relationship between levels of arts engagement and thinking style for professionals working in museums?

Null Hypotheses

HO₁: There is no relationship between sex and thinking style when controlling for academic major, occupation, levels of arts engagement, and age as measured by the LNTSP and Levels of Arts Engagement survey.

HO₂: There is no relationship between age and thinking style when controlling for sex, academic major, occupation, and levels of arts engagement as measured by the LNTSP and Levels of Arts Engagement survey.

H0₃: There is no relationship between academic major and thinking style when controlling for occupation, levels of arts engagement, age, and sex as measured by the LNTSP and Levels of Arts Engagement survey.

H0₄: There is no relationship between occupation and thinking style when controlling for levels of arts engagement, age, sex, and academic major as measured by the LNTSP and Levels of Arts Engagement survey.

H0₅: There is no relationship between levels of arts engagement and thinking style when controlling for age, sex, academic major, and occupation as measured by the LNTSP and Levels of Arts Engagement survey.

Research Design

The research design for this study was derived from theories and concepts related to workplace and management styles research. This nonexperimental correlational study ($N = 101$) explored (a) the prevalence of linear, nonlinear, or balanced linear/nonlinear thinking style for professionals working in museums. (b) If levels of arts engagement has a relationship to thinking style, and (c) If thinking style has a relationship with (a) age; (b) sex; (c) academic major; and (d) occupation.

There are six types of non-experimental research designs: descriptive, comparative, correlational, survey, ex post facto, and secondary data analysis (McMillan & Schumacher, 2006). The researcher concluded that a correlational design would be most appropriate for this study to determine the extent of the relationship between the variables. Correlational design does not incorporate random assignment or the manipulation of experimental variables (Pedhazur & Scmelkin, 1991). This type of research design can recognize trends and patterns in data, but it does not support findings of causes for these observed patterns (Aldrich, 1995).

Research with this method has had a marked influence on people, policy, and laws. One example are the correlations between socioeconomic conditions and educational proficiency (Morgan, Farkas, Hillemeier, & Maczuga, 2009), which has provided a rationale for decisions involving equality in education.

The focus of this research was to uncover potential relationships between thinking style, sex, age, academic major, occupation, and levels of arts engagement among professionals working in museums, thus a non-experimental correlational research design was used.

Populations and Sample Size

The population for this study was professionals working in museums. The American Alliance of Museums (2014) lists the following areas of professional focus within the museum field on their website: accounting/finance, administrative/clerical, curator, assistant/deputy/associate director, chief operating officer, conservation, development/membership, directors/administrators, education, exhibitions, facility/operations, internships/fellowships, public relations/marketing, publications, registrar/collections management, security, and visitor services/customer service. Each of these positions requires and brings unique skills, talents, and expertise to advance museum practice. The varied backgrounds represented by these positions offers a microcosm of many professions existing within the museum field and allows for a more generalizable sample.

To be able to make inferences regarding the characteristics of the population from measure of this sample, size of the sample was considered. For methods such as correlational analysis, a sample size of at least 5 and up to 50 participants per variable is

recommended (Green, 1991). Given that this study had 5 variables, a minimum total sample size of 25 was recommended (Green, 1991). Green (1991) suggests $N > 50 + 8m$ (where m is the number of IVs) for testing the multiple correlation and $N > 104 + m$ for testing individual predictors (assuming a medium - sized relationship). In the present study $101 > 50 + 8(5) = 90$ and $101 < 104 + 5 = 109$, therefore the number of cases to be used in this study for multiple correlations is valid, but the number for testing individual predictors is below the minimum. For purposes of this study, a sample size of 200 participants was sought to strengthen statistical power and reduce the possibility of Type II error (Green, 1991). Unfortunately, as a result of participants incorrectly filling out Web-based self-report surveys the researcher was unable to obtain 200 samples and ended up with $N = 101$. According to Gay & Diehl (1992), generally the number of respondents acceptable for a study depends upon the type of research involved – descriptive, correlational, or experimental. In correlational research Gay & Diehl (1992) recommend that at least 30 subjects required to establish a relationship.

Variables and Instrumentation

The following section details each of the survey instruments used in measuring each research variable. First, linear/nonlinear thinking style will be discussed, followed by arts engagement, and lastly the demographic characteristics. Each scale was scored by aggregating the total scores for each question on a given measure and reporting the total score as the composite score for the measure. Both composite and individual scores from each question on a given measure were examined for significance. Instruments were scored and reported separately. Full versions of each instrument can be found in the Appendix.

Nonlinear Thinking Style

Nonlinear thinking style was measured by the Linear Nonlinear Thinking Style Profile (LNTSP) instrument (Vance et al., 2007b). The LNTSP instrument, was chosen because validation study results across multiple populations reveal a 4-factor model of linear and nonlinear thinking style involving the manner in which individuals attend to a particular kind of information source (internal vs. external) and subsequent linear versus nonlinear processing of that information. The results also indicate that the LNTSP has acceptable convergent validity through two commonly used and conceptually related instruments, the Myers-Briggs Type Indicator (MBTI) and Cognitive Style Index, as well as external validity and face validity across students from different academic major programs, individuals from distinctly different professional careers, and managerial and professional workshop participants (Vance et al., 2007a, 2007b). The Cronbach's alpha reliability estimates for the 4 subscales of the LNTSP were: external information sources (EIS, 8 items) 0.86, inner information sources (IIS, 8 items) 0.84, linear decision-making (LDM, 5 items) 0.77, and the nonlinear decision-making (NDM, 5 items) 0.74 (Vance et al., 2007b). The LNTSP was developed to test a comprehensive thinking style model that accurately reflects a person's propensity to rely on linear and nonlinear sources of information and processes to guide subsequent action.

The LNTSP instrument contains two sets of paired forced-choice items and corresponding scales of measurement. The first set of forced-choice items included 15 pairs of statements that describe alternative behaviors. Using a Likert-type scale (3 = very often, 2 = moderately often, 1 = occasionally, and 0 = rarely or never), respondents were asked to allocate exactly 3 points across each pair of alternative statements according to

how frequently they engage in such behaviors. An example pair of statements is “I primarily rely on logic when making career decisions” and “I primarily rely on feelings when making career decisions.” The second set of forced-choice items included 22 paired words or phrases that influence behaviors. Using a Likert-type scale (3 = very strong influence on how I behave, 2 = strong influence on how I behave, 1 = moderate influence on how I behave, and 0 = little or no influence on how I behave), respondents were asked to allocate exactly three points across each pair of alternative words or phrases. Example items included “Feelings” and “Facts,” “Inner Knowing” and “Logical,” and “Felt Sense” and “Reason.” The more negative the total score, the more nonlinear, and the more positive the total score, the more linear the thinking style. A quite balanced total score would likely be between around -3 to +3.

Levels of Arts Engagement

The Levels of Arts Engagement instrument measures levels of arts engagement based on participants’ level of active engagement with the arts over the course of their lifetime. Arts engagement was measured by a modified instrument developed by the researcher. This instrument is a modification of three existing instruments. The researcher modified the instrument because existing ones only measured levels of arts engagement over smaller spans of time or focused on motivations for arts engagement or preferred types of arts engagement.

The development of the arts engagement survey was informed by three existing surveys: (1) Levels of Engagement with Art by Korn & Associates (2005) developed for the Dallas Museum of Art. That survey examined the Dallas Museum of Art’s framework for understanding visitors’ engagement with art. (2) The 2008 Survey of Public

Participation in the Arts conducted by NEA (2012). This survey addressed how Americans participate in the arts over the course of a year, what kinds of art forms and activities they engage with, and in what numbers. (3) The 2012 Houston Arts Survey, Participation, Perceptions, and Prospects (Klineberg et al., 2012). This survey sample of 1,200 Harris County adults was asked about their free-time activities, reasons for attending or not attending arts events, personal involvement in creative activities, support for arts education and the importance they attach to the arts for the city's overall quality of life.

The researcher identified three distinct levels of arts engagement based on the work of Korn & Associates (2005) at the Dallas Museum of Art. The DMA study originally identified three distinct levels of engagement with art: awareness, curious, commitment. The levels are based on visitors' prior art knowledge, art consumer behavior, and degree of participation in art experiences. The DMA also identified four audience clusters associated with the three levels. These four clusters are based on visitors' preferences for types of interpretation and programming, comfort level with looking and talking about art, and enthusiasm and passion for art. The four visitor clusters—tentative observers, curious participants, discerning independents, and committed enthusiasts—exist within the three levels of engagement. The researcher modified these classifications to create an arts engagement measure with the following three levels: passive participants, participants, committed participants and enthusiasts. These three levels are based on participants' level of active engagement with the arts. A description of each level is found below. These descriptions are modifications from the Korn & Associates (2005) study.

1. Passive participants: have the least amount of arts engagement. Most experiences and exposure they have had has not been self-motivated, but rather part of either a prescribed curriculum at school or outings that they have not self-initiated. In summary, passive participants are neither very knowledgeable about art nor motivated to spend time engaged in the arts. Their participation is more opportunistic or forced. Passive participants are those for whom arts engagement is not a defining and vital part of their life.
2. Participants: have more engagement with the arts than passive participants and they seek out art engagement on their own. Participants are reasonably interested in engagement with the arts and seek out experiences on a casual basis. Participants sometimes visit commercial art galleries, museums, and cultural institutions. Participants are those who engage in arts engagement, but who don't feel it's absolutely vital to do so.
3. Committed participants and enthusiasts: have the strongest art background and engagement with the arts. Committed participants and enthusiasts often include practicing artists or those involved in the creative arts industries. These individuals visit commercial art galleries, museums, and cultural institutions on a regular basis. For this cluster, engagement with the arts is a defining and vital part of their lives.

The Level of Arts Engagement survey contains 11 statements/questions that describe exposure to arts experiences. These statements are modified from the Korn & Associates (2005) DMA study, the 2008 Survey of Public Participation in the Arts conducted by National Endowment for the Arts (2013), and the 2012 Houston Arts

Survey (Klineberg et al., 2012) Participation, Perceptions, and Prospects. The researcher used the surveys incorporated by these studies to identify relevant themes and corresponding statements that should be used to measure arts engagement. The names of the study, themes identified, and statements used by the researcher for the Level of Arts Engagement instrument are shown in Table 1.

Table 1

Sample Table of Pre-Existing Arts Surveys

Institution	Theme	Sample Survey Items
DMA	Arts consumption and visiting cultural institutions	I visited arts institutions and/or cultural organizations on my own or with my family when I was 18 years old or younger I currently visit arts institutions or cultural organizations When I visit other cities, I visit the local art museums
NAEA	Forms of art consumption	I currently attend Visual and or Performing Arts events
NAEA	Consuming art through electronic media	I follow blogs and publications about art I use TV, radio, or the Internet to access the arts (music, visual, graphic, theater, etc.)
NAEA	Making and sharing art	I created art (music, visual, graphic, theater, etc.) as a child under 18 I currently create or share art (music, visual, graphic, theater, etc.) through various activities
NAEA	Participating in arts learning	I have taken art classes in high school I have taken art classes in college
Houston	The perceived importance of the arts	Engagement with the Arts (museums, fine art, music, theater, etc.) is vital to me When I visit other places, I visit the local art museums or historic homes

The Level of Arts Engagement survey uses a Likert-type scale (0 = never, 1 = rarely, 2 = sometimes, 3 = most of the time), respondents were asked to choose statements that reflect their personal experience. For levels of arts engagement analysis participants were separated into (3) groups based on their responses to questions regarding their arts engagement. A score of 0-11 = passive participant, 12-22 = participant, 23-33 = committed participant and enthusiast.

Validity and reliability of the instrument were tested. There are three basic approaches to the validity of tests and measures content validity, construct validity, and criterion-related validity (Mason & Bramble 1989). The content validity approach measures the degree to which the test items represented the domain of arts engagement. In order to establish the content validity of the measuring instrument, the researcher identified overall content to be represented through a literature review of instruments. The researcher then consulted a panel of museum educators and artists and asked each of them to identify the content of the test the researcher was developing.

To achieve construct validity of the instrument the researcher began using a literature review to define arts engagement. A panel of five artists and ten educators was then asked to evaluate this definition of arts engagement. After a consensus was achieved the researcher showed that the existing definition was unique to arts engagement. One question of validity that arose is that a differentiation should be made when considering active arts engagement as opposed to passive/observance arts engagement. The researcher could not devise a way to do this without having two separate surveys and chose to combine the two.

Criterion-related validity was achieved by administering the instrument to a group of five artists as they were already known to exhibit the traits to be measured. A range of items were refined such as the types of art activities and using a combination of questions related to both active and passive arts experiences. An additional item added was the inclusion of digital/online arts participation activities.

The reliability of the instrument was tested by checking the extent to which the instrument yielded the same results on two repeated trials to the selected group of artists.

Demographics

The demographic survey captures (a) age; (b) sex; (c) academic major; and, (d) occupation. The researcher chose these demographics because empirical study findings provide evidence that thinking styles have a relationship with age (Eshet-Alkalai & Chajut, 2009), sex (Sladek, Bond, & Phillips, 2010), and have predictive power for academic achievement and occupation (Dunn et al., 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997; Sternberg & Zhang, 2001).

Procedures

Web-based Survey Research

Web-based surveys are a continuously emerging scientific research methodology (Buchanan & Smith, 1999a). Several studies have checked the validity of Web-based surveys by comparing the results of studies conducted on the Web with identical studies in the real world. The following studies suggest that the validity and reliability of data obtained through Web-based surveys are comparable to those obtained by classical methods (Buchanan & Smith, 1999b; Krantz, Ballard, & Sher, 1997; Senior, Philips, Barnes, & David, 1999).

The number of Web-based surveys being conducted has increased dramatically in the last 10 years. A Google query done in February 2014 for “Web-based surveys” had 300,000 results. Web-based surveys are becoming increasingly popular because they are believed to be faster, better, cheaper, and easier to conduct than surveys using more-traditional methods. The increase in the number of Americans who have access to the Internet, and the relatively low cost of conducting Web-based surveys has also contributed to this proliferation. Survey professionals, academics, and large organizations are no longer the only people conducting surveys on the Web (Couper, 2000). Software, such as Survey Monkey, capable of producing survey forms and detailed analytics at the click of a button is available to the general public at an affordable cost. Such software is enabling anyone to conduct Web-based surveys and accompany those surveys with basic analytics of the captured data. With such easy access to web-based self-report survey design the range and the quality of Web-based surveys vary considerably (Gunn, 2002). Regardless of format, survey research techniques require good reliability and validity estimates of the instrument so that the measurement is credible and the subsequent data collected is of high quality.

Web-based self-report surveys. A Web-based self-report survey involves a computerized, self-administered questionnaire sent by the researcher, which the respondent receives, and completes. For this research study, the Web-based self-report survey was delivered by email with a URL-embedded-message in the text which the respondent clicked and was then taken to a host site where they viewed and responded to the survey. The following sections discuss the advantages and limitations of utilizing Web-based self-report surveys.

Advantages of web-based self-report surveys. There are numerous documented advantages to utilizing Web-based surveys. To begin there is great cost reduction with the elimination of paper, postage, and data entry costs (Cobanoglu, Warde, & Moreo, 2001; Dillman, 2000). Costs for surveying additional respondents is greatly reduced as well once electronic data collection systems are developed and put into place (Dillman, 2000). Another advantage to Web-based surveys is that data are often available in real time in graphic and numerical format allowing for quick analysis. The use of the Web-based self-report survey allowed for data to be easily imported to Excel sheets and SPSS for data analysis. The response requirements of Web-based instruments decrease the likelihood of missing data and less threat of unreliable researcher observations and less handling of the data by research personnel, which results in lower risk of data coding and entry errors, making the response set more reliable and valid (Lyons, Cude, Lawrence, & Gutter, 2005; Skitka & Sargis, 2006; Wright, 2005; Yun & Trumbo, 2000; Zhang 1999). For this study, participants did complete the survey, but the complexity of point allocation caused many respondents to complete the survey incorrectly. This is discussed in detail later in the paper.

Zhang (1999) has noted that the greatest time savings found in Web-based surveys is with turnaround time. Cobanoglu et al. (2001) confirm this in a research study that found a mean response speed of 5.97 days for the Web-based surveys compared to 16.46 days for mailed surveys. The turn-around time for Web-based surveys has been reported as two to three days by Yun and Trumbo (2000), with 80% of responses collected in the first three days, most of which are submitted within the first 24 hours. The researcher found this to be true with the Web-based self-report survey employed for

this project. According to research findings, Web-based survey methods also seem to offer individuals a better sense of anonymity, leading to a decreased likelihood of response bias and increased response rate (Daley, McDermott, McCormack-Brown, & Kittleson, 2003; Skitka & Sargis, 2006).

Limitations of web-based self-report surveys. Some of the limitations to using Web-based surveys include lack of participation due to distance from participants, not all potential respondents are equally computer literate (Dillman, Smyth, & Christian, 2009), software applications and hardware may not be compatible and screen configurations may appear significantly different from one respondent to another, depending on settings of individual computers (Dillman et al., 2009, 2000; Yun & Trumbo, 2000). Other limitations related to Web-based survey methodologies include the occurrences of multiple responses from a single participant and or the receipt of unsolicited responses. Participants may also intentionally submit their responses multiple times, possibly to increase their chances at winning incentives, or unintentionally hit the submit button more than once. Unsolicited responses may occur if the solicitation for participation is passed from the intended party to an outside person who that was not originally included in the sampling frame nor detected in the final data set (Lyons et al., 2005). Web-based surveys are confronted with limited access to particular certain demographic groups, which restricts generalizability (Eastin & LaRose, 2000; Skitka & Sargis, 2006; Tourangeau, 2004). As a result, Web-based instruments can be limited by a threat to external validity. Self-selection bias is another major limitation of online survey research (Stanton, 1998; Thompson, Surface, Martin, & Sanders, 2003; Wittmer, Colman, &

Katzman, 1999). In any given Internet community, there are undoubtedly some individuals who are more likely than others to complete an online survey (Wright, 2005).

Design guidelines for web-based survey. Current research on the design and implementation of Web-based surveys has yet to produce an authoritative set of rules. Regardless, this field is greatly informed by the cognitive load theory (Clark, Nguyen, & Sweller, 2005; Sweller, 1998) and the field of instructional design. Some very basic guidelines the researcher considered when designing the survey include:

- Short and to the point invitation letter (Dillman, 2000).
- Interesting, but simple to answer, questions (Dillman, 2000).
- The use of clear, unambiguous and concise wording (Andrews, Nonnecke, & Preece, 2003).
- Questions that are presented in a conventional format similar to that normally used on paper, self-administered surveys (Dillman, 2000, p. 379).
- An interface that is supported by multiple platforms and browsers (Yun & Trumbo, 2000).
- A design that makes each question and corresponding potential responses to that question visible on the screen at one time (Mayer & Moreno, 2003).

Sampling Procedures

Methods used for selecting participants and sampling procedures are discussed in the following section. Specific procedures for carrying out the research study followed methods developed by Dillman (2000). These methods were integrated throughout the sampling procedures.

First, permission to conduct the survey was gained from the Editor for Museum-Ed. Museum-Ed is a not-for-profit organization dedicated to providing museum practitioners with opportunities to ask questions, to exchange ideas, to explore current issues, to share resources, to reflect on experiences, and to inspire new directions in museums. Museum-Ed runs a listserv that is national and international in scope. The researcher also sought permission of the editor and Digital Media Consultant, President of the Museum Computer Network (MCN). MCN supports the MCN-L, the Museum Computer Network's Listserv. The listserv is the Museum Computer Network's primary means of communication between conferences. MCN-L provides a lively, supportive forum for discussion and networking among MCN members and colleagues worldwide.

In addition the researcher sought permission from the American Alliance of Museums Emerging Museum Professionals (EMP) Network to post the survey on their listserv. EMP is a national organization with networks in cities such as Chicago, Boston, New York, Los Angeles, and Miami. EMP connects museum professionals in similar fields through a monthly meetings as well as museum and gallery tours. The researcher also obtained permission from Cultural Educators of Miami (CEM) to utilize their professional listserv to distribute the survey. CEM develops the practice of cultural education and advocates for its integration into the Miami community. Its members comprise professionals from an array of cultural institutions throughout South Florida. In addition the researcher utilized his standing on two AAM committees; The AAM EdCom Conference Committee and the AAM EdCom Issues Committee to distribute survey to professionals throughout the country. These committees are comprised of museum

professionals working in institutions that comprise the Northeast Region, Southeast Region, Northwest Region, and Southwest Region of the United States.

The researcher also located the website Museums USA. This website captures information about museums, collected by museum associations, and presents it to the public and to the museum community in a searchable format. This is one of the most extensive listings of museum information for the entire United States currently available. Information on the website includes staff lists with email contact information the researcher used for survey distribution. The researcher used this website to obtain contact information for many individuals throughout the museum field.

Lastly, the researcher contacted the American Alliance of Museums Professional Networks to obtain permission to access emails and listservs and to distribute survey. The networks are organized around job responsibilities and areas of common interest.

- CARE: audience research and evaluation and the voice of the visitor in all aspects of museum operations
- COMPT: professional preparation, training and development of museum staff
- CURCOM: curatorial practice and collections research, care and exhibition
- DAM: development, fundraising and membership
- DIVCOM: the advancement of diversity and inclusion
- EDCOM: the advancement and understanding of learning theories, educational practices and programming
- Historic House Museums: issues common and unique to historic houses
- Latino: for the needs of Latino professionals

- Leadership and Management: leadership, governance, administration, finance and human resources
- LGBTQ Alliance: the range of issues relevant to the lesbian, gay, bi-sexual, transgender community and museums
- Media & Technology: use of media and technology to meet museum's public mission
- NAME: exhibit development and design
- PACCIN: proper care, handling, packing, crating and transporting of museum collections
- PIC Green: environmental sustainable practices in museums
- PRAM: public relations and marketing
- Registrars: registration and collections management
- Security: security, fire, health and safety issues
- SMAC: the advancement of small museums
- Traveling Exhibitions: the specialized area of traveling exhibitions
- Visitor Services: making service to visitors a core component of museum operations

Survey Development

In developing the survey the researcher considered the work of Schwarz and Sudman (1996) and of Dillman (2000) who have developed numerous procedures for survey pretesting and testing. Dillman (2000) suggested a multi-stage testing process that can be applied to either paper or electronic surveys.

1. Stage 1 consists of a review by knowledgeable colleagues and analysts to ensure question completeness, efficiency, relevancy, and format appropriateness.
2. Stage 2 focuses on cognitive and motivational qualities while ensuring wording understandability, interpretation consistency, logical sequencing, and overall positive impression from the look and feel of the survey. This stage is implemented by conducting interviews with participants after they have completed the survey.
3. Stage 3 consists of a small pilot study that emulates all the procedures proposed in the research study.
4. Stage 4 researchers conduct one last check using people who have no connection to the survey.

To follow through with survey pre-testing the researcher worked with colleagues at Vizcaya Museum and Gardens, Lowe Art Museum at the University of Miami, and Perez Art Museum Miami (PAMM). Discussions included a review of the survey questions that helped validate question completeness, efficiency, relevancy, and format appropriateness; conducting interviews with participants after they had completed the survey; and lastly, conducting a small pilot study of 12 working professionals that emulated all the procedures proposed in the research study including completing online versions of the survey, and finally, conducting one last check with people who have no connection to the survey, such as random visitors to Vizcaya Museum and Gardens. At the time of the pilot study problems concerning point allocation did not arise for the researcher.

The issue of complexity in terms of the scoring schema for the survey did not come up and all pilot participants performed accurately in this sense. In reflection, the pilot study participants were all educators and or administrators with experience in survey design and implementation and therefore the pilot sample may not have been representative of the actual desired research population.

Data Collection

For this research study, the Web-based self-report survey was sent by email with a URL-embedded-message in the text which the respondent clicked and was then taken to a host site where they viewed and responded to a survey. For repeated contact (Dillman, 2009), the researcher included: (a) an introductory email informing potential respondents of the upcoming survey; (b) an email with a personalized survey link; and (c) a second reminder email after a 2-week period. The researcher attempted to get a broad sampling of emails from individuals across working in many fields at museums. The majority of these emails were to educators which created a form of bias for survey response. This happened as a result of the researcher working in the field of museum education and having easier access to that population. The researcher asked all individuals who received emails to forward to all of their colleagues in the museum as the researcher desired a broad base of occupational backgrounds.

Dropped Data Analysis

During data analysis the researcher noted that many respondents did not follow the proper 3-point allocation rule for the Web-based self-report survey when answering particular questions in the LNTSP section of the survey. As a result, the researcher consulted the original author of the LNTSP, Dr. Charles Vance. Dr. Vance noted that he

often experienced this issue. Because the participant response is a matter of determining a relative allotment of points, Dr. Vance advised that the researcher could revise surveys where possible to result in a consistent rating pattern. This revision was based on Dr. Vance's experience in consulting with individual participants to correct their response according to the 3-point allocation rule. For example, a 3-2 paired rating was changed to a 2-1, and a 1-3 became a 1-2 (the 1 remained rather than becoming zero since there was at least some preference). This resulted in revising 6.9% ($N = 7$) of the 101 correctly completed surveys. However, as the instrument's author advised, the researcher had to drop any 1-1, 2-2, or 3-3 ratings that were found. This resulted in dropping 52.1% ($N = 110$) of the total 211 surveys that were submitted. Of course, it would have been best to collect more data with the revised directions in mind, but that was not feasible in this research due to lack of further access to the research population and time constraints.

When data points become outliers due to data errors (e.g., the respondent did not complete the item as directed) and the data entries cannot be corrected as in the case of this study, "they should be eliminated as they do not represent valid population data points" (Osbourne & Overbay, 2004, page 2). Understandably this practice is not ideal because it would limit the generalizability of the results and is therefore a limitation in this research, but it is better than including erroneous data that might skew the results unnecessarily (Osbourne & Overbay 2004). Still, the researcher took a number of additional steps to verify whether eliminating the data would be problematic.

To determine if any systematic bias had been introduced into the study by eliminating the 110 participants, the researcher conducted a series of one-way ANOVAs that tested whether there were statistically significant group mean differences between

the group mean scores of those who were retained in the study versus those who were not. The ANOVA results revealed there were no statistically significant differences among the research variables; thus, the researcher had preliminary justification for excluding the incorrect completers from the study as directed by the thinking style measure's author. The results were as follows: Thinking style $F(1, 207) = 2.27, p = .13$; Arts engagement $F(1, 207) = 1.06, p = .30$; Age $F(1, 207) = 1.53, p = .22$; Sex $F(1, 207) = 1.77, p = .19$; and, Academic major $F(1, 207) = 0.21, p = .65$.

In addition, to further test whether systematic bias may have been introduced into the study by excluding the respondents who did not complete the survey correctly, the researcher conducted a principal components analysis (PCA) with varimax rotation to test whether the underlying structure of the research measure was impacted in any way (Tabachnick & Fidell, 1989). PCAs are conducted, rather than factor analyses, when the analytic purpose is exploratory. Further, because to the researcher's knowledge there is no theoretical or empirical reason as to why the two groups might differ with regards to the research measure in question, a PCA would be most appropriate (Tabachnick & Fidell, 1989). Thus, a separate PCA with varimax rotation was run for each separate group; that is, the group who completed the measure correctly versus a second PCA for the group who did not (see Table 2). The PCAs revealed the presence of two distinct components for each respective group. The amount of variance explained by the two resulting components in each analysis was roughly the same, with 54.76% of the variance being explained in the incorrect measure completion group versus 61.24% of the correct measure completion group. Moreover, the pattern and strength of the item coefficients for each PCA were virtually identical. These results in combination with the one-way

ANOVAS that were run where no statistically different differences by group on any of the other research variables were found support the notion that systematic bias was not introduced into the study by virtue of the data deletion procedure employed, as recommended by the measure's author.

Table 2

Principal Components Analysis (PCA) with Varimax Rotation

	correct completion group	correct completion group		incorrect measure completion group	incorrect measure completion group
	Component 1	Component 2		Component 1	Component 2
VAR00001	.133	.655	VAR00001	.249	.751
VAR00002	.098	.790	VAR00002	.162	.784
VAR00003	.270	.549	VAR00003	.311	.640
VAR00004	.221	.592	VAR00004	.316	.692
VAR00005	.420	.437	VAR00005	.450	.464
VAR00006	.717	.348	VAR00006	.721	.389
VAR00007	.792	-.076	VAR00007	.763	.183
VAR00008	.733	.268	VAR00008	.744	.330
VAR00009	.762	.295	VAR00009	.767	.348
VAR000010	.734	.255	VAR000010	.746	.339
VAR000011	.734	.222	VAR000011	.739	.309
VAR000012	.616	.270	VAR000012	.685	.132

Data Analysis

To examine the relationship between continuous variables of thinking style and the independent variables, hierarchical regression analysis was performed. Hierarchical regression was used to examine the relationships between a set of independent variables

(age, sex, academic major, occupation, and levels of arts engagement) and a dependent variable (thinking style), after controlling for the effects of particular independent variables on the dependent variable. Hierarchical regression is the practice of building successive linear regression models, each adding more predictors. After coding the research variables for use in the hierarchical regressions, the independent variables (sex, age, academic major, occupation, levels of arts engagement) were entered in five stages. Dummy coding was used for independent variables that demonstrated a significant link (both correlational and ANOVA) with thinking style (Tabachnick & Fidell, 2001). In the first stage, the independent variables that the researcher wanted to control for were entered into the regression. In the second through fifth stages, the independent variables (sex: coded 1 = male, 2 = female; age: 1 = 21-29, 2 = 30-39, 3 = 40-49, 4 = 50-59, 5 = 60 and older; academic major: 1 = Humanities, 2 = Journalism, 3 = Arts and Architecture, 4 = Education, 5 = other, 6 = Business, 7 = Engineering, 8 = Law; occupation: 1 = Education, 2 = Public Relations/Publications, 3 = Curator, 4 = CEO, Director/Admin/Development/Membership, 5 = Admin/support/clerical, Intern/Fellow, 6 = Registrar, 7 = Exhibitions; levels of arts engagement: 1= 0-11, 2 = 12-22, 3 = 23-33) whose relationship the researcher wanted to examine after the controls were entered and analyzed.

Summary statistics, including statistical means and standard deviations were calculated for the rating scales and other variables measured at the interval level. Data analysis allowed the researcher to identify whether correlations existed between thinking style, sex, age, academic major, occupation, and levels of arts engagement.

CHAPTER IV

RESULTS

This chapter presents the results of the study and is organized into three main sections: background of the sample, examination of the hypotheses, and a brief summary of the chapter. To examine the hypotheses, frequency analysis, means analysis along with hierarchical regression analysis were performed to identify important relations between particular variables of interest.

Background of the Sample

The Web-based self-report survey was sent to 1,000 individuals. 21.1 % ($n = 211$) of the sample responded to the survey. Of these respondents, 47.8% ($n = 101$) correctly completed the survey, representing 10.1% of the total sample population ($N = 1000$) who received the Web-based self-report survey through email. A frequency analysis for the 101 participant's sex, age, academic major, occupation, and levels of arts engagement is examined in the following sections.

Sex

A frequency analysis of sex indicated that 89.1% ($n = 90$) were female and 10.8% ($n = 11$) were male (see Table 2).

Age

A frequency analysis of age indicated that 19.8% ($n = 20$) of the respondents reported belonging to the 20-29 group, 38.6% ($n = 39$) to the 30-39 group, 22.7% ($n = 23$) to the 40-49 group, 11.8% ($n = 12$) to the 50-59 group, and 6.9% ($n = 7$) belonging to the 60 and older group (see Table 2).

Academic Major

A frequency analysis of academic major indicated that 22.7% ($n = 23$) of the respondents were humanities (ancient and modern languages, literature, philosophy, religion, history, anthropology, area studies, communication studies, cultural studies, linguistics) majors, 2.9% ($n = 3$) were journalism and mass communication (television, Internet, video) majors, 46.5% ($n = 47$) were architecture and the arts (architecture, interior design, art history, advertising, architecture, art, crafts, design, fashion, film, music, performing arts, publishing, R&D, software, toys and games, TV and radio, and video games) majors, 6.9% ($n = 7$) were education (teaching, education admin.) majors, 11.8% ($n = 12$) listed Other as their major, 5.9% ($n = 6$) were business (accounting, business admin) majors, .99% ($n = 1$) were engineering and computing (IT, programming, mechanical engineering) majors, and 1.9% ($n = 2$) were law majors (see Table 2).

Occupation

A frequency analysis of occupation indicated that 67.3% ($n = 68$) worked in education, 1.9% ($n = 2$) worked in public relations/marketing/publishing, 4.9% ($n = 5$) worked in curatorial, 13.8% ($n = 14$) worked as CEO/directors/administrators/assistant/Deputy/associate director, 7.9% ($n = 8$) worked in administrative/clerical/support, and 3.9% ($n = 4$) worked in exhibits (see Table 2).

Levels of Arts Engagement

A frequency analysis of levels of arts engagement indicated that 3.96% ($n = 4$) were passive arts participants, 25.74% ($n = 26$) were arts participants, and 70.30% ($n = 71$) were committed arts participants and enthusiasts (see Table 2).

Thinking Style

A frequency analysis of thinking style indicated that 53.4% ($n = 54$) of respondents scored as having a preferred linear style of thinking. Roughly 21 % ($n = 21$) of the respondents scored as having a preferred balanced linear/nonlinear thinking style; 25.7 percent ($n = 26$) of the respondents scored as having a preferred nonlinear thinking style. Of the respondents who scored a linear thinking style ($n = 54$), 21.7% of the participants ($n = 22$) had the highest level of arts engagement. Of the respondents who scored a balanced linear/nonlinear thinking style ($n = 21$), 11.8% of the participants ($n = 12$) had the highest level of arts engagement (committed participants and enthusiasts). Lastly, of the respondents who scored a nonlinear thinking style ($n = 26$), 13.8% ($n = 14$) of the participants had the highest (committed participants and enthusiasts) level of arts engagement (see Table 3).

Table 3

Frequency Table of Variables

Variable	Category	<i>f</i>	Percent
Sex	Male	11	11%
	Female	91	89%
	Total	101	
Age	21-29	20	20%
	30-39	39	39%
	40-49	23	23%
	50-59	12	12%
	60 and older	7	7%
	Total	101	
Academic Major	Humanities	23	23%
	Journalism	3	3%
	Arts and Architecture	47	47%
	Education	7	7%
	Other	12	12%
	Business, Engineering	6	6%
	Law	1	1%
	Total	2	2%
Occupation	Education	101	
	Public Relations/Publications	68	68%
	Curator	2	2%
	CEO/Director/Admin/Development/Membership	5	5%
	Admin/support/clerical, Intern/Fellow	14	14%
	Registrar	8	8%
	Exhibitions	0	0%
	Total	4	4%
Arts Engagement	Passive participant	101	
	Participants	4	4%
	Committed participants and enthusiasts	26	26%
	Total	71	70%
Thinking Style	Linear	101	
	Balanced	54	53%
	Nonlinear	21	21%
	Total	26	26%
Total	101		

Examination of the Hypotheses

For testing the five hypotheses, correlations were conducted to get a preliminary sense of the strength and direction of relations among the variables. In regression analysis, correlations between the independent and dependent variables are first consulted to support inclusion in the final regression equations. Because sex and academic major variables were linked significantly to thinking style, they were represented in the final analyses. To afford comparison with prior thinking style research, the researcher retained all the independent variables in the analyses (Tabachnick & Fidell, 2001).

Table 4
Intercorrelations among Thinking Style, Age, Sex, Academic Major, Occupation, and Levels of Arts Engagement.

		Coded TS	Coded AE	Coded Age	Coded Sex	Coded AM	Coded Occupation
TS	<i>r</i>	1					
	Sig. (1 Tailed)						
	<i>N</i>	101					
AE	<i>r</i>	.03	1				
	Sig. (1 Tailed)	.37					
	<i>N</i>	101	101				
Age	<i>r</i>	.08	-.14	1			
	Sig. (1 Tailed)	.19	.08				
	<i>N</i>	101	101	101			
Sex	<i>r</i>	.18*	.13	-.07	1		
	Sig. (2 Tailed)	.03	.09	.22			
	<i>N</i>	101	101	101	101		
AM	<i>r</i>	-.24**	-.24*	.124	-.24**		
	Sig. (1 Tailed)	.00	.00	.10	.00	1	
	<i>N</i>	101	101	101	101		
						101	
O	<i>r</i>	-.16	-.03	.08	-.29**	.25**	1
	Sig. (1 Tailed)	.08	.37	.20	.00	.00	
	<i>N</i>	101	101	101	101	101	101

Note. * $p < .05$ level. ** $p < .01$ level. TS = Thinking Style; AE = Arts Engagement; AM = Academic Major
O = Occupation

Analysis for Testing H0₁

H0₁ stated there is no relationship between sex and thinking style, after controlling for academic major, occupation, levels of arts engagement, and age. First, a correlation analysis was conducted to test the relation among sex and thinking style (see Table 4). Results supported a relationship between the two variables. The correlation coefficient indicated there was a significant correlation between sex and thinking style ($r = .19, p < .05$). Upon further analysis, a one-way ANOVA $F(5, 95) = 2.74, p = .055$ suggested *marginally* that women tended toward having a more balanced thinking style than men. Means analysis at the descriptive level, where a score of 1 indicated nonlinear thinking style, a score of 2 indicated a balanced linear/nonlinear thinking style, and a score of 3 indicated nonlinear thinking style demonstrated that women ($n = 90, M = 1.77$) tended to have a more balanced thinking style, while men ($n = 11, M = 1.27$) had a more linear thinking style (see Table 5).

Table 5

Means Analysis: Thinking Style and Levels of Arts Engagement by Sex

	<i>N</i>	Mean	Std. Deviation	Std. Error
Coded TS				
Men	11	1.27	.64	.83
Women	90	1.77	.85	1.59
Total	101	1.72	.84	1.55
Coded AE				
Men	11	2.45	.82	.24
Women	90	2.68	.51	.05
Total	101	2.66	.55	.05

Note. TS is Thinking Style, AE is Arts Engagement.

To formally test the hypothesis, a hierarchical regression was run where the demographic variables were entered first as a block, which explained 10.0% of the variance ($p = .03$) in thinking style. Sex (dummy coded male reference group) was entered as the second block, explaining another 2% of the variance (13.0% overall), but did not attain statistical significance ($p = .11$); thus, the first null hypothesis was supported (see Table 6).

Table 6

Summary Hierarchical Regression Analysis with Sex Predicting Thinking Style

Variable	β	R	ΔR^2	Sig. F Change
Step 1				
Age	.13			
Major	-.31			
Occupation	-.07			
Arts Exposure	-.05			
Block		.32	.10	.03
Step 2				
Sex	.16			
Block		.36	.02	.11
Total R^2			.13	

Analysis for Testing H0₂

H0₂ stated there is no relationship between age and thinking style, controlling for sex, academic major, occupation, and levels of arts engagement. The researcher was

unable to reject the null hypothesis. First, a correlation analysis was conducted to test the relation between age and thinking style (see Table 4). The resulting correlation coefficient indicated there was not a significant correlation between age and thinking style ($r = .09, p > .05$). One-way ANOVA analysis $F(5, 95) = 2.74, p = .085$ also did not support a significant relationship between the variables. Means analysis at the descriptive level suggested that participants who were in the 60 years and older age group ($n = 7, M = 2.14$) had the most balanced linear/nonlinear thinking style, those in the 40-49 age group ($n = 23, M = 1.78$) had the second most balanced linear/nonlinear thinking style, while participants who were in the 50-59 age group ($n = 12, M = 1.58$) had the most linear thinking style (see Table 7).

Table 7

Means Analysis: Thinking Style and Levels of Arts Engagement by Age

	<i>N</i>	Mean	Std. Deviation	Std. Error
Coded TS				
21-29	20	1.65	.81	.18
30-39	39	1.69	.83	.13
40-49	23	1.78	.95	.19
50-59	12	1.58	.79	.22
60 and older	7	2.14	.89	.34
Total	101	1.72	.84	.08
Coded AE				
21-29	20	2.80	.41	.09
30-39	39	2.69	.56	.09
40-49	23	2.52	.66	.13
50-59	12	2.75	.45	.13
60 and older	7	2.42	.53	.20
Total	101	2.66	.55	.05

Note: TS is Thinking Style and AE is Arts Engagement

To formally test the hypothesis, a hierarchical regression was run where the demographic variables were entered first as a block (i.e., sex, major, occupation, arts exposure), which explained 11.0% of the variance ($p = .03$) in thinking style. Age was entered as the second block, explaining another 2% of the variance (13.0% overall), but did not attain statistical significance ($p = .17$); thus, the second null hypothesis was supported (see Table 8).

Table 8

Summary Hierarchical Regression Analysis with Age Predicting Thinking Style.

Variable	β	R	ΔR^2	Sig. F Change
Step 1				
Sex	.16			
Major	-.29			
Occupation	-.01			
Arts Exposure	-.08			
Block		.33	.11	.03
Step 2				
Age	.14			
Block		.36	.02	.17
Total R^2			.13	

Analysis for Testing H0₃

H0₃ stated there is no relationship between academic major and thinking style, after controlling for occupation, levels of arts engagement, age and sex. The researcher

was able to reject the null hypothesis. First, a correlation analysis was conducted to test the relation between academic major and thinking style (see Table 4). The resulting correlation coefficient indicated there was a significant correlation between academic major and thinking style ($r = -.25, p < 0.01$). One-way ANOVA analysis $F(5, 95) = 2.74, p = .002$ also suggested a significant relation among the variables. Means analysis at the descriptive level suggested that Humanities majors ($n = 23, M = 1.91$) had the most balanced linear/nonlinear thinking style, those who were arts and architecture majors ($n = 47, M = 1.87$) were the second most balanced linear/nonlinear thinking styles, participants who listed their major as other ($n = 12, M = 1.25$) had the most linear thinking style, and those who listed business ($n = 6, M = 1.33$) as their major had the second most linear thinking style (see Table 9).

Table 9

Means Analysis: Thinking Style and levels of Arts Engagement by Academic major

	<i>N</i>	Mean	Std. Deviation	Std. Error
Coded TS				
Humanities	23	1.91	.90	.18
Journalism	3	1.66	1.15	.66
Arts	47	1.87	.84	.12
Education	7	1.42	.78	.29
Other	12	1.25	.62	.17
Business	6	1.33	.81	.33
Engineering	1	1.00	.	.
Law	2	1.50	.70	.50
Total	101	1.72	.84	.08
Coded AE				
Humanities	23	2.56	.50	.10
Journalism	3	3.00	.00	.00
Arts	47	2.87	.33	.04
Education	7	2.57	.78	.29
Other	12	2.50	.67	.19
Business	6	2.00	.89	.36
Engineering	1	2.00	.	.
Law	2	2.00	.00	.00
Total	101	2.66	.55	.05

Note: TS is Thinking Style and AE is Arts Engagement

To formally test the hypothesis, a hierarchical regression was run where the demographic variables were entered first as a block (i.e., age, sex, occupation, arts exposure), which explained 5.0% of the variance ($p = .33$) in thinking style (see Table 3). Academic major, dummy coded as 0 = non-humanities major and 1 = humanities major (Tabachnick & Fidell, 2001) was entered as the second block, explaining another 5% of the variance (10.0% overall), attaining statistical significance ($p < .01$); thus, the third null hypothesis was not supported (see Table 10).

Table 10

Summary Hierarchical Regression Analysis with Academic Major Predicting Thinking Style.

Variable	β	R	ΔR^2	Sig. F Change
Step 1				
Age	.11			
Sex	.18			
Occupation	-.04			
Arts Exposure	.02			
Block		.22	.05	.33
Step 2				
Major	-.30			
Block		.36	.05	.00
Total R^2			.10	

Analysis for Testing H0₄

H0₄ stated there is no relationship between occupation and thinking style. The researcher was unable to reject the null hypothesis. First, a correlation analysis was conducted to test the relation among occupation and thinking style (see Table 4). The resulting correlation coefficient indicated there was a significant correlation between occupation and thinking style ($r = .17, p < .05$). Further research using one-way ANOVA analysis $F(5,95) = 2.74, p = .78$ did not support a significant relation among the variables. A means analysis at the descriptive suggested that those who worked in education ($n = 68, M = 1.81$) had a balanced linear/nonlinear thinking style while those

who worked as CEO, directors, and administrators ($n = 14$, $M = 1.29$) had a more linear thinking style. Of the preferred nonlinear thinking style respondents ($n = 26$), 76.9% were educators ($n = 20$), while only 3.8% were CEO or administrators ($n = 1$). See Table 11 below.

Table 11

Means Analysis: Thinking Style and Levels of Arts Engagement by Occupation

	<i>N</i>	Mean	Std. Deviation	Std. Error
Coded TS				
Education	68	1.80	.86	.10
PR	2	2.50	.70	.50
Curator	5	2.00	1.00	.44
CEO/Directors	14	1.28	.61	.16
Admin/support	8	1.37	.74	.26
Exhibitions	4	1.75	.95	.47
Total	101	1.72	.84	.08
Coded AE				
Education	68	2.69	.496	2.57
PR	2	2.50	.70	-3.85
Curator	5	2.60	.89	1.48
CEO/Directors	14	2.64	.63	2.27
Admin/support	8	2.37	.74	1.75
Exhibitions	4	3.00	.00	3.00
Total	101	2.66	.55	2.55

Note: TS is Thinking Style and AE is Arts Engagement

To formally test the hypothesis, a hierarchical regression was run where the demographic variables were entered first as a block (sex, age, academic major, arts exposure), which explained 13.0% of the variance ($p = .01$) in thinking style. Occupation was entered as the second block, but did explain any additional variance (13.0% overall),

but did not attain statistical significance ($p = .78$); thus, the fourth null hypothesis was supported (see Table 12).

Table 12

Summary Hierarchical Regression Analysis with Occupation Predicting Thinking Style.

Variable	β	R	ΔR^2	Sig. F Change
Step 1				
Age	.13			
Sex	.17			
Major	-.30			
Arts Exposure	-.07			
Block		.35	.13	.01
<hr/>				
Step 2				
Occupation	-.03			
Block		.36	.00	.78
Total R^2			.13	

Analysis for Testing H0₅

H0₅ stated there is no relationship between levels of arts engagement and thinking style, after controlling for age, sex, academic major, and occupation. The researcher was unable to reject the null hypothesis. First, a correlation analysis was conducted to test the relation between arts engagement and thinking style (see Table 4). The resulting correlation coefficient indicated there was no significant correlation between arts

engagement and thinking style ($r = .03, p > .05$). One-way ANOVA analysis $F(5, 95) = 2.74, p = .26$ further suggested no significant link between the variables.

To formally test the hypothesis, a hierarchical regression was run where the demographic variables were entered first as a block, which explained 12.0% of the variance ($p = .01$) in thinking style. Arts exposure was entered as the second block, explaining another 1% of the variance (13.0% overall), but did not attain statistical significance ($p = .52$); thus, the fifth null hypothesis was supported (see Table 13).

Table 13

Summary Hierarchical Regression Analysis with Levels of Arts Exposure Predicting Thinking Style.

Variable	β	R	ΔR^2	Sig. F Change
Step 1				
Age	.14			
Sex	.16			
Major	-.28			
Occupation	-.03			
Block		.35	.12	.01
Step 2				
Arts Exposure	-.07			
Block		.36	.01	.52
Total R^2			.13	

Summary

The means analyses at the descriptive level revealed that women, those in the 60 or older age group, Humanities majors, and those who worked in education tended to have more balanced thinking styles. The correlations results indicated that there was a statistically significant relationship between thinking style and sex and academic major. Finally, the hierarchical regression results suggested that after controlling for select demographic variables, only being a Humanities major uniquely predicted significant variance in thinking style. Chapter 5 discusses the results and implications of these findings for research, theory, and practice.

CHAPTER V

DISCUSSION

Chapter 5 provides a brief summary of the study, followed by a discussion of the results. Implications for theory, research, and practice are offered followed by limitations of the study.

Summary of the Study

With evidence that arts engagement and nonlinear thinking style both utilize insight, intuition, and emotion in the decision making process (Dorn, 1999; Eisner, 2002; Groves et al., 2008; Vance et al., 2007b), the literature led the researcher to investigate whether there was a relationship between levels of arts engagement and thinking style preference. The overall objectives of this research were to: (a) explore the prevalence of linear, nonlinear, or balanced linear/nonlinear thinking style of professionals working in museums, (b) explore whether thinking style has a relationship with (i) age; (ii) sex; (iii) academic major; (iv) occupation; and, (v) levels of arts engagement.

Two theoretical frameworks underpinned this study: (a) new literacies (Coiro et al., 2008; Leu et al., 2004), and (b) cognitive styles (Gardner et al., 1959; Gardner et al., 1960; Groves et al., 2008; Messick & Ross, 1962; Vance et al. 2007b; Witkin et al., 1977). Five research hypotheses were tested to examine these questions:

H01: There is no relationship between sex and thinking style when controlling for age, academic major, occupation, and levels of arts engagement as measured by the LNTSP and Levels of Arts Engagement survey.

H0₂: There is no relationship between age and thinking style when controlling for sex, academic major, occupation, and levels of arts engagement as measured by the LNTSP and Levels of Arts Engagement survey.

H0₃: There is no relationship between academic major and thinking style when controlling for sex, age, occupation, and levels of arts engagement as measured by the LNTSP and Levels of Arts Engagement survey.

H0₄: There is no relationship between occupation and thinking style when controlling for age, sex, academic major, and levels of arts engagement as measured by the LNTSP and Levels of Arts Engagement survey

H0₅: There is no relationship between levels of arts engagement and thinking style when controlling for age, sex, academic major, and occupation as measured by the LNTSP and Levels of Arts Engagement survey.

A Web-based self-report survey instrument was used to investigate the relation among the variables of interest. Existing literature was used to provide a foundation for the study and guide the research. Correlational and hierarchical regression analyses were used to test the hypothesized models and examine the hypotheses.

Discussion of the Results

Guided by theory and research, the following section discusses the results of each hypothesis that was tested. Preliminarily, the data suggests some statistically significant correlations among the research variables. Correlational analysis did support associations between thinking style and sex, thinking style and academic major, thinking style and occupation, academic major and sex, occupation and sex, and academic major and levels of arts engagement. Results of this study using hierarchical regression analysis did not

support null hypothesis three only; thus, being a Humanities major was the only significant unique predictor of thinking style beyond the demographic control variables.

The lack of significant findings of a relationship between thinking style and age did not correspond to existing research that supports a correlation (Dror, Katona, & Mungur, 1998). Furthermore, a relationship between thinking style and levels of arts engagement was not found during correlational or regression analysis.

The researcher expected the response requirements of the Web-based self-report survey instrument to decrease the likelihood of incorrect and or missing data (Lyons, Cude, Lawrence, & Gutter, 2005; Skitka & Sargis, 2006; Wright, 2005; Yun & Trumbo, 2000; Zhang, 1999), which should have resulted in making the response set more reliable and valid. Instead, the researcher found that over 50% of the respondents did not respond correctly, thus resulting in invalid responses. This resulted in dropping 52.1% ($N = 110$) of the total 211 surveys that were submitted. These cases were dropped from the study because the information was no longer valid and would have skewed the rest of the data set. Eliminating these cases allowed for simplicity and comparability of all variables across analyses. Disadvantages of eliminating these cases included a reduction of statistical power because of a lower sample number and the possibility of inadvertently introducing bias into the study. One-way ANOVAs and the PCA with varimax rotation of the measure did not find evidence that bias was introduced, however. Still, dropping the data is a limitation of this research and future research should be designed to refine the online thinking styles measure sufficiently to eliminate this issue in the future.

Discussion of H0₁

The first null hypothesis stated there would be no relationship between sex and thinking style when controlling for academic major, occupation, levels of arts engagement, and age. Results suggest a partially supported relation among the variables. The correlation coefficient indicated there was a significant correlation between sex and thinking style with a Pearson correlation of ($r = .19, p < .05$) (see Table 3). One-way ANOVA analysis $F(5,95) = 2.74, p = .055$ marginally suggested that women tended toward having a more balanced thinking style than men. Hierarchical regression was run where the demographic variables were entered first as a block. Sex was entered as the second block, but did not attain statistical significance (see Table 5).

Means analysis, where a score of 1 indicated nonlinear thinking style, a score of 2 indicated a balanced linear/nonlinear thinking style, and a score of 3 indicated nonlinear thinking style also suggested that women ($n = 90, M = 1.77$) tended to have a more balanced thinking style, while men ($n = 11, M = 1.27$) tended to have a more linear thinking style (see Table 4). These findings are consistent with previous research that suggests a relationship between sex and thinking style (Sladek et al., 2010).

Discussion of H0₂

The resulting correlation coefficient indicated there was no significant correlation between age and thinking style with a Pearson correlation of ($r = .09, p > .05$) (see Table 3). In addition, one-way ANOVA analysis $F(5,95) = 2.74, p = .17$ did not support a relation among the variables. Hierarchical regression was run where the demographic variables were entered first as a block and Age was entered as the second block, but did not attain statistical significance (see Table 7). This result contrasts with existing

empirical research that provides evidence that thinking styles have a relation to age (Eshet-Alkalai & Chajut, 2009; Vance et al., 2007b). In 2011, Groves, Vance, and Choi found that years of formal education may contribute to one's versatility in utilizing both linear and nonlinear thinking styles. Other empirical studies also have found a correlation between age and thinking style (Gardner, Scherer, & Tester, 1989).

Means analysis suggested that participants who were in the 60 years and older age group ($n = 7$, $M = 2.14$) tended to have the most balanced linear/nonlinear thinking style, those in the 40 - 49 age group ($n = 23$, $M = 1.78$) tended to have the second most balanced linear/nonlinear thinking style, while participants who were in the 50-59 age group ($n = 12$, $M = 1.58$) tended to have the most linear thinking style (See table 6).

Discussion of H0₃

The third null hypothesis stated there would be no relationship between academic major and thinking style when controlling for occupation, levels of arts engagement, age, and sex. The resulting correlation coefficient indicated there was a significant correlation between academic major and thinking style with a correlation of ($r = -.25$, $p < 0.01$) (see Table 3). One-way ANOVA analysis $F(5,95) = 2.74$, $p = .004$ suggests a significant relation among the variables. A hierarchical regression was run where the demographic variables were entered first as a block and Academic Major (non-humanities was comparison variable) was entered as the second block attaining statistical significance ($p < .01$). This regression revealed that being a Humanities major was the sole unique predictor of thinking style beyond the demographic data (see Table 9). Means analysis suggested that Humanities majors ($n = 23$, $M = 1.9130$) tended to demonstrate the most balanced linear/nonlinear thinking style, those who were arts and architecture majors ($n =$

47, $M = 1.87$) tended to demonstrate the second most balanced linear/nonlinear thinking styles, participants who listed their major as other ($n = 12$, $M = 1.2500$) tended to demonstrate the most linear thinking style, and those who listed business ($n = 6$, $M = 1.3$) as their major tended to demonstrate the second most linear thinking style (see table 8).

Further correlational analysis supported a relationship between academic major and levels of arts engagement ($r = -.25$, $p < 0.01$). This analysis showed that people with higher levels of arts engagement tended to major in arts and architecture ($n = 47$) and the humanities ($n = 23$). Findings are consistent and supportive of previous studies that have shown thinking styles to be associated with academic choices and achievement (Dunn et al., 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997, Sternberg & Zhang, 2001). These findings, although preliminary and tentative, may indicate that preferred thinking styles and personal interests are positively linked. Future research can ascertain to degree to which educators and counselors may use this information to help learners choose appropriate academic options as they are related to personal interests.

Discussion of H0₄

The fourth null hypothesis stated that there would be no relationship between occupation and thinking style when controlling for levels of arts engagement, age, sex, and academic major. The resulting correlation coefficient indicated there was a significant correlation between occupation and thinking style with a correlation of ($r = .17$, $p < .05$) (see Table 3). Further research using one-way ANOVA analysis $F(5,95) = 2.74$, $p = .78$ did not support a significant relation among the variables. Hierarchical regression was run where the demographic variables were entered first as a block and

Occupation was entered as the second block, but did not attain statistical significance (see Table 11).

Means analysis suggested that those who worked in education ($n = 68$, $M = 1.81$) tended to have a balanced linear/nonlinear thinking style, while those who worked as CEO, directors, and administrators ($n = 14$, $M = 1.29$) preferred thinking styles and personal interests a more linear thinking style. Of the preferred nonlinear thinking style respondents ($n = 26$), 76.9% were educators ($n = 20$), while only 3.8% were CEO or administrators ($n = 1$) (see Table 10). These findings are not consistent with previous studies that offer evidence of a person's learning and acquisition style as having a predictive effect on learning and career choices (Dunn et al., 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997; Holland, 1973). In addition, of the preferred linear style respondents ($n = 54$) 61.1% ($n = 33$) were educators while 20.37% ($n = 11$) were CEO or administrators. Of the balanced thinking style respondents ($n = 21$) 71.4% ($n = 15$) were educators, while only 9.5% ($n = 2$) were CEO or administrators. Of the preferred nonlinear thinking style respondents ($n = 26$), 76.9% ($n = 20$) were Educators, while only 3.8% ($n = 1$) were CEO or administrators. These findings can inform future research designed to examine the degree to which being a manager or supervisor is associated with thinking styles (Vance et. al. 2007).

Discussion of H0₅

The fifth null hypothesis stated that there would be a no relationship between levels of arts engagement and thinking style when controlling for age, sex, academic major, and occupation. The resulting correlation coefficient indicated there was no significant correlation between levels of arts engagement and thinking style with a

correlation of ($r = .03, p > .05$) (see Table 3). One-way ANOVA analysis $F(5,95) = 2.74, p = .52$ did not support a relation among the variables. Hierarchical regression was run where the demographic variables were entered first as a block and Arts Exposure was entered as the second block, but did not attain statistical significance (see Table 12).

The researcher has not been able to locate any studies that relate linear, balanced linear/nonlinear, and nonlinear thinking styles to arts engagement. Further research should be designed to examine the possible association between the variables beyond the null results of this study. For example, in future studies measuring arts engagement, a distinction should be made to distinguish between participatory engagement and passive engagement to enrich what we know about the possible links between the variables.

Implications

This research offers theoretical, research, and practical implications for educators, curriculum designers, and researchers. Although some of the results of this study were significant, further research should be conducted by applying different theories.

Implications for Theory

The research literature indicated the possibility that arts instruction over extended periods of time can influence cognitive skills affecting many areas of learning including: creativity, innovation, adaptability, observation skills, evidential reasoning, speculative abilities, and the ability to find multiple solutions to complex problems along with intuition, insight, and emotion (Eisner, 2005; Groves, 2008; Yenawine, 1997). As discussed, many of these skills contribute to nonlinear thinking style. In addition, the literature review outlines the theoretical possibility that engagement in the arts could promote not just nonlinear thinking skills, but digital literacy skills. The researcher offers

theoretical evidence to support this notion. The theoretical evidence is drawn from Eshet-Alkalai and Chajut (2009) who place nonlinear thinking style as an essential skill within the theoretical framework of digital literacy, while Kolb (1984), Sternberg and Zhang (2001), and Allinson and Hayes (1996) place nonlinear thinking style within the theoretical framework of cognitive styles. Further understanding of how the arts offer methods of inquiry, representation, and understanding that are mutually synergistic with other fields of study, such as new literacies and cognitive styles should be explored. Nonlinear thinking and intuitive artistic processes common to the visual arts and visual literacy may be useful to the development of digital literacy skills, although future research is required to determine the degree to which this is so. Eisner's (2002, 2005) concepts of what art can teach relates to the approaches of interrelated forms of nonlinear thinking proposed by Vance et al. (2007b). The interrelation of these theoretical concepts leads to the possibility that engagement in the arts might be able to promote nonlinear thinking style and therefore digital literacy skills. Future research needs to be designed to measure this intriguing possibility. For example, a study where nonlinear thinking style and digital literacy scores could be correlated would be a positive, preliminary step.

Implications for Research

This research project helped identify complexities of using a Web-based self-report survey instrument and the limitations offer valuable lessons to improve sample and instrument design. Findings from this study indicate specifically that the use of point allocation surveys as Web-based self-report surveys do not translate well to this medium and can cause serious problems with instrument validity. Lastly, the researcher developed

a new instrument to measure arts engagement over a lifetime that, after further validation, can be used in the field for other applications.

Implications for Practice

Educators can learn more about learners by making use of the LNTSP and Levels of Arts Engagement instruments. The findings, although tenuous, tend to be consistent with previous studies linking thinking styles to academic choices (humanities in this research) (Dunn et al., 1989; Fischer & Fischer, 1979; Grigorenko & Sternberg, 1997, Sternberg & Zhang, 2001).

Limitations of Study

As is the case for all research, the present study has limitations. The limitations of the study are those characteristics of design or methodology that constrain generalizability and utility of findings. The researcher concludes that the sample population was too homogeneous to disprove null H_2 and null H_5 . The resulting respondents to the Web-based self-report survey were 90% female ($n = 90$) and 67% ($n = 67$) working in education. This sample does not represent the hoped for goal of achieving a sufficiently diverse sex and occupational groups from the museum field and therefore future research attempts should be made to achieve a truly diverse and representative sample.

The second limitation concerns nonbiased participation. Sometimes, in survey sampling, individuals chosen for the sample are unwilling or unable to participate in the survey. Nonresponse bias is the bias that results when respondents differ in meaningful ways from nonrespondents (Groves, 2006). The study did not control for nonresponse bias. The occupation characteristics of nonrespondents might have unknowingly

introduced bias into the study's data collection and analysis. For example, a director might have more time and access to a computer to complete the survey as opposed to a maintenance worker or frontline staff member and thus, might have affected diversity of the sample. Future research should be designed that address nonresponse issues. For instance, a study that enables the researcher to compare the respondents and nonrespondents on the research variables for evidence of differences would be very useful.

The third limitation was self-selection bias as a result of voluntary response samples that the researcher collected. Voluntary response samples often oversample people who have strong opinions and under sample people who don't care much about the topic of the survey. This creates bias and thus inferences from a voluntary response sample may not be as trustworthy as conclusions based on a random sample (Ziliak & McCloskey, 2008). This is reflected in the overwhelming response from educators and the underwhelming response from other professions within museums.

Lastly, the research encountered threats of internal validity from testing effects (Brewer, 2000). This refers to factors associated with the measuring devices that cause change or inaccuracies to occur. The Web-based self-report survey that was used for the research was complex and caused many participants to fill out the survey incorrectly by not using the correct paired-item point allocations. This possible limitation should have been pointed out by the instrument's author to avoid problems for future researchers employing the instrument. As a result, the researcher lost 52% ($N = 110$) of the sample causing the findings to be less generalizable. For future study, the researcher strongly recommends a newly designed survey that avoids the point allocation complexity while

not taking away from the instrument's validity. The researcher also recommends the possibility of using question logic and that would not allow a participant to move forward in the survey if they have allocated the incorrect point allocation.

Recommendations

The researcher recommends for future study in measuring arts engagement that a distinction be made between participatory engagement and passive engagement to achieve more nuanced data. For future study, the researcher recommends a revised design for the LNSTP survey that avoids the point allocation complexity, while not taking away from the instruments validity. The researcher has not been able to locate any studies that relate linear, balanced linear/nonlinear, and nonlinear thinking styles to levels of arts engagement. Further research is suggested to explore these possible relationships.

The researcher makes the recommendation for the refinement of a digital literacy model that includes nonlinear thinking style and visual literacy as core skills. Future research in the field of digital literacy should include the development of a consensual definition, theoretical framework, and terminology framework through an initial validation study. Additionally, The literature review makes a case for the future development of digital literacy frameworks and definitions that should consider three strands: techno-procedural, cognitive, and socio-emotional skills. These strands help design an integrated holistic view of digital literacy rather than an approach that is fragmented and limited.

Summary

Using a web-based survey, the researcher found preliminary associations between thinking style, sex and academic major. The thinking style measure used was problematic in the sense that the directions were confusing, resulting in loss of over half the data. Analyses did not reveal significant differences between the group that completed the measure correctly versus those who did. Still, although deleting this data because of the measure itself was a limitation, new knowledge was gained as to how to strengthen a pilot study and thereby future research employing web-based surveys.

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APPENDIX A

Thinking Style Survey

Part I (PLEASE READ INSTRUCTIONS CAREFULLY!): The following pairs of statements describe alternative decision-making styles. For each pair of statements, allocate **EXACTLY 3 POINTS TOTAL** between the alternatives to show how frequently you behave as described, using this scoring key:

- 3 = very often**
2 = moderately often
1 = occasionally
0 = rarely or never

Example:

- A. 2 I prefer to make important decisions on my own.
 B. 1 I prefer to rely on advice from experts when making important decisions

1A.	<u> </u>	I primarily rely on logic when making career decisions.
1B.	<u> </u>	I primarily rely on my feelings when making career decisions.
2A.	<u> </u>	I primarily weigh quantitative factors (such as my age, budget needs, and future earnings) when making a decision about investing.
2B.	<u> </u>	I primarily weigh qualitative factors (such as my gut feelings, or a sense that the decision is right for me) when making a decision about a large purchase or investment
3A.	<u> </u>	When my analysis and intuition are in conflict, I give precedence to my intuitive insights.
3B.	<u> </u>	When my analysis and intuition are in conflict, I give precedence to my analytical reasoning.
4A.	<u> </u>	The most important factor in making a life-altering change (such as a career change) is feeling it is right for me.
4B.	<u> </u>	The most important factor in making a life-altering change (such as a career change) is knowing that the change is based on objective, verifiable facts.
5A.	<u> </u>	When making important decisions, I pay close attention when I experience a “knowing in my bones,” chills, tingling or other physical sensations.
5B.	<u> </u>	When making important decisions, I pay close attention when a number of people with relevant and well-justified expertise give me the same advice.

APPENDIX A (part II)

Part II: The following words or phrases describe alternative decision making input. **EXACTLY 3 POINTS TOTAL** between the alternatives to show how frequently you behave as described, using this scoring key **EXACTLY 3 POINTS TOTAL** between the alternatives to show how frequently you behave as described, using this scoring key:

3 = very strong influence on how I behave

2 = strong influence on how I behave

1 = moderate influence on how I behave

0 = little or no influence on how I behave

Example:

A. 0 Theory

B. 3 Practice

6.A. ____ Instincts	7.A. ____ Empathy
6.B. ____ Concepts	7.B. ____ Rationality
8.A. ____ Felt Sense	9.A. ____ Inner Knowing
8.B. ____ Reason	9.B. ____ Logic
10.A. ____ Feelings	11.A. ____ Heartfelt
10.B. ____ Facts	11.B. ____ Proof
12.A. ____ Hunch	13.A. ____ Deduction
12.B. ____ Data	13.B. ____ Intuition

APPENDIX B
Levels of Arts Engagement Survey

I have created art (music, visual, graphic, theater, dance, etc.) as a child under 18

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I have taken arts (music, visual, graphic, theater, dance, etc.) classes in high school

(0) none (1) one (2) two (3) three or more

I have taken arts (music, visual, art history, graphic, theater, dance, etc.) classes in college

(0) none (1) one (2) two (3) three or more

I visited arts (music, visual, theater, dance, history, etc.) institutions on my own or with my family when I was 18 years old or younger

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I currently visit arts (music, visual, theater, etc.) institutions

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I follow blogs and publications about the arts (music, visual, graphic, theater, dance, etc.)

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I use TV, radio, or the Internet to access the arts (music, visual, graphic, theater, dance, etc.)

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I currently create or share art (music, visual, graphic, theater, dance, etc.) through various activities

(0) rarely or never (1) occasionally (2) moderately often (3) very often

I currently attend arts (music, visual, graphic, theater, dance, etc.) events

(0) rarely or never (1) occasionally (2) moderately often (3) very often

When I visit other places, I visit the local arts (music, visual, graphic, theater, dance, history, etc.) institutions

(0) rarely or never (1) occasionally (2) moderately often (3) very often

APPENDIX B (Part II)
Levels of Arts Engagement

Engagement with the Arts (museums, fine art, music, theater, dance, etc.) is (please check one):

(1) not a defining and vital part of my life. (2) nice, but I don't feel it's vital to participate.

(3) is a defining and vital part of my life.

**A score of 0-11 = passive participant, 12-22 = participants, 23-33 = committed participants and enthusiasts.*

APPENDIX C

Demographic Characteristics

Age

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

Sex

- Male, Female

Academic Major

- Architecture + The Arts (architecture, interior design, art history, advertising, architecture, art, crafts, design, fashion, film, music, performing arts, publishing, R&D, software, toys and games, TV and radio, and video games)
- Business (accounting, business admin)
- Education (teaching, education admin)
- Engineering and Computing (IT, programming, mechanical engineering)
- Humanities (ancient and modern languages, literature, philosophy, religion, history, anthropology, area studies, communication studies, cultural studies, linguistics)
- Law
- Medicine (doctor)
- Nursing & Health Sciences (nursing, physical therapy)
- Hospitality (tourism, restaurant & hotel management)
- Journalism and Mass Communication (television, Internet, video)
- Health and Social Work
- Other

Museum Occupation

- Accounting/Finance
- Administrative/Clerical/Support
- Curator
- Assistant/Deputy/Associate Director
- Chief Operating Officer
- Conservation
- Development/Membership
- Directors/Administrators
- Education
- Exhibitions
- Facility/Operations
- Internships/Fellowships
- Public Relations/Marketing
- Publications
- Registrar/Collections Management
- Security
- Visitor Services/Customer Service
- Miscellaneous

APPENDIX D
Data Scoring Sheet

Survey Number:

Age:

Thinking Style:

Academic Major:

Levels of Arts Engagement:

Occupation:

Sex:

Thinking Style Survey Scoring Sheet

Column 1

Column 2

1A ____

1B ____

2A ____

2B ____

3B ____

3A ____

4B ____

4A ____

5B ____

5A ____

6B ____

6A ____

7B ____

7A ____

8B ____

8A ____

9B ____

9A ____

10B ____

10A ____

11B ____

11A ____

12B ____

12A ____

13A ____

13B ____

Total Col. 1 ____ Total Col. 2 ____

Total Column 1 subtract Total Column 2 = ____ (Final Score)

** Column 1 deals with linear and column 2 nonlinear. The more negative the total score, the more nonlinear, and the more positive the total score, the more linear. A quite balanced total score would likely be between -3 to +3.*

Levels of Arts Engagement

1.

7.

2.

8.

3.

9.

4.

10.

5.

11.

6.

Total Score adding all items together:

**A score of 0-11 = passive participant, 12-22 = participants, 23-33 = committed participants.*

VITAE

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- 1994 B.F.A., School of Visual Arts, New York, New York
- 1997 M.A., Art Education, NYU, New York, New York
- 2009-2015 Doctoral Candidate, FIU, Miami , Florida

PUBLICATIONS & PRESENTATIONS

- Osterman, M. (2013) Digital literacy: A demand for nonlinear thinking styles. In M. S. Plakhotnik & S. M. Nielsen (Eds.), *Proceedings of the 12th Annual South Florida Education Research Conference* (pp. 149-154). Miami: Florida International University. Retrieved from <http://digitalcommons.fiu.edu/cgi/viewcontent.cgi?article=1321&context=sferc>
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Education Division: Google+Hangouts 2014

Supporting Change: The Docents Role, National Docent Symposium, San Francisco, CA
2013

Digital Literacy: A Demand for Nonlinear Thinking Styles, South Florida Education
Research Conference, Miami, FL 2013

A Model for the Field. Florida Association of Museums Annual Conference, Tallahassee,
FL 2012

Digital Literacy: Definition, Theoretical Frameworks, and Competencies. College of
Education and Graduate Student Network Research Conference, Miami, FL 2012

Digital Literacy – Definitions and Frameworks. Cultural Educators of Miami, FL 2011

The Use of Tweets in Formal and Informal Educational Settings. E-Learn 2010--World
Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education,
Orlando, FL 2010

Media Literacy and Museum Education. University of Miami, Guest Speaker, Miami, FL
2010

21st Century Museum and School Partnerships: What Museums Need to Know, AAM
Webinar 2010

Arts Integrated PD Strategies. FAAE Arts Integrated Symposium, West Palm Beach FL,
2010

Professional Development Strategies. NAEA National Conference, Minneapolis, MN
2009

Museum Magnet Schools: Works in Progress. NAEA National Conference, Minneapolis,
MN 2009

Visual Thinking Strategies. Gallery Praxis, University of Florida, Sarasota, FL 2007