Problem-Solving Styles in the Southeast Construction Industry

by

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Abstract

The construction industry has undergone significant changes in recent decades: new project delivery methods, cyber-trek projects, increased complexity of buildings and systems, increased prefabrication, advancing technology and new types of teams and organizations (Brandt, 1993; Farrow & Mouton, 2010; Spence, 2006; Sznewajs & Moore, 2013). At the same time, education and training of construction employees to meet these demands has been evolving. Special efforts have been made to identify key skills and attributes the builder of today must have. One of these key skills is the ability to be an effective problem solver within the construction industry (Ahn, Pearce, & Kwon, 2012; Wiezel & Badger, 2015). Little is known about problem solving within the context of construction education.

This descriptive study seeks to examine the problem-solving styles of construction professionals in an effort to expand the available literature on problem solving within the built environment ($N = 151$). By knowing more about the preferred problem-solving styles, construction education and training may be improved to enhance personal learning and group performance in teams.

The VIEW: An Assessment of Problem-Solving Style was utilized in this study. The VIEW assessment measures one's preferred problem-solving style preferences on three dimensions: Orientation to Change (OC), Manner of Processing (MP), and Ways of Deciding (WD) (Selby, Treffinger, & Isaksen, 2002) . One-way analysis of variance

(ANOVA) and cross tabulations were used in an analysis of the data. Construction professionals tended to prefer a Developer style in the OC dimension and a Task style in the WD dimension at a stronger level than the larger population. Independent variables of job description, years of experience, time of project engagement, and level of education were also examined. Significant differences were found on the MP and WD dimensions based on the time of project engagement. No other significant differences were found.

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List of Abbreviations

ACCE	American Council for Construction Education
AGC	Associated General Contractors of America, Inc.
AIA	American Institute of Architects, Inc.
ASC	Associated Schools of Construction
CM	Construction Management
MP	Manner of Processing
NV	Preference for Novelty
OC	Orientation to Change
SA	Structure and Authority
SPSS®	Statistical Package for Social Sciences
SS	Search Strategy
WD	Ways of Deciding

Chapter 1. INTRODUCTION

The U.S. construction industry represents a critical piece of the nation's economy contributing approximately $1 trillion dollars to the economy each year ("U.S. Census Bureau," 2014). This value represents approximately 7% of Gross National Product ("U.S. Gross National Product," 2014). The U.S. Bureau of Labor Statistics reports 6 million people employed in the construction industry as of September of 2015 ("About the construction sector," 2015).

Gains in construction productivity have not increased and may have decreased since 1964 according to some sources (Melnick, 2007). Since the 1960s, the construction industry has evolved into a complex industry with multiple delivery methods, highly complex buildings, and highly technical approaches to construction. Global competitiveness and regulatory requirements have increased, and the overall workforce is aging. Experts have developed in fields ranging from sustainability to building information modeling that did not exist in previous industry models. Complex teams of construction professionals are assembled for larger projects replacing the master builder referenced in previous generations. Construction managers are commonly involved in projects from inception of the project through the life cycle of the building. In this environment, problem solving is critical to success. Such problem solving occurs both on an individual basis and in groups on construction projects. Little research in construction education has been devoted to how problems are solved or the styles individuals use in solving problems.

Gagne (1992) wrote, “The central point of education is to teach people to think, to use their rational powers, to become better problem solvers” (p. 82). Almost everyone in a professional context regularly solves problems. Jonassen (2000) stated, “Problem solving is generally regarded as the most important cognitive activity in everyday and professional context” (p. 63). With changes in work scope and technology in industry coupled with psychological research, Woolfolk (2004) encouraged increased teaching of problem-solving skills. Practitioners also recognize the need for strong problem solvers for innovation and creativity in industry. Most construction managers will tell you that they spend much of their day solving problems and making decisions, both individually and in groups (Ahn et al., 2012; Wiezel & Badger, 2015).

In a recent study surveying 100 recruiters of construction employees in the Eastern U.S., problem solving ranked second only to ethical issues as one of the key competencies necessary for construction management graduates (Ahn et al., 2012). The study further indicated that the construction industry seeks graduates who are responsible, creative, and critical (Ahn et al., 2012). Recently, a simulated game exercise engaged 338 construction professionals to determine the key success factors of future project managers. One of the major success factors identified was cognitive competencies that involve learning from, making sense of, and disseminating information effectively (Wiezel & Badger, 2015).

The American Council for Construction Education developed a new set of accreditation guidelines for construction education (American Council for Construction Education, n.d.). These guidelines were developed based only on what students should be able to do upon graduation and were published as a set of twenty learning outcomes (as opposed to prescriptive metrics). Essentially mimicking the current approach in business of total quality management, the guidelines centered on the knowledge and abilities the student should have at graduation. Little or no discussion focused on the problem-solving ability of the student. None of the twenty outcomes referenced cognitive ability or problem-solving skills specifically. Given the complex environment in which construction employees must operate, such an approach may not be sufficient for the construction manager of tomorrow.

In construction, companies are constantly challenged to leverage creative strengths to meet customer demands. Organizations benefit when a connection is made between individuals and the environment in which they are engaged (Chatman, 1989; Kristof, 1996). Such a connection is necessary in today's construction environment where innovation is required, and change is frequent. Improved understanding of personal problem-solving styles could help the construction industry identify problem-solving methods and tools that promote better communication and teamwork. Greater understanding within the industry on the various problem-solving styles could also improve diversity in the industry as companies develop teams with a variety of problem-solving styles for a complex workplace.

There are different styles that individuals use in solving problems. Treffinger and Selby define problem-solving styles as "consistent individual differences in the ways people prefer to plan and carry out generating and focusing, in order to gain clarity, produce ideas, or prepare for action when solving problems or managing change"(Selby et al., 2002, p. 1). Essentially, one's own style of problem solving helps identify the role that person can play in managing change and innovating.

Problem solving can be viewed as a subset of learning styles. One's learning style is the approach that student uses to focus on, interpret, and recall academic information. "Learning style consists of distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates" (Gregorc, 1979, p. 234). Gregorc's approach stated that students learn through either a concrete or abstract experience in either a random or sequential way.

Problem solving directly relates to one's cognitive style or the way one prefers to order and convert information. Cognitive styles "are conceptualized as stable attitudes, preferences, or habitual strategies that determine a person's typical modes of perceiving, remembering, thinking and problem solving" (Messick, 1976, p. 5). Every learner has preferred ways or cognitive styles of "perception, organization, and retention that are distinctive and consistent" (Keefe, 1987, p. 7).

These cognitive styles are manifest in the work place in a variety of ways including problem solving. Individuals have specific preferred ways of solving problems. A specific approach to measure one's problem-solving style is the VIEW Assessment. Written to assess three dimensions of style preference, VIEW measures one's Orientation to Change, Manner of Processing and Ways of Deciding (Treffinger & Selby, 2004). The Orientation to Change classifies one as tending toward explorer or developer. An explorer prefers to consider new possibilities and where they may lead. A developer takes the basic elements of an idea or plan and brings that item to fulfillment. The Manner of Processing identifies one as tending toward either external or internal. Those with external tendencies appreciate working with others throughout the process of problem solving. Those with internal tendencies prefer to work alone before sharing ideas. The Ways of Deciding addresses the major emphasis placed on people or tasks by the problem solver. Those with a people preference tend to focus on the impact of choices on the people the item will affect. Those with a task preference tend to make choices that are logical and sensible but could be perceived as impersonal.

If a connection could be established between the approaches used to solve problems in industry, the educational strategies could be altered to teach problem solving in construction management. This may include creating or modifying curricula and instruction that allows all problem-solving styles to participate in learning and growth in the construction industry.

Statement of the Problem

The construction industry is evolving rapidly, and there is an established need for problem solvers. In construction education at the University level, no clear link exists between curricula, educational practices, and problem solving, and current accreditation guidelines do not address problem solving as an outcome of the educational process. Once a problem such as this is identified in construction education, it is typical to first seek industry input as a source of information to help guide and direct our educational approach and curricula. In addition, the limited number of studies in this area indicates a need for further research in correlating problem-solving styles with jobs in industry. Thus, a study on the problem-solving styles used by construction professionals was deemed timely. If common problem-solving styles used by professionals in the industry could be more clearly defined, construction education could possibly be restructured to improve problem solving. More specifically, construction management students could be exposed to problem-solving styles within a construction context to prepare them for the challenges of the profession and make them aware of the risks and limitations associated with their individual style.

Purpose of the Study

The purpose of the study was to determine if certain problem-solving styles are more dominant among specific job categories, experience levels, educational experience, and time of project engagement in the Southeast construction industry than are other problem-solving styles.

Research Questions

The following research questions were used in this study:

1. What are the dominant problem-solving styles of employees in the Southeast construction industry?
2. What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry?
3. What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry?
4. What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry?
5. What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Significance of the Study

While much of construction management education is focused on pre-planning and active management, much of one’s success in the industry will be determined by how well one solves problems on a daily basis. Problems that develop in construction are often tied to dollar values or time - both of which are direct influences of job performance for a contractor. In education, we teach problem solving in indirect ways. Essentially, instructors allow problem solving to develop naturally from the educational experience or field experience on the job. Few attempts to target problem solving as a curriculum goal are made, and those that are made are seldom measured. If problem-solving styles used in the Southeast Construction Industry could be better-understood or prioritized, construction education could begin to address the gap between the needed competency of problem solver and the lack of focus in construction education today. The research may also help human resource professionals better understand various problem-solving styles and how they may impact today's construction teams.

Assumptions of the Study

Several assumptions were made prior to the study. First, VIEW was a valid instrument to examine the problem-solving styles of those working in the Southeast construction industry. Second, it is possible that the recollection of how problems were solved by individuals may be incomplete. It is also feasible that some people may be reluctant to respond honestly to the questions asked. Finally, it is assumed that employees of various companies will exhibit similar problem-solving styles.

Limitations/Delimiters of the Study

A delimitation of this study is that the unit of analysis will be confined to three employee classifications within Southeast construction companies. The organizational structures, the scope of job responsibilities, and the number of departments that occur in construction companies vary. It is anticipated that problem-solving styles will be directly connected to the context in which the problem occurs. Another delimitation to this quasi-experimental design is that only construction companies with yearly revenue exceeding $10 million in the Southeast U.S. were included in the study. In addition to the revenue minimum, this study targets construction companies in commercial applications essentially excluding other type of constructors such as residential or highway builders. This approach was done to focus on larger firms with projects of similar nature and individuals who are more likely to have formal training and deeper experience in the industry.

From a limitations view, participation in the study was voluntary. Only 151 construction personnel were surveyed, so the results of the survey may not be generalized to the larger population. Finally, the instrument used in the study is a self-reported measure.

Definitions of Terms

1. Developer – "an individual who brings tasks (which might be ideas, problem statements, action plans, products, or programs) to fulfillment, who begins with the basic elements or ingredients and then organizes, synthesizes, refines, and enhances them, forming or shaping them into a more complete, functional, useful condition or outcome" (Treffinger & Selby, 2004)
2. Explorer – "an individual who thrives on venturing in uncharted directions or seeks to break new ground and follow possibilities wherever they might lead" (Treffinger & Selby, 2004)
3. External Processor – one who prefers to work with others during the problem-solving process

4. Interdisciplinary - Involving more than one discipline in the built environment that may include owners, architects, contractors, engineers, and various special trades.
5. Internal Processor – one who prefers to work alone during the problem-solving process
6. Open-ended problem - Question that cannot be answered "yes" or "no" or "don't know".
7. Person style – focus on the people while deciding the solution to a problem
8. Problem - "A situation that may present a challenge or offer an opportunity" (Treffinger, Selby, & Isaksen, 2008)
9. Problem-solving style – "Consistent individual differences in the ways people prefer to plan and carry out generating and focusing, in order to gain clarity, produce ideas, or prepare for action when solving problems or managing change" (Selby et al., 2002)
10. Task Style – focus on the "logical, sensible" choices and decisions that can "be justified objectively" (Treffinger & Selby, 2004)

Organization of the Study

Chapter 1 introduces the study, the problem, its purpose, research questions, significance, assumptions, limitations/delimitations, and definitions of terms. Chapter 2 consists of a literature review of problem-solving styles and of problem solving within the construction context. It addresses the historical approach to problem-solving styles, previous research, and style instruments. Chapter 3 addresses the procedures, data collection, and data analysis of the research. It includes the design of the study, research questions, reliability, validity, population sample, data collection, and data analysis. Chapter 4 details the results of the study and provides the demographic characteristics of those studied along with analytical and statistical values. Chapter 5 concludes the dissertation with a summary, conclusions, and recommendations for further research.

Chapter 2. LITERATURE REVIEW

Introduction

The first chapter described the purpose, statement of the problem, research questions, definitions of terms, significance, limitations, assumptions, and organization of the study. The second chapter - literature review - addresses the differences in problem solving and problem-solving styles; how styles relate to adult education; research on creativity as a basis for problem-solving styles; the basis of problem-solving styles; common problem-solving styles inventories and their uses; an overview of the evolution of the construction industry from master builder to a complex array of participants; insight into the requirements of construction education related to problem-solving styles; consideration for the skills and attributes needed of future construction managers; and an overview of industry demographics.

Many educators recognize that each person prefers different styles of learning and solving problems (Basudur, Graen, & Wakabayashi, 1990; Kirton, 1994; G. J. Puccio, 2001; Treffinger et al., 2008). Problem-solving styles group common ways that people solve problems (Selby et al., 2002). Everyone has a mix of problem-solving styles. Some have dominant styles; others may identify that their problem-solving style depends on the circumstances present. There is no correct problem-solving style, and one can develop abilities in less dominant styles.

Creativity and problem solving are closely linked (Treffinger et al., 2008). Multiple facts influence one's creative or problem-solving ability. Style specifically addresses how one prefers to perceive, react, and respond to a given problem (Selby et al., 2002). Other factors include the context of the problem, skills and abilities of the problem solver, the specific task, the motivations and rewards present, and how others interact with the problem. Style is particularly important when one considers how one solves complex, open-ended problems, and changing situations (Treffinger & Selby, 2004).

Previous research has indicated that one's problem-solving style is a key component of leadership (Frisch, 2009). Puccio stated this more broadly:

> From an applied perspective, the goal is to help people become aware of their problem solving preferences so they can better understand their strengths and weaknesses when solving problems creatively. This knowledge may help people to more skillfully solve open-ended problems by recognizing their natural tendencies and to use Creative Problem Solving strategies to strengthen less developed skills (G. J. Puccio, 2001, p. 172).

Buffington, Jablokow, and Martin (2002) stated that an appreciation of different problem solving perspectives led their research participants to "powerful insights in their thinking" (p. 32).

Construction has evolved substantially over the past 200 years from skilled artisans and craftspeople to highly educated and individualized professions (Franks, Reyes, & Pittenger, 2015). Diverse teams are required to assemble today's complex project, and problem solving is a key competency required for success (Ahn et al., 2012; Wiezel & Badger, 2015). With the increasing complexity of the construction management profession, problem-solving style may influence individuals, teams, and organizations in the years ahead. Organizations may align similar or different styles on workforce teams; demands of specific positions may be compared with individual preferences; and improved awareness of styles of other team members may improve team performance (Frisch, 2009; Selby, Treffinger, & Isaksen, 2014). This dissertation attempts to address the connection of problem-solving styles in the construction management industry (see Figure 1).

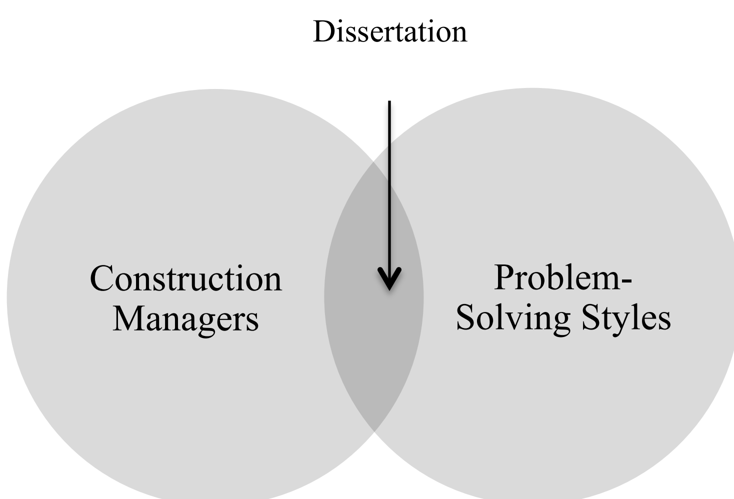

Figure 1

Intersection of Construction Managers and their Problem-Solving Styles

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5. What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Differentiation of Problem Solving and Problem-Solving Style

"A problem represents a gap between where we are or what we have, and a desired location or outcome" (Treffinger et al., 2008, p. 1). In a study that considered the difference in problem solving and decision making using the Myers-Briggs Type Indicator, problem solving was further defined: "Problem solving is a process in which we perceive and resolve a gap between a present situation and a desired goal, with the path to the goal blocked by known or unknown obstacles" (Huitt, 1992, p. 33). Other researchers have moved beyond the definition and considered the characteristics of complex problems in practice (Funke & Frensch, 1995). These characteristics include: novel to the individual, multifaceted obstacles impeding goal attainment, dynamic changes during the problem solving process, and the limited ability to monitor progress towards goal attainment due to uncertainty of the given situation (Funke & Frensch, 1995).

Problem solving is then the behavior in which we engage to obtain an outcome that is desired. In construction, problem solving is typically associated with achieving a goal or milestone or perhaps simply answering a question (Schultz, 2012). Often, this involves a unique project novel to the company and individual, multifaceted obstacles or competing objectives, and dynamic changes during the construction process. In all cases, problem solving seems to address closing a gap between current reality and the place or goal that one would like to obtain (Treffinger et al., 2008).

Problem-solving style is defined as "consistent individual differences in the ways people prefer to generate and focus, in order to gain clarity, produce ideas, and prepare for action when solving problems or managing change" (Selby et al., 2002, p. 1) . This definition has several implications critical for this research. These consistent differences are viewed as stable over time but do vary from person to person. The definition also uses the term prefer which implies a behavior that is liked over another behavior as opposed to actual behavior.

The Role of Style in Adult Education

Just as there is no single approach to how humans solve problems, there is no single factor that ensures a successful adult education program. Malcolm Knowles (1980) defined andragogy as "the art and science of helping adults learn", and this concept clearly differentiates the adult learner as autonomous, free, and growth-oriented.

Adults seek learning opportunities that are meaningful and directly applicable to their lives and the problems they face (Beebe, Mottet, & Roach, 2014). Knowledge conveyed must be practical where adults focus on the underlying reason for learning (Lawler, 1993). For example, students who work on prison reform would be connected and engaged with how education may reduce recidivism in prisons. Concepts discussed and identified in the classroom are learned best when those ideas are directly applicable to their lives outside of class.

Adult learners often have extensive experience and practical knowledge that they bring to the classroom (Beebe et al., 2014; Kolb & Fry, 1975; Vygotsky, 1978). These life experiences are varied and complex and add to the diversity inherent in an adult education setting. They desire to use this experience in the context of the class, and instructors should allow these experiences to shape the learning experience (Caine & Caine, 1991). Such context includes the preferred styles of the adult learner including learning styles and problem-solving styles.

> For learners to be successful, it is imperative that instructors allow learners to march to their own beat while valuing their individuality and encouraging them both to understand and utilize their unique learning-style patterns, so they will flourish as learners in a multitude of learning environments (James & Maher, 2004, p. 137).

Houle (1964) supported an individualistic learning process. By knowing one's learning strengths (styles), Houle recognized that adult learning could be a powerful vehicle for personal growth.

Creativity as a Basis for Problem-Solving Style

The definition of creativity has historically been obtuse since it is such an abstract concept (Isaksen, Dorval, & Treffinger, 2011). One of the original researchers in the area of creativity defined it as “the abilities that are most characteristic of creative people” (Guilford, 1950, p. 444). In late 1980s, Gryskiewicz (1987) interviewed over 400 managers in business and defined creativity as “novel associations that are useful” (p. 305). Recent research has attempted to clarify the definition of creativity. “Creativity involves the development of a novel product, idea, or problem solution that is of value to the individual and/or the larger social group.” (Hennessey & Amabile, 2010, p. 572) These same authors formally defined creativity as “the generation of products that are both novel and appropriate” (Hennessey & Amabile, 2010, p. 570).

In education, Benjamin Bloom’s original taxonomy of learning objectives has historically been used to distinguish the levels of cognition in students. The taxonomy organized thinking skills from lower order to higher order thinking (Engelhart, Furst, Hill, & Krathwohl, 1956). As students mastered a given subject, they were challenged to advance from lower orders of thinking to higher orders of mastery. Changes were made to Bloom’s taxonomy beginning in the 1990s (Anderson, Krathwohl, & Bloom, 2001). One change was the shift from nouns to verbs to indicate action at each level. The other critical change was that “creativity” was added as the highest form of thinking (“Bloom’s taxonomy,” 2008). These changes reflect that learning is active. Since the introduction of the new Bloom’s taxonomy, there has been a shift where teachers have more actively encouraged students to develop their creative abilities (Price-Mitchell, 2015).

Hennessey and Amabile believed that creativity is “one of the key factors that drives civilization forward” (Hennessey & Amabile, 2010, p. 570) . Early interest in creativity focused on the natural approaches those individuals considered creative took in solving problems (Crawford, 1937; Spearman, 1931).

Osborn (1952) outlined a seven-step creative problem-solving process for solving problems. Based on his background of advertising, his research was considered groundbreaking since earlier researchers believed that not all people could be creative. "No matter how feeble or infrequent", all individuals are creative (Guilford, 1950, p. 446). Later research continued to confirm this stating "creativity exists in all people at different levels and in various styles" (Isaksen et al., 2011, p. 4).

Although all have creativity, individuals have different levels and styles of creativity (Kirton, 2003). By "understanding your personal creativity, and the creativity of those around you", one will be more "successful in deliberately using one's creativity" (Isaksen et al., 2011, p. 9). In sum, the more one understands his or her own creativity, the more effective researchers believe they will be at using their own creative skills and helping teams work together to solve challenging problems.

Studies prior to the early 2000s seemed to focus on one's level of creativity. In other words, these studies addressed how creative a person was or perhaps how well an individual employed their creative capacity (Isaksen, 2004). In recent years, studies seem to focus away from the question regarding how creative one may be and towards how one is creative (Isaksen et al., 2011). This question addresses the style of creativity as opposed to the amount of creativity. Isaksen (2004) defines creative style as the ways that one prefers to use their creativity.

Recognizing the shift in research from levels to styles, Isaksen and Aerts (2011) addressed creative style to include both generating and focusing kinds of problem solving. One's creative style includes "both divergent (generating) and convergent (focusing) kinds of problem solving aimed at gaining clarity when facing ambiguous or ill-structured situational demands, generating new ideas and alternatives, and building and developing options and plans to implement novel insights"(Isaksen & Aerts, 2011, p. 9). An individual's style may shift him or her toward a preference for either divergent or convergent approaches. Such considerations of style preferences are the focus of much of the recent research in problem solving.

Problem-Solving Styles

Problem solving involves the thinking and behavior in which we engage to obtain a desired or improved outcome. Throughout the literature, problem solving tends to be linked with creativity and learning styles (Eishani, Ebrahim, & Nami, 2014; Isaksen & Dorval, 1993). The studies used to identify problem-solving styles lean toward some combination of learning styles, cognitive approaches, and creative styles.

The VIEW Model of Problem-solving styles builds on these three key areas of previous research including learning styles, cognitive styles, and psychological type (see Figure 2) (Selby et al., 2014). Learning styles are key factors in one's success when learning new or challenging material. Cognitive styles address how one prefers to process information and can be considered the style with which one prefers to solve problems. Finally, psychological types begin to address the functions of perception and judgment in problem solving.

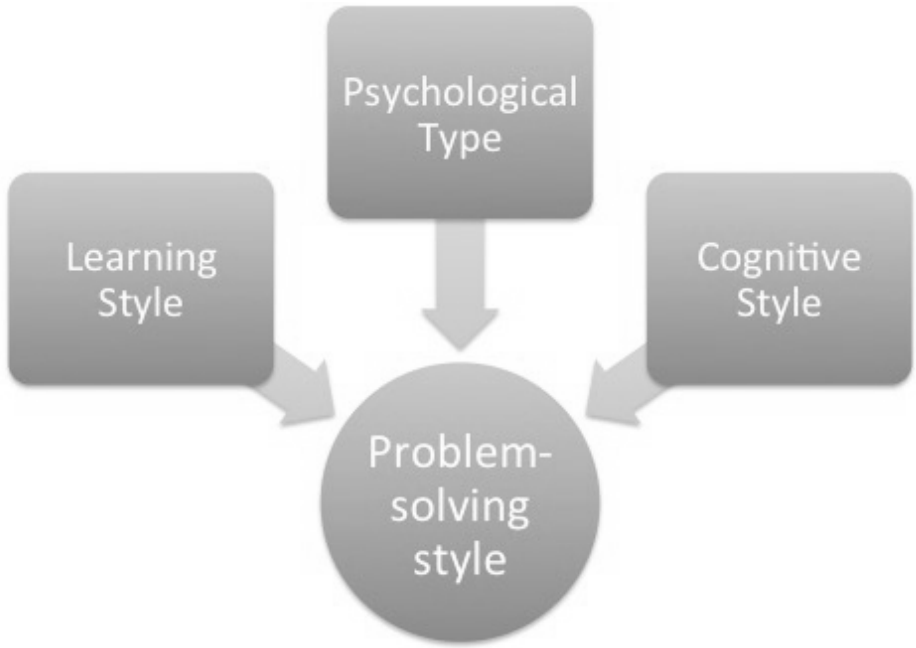

Figure 2

Problem-Solving Style Considers Multiple Styles

Formalized in 2007, the VIEW Assessment involves three dimensions of problem-solving style measured on a continuum (Treffinger & Selby, 2004). The VIEW Assessment measures one's problem-solving styles on three dimensions. One of the dimensions has three sub-dimensions, referred to in VIEW as elements or subscales of the dimension (Treffinger, Selby, & Isaksen, 2014).

The first dimension is orientation to change, and it addresses preferences for responding to and managing structure, authority, and novelty when solving problems (Treffinger, Selby, et al., 2014). On one end of the spectrum are explorers who find new possibilities; in contrast, developers prefer improving on what is familiar. Explorers prefer to generate a large number of possible problem statements emphasizing hopes and aspirations with a focus on a desired future state. For developers, their strengths lie in identifying challenges that are prescribed. With a strong perspective on current reality, developers are often economic and direct in their pursuit of a solution. The OC scale has three sub-dimensions, subscales, or elements. These subscales include preference for novelty (NV), structure and authority (SA), and search strategy (SS) (Treffinger, Selby, et al., 2014).

The subscale related to novelty (NV) addresses the newness or originality one seeks when working on problems (Treffinger, Selby, et al., 2014). Explorers tend to develop options that are original and sometimes even unusual. Developers prefer to find improvements based on established precedence. The subscale related to structure and authority (SA) addresses how one deals with these items when solving problems. Explorers prefer less structure, instead choosing to chart their own paths to enable structure to develop. An explorer would prefer authority at a distance with effective autonomy in developing their approach. Developers prefer to work within the guidance of existing structure and authority. A strong developer would prefer a problem with step-by-step directions. Finally, the search strategy (SS) subscale deals with how people search for data, ideas, or solutions. An explorer would prefer a broad search with no constraints on the direction the search may move. An explorer makes connections and collects data from a broad spectrum of sources. In contrast, developers focus on finding practical and relevant data. A developer would favor an efficient and realistic search.

The second dimension, manner of processing (MP), addresses how and when an individual uses their inner energy and resources when solving problems (Treffinger, Selby, et al., 2014). Externals desire large input and advice from others in making decisions; internals use solitary reflection and quiet concentration to solve problems. In problem definition and clarification, externals consider how the events around the problem are framed as well as how the climate and environment may influence the problem. Externals are typically strong at drawing out the ideas of others and can use the response of one issue to construct higher-level solutions. In contrast, internals would prefer defining and clarifying the problem on their own before sharing a detailed problem statement with others. An internal would prefer quiet contemplation sharing ideas for problem solving only after they had been well developed.

Finally, the ways of deciding (WD) dimensions addresses disposition of individuals as they balance concerns for tasks and interpersonal needs when making decisions (Treffinger, Selby, et al., 2014). This dimension varies from the person orientation that focuses on the effects of ideas and actions on people vs. the task orientation that focuses on well reasoned and impersonal problem solving. Individuals with a person orientation may look for problem solutions that build harmony with others. Personal values and relationships will be key to their thought process, and the best opportunities will have a humanistic approach. Those with a task focus often focus on solving problems based on impersonal judgments in a logical manner. These individuals may remove the human element completely from the problem solving process.

Kirton published the Adaption-Innovation Theory in 1976 (Kirton, 1976). Based specifically on cognitive styles, it was developed to identify adaptors and innovators on a continuous scale (Jablokow & Booth, 2006). "The contention… is that everyone can be located on a continuum ranging from an ability to 'do things better' to an ability to 'do things differently', and the ends of this continuum are labeled adaptive and innovative, respectively." (Kirton, 1976, p. 622) Those who are adaptors are described as preferring to do things better while those who are innovators are described as those who prefer to do things differently.

Kirton's inventory consists of 32 questions or statements and has three subscales: efficiency, rule/group conformity, and originality (Mudd, 1996). Chan (2000) described the subscales of Kirton's inventory. The efficiency subscale categorizes a person's preference for efficiency, precision, and reliability. The rule/group conformity subscale measures how a person prefers to operate regarding rules and regulations. Finally, the originality subscale addresses preference for original ideas. Such definitions would overlap considerably with the orientation to change dimension of the VIEW Assessment.

Basadur's Creative Problem Solving Inventory addresses one's preference for what he terms as the four stages of the creative process (Basadur & Gelade, 2003). By plotting scores on four dimensions, one may determine dominant and supporting preferences. Based specifically on learning styles, the profile classifies people as generator, optimizer, conceptualizer, or implementer (Basadur & Gelade, 2003).

Refined later as Basadur's Inventory, this test gives individuals a score within each of the four profiles (Basadur & Gelade, 2003). Individuals are asked to rank sets of words on a scale from one to four according to how well the words match their approach to solving problems. The scores are totaled, and a preference to each of the four profiles is given based on the total score. Results from the inventory address how individuals prefer to gain knowledge (direct experience or abstract thinking), and use knowledge (offer ideas, defer judgment or select from options). Using a coordinate system to plot results, the x-axis represents the way individuals prefer to use knowledge, and the y-axis represents the way individuals prefer to gain knowledge. This graph creates four separate quadrants that represent the four profiles identified. Research indicates that no individual uses a sole category, but most individuals have a predominate category. Problem generators prefer finding the problem and determining facts. Conceptualizers like defining the problem and generating ideas. Optimizers prefer filtering of the ideas. Implementers prefer seeking consensus and taking action.

While more of a personality test than a style inventory, the Myers Briggs profile was instrumental in developing the VIEW Assessment noted above (Selby et al., 2014). This profile is based on psychological type and describes 16 distinctive personality types that result from the interaction of individual preferences (Martin, 1997). The 16 types have four major elements: favorite world, information, decisions, and structure. The favorite world tends to influence when an individual solving problems may choose to engage others and their environment (Myers & McCaulley, 1985). Extroverts tend to engage others and their environment throughout the problem-solving process while introverts prefer to work through problems alone until a solution is well developed. The information element classifies individuals as sensing or intuitive depending on how one prefers to interpret and add meaning. Sensing individuals focus on what is real and practical; Intuitive individuals focus on thinking through the problem as opposed to hands-on solutions. The decision element addresses whether one focuses on people or the logic when making decisions and classifies individual as either thinking or feeling. Finally, structure addresses whether one prefers to get things decided (judging) or to stay open to new options (perceiving).

Learning Style

Kolb defines learning as “the process whereby knowledge is created through the transformation of experience” (Kolb, 1984, p. 38). Thus, each person may learn in a unique way based on their past experiences. Kolb argues that since personalities and experiences were specific to each individual, each individual would have a unique learning style (Kolb, 1984). Learning styles have been described in multiple ways; however, it can be considered as the preferential way an individual perceives and processes information. Gregorc saw learning styles as “powerful indictors of deep underlying psychological forces that help guide a person’s interactions with existential realities” (Gregorc, 1985, p. 54).

The Dunn and Dunn Learning Styles Model identifies five categories of environmental, emotional, sociological, physiological, and psychological stimuli with 20 elements distributed across those five stimuli (Rundle, n.d.). The development of VIEW drew heavily from elements of the need for structure, proximity to authority, working alone or in pairs, and psychological elements including analytic or global thinkers and impulsive or reflective responders (Selby et al., 2014). A key finding in the Dunn and Dunn research was that the elements affect individuals at varying intensities (Rundle, n.d.). In some cases, Dunn and Dunn found that a certain element might improve an individual’s learning. In other cases, a certain element must be addressed for a person to learn. For example, if a person prefers to work in a group instead of alone, he or she may focus all efforts on developing a group before beginning work. The VIEW model shares a similar approach that styles of problem solving have various levels of impact on an individual’s ability to solve problems (Selby et al., 2014). When problem styles are particularly important to the learner, they can become key factors in one's ability to solve problems.

Psychological Type

Jung's initial research focused initially on introversion and extraversion (Jung, 1990). He considered two psychological types where some individuals focused on the outer world of actions, objects, and people while others focused on concepts and ideas. Such preferences connected to problem solving through two areas (Selby et al., 2014). The most obvious was whether people chose to engage others in solving problems. The other area was whether or not people tended to verbalize problem solving.

Jung further considered whether individuals based thought on the immediate experience of life or the possibilities and meanings of those experiences (Jung, 1990). Sensing individuals gravitated to focus on details and the practical. Intuitive individuals leaned their focus on inspiration and meaning. The intuitive individuals moved from abstract ideas to concrete plans.

Jung also addressed judging functions of thinking and feeling (Jung, 1990). These functions addressed how individuals made decisions and reached conclusions. Thinking individuals tended to detach from emotion during problem solving stressing logical principles, order, or standards. Those individuals with a feeling orientation connected with their emotions. These individuals gravitated to relationships seeking harmonious outcomes.

Judging and perceiving were added to psychological type theory (Myers & McCaulley, 1985). Judging personalities preferred to begin problem solving with a clear structure and work in an orderly, predictable approach until the problem was solved.

Perceiving individuals preferred a dynamic structure. These individuals may openly explore solutions with structure emerging from new and different ideas.

In summary, psychological type provided a basic structure of constructs important to assess problem-solving (Selby et al., 2014). Perhaps the emphasis on differences of individuals and how those differences were used constructively in practice was one of the most important factors psychological type provided in VIEW (Treffinger et al., 2008).

Cognitive Style

Cognitive styles have been a subset of research in cognitive psychology. Cognitive style addresses multiple mental processes including learning, memory, comprehension, problem solving, and creativity (Hayes, 1978). Further, cognitive style connects intellectual function and personality. Cognitive styles can be viewed as filter mechanisms that sort what and how we perceive and process information (Willerman, 1979).

Kirton considered cognitive style in the development of his Adaption-Innovation theory (Kirton, 1994). Adapters worked within the current system and structure to accomplish tasks. Although sometimes viewed as closed-minded, adapters were seen as resourceful and efficient. Innovators, in contrast, often viewed the current structure as the source of the problem. These individuals were original, spontaneous, and insightful. However, others viewed them as sometimes impractical and abrasive. Innovators tended to generate a lot of ideas but were not strong in implementation of those ideas.

Cognitive style influenced VIEW in several ways (Selby et al., 2014). It provided a clear focus on style as opposed to cognitive ability. This focus centered the research on how individuals preferred to access, express, and apply problem solving. Cognitive styles also moved the research beyond personality types to include information-processing strategies (Selby et al., 2014).

Problem-Solving Inventories Focused on Capabilities

In 1982, a personal problem-solving inventory was developed and tested on college students (Heppner & Peterson, 1982). Using factor analysis, the researchers determined that there were three key metrics underlying the problem-solving skills of those students: confidence in one's problem-solving abilities, an approach-avoidance style, and personal control. People who thought they were better problem solvers actually were better problem solvers. Those that constantly sought alternate problem-solving approaches (approach-avoidance) were also better problem solvers. Finally, good problem solvers were more systematic in their problem-solving approaches and deliberately controlled behavior when solving problems.

In 1995, a group of researchers attempted to correlate the self-appraised problem-solving skills as identified by Heppner and Peterson with the Myers-Briggs Type Indicator. Judging, Feeling and Perceiving on the Myers-Briggs scale were found to be highly correlated with the approach-avoidance and problem-solving confidence factors for undergraduate students (Elliott & Herrick, 1995). This study seemed to connect how people view how they solve problems, their emotional disposition, their willfulness, and their overall preference for structure in problem solving. Cognition was linked to psychological type (Huitt, 1992).

In 1997, a group led by V.K. Kumar authored the Creativity Styles Questionnaire (Kumar, Kemmler, & Holman, 1997). The 78-question survey challenged people to consider how they perceived problem solving on eight scales (see Table 1).

Table 1

Key Elements of the Creativity Styles Questionnaire

Scale	Descriptors	Alpha Reliability
Creative Capacity	Higher scores are associated with higher perceived creativity or problem solving on the part of the person taking the survey.	0.76
Belief in Unconscious Process	Higher scores indicate a greater belief in unconscious process as significant to creative work.	0.70
Use of Techniques	Higher scores reflect use of specific techniques to facilitate creative work.	0.81
Use of Other People	Higher scores reflect consulting and sharing ideas and creative products with other people.	0.74
Final Product Orientation	Higher scores reflect higher motivation to be creative when motivated by the final product.	0.45
Environmental Control/Behavioral Self-Regulation	Higher scores reflect a person who develops multiple discrete stimuli to facilitate creative work.	0.83
Superstition	Higher scores indicate superstitious behavior to facilitate creative work.	0.72
Use of the Senses	Higher scores reflect use of the five senses to generate creative work.	0.76

Such early research focused on how well people solved problems, how they perceived their problem-solving ability, or how much problem-solving capacity was used by individuals, particularly students (Isaksen, 2004). Recently, a shift has occurred from a measure of one's problem solving abilities to their preferred form, kind, and style of problem solving (Isaksen et al., 2011). These studies have been extended more widely to business and industry.

Modern Problem-Solving Inventories Focused on Style

Dr. Michael Kirton's Adaption-Innovation Theory addresses creative style preference. It "explores and describes preferred individual differences in the way humans solve problems." (Kirton, 1994, p. 1) Individuals are ranked on a scale from highly adaptive to highly innovative (Kirton, 2003). An adaptive individual is considered precise and reliable. An innovative individual enjoys unstructured situations and looks for new solutions. In banks, bank staff and managers gravitate toward adaptive styles while financial analysts and Vice Presidents tend toward innovative styles (Kirton, Jablokow, & Wolfe, n.d.). Other tests were done on entrepreneurs in an Italian context. While on average more innovative than managers, entrepreneurs surprisingly tended toward adaptive tendencies especially for smaller businesses who have remained in business over time (Previde & Kirton, 1994).

Another style inventory, known as Foursight, is a creativity and problem-solving tool to classify individuals (G. Puccio, n.d.; G. J. Puccio, Wheeler, & Cassandro, 2004) . This tool classifies individuals as having a preference toward a specific stage of the problem-solving process. "Clarifiers" prefer identification and clarification of the problem. "Developers" address solutions of problems. "Implementers" put solutions into action. Puccio argues that all stages are critical, and individuals of all preferences must work together to effectively resolve problems. His company has engaged with such industry giants as Coke and Disney, but little research is published on the cumulative results of their inventories.

The Basadur Creative Problem-Solving Inventory utilizes four distinct profiles that measure an individual's unique creativity to solve problems (Wellman, 2014). The four profiles - Generator, Conceptualizer, Optimizer, and Implementer - focus on areas where individuals have a “relatively greater or lesser inclination”. (Basadur & Gelade, 2003). Problem Generators prefer finding the problem and determining facts. Conceptualizers like defining the problem and generating ideas. Optimizers prefer filtering of the ideas. Implementers prefer seeking consensus and taking action.

This approach has been used to determine the problem-solving styles of management, architectural, and construction students (Peterson, 2006; Wellman, 2014). Business and industry have also been evaluated using the profile (Basadur & Gelade, 2003). People in marketing tend to be generators while those involved in organizational development, strategic planning, or market research tend to be conceptualizers. The Optimizers work in finance, accounting, or information technology programming. Implementers are often those in project management, sales, purchasing, logistics, or information technology operations.

The VIEW Assessment includes three main dimensions of problem-solving style: orientation to change, manner of processing, and orientation to decision making (Treffinger & Selby, 2004). For the orientation to change dimension, an explorer prefers to chart a new course, and a developer prefers to build on the ideas of others. The second dimension, manner of processing, addresses individual preference for working alone (internal style) or working in groups to solve problems (external style). Finally, the third dimension is known as ways of deciding which considers whether one focuses on the impact of a decision on people (people focus) or the specific task ongoing (task focus).

The VIEW Assessment has been used with insurance firms, financial services firms, and large supermarket chains (Esposito, B. & Roehm, S., 2004). Most of this research centered on how teams collaborate to solve problems and how the diversity of problem-solving styles adds to the ability of teams to solve complex problems. The VIEW Assessment was also used to consider the difference in problem-solving styles of traditional patrol and neighborhood patrol officers (Fitzjarrell, 2011). This study indicated that police officers solve problems and manage change using a variety of styles and concluded that exploration of the positives and negatives of those styles could enhance communication in the workplace. A key finding was that officers generally prefer solving problems on logic and fact; however, officers find ill-structured problems in practice. A discrepancy existed between the traditional training officers receive and what they were experiencing in the field. Another key finding was the effect of age on problem-solving dimensions. People that entered the workforce at an older age were more receptive to the orientation to change dimension than younger workers. Awareness and recognition of an individual's problem-solving style in such a context could increase group or team effectiveness.

At IBM's Executive Business Institute, VIEW was applied in multiple organizations of varying kinds and size. Treffinger, Isaksen, and Selby (2014) cite a 2004 report by Esposito et al that stated (p. 39):

> At IBM we have helped clients and employees around the world to appreciate their style using the VIEW instrument. We have had very positive results in every country and every culture where we have used it. We have validated that VIEW results can help individuals test their reported preferences against their typical behavior in varied situations.… VIEW results can enable individuals to identify ways to be at their

> personal best, and to determine how they might benefit from the strengths of others… It can also be used in guiding groups in strategic planning, innovation, product development, project management, or other deliberate change initiative.

The Construction Industry

The Associated General Contractors of America (AGC) has discussed the business of construction as follows:

> The construction industry is a brawny, hearty giant stretching to embrace all kinds of construction activity, from the erection of towering skyscrapers, construction of interstate highway, or the establishment of a massive dam on a wilderness river to major maintenance and alterations. (Spence, 2006, p. 25)

As a major element of the nation's economy, construction involves the combination of material, architects, builders, engineers, owners, and equipment to execute a complete project. Various industries, including subcontractors, manufacturers, vendors, and fabricators, support the process. Over time, the complexity and level of specializations in each of these areas has changed substantially (Spence, 2006). These changes significantly affect approaches to project delivery, team organization and format, and actual construction practices.

For much of history, artisans using relatively crude materials executed construction under the direction of a master builder. Over 4500 years ago, the Egyptian Pyramids were built using this approach. Known as a vizier, the master builder reported directly to the Pharaoh (Freudenrich, 2007). This process continued through the building of the Brooklyn Bridge in the late 1800s as John Augustus Roebling served as the initial master builder (Stamler, 2000). During construction, his foot was crushed resulting in a tetanus infection that led to his death. He turned over the project to his son, Washington Roebling, who along with his spouse, Emily, completed the project as the master builder (Weigold, 1984).

As an example of the crude nature of construction used during this period of history, consider the Brooklyn Bridge's two towers (Weigold, 1984). These towers were constructed by building large open-top pine boxes and floating them upside down to the planned location of the towers. Stone was then set on top of the boxes until they sank to the bottom of the river. Compressed air was then pumped inside the upside down boxes so that workers could enter the boxes from the top. Workers entered the boxes, and sediment was dug out until the boxes sank to bedrock under the weight of the stone. Such work was dangerous with many workers developing decompression sickness. The boxes were filled with compressed air, poorly ventilated, and lit using only gas lamps (Watson, 2014). The bridge still rests on approximately fifteen feet of southern yellow pine at the base of the river. Such construction was viewed as a craft that was handed down from generation to generation (Chinowsky & Diekmann, 2004). Worker injuries and deaths in such an environment were commonplace with 27 deaths in the construction of the Brooklyn Bridge (Watson, 2014).

Over the past 200 years, the construction industry has rapidly changed. Much of this change is due to technological growth and the expanding global economy. In the late 18th and 19th centuries, factories developed with improved metalworking (Brandt, 1993). Methods and tools improved, and railways, canals, and roads assisted in delivering products to the construction site. Many of these efforts limited the amount of work required by hand, increasing the speed of construction. Steel was mass produced, and alterations of concrete provided additional opportunities to build larger buildings with more predictable properties, higher strength, and reasonable costs. Fire resistant buildings evolved, and building codes were also developed to protect the safety of building occupants (Brandt, 1993).

Technology related to vertical transportation in buildings evolved rapidly in the mid 1800s. The need to move material and people vertically in buildings was a problem that had existed throughout history. One early device, developed by Archimedes, involved a lifting device operated by ropes and pulleys with ropes coiled around a winding drum with levers (Verma, 2012). Elevators are recorded as early as 80 A.D. with animals riding elevators in the Roman Coliseum (Blitz, 2015). In the 1700s, machine power was used to drive all types of lifts (Bellis, 2015). However, there was no effective way to prevent the lift from plummeting to the ground if the lifting cable failed. Elisha Otis effectively solved this problem in 1852 with the invention of the safety break making elevators a consistent, reliable device for all types of buildings (Bellis, 2015).

Developments in mechanical and electrical systems also began in the 1800s. The Masonic Temple in Philadelphia was the first to use gas lighting in a public building in 1809, while the Astor Hotel in New York City, built in 1836, was the first hotel with running hot water (Brandt, 1993). Steam generation lifted the water to the fourth floor where it then fed to individual rooms via gravity. During this time, the Tremont Hotel in Washington, D.C. was the first to have indoor plumbing. Despite all these successes, the primary developments through 1900 were limited to improved delivery of materials, hoisting, tools, and equipment.

The 20th century brought the addition of high-rise buildings and skyscrapers (Brandt, 1993). The advance of elevators provided a way to easily reach taller heights of buildings, and cranes allowed a needed way to lift heavy materials in-place on the job site. Unions were formed to protect worker interests, and safety became commonplace on the job primarily evident by the hard hats and safety vests seen on construction sites. Government projects were implemented to stimulate the economy, and the idea of building in ways that were friendly to the environment were introduced. On the materials front, higher-strength steel became common. Pre- and post-tensioned concrete, as well as precast concrete, were introduced in buildings. Block and gypsum board replaced traditional wet plaster in buildings.

Specialization of trade and profession led to a shift away from the master builder concept used in previous generations of construction. In 1888, the American Institute of Architects (AIA) developed a standard for the assignment of the roles and responsibilities for constructors, architects and their clients (Demkin, 2013). Sequential editions of this document, known as the AIA General Conditions for Construction (General Conditions), have defined risk allocation in design and construction (Clough, Sears, & Sears, 2005, pp. 143–144). As a standard construction document, the General Conditions provide a platform for assessment of the events and trends that have shaped construction practice. Key developments since 1888 that have influenced risk allocation include the engagement of attorneys in the delivery process, the influence of professional liability insurance, and court rulings regarding the supervisory responsibilities of parties

(Farrow & Mouton, 2010). In the 1950s and 1960s, substantial changes occurred in the General Conditions. Advocates such as William Parker, an architect and mainstay in AIA document development, argued against proposed changes in the documents with the concern that the modifications could initiate further trends away from the architect's traditional role as master builder (Parker, 1961) .

In the decades that followed, the AIA and the insurers focused on risk mitigation while contractors refused to accept architectural risk. New project delivery systems arose as the debate between responsibility and authority continued. Construction Management (CM), developed in the 1970s, allowed the contractor to undertake additional responsibilities and risks (The Construction Management Association of America, 2012). The owner often engaged the CM early in the development of the project thereby giving the constructor more input in the design-construct process. Design-build emerged in the following decade (1980s). In this delivery approach, architectural and construction firms used joint service agreements to deliver projects with single-point responsibility. Constructor-led agreements were common given the industry requirement to bond or assure performance during the construction process. As with CM, the role of the contractor expanded in design-build delivery. Both delivery systems were driven in part by circumstances where gaps in contractual responsibilities led to unanticipated liability for owners.

Since 2000, project delivery systems have continued to evolve. The trends point toward more stakeholders with more specialization involved throughout the process. Now, instead of the master builder, highly specialized teams of professionals are often utilized to deliver complex construction projects. Frequently, these teams attempt to merge fragmented professionals and processes in an effort to produce a new construction team (Franks et al., 2015). Some firms have sought an integrated team manager as an individual charged with engaging and executing the work of diverse teams (Franks et al., 2015).

Communication between team members on construction projects has increased at a rapid rate. Much of the work on today's construction site is done virtually in real time. Drawings, change orders, and scopes of work are transferred in seconds. Today, the construction industry is generally divided into sectors of commercial, heavy highway, industrial, and residential construction (Spence, 2006). Contractors, often divided as general contractors and specialty contractors, perform the work. General contractors are typically responsible for the entire project and may not self-perform any of the work on the project. They are responsible for the completion of the work, although they may not be doing the work themselves. A general contractor typically works with a series of specialty contractors who do the work within their areas of expertise. For example, an electrical specialty contractor or subcontractor may only perform the electrical work on a given project.

Future trends in the industry include rapidly expanding technological innovation, increase of prefabrication and modularization due to limited skilled labor, and a focus on the overall lifecycle cost of buildings and its impact on the environment (Sznewajs & Moore, 2013). While construction knowledge is important, the industry has recognized the importance of soft skills by construction managers. Key competencies for construction professionals identified by the research for this environment include strong communicators; problem solvers; ability to demonstrate knowledge across multiple disciplines; ability to build knowledge networks inside and outside of the team organizations; ability to display emotional maturity; potential to leverage diverse thinking; effectiveness to build relationships, engage others, mentor people, and build trust (Ahn et al., 2012; Wiezel & Badger, 2015).

Construction Management Education

The speed with which civilization is advancing continues to challenge the way we practice construction and the way construction management professionals are educated. Many of the schools of construction management across the United States are regulated by the American Council of Construction Education (ACCE) ("Document 103: standards and criteria for accreditation of postsecondary construction education degree programs," 2014). This group recently shifted from an hours-based evaluation of topical content to a learning outcomes based approach. While the hours-based approach focuses on technical construction knowledge, several of the learning outcomes focus more on the soft skills required for a construction manager to excel in today's new construction environment. Key outcomes related to soft skills and one's ability to interact with other diverse professionals include the following ("Document 103: standards and criteria for accreditation of postsecondary construction education degree programs," 2014):

- Create written communications appropriate to the construction discipline.
- Create oral presentations appropriate to the construction discipline.
- Analyze professional decisions based on ethical principles.
- Apply construction management skills as an effective member of a multi-disciplinary team.

All of these items relate to the connection of construction managers within a company or team environment.

Competencies of Construction Managers

Future trends in the next decade within construction are anticipated to require further evolution of the competencies required for managers. These trends include globalization, different workforce demographics, rapidly evolving technology particularly in the information and data management areas, and organizational structure (Wiezel & Badger, 2015). Competencies of managers in this area can be considered in categories of leadership, cognitive, technical, and management.

The construction manager of the future is expected to interact with as many as twice the number of stakeholders than current managers (Wiezel & Badger, 2015). This will require vastly improved leadership, people, and thinking skills than those needed today. Professional responsibility, social skills, and the ability to resolve conflict will be critical elements a construction manager must possess (Arian, 2010; Sinha, Thomas, & Kulka, 2007).

Cognitive competencies to allow construction managers to filter a large amount of information, learn from, and disseminate relevant information effectively will be critical (Wiezel & Badger, 2015). Construction managers will be required to communicate complex issues with a diverse audience of stakeholders while displaying emotional maturity (Haselbach & Maher, 2008). Collaborative skills related to teams and interdisciplinary applications will be key components a construction manager must develop (Arian, 2010; Bernold, 2005; Sinha et al., 2007) .

Technical and management activities that many construction managers spent careers on in the past will be shifted to technology based applications (Wiezel & Badger, 2015). Complexities in these areas will increase, and the construction manager will maintain critical involvement. Construction acumen, building techniques, and technical competency will be key (Arian, 2010). However, the work will be less dominant in the overall landscape of the construction manager.

Future changes in construction education will need to expand to include more of an emphasis on the cognitive and leadership competencies (Wiezel & Badger, 2015). These include experiential learning that "gives prominence to soft skills—such as the ability to collaborate, work in groups, read social cues, and respond adaptively" (Davies, Fidler, & Gorbis, 2011) . Further, critical thinking, insight, and strong analyst capabilities will be required (Davies et al., 2011).

Differences in Construction Managers

Formal education practices differ for construction managers across the United States. Although not required, it is increasingly important for construction managers to have an undergraduate degree in construction management, architecture, business, or engineering (U.S. Bureau of Labor Statistics, 2014). The increased complexity of construction is placing greater importance on a specialized approach to education. More than 100 programs offer accredited programs in construction management or the equivalent. A number of community and junior colleges also offer a two-year program which, when combined with relevant work experience, may be sufficient for some construction management jobs. Those with a high school diploma and several years of relevant work experience may qualify to become a construction manager, although most will do so primarily as self-employed general contractors.

Construction firms may engage in construction projects at various times during the design and construction life cycle. In traditional design-bid-build, the contractor will engage after design is complete. In less traditional and more current delivery methods, often the contractor will engage earlier in the design process. Such early engagement significantly changes the role of the construction manager, requiring additional interaction with design specialists as key decisions are made that will influence building cost and performance. Firms considered in this research engage in vertical construction (buildings). The breakdown of delivery methods for this section is as follows (The Construction Management Association of America, 2012):

- Design-Bid-Build Project Delivery 60%
- Construction Management Delivery 25%
- Design-Build Delivery 15%
- Integrated Project Delivery <1%

Of the above delivery methods, early involvement of the contractor is common on all but design-bid-build (Walker & Lloyd-Walker, 2012). Thus, 40% of the current vertical construction market would engage a delivery process that required early involvement of the construction manager. Recent trends include a decline of the design-bid-build method and a corresponding increase in the remaining methods (The Construction Management Association of America, 2012).

Limited specific data is available on the age of construction managers in professional practice. One broad report overview of the industry suggest that 2% are reported under the age of 24, while only 18% exceed 55 years of age (What is the average age of a construction manager?, 2016). This leaves the majority of workers, 80%, between the ages of 24 and 50. The report suggests that the smaller number of younger workers may identify the need for workers with formal education, experience, or training ("What is the average age of a construction manager?," 2016). Another study completed by Advisen Insurance reported the following (Construction workforce survey: responding to changing demographics, 2014):

Less than 30 years old	21%
30 to 39 years old	27%
40 to 49 years old	25%
50 to 59 years old	19%
Older than 60 years old	9%

If one excludes the respondents in the survey who did not know, one third of respondents indicated that their organization now has more workers between the age of 30 and 49 than they did five years ago (Construction workforce survey: responding to changing demographics, 2014). The under-thirty demographic was reported as the largest increasing demographic in 20% of the companies. Only 21% report more employees who are age 50 in the past five years. Such shifts point toward a younger workforce in construction management.

The Occupational Outlook Handbook defines office jobs in construction including construction/project manager and cost estimator (U.S. Bureau of Labor Statistics, 2014). Project managers "plan, coordinate, budget, and supervise construction projects from start to finish"(About the construction sector, 2015). Cost estimators "collect and analyze data in order to estimate the time, money, materials, and labor required to construct a building, or provide a service" (About the construction sector, 2015). . Advertising and marketing staff "plan programs to generate interest in construction services" (About the construction sector, 2015). . Human resources staff "plan, direct, and coordinate the administrative functions of an organization. They oversee the recruiting, interviewing, and hiring of new staff; consult with top executives on strategic planning; and serve as a link between an organization's management and its employees" (About the construction sector, 2015). . Procurement staff "plan, direct, and coordinate the buying of materials, products, or services for project sites" (About the construction sector, 2015). . Financial staffs assure timely payment of obligations and collection of accounts receivable. Administrative services staff "managers plan, direct, and coordinate supportive services of an organization" (About the construction sector, 2015). Data were not found on the number of workers in each area of construction management.

Summary

This chapter addressed problem-solving styles as compared with problem solving, Multiple approaches for evaluating problem-solving style are available in practice, and all build on some combination of psychological type, learning styles, and cognitive style. The connection of problem-solving styles with adult education, creativity as a basis for problem solving, approaches and basis for problem-solving styles, results of studies focused on problem-solving style, the evolution of the construction industry, education requirements for construction managers, the anticipated competencies of the future construction manager, and an overview of industry demographics were considered. Research indicated that knowledge of problem-solving styles could enhance individual and team performance. Specifically, improved insights into how problems are solved and more effective team leadership appear to be benefits of understanding problem-solving styles.

Multiple approaches for evaluating problem-solving style are available in practice, and all build on some combination of psychological type, learning styles, and cognitive style. While studies using various problem-solving style instruments have been conducted in industry, none were found specific to the construction industry. Changes in the construction industry mandate highly specialized and diverse teams to solve problems within the construction context. These changes are occurring rapidly, and the industry and construction educators are attempting to address this to meet the needs of the industry. With a workforce that is growing in younger demographics and growing trends of early contractor involvement, the established research suggests that a better understanding of problem-solving styles in a construction context could impact the performance of the construction manager and address some areas of need identified in the research.

Chapter 3. METHODS

As construction complexity increases, problem solving has been identified as key to individual and project success (Ahn et al., 2012; Wiezel & Badger, 2015). Increased understanding of how workers prefer to approach problem solving has been shown to enhance individual and team performance (Treffinger, Isaksen, et al., 2014; Treffinger et al., 2008). Further study of the diversity of problem-solving styles in the construction industry is warranted.

The purpose, statement of the problem, research questions, definitions of terms, significance, limitations, assumptions, and organization of the study were addressed in chapter one. The second chapter - literature review - addressed the differences in problem solving and problem-solving styles and connected styles to adult education. A foundation of problem-solving style was established through descriptions of creativity, cognitive styles, learning styles, and psychological traits. Several common problem-solving styles inventories and their uses were summarized. The literature review then considered the construction industry and how it has transitioned from a master builder approach to a system using a complex array of participants. Key skills and attributes of construction managers, including strong problem solvers, were addressed, and an overview of industry demographics was provided. This chapter contains five sections: design of the study, population and sample size, instrumentation used in this study, data collection, and data analysis.

Purpose of the Study

The purpose of the study was to determine if certain problem-solving styles are more dominant among specific job categories, experience levels, educational experience, and time of project engagement in the Southeast construction industry than are other problem-solving styles.

Research Questions

The following research questions were used in this study:

1. What are the dominant problem-solving styles of employees in the Southeast construction industry?
2. What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry?
3. What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry?
4. What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry?
5. What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Design of the Study

Problem-solving styles of construction managers across the Southeastern United States were examined in a comparative descriptive design. Additional factors of years of experience, job description, level of education, and time of project engagement were also studied using inferential statistics. The three dimensions of problem-solving style were the dependent variable. Dimensions included Orientation to Change, Manner of

Processing, and Ways of Deciding. The independent variables were years of experience, job description, level of education, and time of project engagement.

Descriptive research is defined as the "procedures and measures by quantitative data" (Wiersma & Jurs, 2009, p. 382). The study of adult education often includes descriptive research (Merriam & Simpson, 2000). Key descriptive statistics include measures of central tendency, measures of dispersion, and measures of relationship.

Inferential statistics are used to study specific groups (independent variables). Such an approach is the "most widely used collection of procedures for analyzing quantitative data in educational research" (Wiersma & Jurs, 2009, p. 431).

Population and Sample

The participants in this study included employees in construction management firms across the Southeastern United States. All construction management firms that participated in the study were medium to large in size with yearly revenue exceeding $10,000,000. All subjects studied were employed within the construction office as compared to construction field personnel. The subjects represented are a homogeneous group having similar training and job design aiding in establishment of power and reliability of the study. The sample size is a relatively small percentage of the overall population. U.S. Bureau of Labor Statistics ("About the construction sector," 2015) reports 1.6 million people nationwide in non-production construction management roles.

Participation in the study was voluntary, and no compensation was provided for participating in the study. Institutional Review Board approval was received before the study was conducted (See Appendix B).

Instrument

VIEW: An Assessment of Problem-Solving Style was used in this study. This self-reporting instrument was designed to measure individual problem-solving preferences on three dimensions and six styles of creative problem solving and change management (Selby et al., 2002). As discussed in the literature review, problem-solving preferences are based on a combination of learning style theory, cognitive style theory, and psychological trait theory.

The VIEW instrument contains 34 pairs of statements where the user is asked to respond on a Likert-style continuum of seven levels between the two statements. Designed as bipolar constructs, survey participants indicate a preference when involved in a problem-solving situation (Treffinger, Selby, et al., 2014). The authors indicated that it takes 10-15 minutes to complete VIEW (Selby et al., 2002).

Once in the VIEW instrument, respondents are given an overall statement prior to the 34 pairs of statements that reads, "When I am solving problems, I am a person who prefers…." Sample pairs of statements within the proprietary instrument include:

Thinking aloud about ideas □□□□□□□ Thinking quietly about ideas

Ideas that are original □□□□□□□ Ideas that are workable

Selby et al. (2002, pp. 1–2) state that the 34 pairs of statements were composed of pairs "so that both phrases present positive expressions of a well-established preference when solving problems and managing change". Of the 34 pairs, 18 measure the Orientation to Change (OC) dimension, while eight questions each measure the Manner of Processing (MP) and Ways of Deciding (WD) dimensions (Treffinger, Selby, et al., 2014).

Orientation to Change (OC)

Since the framework for OC is multidimensional, this measure contains more questions in the survey instrument. The use of the general word orientation within the title of this dimension is deliberate since this dimension has three elements: Preference of Novelty (NV), Structure and Authority (SA), and Search Strategy (SS). Each of these elements or sub-scales essentially combine to provide the overall OC score. Overall, this cognitive aspect of problem solving includes two general styles, the Explorer and the Developer. Scores below the mean move toward the Explorer style that prefers ill-defined situations and challenges. The Explorer is viewed as thriving on adventure. Scores above the mean move toward the Developer style. The Developer is classified as resourceful, organized, and consistent. Scores in the OC dimension are based on 18 unique statements and range from 18 to 126 with a theoretical mean of 72.

Preference of Novelty (NV)

This element of OC considers how one prefers to be new or original in problem solving. Explorers prefer to find new, original ways to solve problems. Developers prefer to match precedence or previous experience often improving on solutions they have seen before. Six statements in VIEW determine one's preference of novelty.

Structure and Authority (SA)

The SA element of OC considers how one prefers to construct or arrange items in problem solving. Explorers often develop their own unique approaches working in their own way to allow structure to emerge. Developers prefer existing structure with step-by-step directions. Developers also prefer to have a higher authority close-by to consult as the problem-solving process evolves. Six statements in VIEW determine one's preference of structure and authority.

Search Strategy (SS)

The final element of the OC addresses how one prefers to search for data, ideas, or solutions. Explorers search with few limits to their searches for promising options. They believe that a wide array of sources will provide for the best solution. Developers prefer a focused search seeking only practical, relevant data. Words like practical, realistic, and efficient would describe the search preferred by the developer. Six statements in VIEW determine one's preference of search strategy.

Manner of Processing (MP)

The MP dimension addresses the procedure one uses for processing information. The dimension also addressed how people choose to interact with others when solving problems or managing change. People who prefer an External style score below the mean and draw energy from others when solving problems. They prefer to engage physically with their environment and others as they solve problems. People who prefer the Internal style score above the mean and tend to prefer individual reflection to solve problems. They often prefer to retreat to a room and work privately to solve a problem. Scores are based on eight unique statements and range from eight to 56, with a theoretical mean of 32.

Ways of Deciding (WD)

The WD dimension considers whether one prefers to focus on the task at hand or the impact of the issue on the people it may impact. Those scoring below the mean tend toward the Person style where the feelings of others are considered when solving problems in an effort to promote harmony. Those scoring above the mean tend toward the Task style. Individuals who are task oriented prefer logical, sensible, and objective decision making without necessarily being concerned about the impact on people. Scores in this dimension are based on eight unique statements and range from eight to 56 with a theoretical mean of 32.

VIEW Training

In order to use the VIEW assessment, the researcher was required to enroll in an online course to become a qualified VIEW user (See Appendix A). Training focused on the following learning outcomes:

- Understand rational for selecting and using VIEW
- Analyze the benefit of knowing one's problem-solving style
- Identify VIEW's three dimensions and six styles
- Identify descriptive statistics common with the VIEW instrument
- Understand the history of VIEW
- Describe how to access and administer VIEW
- Score VIEW
- Prepare reports for VIEW results
- Give feedback and results for VIEW
- Examine approaches to giving feedback for groups using VIEW
- Consider applications for using VIEW
- Connect VIEW and Creative Problem Solving
- Use VIEW appropriately

The researcher completed the class in February of 2016 by completing four written assignments and an exam covering the learning outcomes. All assignments were completed under the direction of Dr. Ed Selby, one of the authors of VIEW. Access to the VIEW assessment, materials, and resources is restricted to registered users.

VIEW Validity and Reliability

The ideal testing instrument in a research project provides both valid and reliable data (Creswell, 2012). Creswell connects validity with the ability to draw conclusions based on test attributes. Reliability references stability and consistency of the results. Ross and Shannon define validity as "the extent to which our data-collection instruments measure what they are supposed to measure" and reliability as "the extent to which they (the data-collection instruments) yield consistent results with minimal error" (Ross & Shannon, 2011, p. 235). Wiersma and Jurs (2009) also identify validity and reliability as related concepts. For validity, Wiersma and Jurs distinguish between internal and external validity. Internal validity was defined as the "extent to which results can be interpreted accurately with no plausible alternative explanations"(Wiersma & Jurs, 2009, p. 7). External validity was defined as the "extent to which research results are generalizable to populations" (Wiersma & Jurs, 2009, p. 9). In other words, a research study has external validity when it can be extended to other situations and other groups.

The authors of VIEW connect reliability with stability and internal consistency and report that VIEW meets standard expectations for reliability (Treffinger, Isaksen, et al., 2014). Multiple test and re-test reliability studies have been conducted to test stability. These include one-month, two-month, and twelve-month intervals. The twelve-month interval study had test-retest correlations of .74 for Orientation to Change,

.83 for Manner of Processing, and .81 for Ways of Deciding (Treffinger, Isaksen, et al., 2014, p. 22). In all cases, results exceeded the generally accepted criterion of greater than .70. The authors suggest that when changes do occur on retesting, these changes tend to happen for individuals with low clarity of preference in a given area. Internal consistency was evaluated using Cronbach's Alpha. For the 44,802 individuals who have completed the VIEW Assessment, values of Alpha were .87 for the Orientation to Change Dimension, .86 for the Manner of Processing Dimension, and .84 for the Ways of Deciding Dimension (Treffinger, Isaksen, et al., 2014, p. 22). All Alpha values exceeded .70, which supports the claim that the instrument is internally consistent.

Evidence to support validity was provided through a variety of "five interrelated sources of evidence" (Treffinger, Isaksen, et al., 2014):

- Test content
- Response processes
- Internal structure
- Relation to other variables
- Uses and consequences

The test content assertion reported extensive statistical data analysis of each item in VIEW. Items studied in multiple reports over 11 years included "if the responses were not distributed across all response choices, if the mean score for any item was appreciably higher or lower than the central point, or if an item demonstrated negative discrimination" (Treffinger, Isaksen, et al., 2014, p. 23). Evidence for response processes included multiple qualitative data studies. In one study, 23 adults were posed with the question "Did your overall score agree with your own personal assessment of your style preference?" 18 of 23 indicated yes with only one responding negatively (Treffinger, Isaksen, et al., 2014, p. 24). Factor analysis was used to confirm internal structure or that it measures what it purports to measure (Treffinger, Isaksen, et al., 2014, p. 31). Correlations have been studied between VIEW scores and other instruments that influenced the design and development of view. These correlations have assisted in confirming the relation to other variables. Finally, extensive documentation exists showing effective applications of VIEW across a variety of goals, purposes, and contexts. The evidence of uses and contexts for VIEW supports it as a powerful and valuable tool.

Data Collection

Initially, a key contact was identified at multiple Southeastern construction companies based in Birmingham, Alabama; Montgomery, Alabama; and Atlanta, Georgia. The individual was invited to participate in the survey and assist by distributing the survey to others at their company who were over the age of 19 and worked in the office in either project management, preconstruction, project engineering, or staff. If the individual agreed, a follow-up e-mail was sent to them with a complete information letter and an electronic link to the survey instrument in Qualtrics. The survey was completed during the summer semester of 2016. Participation was voluntary and no compensation was provided for participation.

The Qualtrics link included the demographic questions and a link to the VIEW Assessment. Once participants responded to the demographic questions, they entered the VIEW Assessment that was recorded by the Creative Problem Solving Group, Inc. Each instrument was coded in both the Qualtrics instrument and the VIEW Assessment, so the surveys from each participant remained together. The survey took approximately 15 minutes to complete.

Data Analysis

VIEW: An Assessment of Problem-Solving Styles was employed to assess the problem-solving styles of personnel within offices of Southeastern general contractors. Descriptive and inferential statistics were analyzed using SPSS® for Windows.

Descriptive Statistics

Demographic data for each independent variable (job description, years of experience, level of education and time of project engagement) were collected using Qualtrics before administering VIEW. The data included the following:

1. Approximately how many years have you worked in the construction industry?
2. What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.

    ___ No schooling completed

    ___ Nursery school to 8th grade

    ___ Some high school, no diploma

    ___ High school graduate, diploma or the equivalent (GED)

    ___ Some college credit, no degree

    ___ Trade/technical/vocational training

    ___ Associate degree

    ___ Bachelor's degree

    ___ Master's degree

    ___ Professional degree

___ Doctorate degree

3. What job title best describes your current job or responsibility?
4. In what category would you place the job description noted above?

   ___ Project management

   ___ Estimator, procurement, or pre-construction

   ___ Support personnel (HR, business development, staff)

   ___ Senior Management

   ___ Other

5. Over the last five-ten years of your professional career, which best describes the jobs where you have been involved?

   ___ Primarily competitive bid with lump sum

   ___ Primarily projects more subjectively chosen or negotiated that are often cost plus

   ___ Balance of the two options above

Based on responses to the above, a summary of the participants in the study was detailed in table form. Individual tables were depicted for current role or responsibility, experience in the industry, highest educational degree, and time of project engagement.

Responses to VIEW were summarized using a combination of all style dimensions as well as a consideration of each style dimension individually. First, the overall combination of style dimensions was detailed. A table noting the frequency and percentage of each problem-solving style was provided. Then, individual dimensions (OC, MP, WD) of problem-solving styles were reported in three formats. A table conveyed the number of occurrences of each dimension and the corresponding percentage of responses. Histograms were used to illustrate the responses to interpret central tendency. A separate table was created to explore descriptive statistics (mean, median, mode, standard deviation, minimum values, maximum values, skewness, kurtosis, and standard error of measure). These descriptive statistics were used to determine if there is a dominant problem-solving style for Southeast construction managers.

Inferential Statistics

Inferential statistics were analyzed to compare the independent variables to the dependent variables of problem-solving style dimensions. A one-way ANOVA was conducted to consider the differences between independent variables (job description, years of experience, level of education and time of project engagement) and each problem-solving style dimension. Ross and Shannon (2011) identify the ANOVA as a way to compare groups and report that a major advantage of the ANOVA is that it can be used to compare more than two levels of the independent variable. Further, "ANOVA allows you to determine whether or not statistically significant differences exist across groups or levels, which indicates whether or not there is a main effect for the independent variable." (Ross & Shannon, 2011, p. 71) A Tukey post hoc test was performed when a statistically significant difference was observed between independent and dependent variables. A post hoc analysis is "necessary to identify the specific nature of the effect and determine which groups differ" (Ross & Shannon, 2011, p. 71). Cross tabulation tables were developed to consider the relationships between each of the problem-solving style dimensions and the independent variables (job description, years of experience, level of education and time of project engagement).

Summary

This chapter presented the purpose of the study, the research questions, the design of the study, the population and sample, the instrumentation, data collection, and data analysis. The validity and reliability of VIEW: An Assessment of Problem-Solving Styles was addressed. All data was collected per the research guidelines established by the Auburn University Review Board.

Chapter 4. FINDINGS

Construction professionals solve problems on a daily basis, and this work is essential to overall project success. Each individual in construction has preferred styles with which they solve problems. This study seeks to examine the relationship between construction professionals and their preferred problem-solving styles. Working to better understand the way constructors prefer to solve problems has the potential to aid team development in a complex construction industry and will assist construction educators in better preparing students to work within the context of a diverse problem-solving style environment.

This chapter presents the findings of the survey. Data regarding the research questions is presented and analyzed. The SPSS® statistical system was used for computing the numerical values indicated.

Purpose of the Study

The purpose of the study was to determine if certain problem-solving styles are more dominant among specific job categories, experience levels, educational experience, and time of project engagement in the Southeast construction industry than are other problem-solving styles.

Research Questions

The following research questions were used in this study:

1. What are the dominant problem-solving styles of employees in the Southeast construction industry?

2. What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry?
3. What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry?
4. What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry?
5. What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Organization of the Data Analysis

A description of the sample is presented including how the data is collated to develop the findings shown. Demographic data on the participants follows using descriptive statistics. Data on job description, years of experience, time of project engagement and educational experience are presented in both written and table form.

Following the demographic data, each research question is stated with the findings associated with that question summarized. For question 1, the preferred problem-solving styles are shown for construction professionals followed by descriptive statistics of responses by problem-solving dimension. Histograms are also shown to visually represent the distribution of problem-solving style dimensions.

Research questions 2-5 addressed whether or not there was a relationship that exists between each of the independent variables and problem-solving styles. The data obtained from the VIEW Assessment was analyzed using analysis of variance (ANOVA) and cross tabulation. An analysis of variance (ANOVA) was used to determine if a significant difference existed between problem-solving style dimensions and each variable: job description, years of experience, time of project engagement, and educational experience. An alpha value of .05 was used throughout for ANOVA. If a significant difference was found, effect size was calculated, and Tukey post-hoc tests were completed. Cross tabulations were developed to examine the relationships between each independent variable and the problem-solving style dimension.

Description of the Sample

The sample for this study included adults working in construction offices across the Southeast United States. Data were collected during the summer semester 2016. The survey focused on operations staff as opposed to field management in construction. This exclusion provided focus to the research effort on problem-solving styles within the construction profession. Construction professionals were male and female and were at least 19 years old. Of the 151 (*N*) participants, 94% completed all parts of the study.

The survey was one of convenience. The author solicited industry executives/recruiters for permission to recruit their operations staff to complete the survey. If the industry executive agreed, an e-mail was forwarded with an information letter along with a link to an online Qualtrics survey. This e-mail was then forwarded to multiple employees within his or her organization.

The Qualtrics survey collected basic demographic data before linking the participant with the VIEW Assessment that operated on an independent survey platform. E-mails were received from VIEW with survey respondents' data in an Excel spreadsheet. The Qualtrics information was exported to Excel and combined with the VIEW data in a single file. Any incomplete or otherwise non-responsive results were deleted. Data were sorted and organized so that the statistical analysis could be done easily.

Demographic Information

Demographic information for responding construction professionals was compiled and is presented for job description, years of experience, time of project engagement, and educational experience. All of these variables were identified as factors that may determine the problem-solving style of survey participants.

Table 2 presents the number and percentage of construction professionals by job description. Data indicated that project managers (40.4%) were the highest responders while safety (3.3%) and human resources (4.0%) staff had the lowest participation rates. Due to the minimal response from safety and human resources individuals, these were merged into a single category for future statistical analysis of the data. Those involved in estimation, procurement, or preconstruction represented 19.9% of those responding while project engineers/field represented 32.5% of the sample.

Table 2

Number and Percentage of Job Descriptions of Construction Professionals

Job Description	*N*	%
Estimating, procurement, or pre-construction	30	19.9
Project managing	61	40.4
Project engineering, Field engineering	49	32.5
Safety	5	3.3
Human Resources	6	4.0
Total	151	100

Table 3 presents number and percentage of construction professionals by years of experience. Data indicated that the highest percentage of construction professionals had between 2-5 years experience (20%) or over 20 years experience (20%) while the fewest construction professionals had less than 1-year experience (10.7%). The remainder of the sample included construction professionals with 6-10 years of experience (18.6%), 11-15 years (15.7%), and 16-20 years (15.0%). Note that 11 people failed to respond to this questions. Representing only 7.3% of the total sample, the missing data is not considered significant.

Table 3

Number and Percentage of Construction Professionals by Years of Experience

Years of experience	*N*	Valid %
Less than 1 year	15	10.7
2-5 years	28	20.0
6-10 years	26	18.6
11-15 years	22	15.7
16-20 years	21	15.0
>20 years	28	20.0
Total	140	100

Table 4 presents number and percentage of construction professionals by type of project engagement. Type of project engagement was defined by the researcher as the project delivery method coupled with the contract structure. It was reasoned that those engaged early in the process, who work through the design and planning with the owner, may have different problem-solving styles than those who just engaged at the start of construction. Thus, type of project engagement was considered an indicator of time of project engagement. Competitively bid, lump sum projects are most often associated with late engagement of the construction professional. Subjectively chosen or negotiated jobs are most often associated with early engagement of the construction professional. Data indicate that most professionals have participated in projects where their firm was more subjectively chosen or negotiated where they were paid on a cost plus a fee basis (52.7%). Those engaged primarily in competitively bid projects with a lump sum represented the smallest percentage in the sample (16.9%). 30.4% reported a balance of the two approaches for the jobs in which each participant had engaged over the past five years. Note that three people failed to respond to this questions. Representing only 2.0% of the total sample, the missing data is not considered significant.

Table 4

Number and Percentage of Construction Professionals by Type of Project Engaged

Type of Average Project Engagement Over Last 5 Years	*N*	Valid %
Primarily competitive bid with lump sum	25	16.9
Primarily projects more subjectively chosen or negotiated that are often cost plus	78	52.7
Balance of the two options above	45	30.4
Total	148	100

Table 5 presents number and percentage of construction professionals by educational experience. Data revealed that the highest percentage of construction professionals had achieved a Bachelor's degree (76.2%). The next highest percentage included those earning a Master's degree (13.2%). Three professionals indicated high school graduation (2.0%), 3 indicated some college credit (2.0%), 2 indicated some trade/technical/vocational training (1.3%), 7 indicated an Associate's degree (4.6%), and 1 indicated a Professional degree (0.7%). Due to the limited responses in some areas, those with a high school diploma, some college credit, and trade/technical/vocational backgrounds were merged into a single category for analysis in this study. The candidate with a Professional degree was similarly merged with those earning a Master's degree.

Table 5

Number and Percentage of Construction Professionals by Educational Experience

Educational Experience	*N*	%
No schooling completed	0	0
Nursery school to 8th grade	0	0
Some high school, no diploma	0	0
High school graduate, diploma or the equivalent (GED)	3	2.0
Some college credit, no degree	3	2.0
Trade/technical/vocational training	2	1.3
Associate degree	7	4.6
Bachelor's degree	115	76.2
Master's degree	20	13.2
Professional degree	1	0.7
Doctorate degree	0	0
Total	151	100

Research Question 1

What are the dominant problem-solving styles of employees in the Southeast construction industry? Participants were asked to complete VIEW: An Assessment of Problem-Solving Style.

VIEW is an assessment designed to measure an individual's preferences with regard to style of solving problems (Treffinger & Selby, 2004). Three dimensions are measured with each dimension represented on a continuum of style preference: Orientation to Change (OC), Manner of Processing (MP), and Ways of Deciding (WD) (Figure 3). In OC, the two preferences are Explorer and Developer; for MP, the preferences are External and Internal; for WD, the preferences are Person and Task. VIEW consists of a 34-item assessment with participants ranking each question from one to seven for each item scored. Scores for the OC dimension range from 18-126 with a theoretical mean of 72; scores on the MP and WD scales range from 8-56 with a theoretical mean of 32.

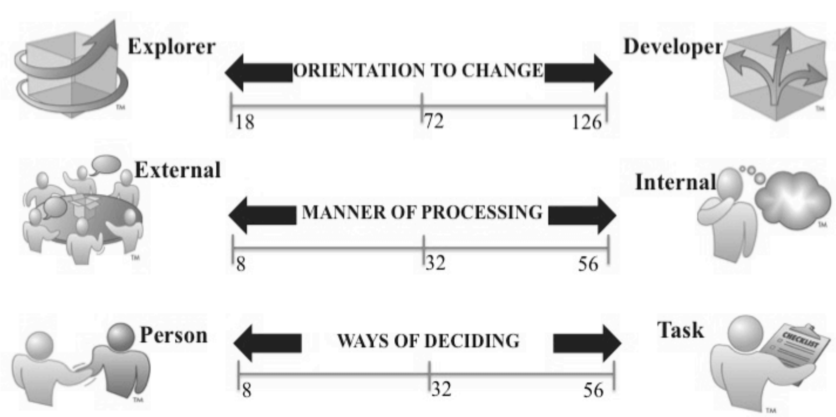

Figure 3

The Three Dimensions of Problem-Solving Styles (Isaksen, Treffinger, & Selby, 2016)

The three dimensions shown above interact with each other to form eight possible problem-solving style preferences. These eight preferences would include: Explorer/External/Person (EEP), Explorer/Internal/Person (EIP), Explorer/External/Task (EET), Explorer/Internal/Task (EIT), Developer/External/Person (DEP), Developer/Internal/Person (DIP), Developer/External/Task (DET), and Developer/Internal/Task (DIT).

With dimensions plotted on a continuum, the assessment does not clearly define styles when respondents are generally neutral on the questions associated with a specific dimension or when they have a balance of extremes on either side of a dimension. For this study, those scoring within one number of the theoretical mean are recorded as a moderate preference (Figure 4). In this study, 24 participants of 151 responding had a moderate preference in one or more problem-solving style dimensions. Additional preferences were defined to include these moderate preferences.

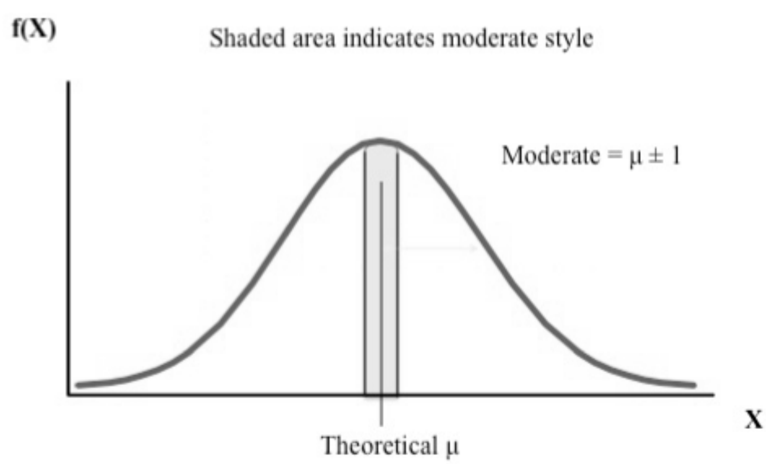

Figure 4

Moderate Style is Assumed to be Within 1 Point of the Theoretical Mean on Each Scale

Table 6 presents the problem-solving styles for construction professionals. Results indicated that the highest percentage of construction professionals had a preference for the DET problem-solving style (31.8%) followed by DIT problem-solving style (25.8%). No construction professionals surveyed preferred the EIP style, and 2% or less preferred the following styles: EEP (2.0%), EIT (1.3%), DIP(1.3%). Fifteen respondents preferred the EET style (9.9%), and five participants preferred the DEP style (3.3%). Of those reporting a moderate preference on some dimension, the highest percentage of construction professionals reported a preference for the Developer/Task style with a moderate preference on the Manner of Processing Dimension (8.6%). One participant (0.7%) reported an External preference on the Manner of Processing Dimension with moderate preferences on each of the Orientation to Change and Ways of Deciding Dimensions. Four participants (2.6%) reported an External/Task style with a moderate preference on the Orientation to Change Dimension. Three participants (2.0%) reported an Internal/Task style with a moderate preference on the Orientation to Change Dimension. Two participants (1.3%) reported moderate preference in every problem-solving style dimension. Three participants (2.0%) reported a preference for the Task style on the Ways of Deciding Dimension with moderate preferences on each of the Orientation to Change and Manner of Processing. One participant (0.7%) reported an Explorer/External style with a moderate preference on the Ways of Deciding Dimension. Two participants (1.3%) reported an Explorer/Internal style with a moderate preference on the Ways of Deciding Dimension. One participant (0.7%) reported a preference for the Explorer Style on the Orientation to Change Dimension with moderate preferences on each of the Manner of Processing and Ways of Deciding Dimensions.

Table 6

Problem-Solving Styles of Construction Professionals

OC	MP	WD	*N*	%
E	E	P	3	2.0
E	E	T	15	9.9
E	I	P	0	0
E	I	T	2	1.3
D	E	P	5	3.3
D	E	T	48	31.8
D	I	P	2	1.3
D	I	T	39	25.8
Moderate	E	Moderate	1	0.7
Moderate	E	T	4	2.6
Moderate	I	T	3	2.0
Moderate	Moderate	Moderate	2	1.3
Moderate	Moderate	T	3	2.0
E	E	Moderate	1	0.7
E	I	Moderate	2	1.3
E	Moderate	Moderate	1	0.7
E	Moderate	P	1	0.7
E	Moderate	T	1	0.7
D	Moderate	Moderate	2	1.3
D	Moderate	T	13	8.6
D	E	Moderate	3	2.0
Total			151	100

One participant (0.7%) reported a preference for External/Person style with a moderate preference on the Manner of Processing Dimension. One participant (0.7%) reported a preference for the External/Task style with a moderate preference on the Manner of Processing Dimension. Three people (2.0) reported a preference for the Developer/Explorer style with a moderate preference in the Ways of Deciding dimension. One participant (0.7%) reported a preference for the Developer Style on the Orientation to Change Dimension with a moderate preference in each of the remaining dimensions.

Table 7 presents the frequency and percentage of construction professionals with scores on each dimension of VIEW. For the Orientation to Change Dimension, data indicated 26 participants (17.2%) preferred an Explorer style, 112 participants (74.2%) preferred a Developer style, and 13 participants (8.6%) preferred a moderate style. For the Manner of Processing Dimension, data indicated 48 participants (31.8%) preferred an Internal style, 80 participants (53.0%) preferred an External style, and 23 participants (15.2%) preferred a moderate style. For the Ways of Deciding Dimension, data indicated 11 participants (7.3%) preferred a Person style, 128 participants (84.8%) preferred a Task style, and 12 participants (7.9%) preferred a moderate style.

Table 7

Frequency and Percentage of Construction Professionals Scores on VIEW

Dimension	Classification	*N*	%
OC	Explorer	26	17.2
	Developer	112	74.2
	Moderate	13	8.6
MP	Internal	48	31.8
	External	80	53.0
	Moderate	23	15.2
WD	Person	11	7.3
	Task	128	84.8
	Moderate	12	7.9

N = 151

Table 8 summarizes the descriptive statistics for construction professionals on all dimensions. For the Orientation to Change Dimension, participants responded with scores ranging from 23 to 117, which approaches the full range of 18-126. The observed mean was 82.0, which exceeds the theoretical mean of 72 and the mean of 74.5 in the master database of VIEW users (*N*=44,802) (Treffinger, Isaksen, et al., 2014). The standard deviation was 14.7, which was less than the standard deviation reported of 15.7 in the master database of VIEW users. The distribution of the sample was moderately skewed (-.507), and Kurtosis was 1.222 indicating a Leptokurtic or heavier tailed distribution (Figure 5). The standard error for skewness was 0.197, and the standard error of Kurtosis was 0.392.

Table 8

Summary of Descriptive Statistics for Scores on Each Dimension of VIEW

Measure	Scores on OC Dimension	Scores on MP Dimension	Scores on WD Dimension
Mean	82.0	29.5	39.6
Median	82.0	30.0	40.0
Mode	71.0	33.0	38.0
Standard Deviation	14.7	7.8	6.8
Maximum	117.0	51.0	53.0
Minimum	23.0	8.0	13.0
Skewness	-.507	-.093	-.640
Std Error of Skewness	.197	.197	.197
Kurtosis	1.222	-.200	1.723
Std Error of Kurtosis	.392	.392	.392

The range of the Manner of Processing Dimension varied from 8 to 51, approaching the full range of 8-56. The observed mean was 29.5, which is lower than the theoretical mean of 32 but almost identical to the mean of 29.4 reported in the master database of VIEW users. The standard deviation was 7.8, which was less than the standard deviation of 9.1 reported in the master database of VIEW users. The distribution of the sample was fairly symmetrical (Skewness = -.093), and Kurtosis was -

.200 indicating a Platykurtic or lighter tailed distribution (Figure 6). The standard error for skewness was 0.197, and the standard error of Kurtosis was 0.392.

The range of Ways of Deciding Dimension varied from 13 to 53, which is less than the full range of 8-56. The observed mean was 39.6 which was higher than the theoretical mean of 32 and higher than the mean of 35.2 reported in the master database of VIEW users. The standard deviation was 6.8, which was less than the standard deviation of 8.3 reported in the master database of VIEW users. The distribution of the same was moderately skewed (-.640), and Kurtosis was 1.723 indicating a Leptokurtic or heavier tailed distribution (Figure 7). The standard error for skewness was 0.197, and the standard error of Kurtosis was 0.392.

The histograms presented in Figures 5-7 illustrate the distribution of construction professionals scores on each dimension of VIEW. Frequency of responses was displayed on the y-axis, and the range of scores was shown on the x-axis. The curves for Orientation to Change and Ways of Deciding were negatively skewed indicating a preference for Developer and Task problem-solving styles.

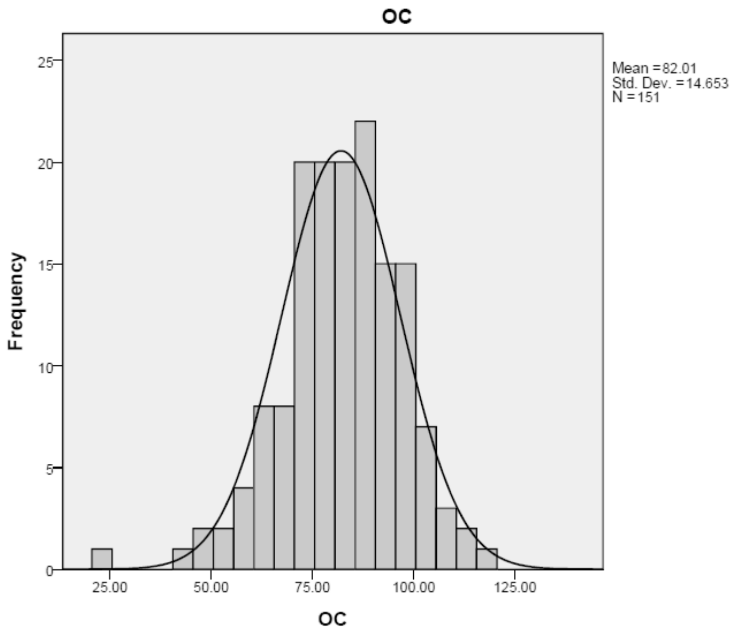

Figure 5

Distribution of Scores for Construction Professionals on OC Dimension

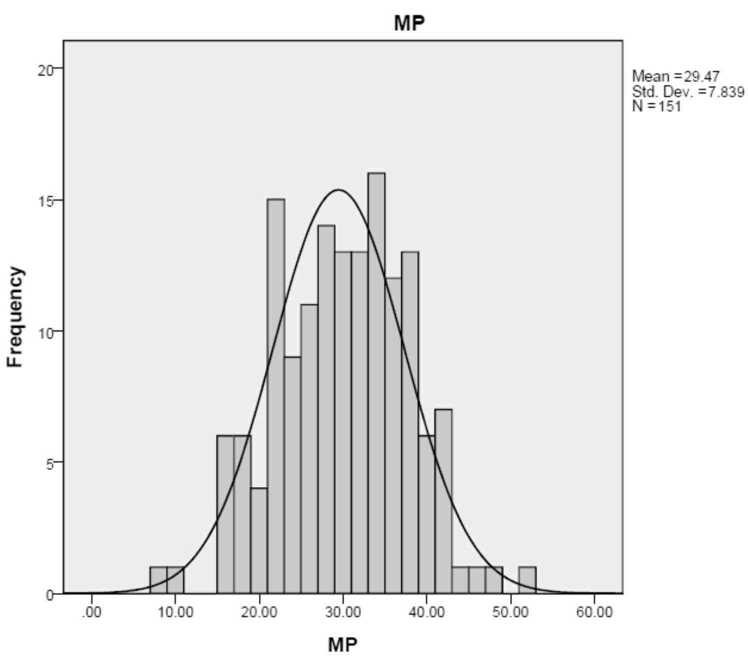

Figure 6

Distribution of Scores for Construction Professionals on MP Dimension

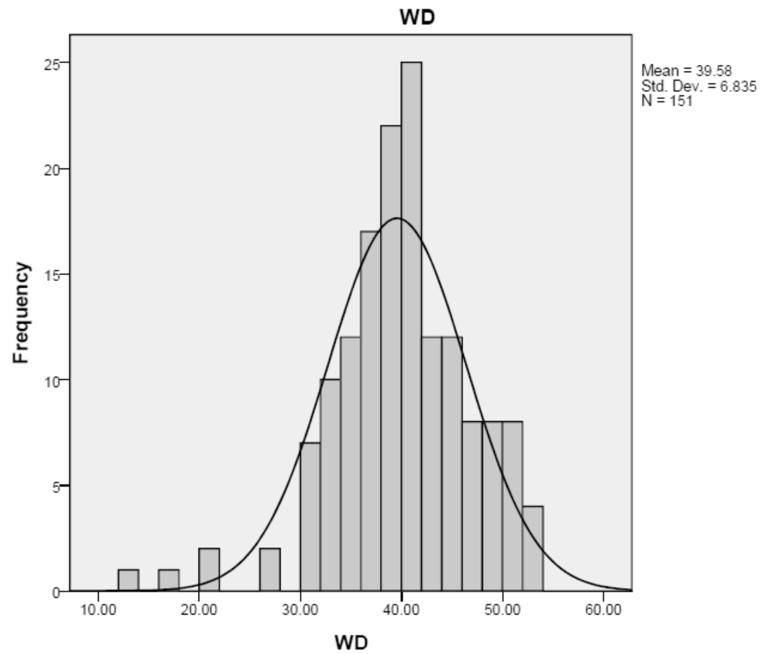

Figure 7

Distribution of Scores for Construction Professionals on WD Dimension

Research Question 2

What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry? Results of the one-way ANOVA are presented in Table 9 that consider the difference of problem-solving styles by job title for all three problem-solving dimensions.

Table 9

Analysis of Variance of Various Job Descriptions on the Problem-Solving Style Dimensions

		Sum of Squares	*df*	*MS*	*F*	*Sig.*
OC	Between Groups	459.714	4	114.929	0.529	0.715
	Within Groups	31747.279	146	217.447		
	Total	32206.993	150			
MP	Between Groups	417.314	4	104.328	1.731	.146
	Within Groups	8800.302	146	60.276		
	Total	9217.616	150			
WD	Between Groups	115.710	4	28.928	.613	.654
	Within Groups	6891.164	146	47.200		
	Total	7006.874	150			

$p < .05$

An ANOVA was conducted to determine if a difference exists between preferred problem-solving styles and the various job descriptions of construction professionals. Results indicated no significant difference $F_{150} = 0.529$, $p = 0.715$ existed between job descriptions on the Orientation to Change (OC) dimension. Results indicated no significant difference $F_{150} = 1.731$, $p = 0.146$ existed between job descriptions on the Manner of Processing (MP) dimension. Results indicated no significant difference $F_{150} = 0.613$, $p = .654$ existed between job descriptions on the Ways of Deciding (WD) dimension. Therefore, the analysis of the data revealed no significant difference between the various job descriptions on each of the three problem-solving style dimensions.

Cross-Tabulation

Cross-tabulations were used to consider the relationship between job description and each problem-solving style dimension. Table 10 presents the cross-tabulation between the job descriptions of construction professionals and preferences on the OC dimension. For each job title considered, construction professionals indicated a preference for the Developer style. Construction professionals who reported working in estimating, procurement, or pre-construction indicated a preference for the Explorer style in five cases (16.7%) and the Developer style in 24 cases (80.0%). Only 1 person (3.3%) of those in estimating, procurement, or pre-construction indicated a moderate style on the Orientation to Change dimension. Construction professionals who reported working in project management indicated a preference for the Explorer style in seven cases (26.9%) and the Developer style in 46 cases (75.4%). Eight project managers (13.1%) reported a moderate style on the Orientation to Change dimension. Construction professionals who reported working as project engineers indicated a preference for the Explorer style in 10 cases (20.4%) and the Developer style in 35 cases (71.4%). Four project managers (8.2%) reported a moderate style on the Orientation to Change dimension. The other category was tabulated, but the results contained such a wide dispersion of careers, and the number of participants was so small that it is not considered applicable data.

Table 10

Cross Tabulation of Various Job Descriptions and Preferences on the Orientation to Change (OC) Dimension

		Estimating, procure., or pre-constr.	Project Mgt.	Project Eng.	Other	Total
E	Count	5	7	10	4	26
	% within E	19.2	26.9	38.5	15.4	100
	% within job descript.	16.7	11.5	20.4	36.7	17.2
D	Count	24	46	35	7	112
	% within D	21.4	41.1	31.3	6.3	100
	% within job descript.	80.0	75.4	71.4	63.4	74.2
M	Count	1	8	4	0	13
	% within M	7.7	61.5	30.8	0	100
	% within job descript.	3.3	13.1	8.2	0	8.6
Total	Count	30	61	49	11	151
	% within OC letter	19.9	40.4	32.5	7.3	100
	% within job descript.	100	100	100	100	100

Table 11 presents the cross-tabulation between the job descriptions of construction professionals and preferences on the MP dimension. For each job title considered, construction professionals indicated a preference for the External style. Construction professionals who reported working in estimating, procurement, or pre-construction indicated a preference for the External style in 13 cases (43.3%) and the Internal style in 10 cases (33.3%). Seven of those in estimating, procurement, or pre-construction (23.3%) indicated a moderate style on the Manner of Processing dimension. Construction professionals who reported working in project management indicated a preference for the External style in 31 cases (50.8%) and the Internal style in 21 cases (34.4%). Nine (14.8%) project managers reported a moderate style on the Manner of Processing dimension. Construction professionals who reported working as project engineers indicated a preference for the Explorer style in 25 cases (51.0%) and the Internal style in 17 cases (34.7%). Seven project managers (14.3%) reported a moderate style on the Orientation to Change dimension. The other category was tabulated, but the results contained such a wide dispersion of careers, and the number of participants was so small that it is not considered applicable data.

Table 11

Cross Tabulation of Various Job Descriptions and Preferences on the Manner of Processing (MP) Dimension

		Estimating, procure., or pre-constr.	Project Mgt.	Project Eng.	Other	Total
I	Count	10	21	17	0	48
	% within I	20.8	43.8	35.4	0	100
	% within job descript.	33.3	34.4	34.7	0	31.8
E	Count	13	31	25	11	80
	% within E	16.3	38.8	31.3	13.8	100
	% within job descript.	43.3	50.8	51.0	100	53
M	Count	7	9	7	0	23
	% within M	30.4	39.1	30.4	0	100
	% within job descript.	23.3	14.8	14.3	0	15.2
Total	Count	*30*	*61*	*49*	*11*	151
	% within MP letter	*19.9*	*40.4*	*32.5*	*7.3*	100
	% within job descript.	*100*	*100*	*100*	*100*	100

Table 12 presents the cross-tabulation between job descriptions of construction professionals and preferences on the WD dimension. For each job title considered, construction professionals indicated a preference for the Task style. Construction professionals who reported working in estimating, procurement, or pre-construction indicated a preference for the Task style in 29 cases (96.7%) while none had a preference for the Person style (0%). One person (3.3%) of those in estimating, procurement, or pre-construction indicated a moderate style on the Ways of Deciding dimension. Construction professionals who reported working in project management indicated a preference for the Task style in 52 cases (85.2%) and the Person style in four cases (6.6%). Five project managers (8.2%) reported a moderate style on the Ways of Deciding dimension. Construction professionals who reported working as project engineers indicated a preference for the Task style in 38 cases (77.6%) and the Person style in five cases (10.2%). Six project managers (12.2%) reported a moderate style on the Ways of Deciding dimension. The other category was tabulated, but the results contained such a wide dispersion of careers, and the number of participants was so small that it is not considered applicable data.

Table 12

Cross Tabulation of Various Job Descriptions and Preferences on the Ways of Deciding (WD) Dimension

		Estimating, procure., or pre-constr.	Project Mgt.	Project Eng.	Other	Total
T	Count	29	52	38	9	128
	% within T	22.7	40.6	29.7	7.0	100
	% within job descript.	96.7	85.2	77.6	81.6	84.8
P	Count	0	4	5	2	11
	% within P	0	36.4	45.5	18.2	100
	% within job descript.	0	6.6	10.2	18.4	7.3
M	Count	1	5	6	0	12
	% within M	8.3	41.7	50.0	0	100
	% within job descript.	3.3	8.2	12.2	0	7.9
Total	Count	30	61	49	11	151
	% within WD letter	19.9	40.4	32.5	7.3	100
	% within job descript.	100	100	100	100	100

Research Question 3

What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry? Results of the one-way ANOVA are presented in Table 13 that consider the difference of problem-solving styles by years of experience for all three problem-solving dimensions. Note that the number of respondents to this questions (*N*=140) is less than the 151 individuals who completed the survey indicating that 11 people did not respond to this question. This is less than 7% of the maximum number of respondents on any question.

Table 13

Analysis of Variance of Years of Experience on the Problem-Solving Style Dimensions

		Sum of Squares	*df*	*MS*	*F*	*Sig.*
OC	Between Groups	1743.514	5	348.703	1.687	0.142
	Within Groups	27693.029	134	206.664		
	Total	29436.543	139			
MP	Between Groups	55.716	5	11.143	0.173	0.972
	Within Groups	8653.220	134	64.576		
	Total	8708.936	139			
WD	Between Groups	141.982	5	28.396	0.614	0.689
	Within Groups	6193.868	134	46.223		
	Total	6335.850	139			

$p < .05$

An ANOVA was conducted to determine if a difference existed between preferred problem-solving styles and years of experience of construction professionals. Results indicated no significant difference $F_{139} = 1.687$, $p = 0.142$ existed between years of experience on the Orientation to Change (OC) dimension. Results indicated no significant difference $F_{139} = 0.173$, $p = 0.972$ existed between years of experience on the Manner of Processing (MP) dimension. Results indicated no significant difference $F_{139} = 0.614$, $p = .689$ existed between job descriptions on the Ways of Deciding (WD) dimension. Therefore, the analysis of the data revealed no significant difference between the years of experience on each of the three problem-solving style dimensions.

Cross-Tabulation

Cross-tabulations were used to consider the relationship between years of experience and each problem-solving style dimension. Table 14 presents the cross-tabulation between the years of experience of construction professionals and preferences on the OC dimension. For each range of experience considered, construction professionals indicated a preference for the Developer style. Construction professionals who reported a year or less experience indicated a preference for the Explorer style in three cases (20%) and the Developer style in 12 cases (80%). Construction professionals with more than one year experience but less than five years experience indicated a preference for the Explorer style in four cases (14.3%) and the Developer style in 20 cases (71.4%). Four people (14.3%) with 1-5 years experience indicated a moderate style on the Orientation to Change Dimension. Construction professionals with more than five years experience but less than 10 years experience indicated a preference for the Explorer style in four cases (15.4%) and the Developer style in 19 cases (73.1%). Three people

(11.5%) with 5-10 years experience indicated a moderate style on the Orientation to Change Dimension.

Construction professionals with more than 10 years experience but less than 15 years experience indicated a preference for the Explorer style in three cases (13.6%) and the Developer style in 16 cases (72.7%). Three people (13.6%) with 10-15 years experience indicated a moderate style on the Orientation to Change Dimension. Construction professionals with more than 15 years experience but less than 20 years experience indicated a preference for the Explorer style in two cases (9.5%) and the Developer style in 17 cases (81.0%). Two people (9.5%) with 15-20 years experience indicated a moderate style on the Orientation to Change Dimension. Construction professionals with more than 20 years experience indicated a preference for the Explorer style in seven cases (25%) and the Developer style in 20 cases (71.4%). One person (3.6%) with more than 20 years experience indicated a moderate style on the Orientation to Change Dimension.

Table 14
Cross Tabulation of Years of Experience of Construction Professionals and Preferences on the Orientation to Change (OC) Dimension

		<= 1 yr	1-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	>20 years	Total
E	Count	3	4	4	3	2	7	23
	% within E	13.0	17.4	17.4	13.0	8.7	30.4	100
	% within yrs. exp.	20.0	14.3	15.4	13.6	9.5	25.0	16.4
D	Count	12	20	19	16	17	20	104
	% within D	11.5	19.2	18.3	15.4	16.3	19.2	100
	% within yrs. exp.	80.0	71.4	73.1	72.7	81.0	71.4	74.3
M	Count	0	4	3	3	2	1	13
	% within M	0	30.8	23.1	23.1	15.4	7.7	100
	% within yrs. exp.	0	14.3	11.5	13.6	9.5	3.6	9.3
Total	Count	15	28	26	22	21	28	140
	% within WD	10.7	20.0	18.6	15.7	15.0	20.0	100
	% within yrs. exp.	100	100	100	100	100	100	100

Table 15 presents the cross-tabulation between the years of experience of construction professionals and preferences on the MP dimension. For each range of experience considered, construction professionals indicated a preference for the External style. Construction professionals who reported a year or less experience indicated a preference for the External style in eight cases (53.3%) and the Internal style in five cases

(33.3%). Two people (13.3%) with one year or less experience indicated a moderate style on the Manner of Processing Dimension. Construction professionals with more than one year experience but less than five years experience indicated a preference for the External style in 15 cases (53.6%) and the Internal style in five cases (17.9%). Eight people (28.6%) with 1-5 years experience indicated a moderate style on the Manner of Processing Dimension. Construction professionals with more than five years experience but less than 10 years experience indicated a preference for the External style in 13 cases (50%) and the Internal style in 11 cases (42.3%). Two people (7.7%) with 5-10 years experience indicated a moderate style on the Manner of Processing Dimension. Construction professionals with more than 10 years experience but less than 15 years experience indicated a preference for the External style in 12 cases (54.5%) and the Internal style in seven cases (31.8%). Three people (13.6%) with 10-15 years experience indicated a moderate style on the Manner of Processing Dimension. Construction professionals with more than 15 years experience but less than 20 years experience indicated a preference for the External style in 11 cases (52.4%) and the Internal style in eight cases (38.1%). Two people (9.5%) with 15-20 years experience indicated a moderate style on the Manner of Processing Dimension. Construction professionals with more than 20 years experience indicated a preference for the External style in 16 cases (57.1%) and the Internal style in eight cases (28.6%). Four people (14.3%) with more than 20 years experience indicated a moderate style on the Manner of Processing Dimension.

Table 15

Cross Tabulation of Years of Experience of Construction Professionals and Preferences on the Manner of Processing (MP) Dimension

		<= 1 yr	1-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	>20 years	Total
E	Count	8	15	13	12	11	16	75
	% within E	10.7	20	17.3	16	14.7	21.3	100
	% within yrs. exp.	53.3	53.6	50	54.5	52.4	57.1	53.6
I	Count	5	5	11	7	8	8	44
	% within I	11.4	11.4	25	15.9	18.2	18.2	100
	% within yrs. exp.	33.3	17.9	42.3	31.8	38.1	28.6	31.4
M	Count	2	8	2	3	2	4	21
	% within M	9.5	38.1	9.5	14.3	9.5	19	100
	% within yrs. exp.	13.3	28.6	7.7	13.6	9.5	14.3	15
Total	Count	15	28	26	22	21	28	140
	% within WD	10.7	20.0	18.6	15.7	15.0	20.0	100
	% within yrs. exp.	100	100	100	100	100	100	100

Table 16 presents the cross-tabulation between the years of experience of construction professionals and preferences on the WD dimension. For each range of experience considered, construction professionals indicated a preference for the Task style. Construction professionals who reported a year or less experience indicated a preference for the Task style in 13 cases (86.7%) and the Person style in two cases (13.3%). Construction professionals with more than one year experience but less than five years experience indicated a preference for the Task style in 22 cases (78.6%) and the Person style in one case (3.6%). Five people (17.9%) with 1-5 years experience indicated a moderate style on the Ways of Deciding Dimension. Construction professionals with more than five years experience but less than 10 years experience indicated a preference for the Task style in 21 cases (80.8%) and the Person style in one case (3.8%). Four people (15.4%) with 5-10 years experience indicated a moderate style on the Ways of Deciding Dimension. Construction professionals with more than 10 years experience but less than 15 years experience indicated a preference for the Task style in 20 cases (90.9%) and the Person style in one case (4.5%). One person (4.5%) with 10-15 years experience indicated a moderate style on the Ways of Deciding Dimension. Construction professionals with more than 15 years experience but less than 20 years experience indicated a preference for the Task style in 17 cases (81%) and the Person style in four cases (19%). Construction professionals with more than 20 years experience indicated a preference for the Task style in 26 cases (92.9%) and the Person style in one case (3.6%). One person (14.3%) with more than 20 years experience indicated a moderate style on the Ways of Deciding Dimension.

Table 16

Cross Tabulation of Years of Experience of Construction Professionals and Preferences on the Ways of Deciding (WD) Dimension

		<= 1 yr	1-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	>20 years	Total
T	Count	13	22	21	20	17	26	119
	% within T	10.9	18.5	17.6	16.8	14.3	21.8	100
	% within yrs. exp.	86.7	78.6	80.8	90.9	81.0	92.9	85.0
P	Count	2	1	1	1	4	1	10
	% within P	20	10	10	10	40	10	100
	% within yrs. exp.	13.3	3.6	3.8	4.5	19	3.6	7.1
M	Count	0	5	4	1	0	1	11
	% within M	0	45.5	36.4	9.1	0	9.1	100
	% within yrs. exp.	0	17.9	15.4	4.5	0	3.6	7.9
Total	Count	15	28	26	22	21	28	140
	% within WD	10.7	20.0	18.6	15.7	15.0	20.0	100
	% within yrs. exp.	100	100	100	100	100	100	100

Research Question 4

What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry? Results of the one-way ANOVA are presented in Table 17 that consider the difference of problem-solving styles by time of project engagement for all three problem-solving dimensions. Note that the number of respondents to this questions (N=148) is less than the 151 individuals who completed the survey indicating that three people did not respond to this question.

Table 17

Analysis of Variance of Various Type of Project Engagement on the Problem-Solving Style Dimensions

		Sum of Squares	*df*	*MS*	*F*	*Sig.*
OC	Between Groups	103.568	2	51.784	0.240	0.787
	Within Groups	31251.209	145	215.526		
	Total	31354.777	147			
MP	Between Groups	749.893	2	374.947	6.767	.002
	Within Groups	8033.965	145	55.407		
	Total	8783.858	147			
WD	Between Groups	695.996	2	347.998	8.172	<.001
	Within Groups	6174.923	145	42.586		
	Total	6870.919	147			

$p < .05$

An ANOVA was conducted to determine if a difference existed between preferred problem-solving styles and the time of project engagement of construction professionals. Results indicated no significant difference $F_{147} = 0.240$, $p = 0.787$ existed between time of project dimension on the Orientation to Change (OC) dimension. Results indicated a significant difference $F_{150} = 6.767$, $p = 0.002$ existed between Type of Project

Engagement on the Manner of Processing (MP) dimension. Results indicated a significant difference $F_{150} = 8.172$, $p < 0.001$ existed between Type of Project Engagement on the Ways of Deciding (WD) dimension. For the MP dimension, the effect size was .0723 ($\omega^2 = .0723$), and for the WD dimension, effect size was .0884 ($\omega^2 = .0884$). Levene's test for homogeneity passed for all three dependent variables (p=.321, 1.144, and .356).

Tukey post-hoc pairwise comparisons for the MP dimension show significant differences between those that work primarily on competitively bid jobs with lump sum and those that work on a balance of competitively bid, lump sum and subjectively chosen or negotiated, cost plus projects ($p = .002$). Similarly, Tukey post-hoc pairwise comparisons for the MP dimension show differences between those that work primarily on subjectively chosen or negotiated, cost plus projects and those that work on a balance of competitively bid, lump sum and subjectively chosen or negotiated, cost plus projects ($p = .031$). Tukey post-hoc pairwise comparisons for the WD dimension show significant differences between those that work primarily on competitively bid jobs with lump sum and those that work on a balance of competitively bid, lump sum and subjectively chosen or negotiated, cost plus projects ($p = .036$). Similarly, Tukey post-hoc pairwise comparisons for the WD dimension show significant differences between those that work primarily on subjectively chosen or negotiated, cost plus projects and those that work on a balance of competitively bid, lump sum and subjectively chosen or negotiated, cost plus projects ($p < .001$).

Cross-Tabulation

Cross-tabulations were used to consider the relationship between job description and each problem-solving style dimension. Table 18 presents the cross-tabulation between the type of project engagement of construction professionals and preferences on the OC dimension. For each type of project engagement considered, construction professionals indicated a preference for the Developer style. Construction professionals who reported working on competitively bid, lump sum projects indicated a preference for the Explorer style in six cases (24.0%) and the Developer style in 17 cases (68.0%). Two of those primarily working in competitively bid, lump sum projects (8.0%) indicated a moderate style on the Orientation to Change dimension. Construction professionals who reported working primarily on subjectively selected or negotiated, lump sum projects indicated a preference for the Explorer style in 14 cases (17.9%) and the Developer style in 56 cases (71.8%). Eight of those who reported working primarily on subjectively selected or negotiated, lump sum projects (10.3%) indicated a moderate style on the Orientation to Change dimension. Construction professionals who reported working on a mix of negotiated and competitively bid projects indicated a preference for the Explorer style in six cases (13.3%) and the Developer style in 36 cases (80.0%). Three of those working on a mix of projects (6.7%) reported a moderate style on the Orientation to Change dimension.

Table 18

Cross Tabulation of Various Type of Project Engagement and Preferences on the Orientation to Change (OC) Dimension

		Competitively bid, lump sum	Subjectively chosen, cost plus	Mix of the previous two	Total
E	Count	6	14	6	26
	% within E	23.1	53.8	23.1	100
	% within type of engagement	24.0	17.9	13.3	17.6
D	Count	17	56	36	109
	% within D	15.6	51.4	33.0	100
	% within type of engagement	68.0	71.8	80.0	73.6
M	Count	2	8	3	13
	% within M	15.4	61.5	23.1	100
	% within type of engagement	8.0	10.3	6.7	8.8
Total	Count	25	78	45	148
	% within OC letter	16.9	52.7	30.4	100
	% within type of engagement	100	100	100	100

Table 19 presents the cross-tabulation between the type of project engagement of construction professionals and preferences on the MP dimension. For those primarily engaged in either competitive bid, lump sum projects or subjectively selected, negotiated projects, construction professionals indicated a preference for the External style. Those construction professionals who reported working on a mix of project types indicated a preference for the Internal style. Construction professionals who reported working primarily on competitively bid, primarily lump sum projects indicated a preference for the External style in 19 cases (76.0%) and the Internal style in three cases (12.0%). Three of those working primarily on competitively bid, primarily cost plus projects (12.0%) indicated a moderate style on the Manner of Processing dimension. Construction professionals who reported working primarily on subjectively chosen or negotiated, primarily cost plus jobs indicated a preference for the External style in 42 cases (53.8%) and the Internal style in 24 cases (30.8%). Twelve (15.4%) of those working primarily on competitively bid, primarily cost plus projects reported a moderate style on the Manner of Processing dimension. Construction professionals who reported working a mix of projects indicated a preference for the Explorer style in 17 cases (37.8%) and the Internal style in 21 cases (46.7%). Seven people who reported working on a mix of projects (15.6%) reported a moderate style on the Manner of Processing dimension.

Table 19

Cross Tabulation of Various Type of Project Engagement and Preferences on the Manner of Processing (MP) Dimension

		Competitively bid, lump sum	Subjectively chosen, cost plus	Mix of the previous two	Total
E	Count	19	42	17	78
	% within E	24.4	53.6	21.8	100
	% within type of engagement	76.0	53.8	37.8	52.7
I	Count	3	24	21	48
	% within I	6.3	50.0	43.8	100
	% within type of engagement	12.0	30.8	46.7	32.4
M	Count	3	12	7	22
	% within M	13.6	54.5	31.8	100
	% within type of engagement	12.0	15.4	15.6	14.9
Total	Count	25	78	45	148
	% within MP letter	16.9	52.7	30.4	100
	% within type of engagement	100	100	100	100

Table 20 presents the cross-tabulation between type of project engagement of construction professionals and preferences on the WD dimension. For each type of project engagement considered, construction professionals indicated a preference for the Task style. Construction professionals who reported working primarily on competitively bid, primarily lump sum projects indicated a preference for the Task style in 22 cases (88.0%) and the Person style in one cases (4.0%). Two of those working primarily on competitively bid, primarily cost plus projects (8.0%) indicated a moderate style on the Ways of Deciding dimension. Construction professionals who reported working primarily on subjectively chosen or negotiated, primarily cost plus jobs indicated a preference for the Task style in 63 cases (80.8%) and the Person style in seven cases (9.0%). Eight (10.3%) of those working primarily on competitively bid, primarily cost plus projects reported a moderate style on the Ways of Deciding dimension. Construction professionals who reported working a mix of projects indicated a preference for the Task style in 41 cases (91.1%) and the Person style in two cases (4.4%). Two people who reported working on a mix of projects (4.4%) reported a moderate style on the Ways of Deciding dimension.

Table 20

Cross Tabulation of Various Type of Project Engagement and Preferences on the Ways of Deciding (WD) Dimension

		Competitively bid, lump sum	Subjectively chosen, cost plus	Mix of the previous two	Total
T	Count	22	63	41	126
	% within T	17.5	50.0	32.5	100
	% within type of engagement	88.0	80.8	91.1	85.1
P	Count	1	7	2	10
	% within P	10.0	70.0	20.0	100
	% within type of engagement	4.0	9.0	4.4	6.8
M	Count	2	8	2	12
	% within M	16.7	66.7	16.7	100
	% within type of engagement	8.0	10.3	4.4	8.1
Total	Count	25	78	45	148
	% within WD letter	16.9	52.7	30.4	100
	% within type of engagement	100	100	100	100

Research Question 5

What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry? Results of the one-way ANOVA are presented in Table 21 that consider the difference between preferred problem-solving styles and educational experience for all three problem-solving dimensions.

Table 21

Analysis of Variance of Various Educational Experience on the Problem-Solving Style Dimensions

		Sum of Squares	*Df*	*MS*	*F*	*Sig.*
OC	Between Groups	51.912	2	25.956	0.119	0.887
	Within Groups	32155.082	148	217.264		
	Total	32206.993	150			
MP	Between Groups	29.725	2	14.863	0.239	0.787
	Within Groups	9187.891	148	62.080		
	Total	9217.616	150			
WD	Between Groups	190.631	2	95.315	2.070	0.130
	Within Groups	6816.243	148	46.056		
	Total	7006.874	150			

$p < .05$

An ANOVA was conducted to determine if a difference existed between the level of education of construction professionals on the three problem-solving style dimensions. Results indicated no significant difference $F_{150} = 0.119$, $p = 0.887$ existed between educational level on the Orientation to Change (OC) dimension. Results indicated no significant difference $F_{150} = 0.239$, $p = 0.787$ existed between educational level on the Manner of Processing (MP) dimension. Results indicated no significant difference $F_{150} = 2.07$, $p = 0.130$ existed between educational level on the Ways of Deciding (WD) dimension. Therefore, the analysis of the data revealed no significant difference between the various job descriptions on each of the three problem-solving style dimensions.

Cross-Tabulation

Cross-tabulations were used to consider the relationship between educational level and each problem-solving style dimension. Table 22 presents the cross-tabulation between the educational level of construction professionals and preferences on the OC dimension. For each educational level considered, construction professionals indicated a preference for the Developer style. Construction professionals who reported having at least a high school education but no college degree indicated a preference for the Developer style in 15 cases (100.0%). Construction professionals who reported having a college degree indicated a preference for the Explorer style in 22 cases (19.1%) and the Developer style in 81 cases (70.4%). Twelve of those with a college degree (10.4%) indicated a moderate style on the Orientation to Change dimension. Construction professionals who reported having a Master's or Professional degree indicated a preference for the Explorer style in four cases (19.0%) and the Developer style in 16 cases (76.2%). One person with a Master's or Professional degree (4.8%) reported a moderate style on the Orientation to Change dimension.

Table 22

Cross Tabulation of Various Educational Experience and Preferences on the Orientation to Change (OC) Dimension

		High School but no College Degree	College Degree	Masters or Professional Degree	Total
E	Count	0	22	4	26
	% within E	0	84.6	15.4	100
	% within edu. exp.	0	19.1	19.0	17.2
D	Count	15	81	16	112
	% within D	13.4	72.3	14.3	100
	% within edu. exp.	100	70.4	76.2	74.2
M	Count	0	12	1	13
	% within M	0	92.3	7.7	100
	% within edu. exp.	0	10.4	4.8	8.6
Total	Count	15	115	21	151
	% within OC letter	9.9	76.2	13.9	100
	% within edu. exp.	100	100	100	100

Table 23 presents the cross-tabulation between the level of education of construction professionals and preferences on the MP dimension. For each educational level considered, construction professionals indicated a preference for the External style.

Construction professionals who reported at least a high school education but no college degree indicated a preference for the External style in seven cases (46.7%) and the Internal style in five cases (33.3%). Three of those who reported at least a high school education (20%) but no college degree indicated a moderate style on the Manner of Processing dimension. Construction professionals who reported having a college degree indicated a preference for the External style in 62 cases (53.9%) and the Internal style in 36 cases (31.3%). Seventeen (14.8%) of those with a college degree reported a moderate style on the Manner of Processing dimension. Construction professionals who reported a Master's or Professional degree indicated a preference for the Explorer style in 11 cases (52.4%) and the Internal style in seven cases (33.3%). Three people who reported working on a mix of projects (14.3%) reported a moderate style on the Manner of Processing dimension.

Table 23

Cross Tabulation of Various Educational Experience and Preferences on the Manner of Processing (MP) Dimension

		High School but no College Degree	College Degree	Masters or Professional Degree	Total
E	Count	7	62	11	80
	% within E	8.8	77.5	13.8	100
	% within edu. exp.	46.7	53.9	52.4	53.0
I	Count	5	36	7	48
	% within I	10.4	75.0	14.6	100
	% within edu. exp.	33.3	31.3	33.3	31.8
M	Count	3	17	3	23
	% within M	13.0	73.9	13.0	100
	% within edu. exp.	20.0	14.8	14.3	15.2
Total	Count	15	115	21	151
	% within MP letter	9.9	76.2	13.9	100
	% within edu. exp.	100	100	100	100

Table 24 presents the cross-tabulation between educational experience of construction professionals and preferences on the WD dimension.

Table 24

Cross Tabulation of Educational Experience and Preferences on the Ways of Deciding (WD) Dimension

		High School but no College Degree	College Degree	Masters or Professional Degree	Total
T	Count	15	96	17	128
	% within T	11.7	75.0	13.3	100
	% within edu. exp.	100	83.5	81.0	84.8
P	Count	0	9	2	11
	% within P	0	81.8	18.2	100
	% within edu. exp.	0	7.8	9.5	7.3
M	Count	0	10	2	12
	% within M	0	83.3	16.7	100
	% within edu. exp.	0	8.7	9.5	7.9
Total	Count	15	115	21	151
	% within WD letter	9.9	76.2	13.9	100
	% within edu. exp.	100	100	100	100

For each educational level considered, construction professionals indicated a preference for the Task style. Construction professionals who reported at least a high school education but no college degree indicated a preference for the Task style in 15 cases

(100%). Construction professionals who reported having a college degree indicated a preference for the Task style in 96 cases (83.5%) and the Person style in nine cases (7.8%). Ten (8.7%) of those with a college degree reported a moderate style on the Ways of Deciding dimension. Construction professionals who reported a Master's or Professional degree indicated a preference for the Task style in 17 cases (81.0%) and the Person style in two cases (9.5%). Two people who reported working on a mix of projects (9.5%) reported a moderate style on the Ways of Deciding dimension.

Summary

Descriptive data results indicated that construction professionals tend toward the Developer preference on the OC dimension and the Task preference on the WD dimension more than those in a variety of industries. The problem-solving style combinations of DIT and DET were present in 56.6% of those surveyed.

Cross tabulation data indicated variations in problem-solving style preferences across independent variables considered. However, only two variations in style preference were found to be significant in the ANOVA analyses. Results of the ANOVA yielded significant differences between the two times of project engagement on the MP and WD dimensions. Tukey post-hoc pairwise comparisons for the MP and WD dimension show significant differences between those that work primarily on competitively bid jobs with lump sum and those that work on a balance of competitively bid, lump sum and subjectively chosen or negotiated, projects. However, the effect size was medium.

This chapter presented the findings of the statistical analyses of the survey data. Chapter 5 discusses the implications of these findings in detail and considers the implications for the professional practice of construction. This chapter will also consider areas for additional research and provide an overall summary of the study.

Chapter 5. SUMMARY, CONCLUSIONS, DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

The purpose of the study was to determine if certain problem-solving styles are more dominant among specific job categories, experience levels, educational experiences, and time of project engagement in the Southeast construction industry than are other problem-solving styles. The first chapter provided an introduction to problem-solving styles and construction. The statement of the problem, purpose, research questions, significance, assumptions, limitations, and definition of the terms were also identified. The second chapter outlined the literature review of problem-solving styles, the construction industry, and construction management education. The third chapter described the design of the study, the population and sample, the survey instrument, the training required to use the VIEW instrument, validity and reliability of VIEW, data collection, and how the data would be analyzed. The fourth chapter presented the findings of the study including how the data was organized, a description of the sample, and descriptive and/or inferential statistics on each of the research questions. This chapter provides a summary of this study, conclusions, implications, and recommendations.

Research Questions

The following research questions were used in this study:

1. What are the dominant problem-solving styles of employees in the Southeast construction industry?
2. What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry?
3. What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry?
4. What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry?
5. What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Summary

Experiential techniques such as problem solving have been established as an effective technique in adult learning (Brookfield, 1986; Knowles, Swanson, & Holton, 2005). Current literature (Ahn et al., 2012; Wiezel & Badger, 2015) has emphasized problem-solving as a key skill required of construction managers; however, little research exists on how problems are solved in professional practice. This study added to the understanding of adult learning by considering the preferred problem-solving styles of construction professionals.

The complexity and level of specialization in construction has increased at a rapid pace (Spence, 2006). Project delivery options have evolved, and more stakeholders are involved in the construction process (Franks et al., 2015). Highly specialized teams of diverse professionals construct today's buildings. In construction, these diverse teams are created or developed at the start of each project, which makes it critical that the team quickly understands how to work together in a multi-disciplinary environment. Understanding of how construction professionals prefer to solve problems represents a first step toward improving both the individual constructor as problem solver and the performance of collaborative teams in the built environment.

This study examined the preferred problem-solving styles of construction professionals and the demographic variables of job description, years of experience, type of project engagement, and educational experience. The sample population for this study was 151 construction professionals located in the Southeastern United States, and the study was conducted during the summer semester, 2016. The participants completed a brief demographic questionnaire and the VIEW Assessment. Participation in the study was voluntary.

A demographic questionnaire was administered to obtain job description, years of experience, type of project engagement, and educational experience of construction professionals. Job descriptions reported included three major categories of project managing (40.4%), project or field engineering (32.5%), and estimating, procurement, or pre-construction (19.9%). Construction professionals surveyed were well distributed with regard to years of experience. When five-year categories of job experience were identified (6-10, 11-15, etc.), all had 21 or more respondents making all five-year experience intervals greater than or equal to 15% of total respondents. Most participants reported engagement in subjectively chosen or negotiated projects that were often cost-plus (52.7%). Of the remaining, 16.9% reported primarily competitive bid, lump sum projects while 30.4% reported a balance of the two approaches. Construction professionals primarily reported a college undergraduate degree (76.2%) followed by those with a Master's degree (13.2%).

Research Question 1

What are the dominant problem-solving styles of employees in the Southeast Construction Industry? The VIEW Assessment provides preferred problem-solving styles on three dimensions: Orientation to Change (OC-Explorer or Developer style), Manner of Processing (MP-External or Internal style), and Ways of Deciding (WD-Person or Task style). For the OC dimension, 74.2% preferred the Developer style; 17.2% preferred the Explorer style; and 8.6% were Moderate. For the MP dimension, 53.0% preferred the External style; 31.8% preferred the Internal style; and 15.2% were Moderate. For the WD dimension, 84.8% preferred the Task style; 7.3% preferred the Person style; and 7.9% were Moderate. Within this study, a majority of construction professionals indicated a preference for the Developer style, External style, and Task style.

The master database of VIEW respondents (*N*=44,802) reports responses on preferred problem-solving styles for a wide range of professions (Treffinger, Isaksen, et al., 2014). The mean score for construction professionals on the OC dimension was 82.0, which exceeded the mean of 74.5 in the master database. On the MP dimension, construction professionals averaged 29.5, which was almost identical to the 29.4 reported in the master database. On the WD dimension, the mean score for construction professionals was 39.6, which was higher than the mean of 35.2 reported in the master database.

When combinations of the VIEW dimensions are considered, two dominant styles emerge from the 21 styles observed in the data. Developer/External/Task (31.8%) and Developer/Internal/Task (25.8%) combined to represent 57.6% of the sample considered. When Developer/Moderate/Task (8.6%) is also added, 64.2% of respondents were both a Developer on the OC dimension and Task on the WD dimension.

Research Question 2

What, if any, are the relationships of problem-solving styles among construction professional job descriptions in the Southeast construction industry?

Results of the ANOVA indicated that there was no significant difference between preferred problem-solving styles and job descriptions. This was consistent across all dimensions with the OC dimension having $F_{150} = 0.529$, $p = 0.715$; the MP dimension having $F_{150} = 1.731$, $p = 0.146$; and the WD dimension having $F_{150} = 0.613$, $p = 0.654$. While the ANOVA results did not indicate a significant difference, the descriptive statistics of the cross tabulation revealed some consistencies. For every job description considered, the preferences noted in Research Question 1 for the Developer style on the OC dimension, the External style on the MP dimension, and the Task style on the WD dimension were observed.

Research Question 3

What, if any, is the relationship of problem-solving styles and years of experience in the Southeast construction industry?

Results of the ANOVA indicated that there was no significant difference between preferred problem-solving styles and years of experience in the construction industry. This was consistent across all dimensions with the OC dimension having $F_{139} = 1.687$, p

= 0.142; the MP dimension having $F_{139} = 0.173$, $p = 0.972$; and the WD dimension having $F_{139} = 0.614$, $p = 0.689$. While the ANOVA results did not indicate a significant difference, the descriptive statistics of the cross tabulation revealed some consistencies. For every interval of experience considered, the preferences noted in Research Question 1 for the Developer style on the OC dimension, the External style on the MP dimension, and the Task style on the WD dimension were observed.

Research Question 4

What, if any, is the relationship of problem-solving styles and time of project engagement in the Southeast construction industry?

Results indicated no significant difference existed between time of project engagement and the OC dimension ($F_{150} = 0.240$, $p = 0.787$). Results indicated a significant difference existed between time of project engagement on both the MP ($F_{150} = 6.767$, $p = 0.002$) and WD ($F_{150} = 8.172$, $p < 0.001$) dimensions. The effect size was moderate for each area with $\omega^2 = 0.0723$ for the MP dimension and $\omega^2 = 0.0844$ for the WD dimension. Tukey post-hoc pairwise comparisons for the MP and WD dimensions show significant differences between those that work primarily on competitively bid jobs with lump sum and those that have worked on a balance of competitively bid, lump sum and subjectively chosen or negotiated, cost plus projects.

The cross-tabulations revealed that the Developer dimension and the Task dimension are the dominant styles for all regardless of project engagement. The External dimension was preferred by those that engage in competitively bid, lump sum projects (76.0%) and those who were engaged in subjectively chosen, cost plus projects (53.8%).

However, those construction professionals who report working on a mix of the two project styles tended to prefer an Internal style (46.7%).

Research Question 5

What, if any, is the relationship of problem-solving styles and educational experience in the Southeast construction industry?

Results of the ANOVA indicated that there was no significant difference between preferred problem-solving styles and educational experience in the construction industry. This was consistent across all dimensions with the OC dimension having $F_{150} = 0.119$, $p = 0.887$; the MP dimension having $F_{150} = 0.239$, $p = 0.787$; and the WD dimension having $F_{150} = 2.07$, $p = 0.130$. While the ANOVA results did not indicate a significant difference, the descriptive statistics of the cross tabulation revealed some consistencies. For every interval of experience considered, the preferences noted in Research Question 1 for the Developer style on the OC dimension, the External style on the MP dimension, and the Task style on the WD dimension were observed.

Conclusions

Analysis of the data resulted in the following conclusions:

Research Question 1

1. Construction professionals exhibited a preference for the Developer style on the OC dimension. This dimension attempts to assess one's preference for managing structure and authority when dealing with change or solving problems (Treffinger et al., 2008). A person with a Developer profile prefers a structured environment with clear guidance from authority. The Developer prefers to follow established rules and procedures to solve a given problem. Many of the benefits of this style

are valued greatly in construction: stability, maintaining order, and an accurate, methodical approach to solving problems. The negatives associated with a Developer style include resistance to change and a tendency to be impatient and inflexible (Treffinger et al., 2008).

2. Construction professionals exhibited a preference for the External style on the MP dimension but matched the scores on the master database. Based on the cross tabulation data, this preference was not as clear as the preferences on the OC and WD dimensions. A person with a preference for the External style enjoys interacting with others to solve problems. These individuals tend to be action-oriented, engage in a variety of tasks, and prefer to move around when working. An External style individual would be able to respond quickly in a group of individuals and maintain multiple social contacts. However, External solvers may tend to act without thinking and avoid listening to the ideas of others.
3. Construction professionals exhibited a preference for the Task style on the WD dimension. The Task style individual prefers a rational, logical approach to making decisions often choosing the facts of the situation over the impact of that decision on people. A Task style individual prefers using objectivity in making logical and rational decisions. However, Task style problem-solvers are often viewed as critical, detached, and unconcerned with people.
4. The results suggested a preference for the population along two dominant style dimensions. The dominant combined style dimensions were Developer/External/Task and Developer/Internal/Task comprising 57.6% of those surveyed.

Research Question 2-5

5. With the exception of question 4, no significant difference was found. Where a significant difference existed in question 4, the minimal effect size coupled with the impacted variable that included both project engagement styles, essentially yielded this result as interesting but without clear conclusions.

Implications

The results indicate a number of implications for construction professions with regard to education, training, and team effectiveness. Key to many of these implications is the research by Treffinger et al. (2008) who determined that improved awareness of one's preferred problem-solving style and the styles of others can improve both personal productivity and effective teamwork.

The majority of respondents surveyed preferred a rational, methodical, and carefully structured approach to solving problems. While this approach has served the construction industry well in traditional design-bid-build relationships, it is questionable as to whether this approach is sufficient to meet the demands of new delivery approaches that engage the contractor before design is completed and a structured approach can be developed.

Traditional educational approaches in construction management have been focused on structured approaches to solving problems (developing estimates, creating a schedule, solving a structures problem). Such approaches are necessary for a risk-filled, low margin industry but may not be sufficient for an industry that will increasingly face ill-structured, complex problems involving a large number of stakeholders. A balance is needed to continue the focused method-oriented education typical of construction management while encouraging the constructor to embrace ill-structured problems and work in an environment for short periods of time where ideas are exchanged and ideas of all stakeholders are heard.

Respondents to the survey preferred the Task style (84.8% of respondents). While such a problem-solving style is preferred to complete a defined task such as a construction project, this style has a tendency to neglect the needs of people on the job. In an era with extreme competition for employees, this problem-solving style has a potential to negatively impact human capital across construction companies. Training to introduce constructors to the Person style in the WD dimension may encourage reflection and the development of solutions that will benefit others within the company and beyond.

Finally, construction professionals prefer to solve problems, make decisions, and manage change using a variety of approaches. The preferred styles do not have a clear relationship with any of the independent variables considered in the study including job description, years of experience, type of project engagement, and educational background. Training and education in the area of strengths and weaknesses of problem-solving styles could enhance overall teamwork as individuals gain awareness of both their personal style and the style preferred by others.

Recommendations for Future Research

Little research exists in the combined areas of commercial construction and problem solving. As a result, there are numerous opportunities for future research including the following:

1. Since today's construction problems involve a variety of professionals, further research is needed on how partners in architecture, engineering, and developers

prefer to solve problems. Such work would provide insight on how construction managers would best work collaboratively with these professions.

2. This study focused on construction professionals primarily in office staff positions and not those in field supervisory positions. It is recommended that problem-solving styles of positions including Superintendents and Assistant Superintendents be studied.
3. Problem-solving style research is based on a theory and has limited data that analyzes actual practice. Work is needed to study problem-solving styles in real world situations.
4. A study utilizing qualitative design would provide another research dimension for problem-solving styles. This study only considered a self-reporting instrument to establish problem-solving preferences. A qualitative study such as interviews could provide additional insight over why specific styles are preferred or how alternative styles might influence the construction industry.
5. One variable not studied was the type of problem faced by construction professionals. Additional research is needed to determine if problem-solving styles change for construction professionals when faced with different types of problems.
6. Longitudinal studies should be conducted to determine if problem-solving styles change over time.
7. The Orientation to Change Dimension can be separated into 3 sub-dimensions. These sub-dimensions should be studied to provide additional insight on the constructor's propensity for the Developer style.

8. Since construction professionals will be engaged with individuals with various problem-solving styles, research is needed to determine the problem-solving styles facilitated in construction management education. If certain styles are not facilitated, educational approaches may need to be adjusted to expose managers to the various problem-solving styles preferred in practice.

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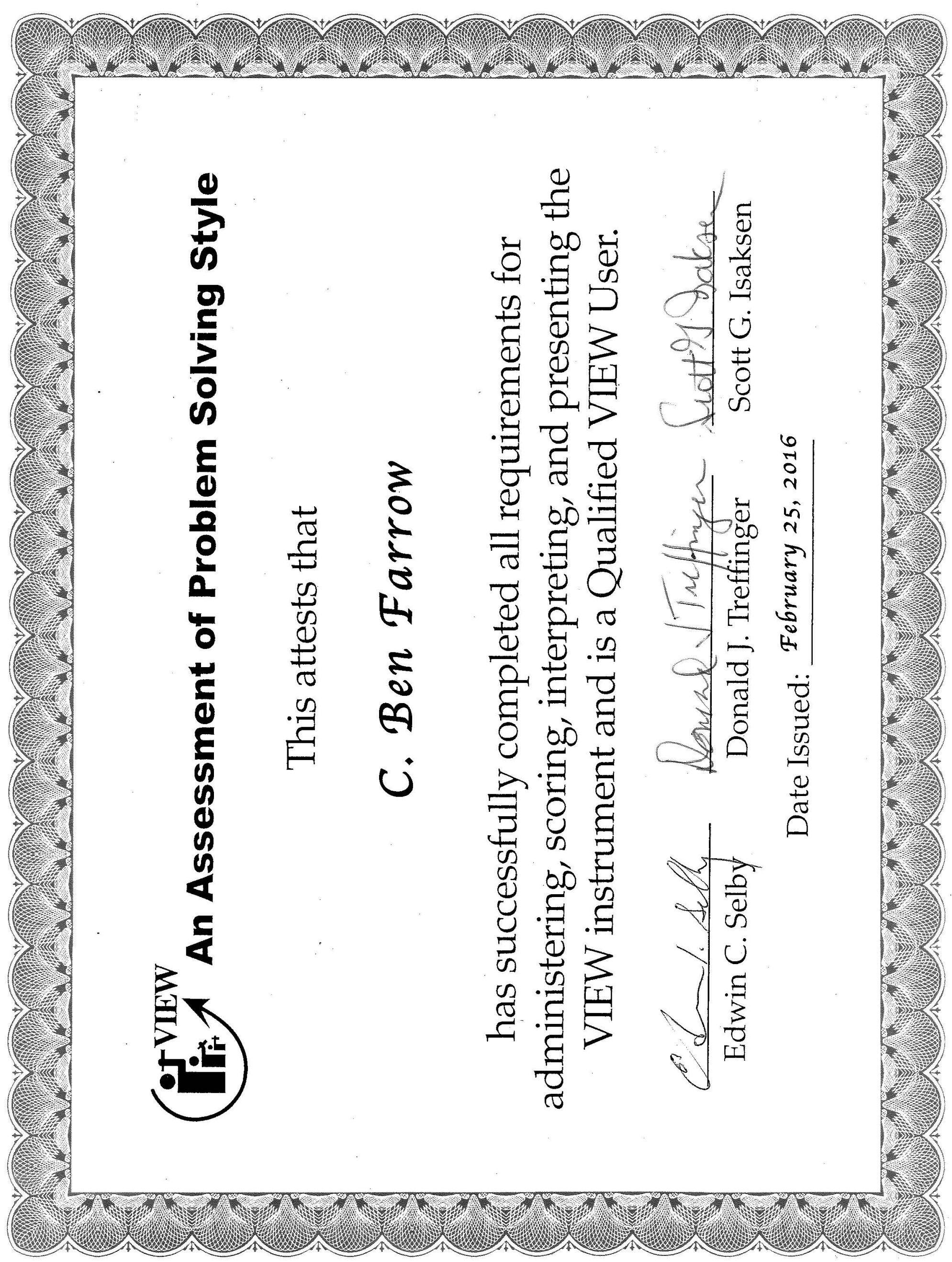
Appendix A. VIEW Training Certification



VIEW

An Assessment of Problem Solving Style

This attests that

C. Ben Farrow

has successfully completed all requirements for administering, scoring, interpreting, and presenting the VIEW instrument and is a Qualified VIEW User.

Edwin C. Selby   Donald J. Treffinger   Scott G. Isaksen

Date Issued: *February 25, 2016*

Appendix B. Auburn University Institutional Review Board Approval

(Letter to be included with pending IRB approval Protocol # in e-mail to participants)

INFORMATION LETTER
"Problem-Solving Styles in the Southeast Construction Industry"

You are invited to participate in a research study to investigate problem-solving styles of those in the Construction Industry. This study is being conducted by Ben Farrow, Hunt Associate Professor in Building Science (BSCI) and graduate student in the Department of Educational Foundations, Leadership, and Technology (EFTL) at Auburn University, under the direction of Dr. James Witte, a professor of the Department of Educational Foundations, Leadership, and Technology at Auburn University. You were selected as a possible participant because you are currently working in the Southeast Construction Industry and are over the age of 19.

If you decide to participate in this research study, you will be asked to take an online survey. Your total time commitment will be approximately 15-20 minutes. Your participation in this study is completely voluntary. If you would like feedback on the results of your individual problem-solving styles, you will have the option to enter your name and e-mail so that results could be sent to you. If you do not want feedback, enter a fake name and no e-mail, and the survey results will be anonymous. All information collected in this study is strictly confidential. The data you provide will be grouped with data from other participants, and no one will be able to identify your results. Your decision about whether or not to participate in the survey or feedback will not jeopardize your future relations with the Department of EFLT or BSCI or your employer.

There will be no cost to participate or compensation provided for your efforts. Information collected through your participation may be used for doctorial dissertation, publication or professional presentation. If you have any questions about this study, please contact Ben Farrow at farrocb@auburn.edu . If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subects Research or the Institutional Review Board by phone (334) 844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu .

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. THIS LETTER IS YOURS TO KEEP.

C. Ben Farrow

Investigator's signature

03/01/2016
Date

C. Ben Farrow
Print Name

The Auburn University Institutional Review Board has approved this Document for use from 06/06/2016 to 06/05/2017
Protocol # 16-180 EP 1606