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CRITICAL AND HIGHER ORDER THINKING SKILLS REQUIRED FOR
ADMISSION TO PHYSICAL THERAPIST EDUCATION PROGRAMS:
A MODIFIED E-DELPHI STUDY

by

Emily Shannon Hughes

A Dissertation

Submitted for Partial Fulfillment of the
Requirements for the Degree of
Doctor of Education

Major: Higher and Adult Education

The University of Memphis

December, 2017

Dedication

For my Dad, I hope you are proud.

I wish you could be here to see what I have accomplished,
because I did buckle down and work hard this year.

Acknowledgments

After being in school for what seems forever, I write this final note of thanks for all who have been with me and supported me through this long process. First to my Mom for always asking about what I was doing and allowing me to unload. Next to Chris, my husband, you encouraged me in this long process and were understanding of the long weekends and time away from us. I would never be where I am without knowing you,

Dad and Chris were behind me.

I have to give thanks to my FINAL advisor and committee chair, Dr. Donna Menke for helping me through all the bizarre and peculiar trials that are part of the dissertation process. I also thank my dissertation committee for the guidance and commentary in the

creation of this product.

Thanks to the faculty of the University of Tennessee Health Science Center, Department of Physical Therapy, and my Chair, Carol Likens, who allowed me to grow and develop as well as gave me the nudge to finish.

And lastly, without the support of friends, especially Jason Townsend, Jacque Bradford, Wes Williamson, Ruth Mulvany, Susan Appling and Elizabeth Whittington, I would still

be trying to decide which end was up.

Abstract

Hughes, Emily Shannon. Ed. D. The University of Memphis. December 2017. Critical and Higher Order Thinking Skills Required for Admission to Physical Therapist Education Programs: A Modified E-Delphi Study. Major Professor: Donna Menke, Ph.D.

Physical therapy has changed from its humble beginnings as informal classes for reconstruction aides (RAs) educated in gymnasiums to the professional education programs for students graduating with an entry-level Doctor of Physical Therapy. The occupation, now a profession, complete with autonomy, direct access, and great responsibility for decision-making for those we care for has changed; however, the need for physical therapists to care for those with physical disabilities has not changed. In order for physical therapists to manage care, responsibility, and autonomy in the ever-changing economic and healthcare environment, physical therapist education programs need, as part of the admission process, some standardization to help them select the best students who have the potential to succeed academically, as well as, pass the national licensure examination. Therefore, the purpose of this study was to determine which critical thinking skills and higher order constructs would be essential to assess on an admission examination for entrance into physical therapist education programs. A modified e-Delphi was used to answer this question by surveying a group of experts determined by the criteria of being a licensed physical therapist who has been published for their research on critical thinking and higher order thinking, as well as, program directors of physical therapist education programs. The critical thinking skills of *clarifying meaning, assessing claims, assessing arguments, stating results, self-examination, and self-correction*, and the higher order thinking constructs of *critical thinking* and *logical thinking* emerged as the consensus items to be assessed in a

discipline-specific examination prior to entrance into a physical therapist education program.

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Chapter 1

Introduction

The U.S. Bureau of Labor Statistics predicts a 34% increase in growth of jobs for physical therapists from 2014 to 2024, which is greater than the average for all other occupations, such as other healthcare providers or customer service positions (U.S. Department of Labor, 2015). With the baby boomer generation fast approaching an age that generally requires increased health-care services, there will be a greater demand for physical therapists in the coming years (U.S. Department of Labor, 2015). However, a study published in 2016 on workforce projections shows that physical therapists will be in short supply, with a shortfall of between 25,000 to 46,000 physical therapists by the year 2020 (Landry et al., 2016). Physical therapist education programs are already seeing an increase in the number of students applying for admissions (CAPTE, 2015b). During the decade between 2004-2014, program applicants more than quadrupled from a mean of 98 applicants per program to a mean of 471 applicants per program (CAPTE, 2015b).

According to Landry et al. (2016), physical therapist education programs must either increase the number of students they admit, or new programs will need to develop to meet the growing demand. As the applicant pool increases, physical therapy education programs struggle with identifying admission criteria that will best predict success for the limited number of seats in their program. The deficiency of uniform admission requirements across programs has created a process that lacks level of predictive validity needed to ensure greater success among those students who are ultimately admitted to physical therapist education programs (APTA, 2015a). Although the majority of schools examine prerequisite course work, grade point average (GPA), clinical observation hours, and scores on the Graduate Record Examination (GRE), none of these measures are

strong predictors of academic or clinical success (Vendrely, 2007). Thus, many of the 236 accredited programs have established additional, program-specific admissions requirements that creates additional obstacles for prospective applicants to navigate. For example, The University of New Mexico in Albuquerque, requires a course on nutrition and wellness. Belmont University in Nashville, Tennessee requires 50 hours of observation/volunteer experience compared with Hardin-Simmons University in Abilene, Texas, which requires 80 hours but recommends 300 hours (APTA, 2015b; PTCAS, 2016b). A 2015 survey by the Admissions Task Force of American Counsel of Academic Physical Therapy (ACAPT) gathered information from applicants to the Physical Therapy Centralized Application Service (PTCAS) concerning the admissions process and reported that 72% of applicants perceived a need for “more consistency in admissions policies and procedures across programs” (ACAPT, 2014, p. 4).

A separate task force was appointed by the American Physical Therapy Association (APTA) in 2015 to explore factors contributing to excellence in physical therapist education. Among the nine recommendations this group made to the APTA Board of Directors was the adoption of a standardized physical therapy entrance examination similar to that used by other doctoring professions (APTA, 2015a). For example, the standardized entrance exam for medical school is the Medical College Admissions Test (MCAT); for pharmacy school, it is the Pharmacy College Admission Test (PCAT); and for the dental programs, it is the Dental Admissions Test (DAT). This exam would assess the students’ knowledge of the prerequisite curriculum, as well as, their ability to apply higher order critical thinking skills necessary to be part of the dynamic practice of physical therapy in the evolving health-care field (APTA, 2015a). An exam such as this would be a quantifiable factor for consideration of student selection

and retention through the physical therapist education program (Williams, 2003), and hopefully reduce unwarranted variation in the admission process nationwide. Because no work has yet begun on this initiative, this dissertation identified constructs to be addressed by this type of discipline-specific entrance examination for admission to entry-level doctoral physical therapist education programs in the United States. In addition, this study sought to quantify the level of agreement for higher order thinking constructs used to assess prospective students' critical thinking skills as they relate to the physical therapy profession.

The Background of the Study

This section discusses the changes physical therapist education has had over the course of this profession, leading to an introduction to critical thinking and how critical thinking and higher order skills are used in physical therapy. Studies assessing critical thinking in physical therapist education are briefly reviewed. The section concludes with a review of the current admissions process, as well as studies attempting to identify factors in selecting the applicants most likely to succeed in professional education programs and pass the national examination to obtain licensure as a physical therapist, the National Physical Therapist Examination (NPTE).

History of physical therapist education. Physical therapist education has always been driven by need. When World War I broke out in 1917, the Army saw benefit from early physical therapists, called *reconstruction aides (RAs)*, to help rehabilitate injured soldiers (Heaton, 1968; Le Postollec, 2000; Moffat, 2003). Fifteen schools were founded by The Surgeon General to educate RAs to meet the wartime demand (*The beginnings: physical therapy and the APTA*, 1979; Heaton, 1968; Swisher & Page, 2005). The training centers were primarily gymnasiums, and education was for women with prior

physical education backgrounds (*The beginnings: physical therapy and the APTA*, 1979). These rehabilitation efforts resulted in soldiers returning to combat, while others returned to a functioning civilian life (Heaton, 1968). When the war ended, many RAs returned to their former occupations. In 1921, Mary McMillian, an RA and the first physical therapist in the U.S., established an association to preserve the value of the RA (Le Postollec, 2000; Swisher & Mandich, 2002). She contacted over 800 RAs and invited them to join the American Women's Therapeutic Association. She later was elected the association's first president (Heaton, 1968; Swisher & Page, 2005). In 1922, the name of the association was changed to the American Physiotherapy Association, to reflect the change of the occupation title from reconstruction aide to physical therapist (PT). Membership was open to those who had graduated from a recognized school of physiotherapy (*The beginnings: physical therapy and the APTA*, 1979; Moffat, 2003).

Also in 1922, the American Medical Association (AMA) advocated physical therapy courses in medical school and created the Council on Physical Therapy. During this time, a survey was sent to physicians and physical therapists concerning education practices (Heaton, 1968). The physicians, who dictated treatment, felt that physical therapists should be educated by a physician in a medical school setting, not the university setting. However, physical therapists felt that education for physical therapists should be at a college, a physical therapy school, which offered a degree in physical therapy. In 1927, New York University (NYU) established the first four-year Bachelor of Science in physical therapy even though many physical therapists thought the time requirement and degree status was not practical (Swisher & Page, 2005). A compromise was struck that included a length of study of nine months, which ended with a certificate

of completion from a physical therapy program, and covered “1,200 hours of theory and practice” (*The beginnings: physical therapy and the APTA*, 1979, p. 71).

With the onset of World War II in 1939 and a second polio epidemic in the 1940s, there were not enough qualified physical therapists to meet healthcare needs (*The beginnings: physical therapy and the APTA*, 1979; Moffat, 2003). Seven army hospitals started PT courses and fifteen existing PT schools accelerated their programs (Heaton, 1968). Even as the war came to a close, the public recognized the benefits of physical therapy care and the physical therapist education programs persevered and grew in both the military and civilian populations. Moreover, fifteen of the twenty-one schools transitioned to offer a Bachelor of Science degree (*The beginnings: physical therapy and the APTA*, 1979). In the 1950s, there was a slow increase in the number of physical therapists and physical therapist program development, spurred by yet another polio outbreak, and the need for management of other physical disabilities (Moffat, 2003). Advances in orthopedic surgery, cardiopulmonary developments and advances in neuromuscular rehabilitation allowed more physical therapists to move into these specialty practice areas (Moffat, 2003). New criteria for physical therapist education was developed in 1957 by the American Physical Therapy Association (APTA), the newly adopted name for the APA (Swisher & Page, 2005). The APTA helped to develop and mandate a state licensure examination for practice as a physical therapist that would assist in assurance of the level of proficiency of physical therapists (Moffat, 2003; Swisher & Page, 2005).

Veterans returning from the Vietnam War with both psychological and physical disabilities, as well as individuals with postpolio syndrome and viral tuberculosis, all benefitted from physical therapy care in the late 1960s and early 1970s (Moffat, 2003). In

the 1970s, a new trend began in physical therapist education with a graduate degree in physical therapy, and the first doctoral program was established at NYU in 1973 (NYU, 2016). In 1981, there were twenty-four post-baccalaureate masters physical therapist education programs, eight post-baccalaureate doctoral physical therapist education programs, eighty-six entry-level Bachelor of Science or certificate programs, and nine entry-level masters programs (Swisher & Page, 2005). In 1983, CAPTE, the Commission on Accreditation in Physical Therapy Education became the sole accrediting agency for all U.S. physical therapist education programs and continues to function in this capacity (CAPTE, 2011). In the 1990s, due to the increased numbers of education programs and graduates and overhauls of the healthcare system, a study predicted that the supply of physical therapists would finally outweigh the demand (Moffat, 2003). However, the pendulum has swung back again, and the demand for physical therapists is once again greater than the supply due to the increased needs of the aging population (Landry et al., 2016).

Physical therapist education has changed considerably, especially within the past three decades. During the 1990s, the entry-level bachelor's degree program transitioned to more entry-level master's programs, and the entry-level Doctor of Physical Therapy was introduced by Creighton University in 1993 (Swisher & Page, 2005). The introduction of the DPT, and a move toward professionalization of physical therapist practice, led the APTA to the formation of the Vision 2020 statement. This statement outlined the proposed future of physical therapist practice as a profession that included services that would be provided by doctors of physical therapy who have autonomous practice. Consumers would also have direct access to physical therapists as the primary

practitioner of choice for neuromusculoskeletal problems resulting in movement and mobility dysfunction (APTA, 2000).

As of 2015, all entry-level physical therapist education programs grant the DPT, and most programs require applicants to obtain a baccalaureate degree prior to being admitted to a physical therapist education program (APTA, 2015b). Once admitted to a physical therapist education program, these students have approximately three years of post-baccalaureate education that consists of didactic course work and clinical internships which will then culminate in the DPT (CAPTE, 2014).

Critical thinking, higher order thinking, and physical therapy. To effectively educate healthcare providers, including physical therapist students, education programs cover the psychomotor skills and techniques utilized in treating those who have medical conditions, and the clinical reasoning skills to make decisions using critical and higher order thinking (Huhn, Black, Jensen, & Deutsch, 2013). Higher order thinking includes different types of thinking processes such as critical thinking, logical thinking, reflective thinking, metacognitive thinking and creative thinking. Higher order thinking comes into play when someone encounters an unfamiliar task, dilemma, question or general uncertainty (King, Goodson, & Rohani, 1998). A type of higher order thinking is the process of critical thinking, which occurs when questioning “information, ideas or behaviors” leads to developing a conclusion about what to do or what to believe (Facione, Sanchez, Facione, & Gainen, 1995; Merriam & Brockett, 1997, p. 284). *The Delphi Report* defines critical thinking as the “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference” (Facione, 1990b, p. 2). The individual processes of interpretation, analysis, evaluation and inference are the critical thinking skills used to make a decision (Facione, 1990b).

The Commission on American Physical Therapist Education's 2015 accreditation standards, places emphasis on critical thinking skills in accredited education programs. Critical thinking skills promote students to "become aware of multiple styles of thinking, diverse social concepts, values, and ethical behaviors that will help prepare them for identifying, redefining, and fulfilling their responsibilities to society and the profession" (CAPTE, 2015a, p. v). As part of clinical reasoning and clinical-decision making, critical thinking helps the student to apply current evidence to practice in order to reduce errors and improve patient outcomes in the constantly changing health-care arena (Brudvig, Dirkes, Dutta, & Rane, 2013; CAPTE, 2015a).

Physical therapist admissions. The educational process for physical therapy students is rigorous; consisting of obtaining a four-year undergraduate degree, applying for and being admitted to a physical therapist education program, and then at least three years of post-baccalaureate education in a physical therapist education program, which culminates in an entry level DPT degree (APTAc, 2015). The admissions process for physical therapist education is variable from program to program with some physical therapist education programs requiring different courses. For example, Thomas Jefferson University, Rocky Mountain University of Health Sciences, Clarke University, and Mount St. Joseph University are the only universities that require an ethics course. The University of South Alabama is the only physical therapist education program to require a computer science course as a pre-requisite (PTCAS, 2016a). Some programs may require one, two or three letters of recommendation or the candidate may have to go to the campus for a personal interview (CAPTE, 2014).

This variability leads to problems with admissions. Applying to multiple physical therapist education programs is costly, but increases a student's likelihood of acceptance.

The variability may decrease the number of programs for which the student can apply because he or she may not have the pre-requisite courses or information for a particular program. However, there are some consistencies in the admissions process. These include pre-requisite coursework in an undergraduate degree program, minimum scores on the Graduate Record Examination (GRE), minimum grade-point average (GPA) and observation hours supervised by a licensed physical therapist (CAPTE, 2014). The GRE is used as a tool by many graduate education programs to help predict who would be successful (ETS, 2016). The GRE assesses verbal, quantitative and analytical factors and the analytical part of the examination includes critical thinking and higher order thinking (ETS, 2016). The GRE is used by physical therapist education programs, despite the literature being inconclusive in its ability to predict success in physical therapist education programs and the National Physical Therapist Examination (NPTE) (Hinds, 2014). Some authors suggest that the GRE should be used with other factors to determine who is successful in physical therapist education (Utzman, Riddle, & Jewell, 2007a, 2007b). Also, this tool is not used consistently across physical therapist education programs, with some schools focusing on one part of the test over another (ASU, 2015; UTC, 2016; UTHSC, 2016).

Statement of the Problem

Critical thinking and higher order thinking, necessary skills for clinical reasoning, allow the health care professionals to consider all options, raise questions, and analyze solutions to make decisions concerning a patient's health (Cervero, 1988; Higgs, Jones, Loftus, & Christensen, 2008; Simpson & Courtney, 2002). Some studies have suggested that assessing critical thinking during the admission process would be beneficial to predict which students would be successful in physical therapist education and on the

National Physical Therapy Examination (NPTE) (Domenech & Watkins, 2015; Suckow et al., 2015). Currently, there is no pre-admission examination specific to physical therapy or one that has critical and higher order thinking as part of its focus.

A discipline specific exam, as well as admission process standardization could help programs select applicants who show the most promise of success in the physical therapist education program and the National Physical Therapist Examination (Domenech & Watkins, 2015). Other healthcare programs have adopted entrance examinations specific to their fields, such as the Medical College Admissions Test (MCAT), Pharmacy College Admissions Test (PCAT), and the Dental Admissions Test (DAT) (APTA, 2015a; Domenech & Watkins, 2015). These examinations have a conscious focus on critical thinking to help create a better health care provider.

Much of the current literature surrounding the admissions process is focused on using the current pre-admission tool, the GRE, to predict success in physical therapy education and the National Physical Therapist Examination (NPTE) (Day, 1986; Dockter, 2001; Shiyko & Pappas, 2009; Templeton, Burcham, & Franck, 1993; Thieman, Weddle, & Moore, 2003; Utzman et al., 2007b; Zipp, Ruscigno, & Olson, 2010). Other studies have looked at information such as gender, race and age as predictors for success (Hollman et al., 2008; Templeton et al., 1993; Utzman et al., 2007b). Literature regarding critical thinking and physical therapist education has been concentrated on the assessment of critical thinking during the education process. There is limited research looking specifically at critical thinking as a variable linked to admission to physical therapy programs (Nuciforo, Litvinsky, & Rheault, 2014). At this time, there is no research examining which critical thinking skills and higher order thinking constructs should be included in a discipline-specific entrance examination. The findings from this study are a

starting place for CAPTE and the developers of a pre-admissions examination to begin assessing the critical thinking section for that type of examination.

Purpose Statement and Research Questions

The purpose of this modified e-Delphi study was to determine which critical thinking skills and higher order thinking constructs should be included on a standardized pre-admission examination, if such an examination were adopted by CAPTE accredited entry-level Doctor of Physical Therapy education programs. The following research questions guided this research:

RQ1: Based on the expert opinions of physical therapist educators, which higher order thinking constructs are specific to the practice of physical therapy?

RQ2: Based on the expert opinions of physical therapist educators, which critical thinking skills as defined by *The Delphi Report*, should be measured on a discipline specific pre-admission examination?

The Modified e-Delphi

The Delphi method is used to obtain “information, opinions and ideas from a panel of experts, using a specific sequence” (Mead & Moseley, 2001, p. 4). The purpose of the study is conceptualized, and a question is formed by the primary researcher. An anonymous panel of experts is chosen and these experts can be homogeneous, alike and generally a small group, or heterogeneous, more diverse and generally a larger group (Fink, Kosecoff, Chassin, & Brook, 1984; Goodman, 1987). A question or a questionnaire is submitted to this expert panel (Day & Bobeva, 2005). The responses are returned and analyzed by the researcher, who compiles and organizes the data to return it to the group for two to three more rounds (Merriam & Simpson, 1995). In these subsequent rounds, the experts and researcher focus the answers into a consensus, which

answers the original question (Custer, Scarcella, & Stewart, 1999; Fink et al., 1984; Merriam & Simpson, 1995; Portney & Watkins, 2008; Powell, 2003; Williams & Webb, 1994). In the traditional Delphi method, this question or questionnaire is open-ended to generate statements and opinions from the panel (Fink et al., 1984). According to Keeney, Hasson and McKenna (2011) there have been “hundreds and possibly thousands” (p. 6) of modifications of the Delphi method and therefore its new name, the modified Delphi. The iteration of the modified Delphi chosen for this study is where the question can be close-ended with responses driven from the literature (Custer, Scarcella, & Stewart, 1999; Sumsion, 1998). The modified e-Delphi method uses the Internet and a survey to take the place of paper, pencil and postage (Holloway, 2012).

The modified e-Delphi was chosen for this study because of its flexibility, the wide group of experts it can reach, and the potential information it can narrow down (Custer et al., 1999; Hasson, Keeney, & McKenna, 2000; Sumsion, 1998). Using the modified e-Delphi allows a geographically diverse expert panel to choose which critical thinking skills and higher order thinking constructs are the most important to assess prior to physical therapist education. These experts are located across the U.S., and it would not be cost effective to bring these experts together in one location to discuss critical thinking and higher order thinking. The Delphi method also mitigates the likelihood of one voice over-powering all other voices concerning this topic (Domholdt & Domholdt, 2000; Hasson et al., 2000; Mead & Moseley, 2001; Merriam & Simpson, 1995; P. L. Williams & Webb, 1994). Using an Internet-based program to generate the survey and manage the in-coming data is time and cost effective to the researcher for this modified e-Delphi study (De Villiers, De Villiers, & Kent, 2005).

Any of the Delphi methods are useful when there is little evidence available on a topic or when the evidence is fragmented (Mead & Moseley, 2001). In relation to the current topic, literature concerning critical thinking and higher order thinking abounds outside of the realm of physical therapist education. However, within physical therapist education, critical thinking and higher order thinking is concerned with current students, and the literature is conflicting. The topic of this study does not lend itself to experimental methods where one group of students applying for physical therapy school would be compared to a different group. The study needs a way to narrow down a list of critical thinking skills and higher order thinking constructs. Through the process of attaining consensus, the Delphi method allows a smaller list of essential skills to be identified that can be used to guide developers of an examination that would assess those critical thinking skills and higher order thinking constructs deemed the most important to assess (Holloway, 2012; Keeney, Hasson, & McKenna, 2006).

Significance of Study

A study of critical thinking and higher order constructs that would be assessed in an examination prior to admission to physical therapist education programs is important for several reasons. First, the Board of Directors of the American Physical Therapy Association (APTA) has passed, as part of the Professional Affairs Unit, that “competencies that include higher order constructs” should be adopted and “standardized across all physical therapist education programs” from the pre-admissions phase to matriculation (APTA, 2015a, p. 7). Supporting this statement, they include that “the profession should support the development of a standardized admissions exam for physical therapist applicants” that would help minimize the unwarranted variation among physical therapist education programs (APTA, 2015a, p. 10). The Excellence in Physical

Therapist Education Task Force report gives examples of important competencies for physical therapists that would satisfy higher order skills. These included managing conflict, building relationships, assessing efficiency in management, or interpreting clinical data to reason and make clinical decisions (APTA, 2015a).

This study could be a component of the plan to advance the level of successful professional physical therapists graduating from physical therapist education programs. An admission examination that assesses critical and higher order thinking should yield a more successful physical therapist student, as well as facilitating a passing score on the National Physical Therapy Examination for licensure. Because of this, these physical therapists will then demonstrate elevated higher order and critical thinking skills that will allow them to deliver quality patient care by gathering, analyzing, and processing information to make complex clinical decisions (Stone, Davidson, Evans, & Hansen, 2001). This in turn is a step in the process of meeting the vision statement of the American Physical Therapy Association “transforming society by optimizing movement to improve the human experience” (APTA, 2015d para. 2).

Next, the study by Domenech and Watkins (2015), which assessed critical thinking in a cohort of first year DPT students, found that, overall, the entering physical therapist education students’ demonstrated scores that suggested that these students may have difficulty with physical therapist education. The authors concluded that assessing critical thinking as a pre-admission requirement would be advantageous to physical therapist education programs because it may improve academic and licensure success and decrease withdrawals or dismissals (Domenech & Watkins, 2015). Suckow, Brahler, Donahoe-Fillmore, Fisher, and Anloague (2015) also recommends admission criteria

include critical thinking scores used “to screen prospective students for critical thinking abilities” (p. 76).

Lastly, the GRE is a test for general admission to graduate programs or business schools. The context for the GRE is not specific to health-care or physical therapy. The Association of American Medical Colleges (AAMC), the American Association of Colleges of Pharmacy (AACP) and American Dental Education Association (ADEA) are the associations responsible for management of education in their respective fields and establishing the content for their discipline-specific examinations. Each of these associations includes assessment of critical thinking as an important focus of the exams. They have found that it is important to assess critical and higher order thinking prior to admission to these healthcare fields (AAMC, 2015; DeHart, Aljets, Meagher, Wegner, & Ybarra, 2015; Hoelscher, 2015; Hoelscher & Waldschmidt, 2015; Jungnickel & DeHart, 2013; Schwartzstein, Rosenfeld, Hilborn, Oyewole, & Mitchell, 2013).

Utzman et al. (2007a) advocates the used of the GRE in the admission process until “an admission test with content more relevant to physical therapy” (p. 1178) is developed that may help predict which student will be successful in physical therapist education. Recommendations from the systematic review by Brudvig et al. (2013) also included creation of a critical thinking tool specific to the discipline of physical therapist education. Brookfield, a leader in higher education critical thinking, challenges that critical thinking “is irrevocably context bound” (Brookfield, 1997, p. 18). This statement supports the need for this study to find critical thinking skills and higher order constructs specific to physical therapy.

Conceptual Framework

This study was attempting to define which critical thinking skills and higher order thinking constructs are important to assess prior to admission to physical therapist education program. The critical thinking skills identified by Facione (1990b) and *The Delphi Report*, as well as, King, Goodson, & Rohani's (1998) higher order thinking constructs were used as the framework of this study.

Facione (1990b) set out to define critical thinking and critical thinkers. He assembled an international team of 46 experts and using the Delphi Method came to a consensus on what critical thinking is and who thinks critically. *The Delphi Report* references specific critical thinking skills. Interpretation, analysis, evaluation, self-regulation, explanation and inference are used to make judgments in all areas of life and learning. *Interpretation* is the ability to understand and convey the meaning from a variety of situations using the tools of categorization, decoding significance or clarification of meaning. *Analysis* is identifying the relationships between concepts by examining ideas, detecting arguments or analyzing arguments. Assessing the credibility of perceptions and logic of the relationships by assessing claims or arguments is part of *evaluation*. *Inference* uses querying evidence, finding alternatives and drawing conclusions to identify what is needed to make conclusions, or form hypotheses. *Self-regulation* applies the "skills in analysis and evaluation" (p. 10) to monitor one's own cognitive activities through self-examination and self-correction.

An *explanation* is to declare or justify reasoning by stating the results, justifying the procedures and presenting arguments based on the context. There is debate on whether critical thinking is a generalized skill (Profetto-McGrath, 2005) or if it is bound to context. *The Delphi Report* says that though these skills transcend subjects, and

application of these skills “in many contexts requires domain-specific knowledge” (Facione, 1990b, p. 5). Brookfield (1997) is also strongly in favor of critical thinking being bound to the context or domain in which it occurs.

Traditionally, higher order thinking has been part of another perspective as it is in Bloom’s taxonomy or part of over-all *thinking* (Kratwohl, 2002; Lewis & Smith, 1993; Williams, 1999). King, Goodson, and Rohani (1998) do not look at higher order thinking as part of a whole. They elevate higher order thinking as a separate construct, which includes critical thinking, metacognitive, reflective, creative and logical thinking. These processes of thinking allow a person to find a solution when faced with a new problem, question, dilemma or uncertainty.

Assumptions

One assumption for this study was critical thinking can be measured using an assessment tool. This has been shown using the HSRT by Huhn et al. (2013) and the California Critical Thinking Skills Test (Bartlett & Cox, 2002; Zettergren & R. Beckett, 2004), both developed by Facione. The second assumption was undergraduate education fosters critical thinking (Facione, 2007; Facione et al., 1995; Newton & Moore, 2013). The third assumption was there are critical thinking skills and higher order constructs that are discipline specific to physical therapist education. The fourth assumption was program directors represent themselves by acting as proxy for their admissions committee and faculty. The fifth assumption was the physical therapists who have published on critical thinking and higher order thinking who chosen for this study remained committed to this study and complete all rounds of the modified e-Delphi method. The last assumption was that the modified e-Delphi method yielded a consensus of critical thinking and higher order thinking terms that can be used to guide which skills

should be assessed on an examination prior to admission to a physical therapist education program.

Limitations

A limitation to this study includes the methods used to determine the critical thinking and higher order thinking constructs. The nature of the modified e-Delphi incorporates both qualitative and quantitative validity and reliability. For some this decreases the overall rigor of the study. Also, any Delphi method study is not meant to be generalized to a population, but to capture the opinion of a group of experts related to the topic.

Another limitation was that there is a possibility of group bias because the results of each round of opinions is submitted back to the group of experts. This group bias is minimized with anonymity, which should allow each expert to freely give their honest opinion of the topic.

Delimitations

Critical and higher order thinking skills needed by entering physical therapy students was explored within the frame of *The Delphi Report*. The survey used in this study was sent to physical therapy program directors who act as proxy for their admissions committee and faculty members, and physical therapists who have published articles in peer-reviewed journals concerning critical thinking and higher order thinking. These physical therapists also hold a current physical therapist license in the U. S. This study was limited by the physical therapist education programs accredited through CAPTE in the United States. Studies reviewed concerning critical thinking limited to quantitative assessment examination techniques.

Definition of Terms

Admissions- The process that the applicant accesses PTCAS, fills out a single application, and uploads the required documentation to apply to multiple programs. Then this application is expedited to the physical therapist education program for review based on the processes established at that physical therapist education program and the mission and standards of the institution (APTA, 2000, 2015b).

American Physical Therapy Association (APTA)- A not-for-profit professional membership organization who represents physical therapists, physical therapist assistants and students. This organization “seeks to improve the health and quality of life of individuals in society by advancing physical therapist practice, education, and research, and by increasing the awareness and understanding of physical therapy's role in the nation's health care system” (APTA, 2016a).

Autonomy in physical therapy. The APTA Board of Directors defines autonomy as “physical therapists shall have control over all clinical decisions relating to physical therapy” (APTA, 2012, p. 1).

CAPTE- Commission on Accreditation in Physical Therapy Education (CAPTE, 2011).

Clinical decision-making. A process of using critical thinking and problem solving to make decisions and the action that results (Higgs, Jones, Loftus, & Christensen, 2008).

The decision-making is the application of thinking to clinical practice (Magistro, 1989).

Clinical reasoning- A context-driven way of thinking that makes sense of differing factors. It accounts for the practitioners’ frame of reference and knowledge. It is built on reasoning and metacognition, and it is the total of thinking (Higgs et al., 2008)

Context- The situation in which critical thinking, clinical reasoning and clinical decision-making occurs. For this study, the context is bounded by healthcare, physical therapy and physical therapy education.

Critical Thinking (CT)- A cognitive process that is purposeful and self-reflective, where a judgement is structured about what to do or what to consider in a certain context (Facione et al., 1995).

Direct Access- Access to physical therapy services without the need for referral from a healthcare provider (APTA, 2000; Swisher & Page, 2005).

Higher order thinking- Skills or constructs that would allow healthcare professionals to deliver quality patient care by gathering, analyzing and processing information to make complex clinical decisions (Stone et al., 2001). Higher order thinking constructs are defined in this study as critical thinking, logical thinking, reflective thinking, metacognitive thinking and creative thinking (King et al., 1998).

Physical Therapy (PT)- The APTA defines physical therapy as the “dynamic profession with an established theoretical and scientific base and widespread clinical applications in the restoration, maintenance, and promotion of optimal physical function” (APTA, 2015d, para. 4)

Physical Therapist (PTs).-The APTA defines physical therapists as “health care professionals who diagnose and treat individuals of all ages, from newborns to the very oldest, who have medical problems or other health-related conditions that limit their abilities to move and perform functional activities in their daily lives” (APTA, 2015e, para. 1) .

Physical Therapist Education (PTE)- The APTA defines physical therapist education as “the didactic and clinical education that prepares graduates for entry into practice of

physical therapy. Education for the advancement of practicing physical therapists is termed post-professional” (APTA, 2015c, para. 1).

Study Overview

Chapter one includes the background of the study, which lays out the history of physical therapist education and the evolution from certificate of completion from a physical therapist education program to the entry-level Doctor of Physical Therapy, including the changes that have occurred to transform physical therapy from an occupation to a profession. Next, higher order thinking and critical thinking was described in relation to clinical reasoning and clinical decision-making, skills essential to the practice of physical therapy. Lastly, the admission process and studies related to prediction of student success in physical therapist education was explored. The statement of the problem, the purpose of this study and the research questions were presented, followed by the significance of the study. Concluding this chapter were the study limitations, delimitations and definition of terms.

Chapter two is the review of the literature concerning critical thinking, and higher order thinking. These concepts were also reviewed in light of higher education and specifically physical therapy education. The history and use of assessment tools of critical thinking and higher order thinking in specific disciplines was presented, and arguments were made to adopt this type of tool for use in the admission process for physical therapy education.

Methods used to answer the research question are presented in chapter three. A review of the Delphi method and its adaptations was discussed, followed by how the Delphi method was specifically used in this study. The sampling procedures used to select the experts for this study, as well as, issues of validity and reliability are described.

Data collection procedures are discussed in chapter three. Chapter four includes the presentation of the data obtained and analyzed from the rounds of the modified e-Delphi. Chapter five is a summary and discussion of the findings from the entire study. This chapter provides an answer or answers to the research questions presented in chapter one.

Chapter 2

Review of Literature

Introduction

Educational mandates to incorporate critical thinking into higher education curriculum have increased since the 1980's (Facione & Facione, 2008). This is because critical thinking has been recognized in its importance in communications, society, and the economy. Critical thinking has also been linked to being a responsible citizen, an engaged student and an effective employee (Brookfield, 1987; Facione, 2007; Facione, Sanchez, Facione, & Gainen, 1995). With increased autonomy in the practice of physical therapy, the ability to critically think and make decisions has become a focus of the physical therapist education (PTE) process. Studies related to physical therapist education and critical thinking have focused on assessing critical thinking during the progression of a student through physical therapist education (Bartlett & Cox, 2002; Huhn, Black, Jensen, & Deutsch, 2011; Suckow, Brahler, Donahoe-Fillmore, Fisher, & Anloague, 2015; A. Vendrely, 2005; A. M. Vendrely, 2007; Zettergren & Beckett, 2004). Some studies have suggested that assessing critical thinking during the admission process would be beneficial to predict which students would be successful in physical therapist education and on the National Physical Therapy Examination (NPTE) (Domenech & Watkins, 2015; Suckow et al., 2015). From an extensive review of the literature on this topic, it was found that there has not been a study up to this point that examines which critical and higher order thinking skills are important to assess as part of an entrance exam prior to entering physical therapy school.

This review of literature explores the history and definitions of critical thinking, cognitive critical thinking taxonomies, assessment issues with critical thinking, and

critical thinking in healthcare. Next, higher order thinking, including definition and skills are reviewed. Current admissions practices to graduate physical therapy schools and the current assessment of critical thinking for physical therapist education is examined. The end of the literature review focuses on different standardized instruments that assess critical thinking as part of the examination. Those related to healthcare are introduced which include the MCAT, PCAT, DAT and the HSRT. The general standardized tests, the GRE and the CCTST are compared and contrasted against the healthcare specific standardized exams.

Critical Thinking: History

In the 20th Century, Dewey is called the father of modern critical thinking (Fisher, 2011). In his work, *The Problem of Training Thought*, Dewey (1910) calls for active, reflective, and skillful thinking versus passively accepting ideas and beliefs as fact from others (Fisher, 2011). Even with this straightforward definition of critical thinking, there is still a variety of definitions related to critical thinking (Brookfield, 2012; Ennis, 1989; Facione, 2007; Paul & Elder, 2008a). Kahlke and White (2013) report that this variation in definitions is based on how and why we think, because critical thinking is “representative of fundamental differences in epistemological and normative beliefs” (p. 21).

Critical Thinking: Definitions.

Brookfield (2012) describes critical thinking as way of life, more than a set of skills. Critical thinking is a process of assessing different assumptions to see if they are accurate, so that further informed actions are taken to satisfy a wider purpose. Paul and Elder (2008b) define critical thinking as “the art of analyzing and evaluating thinking with a view to improving it” (p. 2). These authors convey that critical thinking must be

cultivated in a systematic, disciplined process to avoid distorted or prejudiced thought (Paul & Elder, 2008b). They give a checklist or a process to critical thinking in their book, *The Miniature Guide to Critical Thinking Concepts and Tools* (Paul & Elder, 2008b). Another authority in critical thinking is Ennis (1989) and he defines critical thinking as the “reasonable reflective thinking focused on deciding what to believe or do” (Ennis, 1993, p. 180). He goes on to list the abilities or skills and dispositions that will help guide reasonable and reflective decisions (Ennis, 2015). He points out that critical thinking varies from field to field and general instruction is not enough for transfer from one context to another (Ennis, 1990).

In 1990, Peter Facione as the lead investigator, published *The Delphi Report*, a project on critical thinking for the American Philosophical Association (Facione, 1990b). This report was the conceptualization of critical thinking by a 46-member panel of experts on critical thinking from various fields. The definition proposed by this panel was that critical thinking (CT) is the:

purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. (Facione, 1990b, p. 2)

These experts, who included Ennis, said that though critical thinking skills can transcend context, learning critical thinking skills may require context specific knowledge (Facione, 1990b).

Perspectives. Not only are there many scholars that define critical thinking, critical thinking is defined from differing perspectives. Critical thinking can be framed from the intellectual, learning style, process of self or cognitive perspectives. From the intellectual or developmental perspective, critical thinking develops as the student progresses as a thinker and depends on the level of intellectual knowledge (Paul & Elder, 1997). This perspective looks at the transformation of the person's "beliefs about the nature of knowledge and truth" (Kurfiss, 1988, p. 6) and as the person develops, they use "more complex critical thinking skills to understand, organize, and use knowledge" (Wolcott & Lynch, 1997, pp. 90-91). The learning style perspective of critical thinking looks at the how someone learns or processes information, and how they apply critical thinking to problem solving. Each learning style would approach critical thinking differently (Wessell & Williams, 2004).

Brookfield (2012) approaches critical thinking from a perspective that critical thinking is a process of self. Critical thinking can help a person see things or beliefs from a different vantage point (Brookfield, 2012; Ennis, 1997; Scriven & Paul, 2013). Thinking critically can help someone live a satisfactory life where decisions are made from accurate assessment of the situation that seeks to overcome "our native egocentrism and sociocentrism" (Paul & Elder, 2008b, p. 2).

The last perspective discussed here is that critical thinking is a set of cognitive skills implying that critical thinking is a process of technical application of skills in a situation. This is the approach that predominates today (Brookfield, 2012). Bloom's taxonomy gives a hierarchical representation of the process of moving through critical thinking skills from lower order thinking at the bottom of the pyramid to the higher order thinking at the top (Krathwohl, 2002). Each has to be mastered in order to move to the

next (Munzenmaier & Rubin, 2013). Ennis (2011) lists critical thinking abilities versus skills in his cognitive approach to critical thinking and he uses a set of descriptors in groups to relate back to the abilities they represent. In Facione's (1990b) work, the critical thinking skills are defined with specific sub-skills important to each skill. For this review of literature, the cognitive process of critical thinking is examined further.

Bloom's Taxonomy. The Taxonomy of Education Objectives, created by Benjamin Bloom and a collaboration of educators, researchers, evaluators and instructional designers in 1956, was originally intended to ease the stress on faculty when creating comprehensive examinations (Krathwohl, 2002). It was designed to give some scientific order to the different disciplines in education (Wineburg & Schneider, 2009). Now referred to as Bloom's Taxonomy, it has moved beyond its humble goal to becoming a way to organize and communicate learning objectives.

It is commonly used to simplify the process of understanding critical thinking and facilitating higher order thinking (Munzenmaier & Rubin, 2013; Plack & Driscoll, 2011; Simpson & Courtney, 2002). These skills are on a continuum from the most basic to the most complex creating a hierarchy of critical thinking skills that ranks them from lower order thinking skills (LOTS) to higher order thinking skills (HOTS) (Munzenmaier & Rubin, 2013). The higher order thinking skills are application, analysis, synthesis, and evaluation, and the lower order thinking skills are comprehension and knowledge (Munzenmaier & Rubin, 2013). In order to progress to the next more complex level in the hierarchy, you must master the prior level (Krathwohl, 2002).

Bloom's Taxonomy does not give an outright definition of critical thinking; rather, it is a hierarchical process which gauges learners' critical thinking based on the skills level of the learner (Ennis, 1993). Some have proposed that it should be rearranged

where the first skill, knowledge, is at the top, and evaluation is the starting point at the bottom (Wineburg & Schneider, 2009; Wright, 2012). Wright (2012) feels that the original taxonomy leaves out creativity, and in the current digital world, creativity followed by analysis of what works and what does not, leads to knowledge. Wineburg and Schneider (2009) consider rote advancement, from lower order skills to the higher order skills does not equal critical thinking. Critics of Bloom's Taxonomy also feel that it is too simplistic, it has not been validated and is not up-to-date (Munzenmaier & Rubin, 2013; Sugrue, 2011). Ennis (1993) writes that Bloom's Taxonomy is a good starting point for critical thinking, but it is too vague and does not give a process to measure the outcome of the process. Paul (1985) points out that Bloom's Taxonomy holds to no educational theoretical framework, leaving out the culture, society or system. He feels that critical thinking is not a neutral, detached process and it must be integral to the teacher and the learner (Paul, 1985).

The Delphi Report. Due to the multitude of definitions and meanings associated with critical thinking, the American Philosophical Association recruited Facione to organize an expert panel to attempt to define critical thinking (Simpson & Courtney, 2002). Facione, a researcher, businessman and educator, was chosen because of his interest in teaching and assessing critical thinking (The California Academic Press, 2013; Simpson & Courtney, 2002). This international expert panel was made up of individuals from different fields ranging from economics and education to philosophy and physics. Using the Delphi method, generally a qualitative research methodology, rounds of questions were answered, then considered and reconsidered to reach a consensus. The answers to the questions were summarized and redistributed, and based on the experts' opinions, comments and arguments; a consensus was finally achieved in two years' time

(Facione, 1990c). When it was reached, the results were published in 1990 and called *The Delphi Report*.

Prior to this report there was no generally accepted definition of critical thinking (Giancarlo & Facione, 2001). This work has been the basis for government policy, government research, educational research, nursing research and several critical thinking assessment tests (Facione & Facione, 1996; Facione, 1990a; Press, 2013; Sharp, Reynolds, & Brooks, 2013; Simpson & Courtney, 2002).

According to the definition in *The Delphi Report*, critical thinking involves a “purposeful, self-regulatory judgment, a human cognitive process... [where] a person forms a judgement about what to believe or what to do in a given context” (Giancarlo & Facione, 2001, p. 30). The key point is that critical thinking is a process and there are skills necessary to that process (Facione, personal communications, March 22, 2016). The skills that are essential to *The Delphi Report* are interpretation, analysis, evaluation, inference, explanation and self-regulation (Facione, 1990b). Unlike Bloom’s Taxonomy, the critical thinking skills in *The Delphi Report* should stand alone and do not have a linear order (Facione, personal communications, March 22, 2016).

The report further refines each skill into sub-skills. *Interpretation* is the ability to understand and convey the significance of an experience. The sub-skills are categorization, decoding significance and clarifying meaning. Categorization occurs when experiences or beliefs are framed for understanding. When the significance is decoded, the situation or experience is described in relation to affective attitude or motive behind situation. Restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion is clarifying the meaning. This skill helps to recognize a problem, clarify the meaning and restate it without prejudice.

The next skill is *analysis*, where concepts or situations are examined, and relationships are identified. Examining ideals, detecting arguments and analyzing arguments are the sub-skills of analysis. When ideals are examined, they are compared and contrasted, and problems with the ideal are identified and broken down. Determining if an idea or situation has reasons to support or refute it is detecting arguments. Analyzing arguments is a complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected (Facione, 1990a).

Evaluation is the third skill defined in *The Delphi Report*. Deciding if a person or their statements are credible or finding that relationships are logical defines evaluation. The sub-skills of evaluation include assessing claims which is recognizing factors that make the source of information credible and assessing arguments which is judging if an argument is plausible or false (Facione, 1990a). The fourth skill is *inference*, where components are assembled for a hypothesis, then considered, and a conclusion is made. Querying evidence, conjecturing alternatives and drawing conclusions are the sub-skills related to inference. Querying evidence occurs when additional support information is needed to develop or reinforce an argument and how to find that additional support information. Creating other alternative ways to ask a question, multiple ways resolve an issue or project consequences is conjecturing alternatives. Drawing conclusions ensues when hypothesis are tested or opinions are compared to determine what to do or believe (Facione, 1990a).

Explanation is the fifth critical thinking skill (Facione, 1990a). This is when the results of reasoning are stated and justified based on the evidence examined to create a decision. Stating results by giving accurate statements, justifying procedures by

presenting the evidence behind the decision and presenting arguments are the sub-skills of explanation. The last skill is *self-regulation*, which is the metacognitive activity of assessing one's analysis, judgements and evaluation (Facione, 1990a, 2007). This is performed through the sub-skills of self-examination and self-correction. Self-examination is looking at the reasoning used, and opinions created, as well as "motivation, values, attitudes and interests" that determine the outcome (Facione, 1990a, p. 10). Self-correction occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake. Facione (2007) regards self-regulation as the most important skill in critical thinking because it is looking at all the skills and re-applying them, even to yourself. The panel of experts goes on to say that those that have proficiency in critical thinking skills, but fail to use these skills properly do not possess good critical thinking. Also, mastery of all skills does not equate critical thinking ability (Facione, 1990a).

Critics argue that critical thinking is more than just cognitive skills (Kahlke & White, 2013). This was an issue that divided the experts on the Delphi panel. Two-thirds of the experts believed that affective factors disposed a person to be a good critical thinker, and one-third of the experts believed that critical thinking was about skills, not the attitude associated with the skill (Facione, 1990a). Therefore, The Delphi Report does not just define critical thinking, it also describes an ideal critical thinker or the *dispositions* of a critical thinker as:

habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria,

focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. (Facione, 1990a, p. 2)

A criticism to *The Delphi Report* is the idea that critical thinking is only context or domain specific, versus a general skill. Many critical thinking scholars conclude that critical thinking is a general skill that can cross domains (Brookfield, 2012; Ennis, 1989), some feel that it can be both context specific with carryover to other contexts (Ennis, 1997; Simpson & Courtney, 2002) and some argue that it is only context specific (McPeck, 1990). The Delphi Report takes the position that many critical thinking skills can cross contexts or domains, however many skills require context or domain specific knowledge to make reasonable judgements in these situations (Facione, 1990a).

Summary. This section briefly explored the history and definitions of critical thinking. The critical thinking skills used for this dissertation are defined by *The Delphi Report*, a Delphi study conducted by Facione in 1990.

Higher Order Thinking

Like critical thinking, higher order thinking has been defined in the literature several ways because of the many ways to view this topic (Lewis & Smith, 1993; Williams, 1999). Lewis and Smith (1993) feel that the differences in definitions have to do with the bodies the definitions arise from. From a philosophical perspective, higher order thinking is part of *thinking* and uses cognitive skills to explain reasons for behavior or action (Lewis & Smith, 1993). The other perspective is a psychological perspective, where higher order thinking is related to problem solving.

Two perspectives on higher order thinking stand out in the literature. One uses Bloom's Taxonomy to define higher order thinking, where critical thinking is the overarching process and higher order thinking is a subset or a skill of critical thinking. As

described previously, the higher order thinking skills are located at the top of the pyramid. These are application, analysis, synthesis, and evaluation, and the lower order thinking skills, located at the base of the pyramid, are comprehension and knowledge (Krathwohl, 2002; Munzenmaier & Rubin, 2013). The second perspective defines higher order thinking as an umbrella term that includes other complex ways of thinking (Facione, 1990a; King, Goodson, & Rohani, 1998).

Using Bloom's Taxonomy, critical thinking skills and higher order thinking are a set of skills that can be taught in a specific order and objectively assessed. As many have pointed out, this hierarchy is outdated (Munzenmaier & Rubin, 2013; Sugrue, 2011; Wright, 2012), critical thinking and higher order thinking are not one way processes (Paul, 1985), and that Bloom's Taxonomy ignores other ways of thinking such as creative thinking (Wright, 2012). Other criticisms of Bloom's Taxonomy have been previously presented in the last section of this review of literature.

The second definition elevates higher order thinking as the overarching term and critical thinking, as well as creative thinking, metacognitive thinking, reflective thinking, and logical thinking fall under this term (King et al., 1998). *The Delphi Report* also follows this definition where "CT [critical thinking] is one among a family of closely related forms of higher-order thinking, along with, for example problem-solving, decision making and creative thinking" (Facione, 1990a, p. 5). Lewis and Smith (1993) propose a definition of higher order thinking as "occurring when a person take new information and information store in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations" (Lewis & Smith, 1993, p. 136). This definition incorporates all the types of thinking and melds the philosophical and psychological perspectives of higher order thinking.

King, Goodson, and Rohani (1998) describe higher order thinking skills as being activated when a person faces a new problem, a new question, a dilemma or uncertainty. The skills of creative thinking, critical thinking, reflective thinking, metacognitive thinking and logical thinking will help a person create a solution that could be applied to a larger array of problems. The solution or result of this encounter is framed by the context of available knowledge and experience with a product of growth and intellect.

The following definitions of each type of thinking were used to guide King et al., in the 1998 work, *Higher Order Thinking Skills*. Creative thinking is "generating and producing ideas through brainstorming, visualizing, associating relationships, making analogies, inventing, inferring and generalizing" (Fogarty & McTighe cited in King et al., 1998, p. 34). Dewey (1910) defines reflective thinking as "the ground or basis for a belief is deliberately sought and its adequacy to support the belief examined" (p.1). Metacognitive thinking is a method "of being aware of monitoring, supervising, organizing, and making executive decisions about one's own thinking process (Crowl et al., cited in King et al., 1998, p. 34). King et al. cites Facione (1998) for critical thinking because he sees critical thinking as a separate domain with a specific definition. Lastly, logical thinking is defined as "identifying reasoning fallacies in one's own and in others' thinking" (Kirby, Goodpasture and Levine as cited in Moore, 2010, p. 5).

Summary. This section on higher order thinking, briefly explored the history and definitions surrounding this topic. The higher order thinking definitions used for this dissertation are defined by *Higher Order Thinking Skills*, a white paper presented by King, Goodson, and Rohani in 1998.

Critical Thinking and Higher Order Thinking in Professional Healthcare Education

The current healthcare front is becoming more complex as healthcare professionals have to not only treat the patient but also have knowledge and understanding of the patient's cognitive and emotional self as well as the social situation of the patient (Huhn & Parrott, 2017; Institute of Medicine, 2001; Simpson & Courtney, 2002). Critical thinking and higher order thinking have been linked to clinical reasoning. This is a necessary skill, a process that looks at multiple variables, which allows health care professionals to consider all options, raise questions, and analyze solutions to make a value judgement concerning a patient's health (Cervero, 1988; Higgs, Jones, Loftus, Christensen, 2008; Simpson & Courtney, 2002). Clinical reasoning, along with knowledge of best practices supported by research, will allow the health care professional to formulate a decision in best interest of patient (Institute of Medicine, 2001; Miri, 2007, James et al., 2016). In addition, health care professionals who use clinical reasoning, based on application of critical thinking will improve patient outcomes (ACCP, 2000, Profetto-McGrath, 2005).

Critical thinking has become a focus of many of the discipline specific admissions exams for professional health care education programs such as the Medical College Admission Test (MCAT), the Dental Admission Test (DAT) and the Pharmacy College Admission Test (PCAT). This shift of focus in health care professional education began with a book published in 2003 called *Health Professions Education: A Bridge to Quality* (Greiner & Knebel, 2003). Made by the Institute of Medicine (IOM) called for a reform of health care professional education and was based on the "vision of a future health system laid out in *Crossing the Quality Chasm*" (Greiner & Knebel, 2003, p. xi). This book created a list of "core competencies that all health clinicians should possess,

regardless of their discipline, to meet the needs of the 21st-century health care system” (Greiner & Knebel, 2003, p. 45). These are to provide patient-centered care, to work in interdisciplinary teams, to employ evidence-based practice, to apply quality improvement and to use informatics (Greiner & Knebel, 2003). Critical thinking is essential to each of these competencies.

The Association of American Medical Colleges (AAMC) and The Howard Hughes Medical Institute partnered to assess medical education practices. From this partnership, a report titled, *Scientific Foundations for Future Physicians*, was published (AAMC-HHMI, 2009). Part of this report was specific to pre-admission and it states that “the undergraduate years should be devoted to creative engagement in the elements of a broad, intellectually expansive liberal arts education...that are also the foundation of intellectual growth” (AAMC-HHMI, 2009, p. 2). Shifting the focus from rigid preparation for professional medical education, will allow the development of scientific reasoning, synthesis of information, clinical problem solving, management of conflicts of interest, and critical analysis of scientific literature. Also included in this processes is the recognition of the risk involved in medical practice and communication with a variety of individuals.

The MCAT has been used to evaluate prospective medical students since 1928 (Olsen, 2016). The latest revision, released in 2015, the AAMC uses the information gained from *Scientific Foundations for Future Physicians*, to include a new section called Critical Analysis and Reasoning Skills (AAMC, 2015). The AAMC acknowledges that being a good medical doctor is more than knowledge of the hard sciences such as chemistry and biology. Understanding how people think, behave, react and make decisions will improve bedside manner and communication to create a well-rounded

physician (Kirch, 2012). Therefore, the new section is designed to test the skills of critical analysis and reasoning. Material for this section “come[s] from a variety of humanities and social sciences disciplines” (AAMC, 2015, p. 3). Assessing behavioral and social sciences is accepted as critical to overall effective healthcare, especially related to cognitive impairment, mental health and substance abuse (Kaplan, Satterfield & Kingston, 2012).

Another discipline specific examination, the PCAT, is undergoing changes that coincide with the shifting focus to more holistic assessment of applicants. The PCAT was “developed to measure the abilities, aptitudes, and skills that pharmacy schools deem essential for success in their programs” (Pearson- Meagher, 2016, p. 1). Pharmacy schools were assessed in 1973 and were found to have a plethora of admissions processes. Most of these schools were interested in establishing a standardized exam process that could substantiate data on placement and retention, and in 1974 the first PCAT was administered. There have been many revisions over the years and in 2012, The Argus Commission, a task force created by the American Association of College of Pharmacy, recommended that PCAT should include critical thinking and problem solving. This would ensure that these applicants would have “an inquisitive mind” (Speedie, 2012, p. 3). The Argus Commission also detailed that the PCAT advisory Committee “study in detail the MCAT 5” as a way to update the PCAT (p. 4). Though critical thinking skills of interpretation, evaluation and analysis are not outright reported separately, these skills are assessed throughout the examination in the multiple choice questions, and essay section (Pearson, 2016).

Each year, the American Dental Association shows that the DAT is a valid predictor of success in dental school in the areas of the hard sciences and mathematics

(ADA, 2016), but as Tsai (2013) points out, this examination does not indicate a successful dentist in regards to complex situations requiring critical thinking. In 2011, the American Dental Education Association (ADEA) released a list of competencies for the general dentist. According to this list, the general dentist must have “knowledge, experience, critical thinking and problem solving skills, professionalism, ethical values, and technical and procedural skills” (ADEA, 2011). Using these competencies, changes were made to the DAT to include enhanced assessment of critical thinking skills in the Quantitative Reasoning Test. These changes were piloted for the 2014-2015 tests and then were part of the examination score beginning in 2016 (Hinshaw, 2013).

Each of these discipline specific examinations have responded to literature in their respective fields. This literature calls into question these skills related to critical and higher order thinking as substantial aspects of the well-rounded healthcare provider and should be assessed prior to admittance into a professional education program.

Admissions Process in Physical Therapist Education

The admission process to a physical therapist education program varies from program to program and with little agreement on variables there is conflicting data to show which variables can predict success in these programs (Scott et al., 1994; Zipp, Ruscigno, & Olson, 2010). Currently, the admission requirements for physical therapy education programs generally consist of pre-requisite coursework, a minimum overall grade point average (GPA), a minimum score on the Graduate Record Exam (GRE), and completion of a certain number of observation/volunteer hours under the supervision of a licensed physical therapist (CAPTE, 2014). Programs may also require recommendation letters, a personal interview, a writing sample and/or a criminal background check.

Emphasis on requirements varies from program to program to select the applicant that is most likely to succeed in their program and when taking the NPTE (APTA, 2015b).

The Graduate Record Examination (GRE). The current pre-admission exam, the GRE, is an examination that is non-specific to physical therapist practice (Hinds, 2014). The three sections of the GRE are verbal, quantitative and analytical, assessing the written, mathematical and critical thinking skills of a student (ETS, 2016). Some physical therapy programs like the University of Tennessee Health Science Center in Memphis, TN and Alabama State University in Montgomery, AL only considers verbal and quantitative reasoning sections whereas The University of Tennessee at Chattanooga focuses on just the analytical section. This variation in emphasis adds to the inconsistency of admissions processes (ASU, 2015; UTC, 2016; UTHSC, 2016).

The GRE has been shown to be predictive of success in other graduate education programs (Wendler & Bridgeman, 2014). Bridgeman, Burton, and Cline (2008) found that for a sample of 4,451 students from multiple graduate school departments, the students with the top GRE scores had the top GPA's in their first year of graduate school. Kuncel, Hezlett, and Ones (2001) performed a meta-analysis on a database of articles, dissertations and research reports looking at the predictive validity of the GRE. These authors found "moderately large predictor coefficients" (p. 5.4.3) showing that the verbal, quantitative and subjects tests would predict among other things, graduate GPA, comprehensive examination scores, and to a small completing the graduate degree (Kuncel et al., 2001). However, there are mixed results when looking at the GRE and success in physical therapist education programs and performance on the National Physical Therapist Examination (NPTE) (Hinds, 2014). In 1986, investigating preadmission GPA and the GRE, Day was able to show that the analytical GRE score and

“preadmission overall GPA were the two most significant predictors” (p. 1560) of success in the physical therapist education program. Utzman, Riddle, and Jewell (2007a) studied demographic information and quantifiable data to predict academic struggle in physical therapy students. They found that GRE, race or ethnicity, and GPA could be predictors of students who are at greatest risk for academic difficulty. That same year Utzman, Riddle, and Jewell (2007b) also published an article showing that certain demographics, undergraduate GPA and GRE scores can predict those that are at risk for failing the NPTE.

Hollman et al. (2008), found that the GRE can predict NPTE success, and determined that it should guide admissions decisions. In a study validating pre-admission requirements, Shiyko and Pappas (2009) found that the GRE was a strong predictor of academic success. This study used multiple regressions and logistical regressions to show that higher GRE scores were able to predict, with a 95% Confidence Interval, higher graduate GPA. However, Andrews, Johansson, Chinworth, and Akroyd (2006) were unable to show that cognitive predictors, including the GRE, were strong predictors of success. In 2014, Hinds found a weak correlation between GRE scores and first time pass rate on the NPTE (Hinds, 2014). This dissertation looked at three cohorts of DPT students (n = 102) and the qualitative, verbal and total scores on the GRE. The GRE scores were correlated to passing scores on the NPTE. With such a small sample size, making a generalized statement that the GRE can predict or correlate with passing the NPTE is difficult. Also Hinds (2014) points out, the lack of conclusive evidence that the GRE predicts successful outcomes in physical therapist education programs and on the NPTE, may be due to the fact the GRE is an examination for business and graduate school, and may not be specific to the context of physical therapist practice. Kuncel et al.

(2001) reports increased interest in the specific context and subject matter leads to improved interest and motivation. Because of that, the GRE Subject Test was “the strongest predictor of graduate school success for all success criteria” (p. 5.4.3). In a 2015 dissertation by Meiners (2015), GPA and age were found to be more significant predictors of success on the NPTE than GRE scores.

Based on a recent study by Huhn and Parrott (2017), the authors argue that the GRE cannot fully capture the needed critical and cognitive skills needed to tackle complex clinical problems. They suggest the Health Sciences Reasoning Test (HSRT) developed in conjunction with Facione and Insight Assessment as way to predict success on the NPTE (Huhn & Parrott, 2017).

Assessment of Critical Thinking and Higher Order Thinking in Physical Therapy

Higher order thinking in literature associated with physical therapy or physical therapist education has not been specifically assessed from the perspective of King, Goodson and Rohani’s (1998) work. A study by Zettergren and Beckett (2004), the authors suggest that physical therapists require higher order thinking skills, defined as reflective thinking or metacognitive thinking, in order to be successful. However, in this study these higher order thinking skills are associated with critical thinking rather than as stand-alone skills. In physical therapy and physical therapist education, higher order thinking has been predominately assessed using Bloom’s taxonomy as the framework. Higher order thinking are skills such as analysis, synthesis and evaluation and these are used to gauge the development or growth in a student (Dunfee, Rindfleisch, Driscoll, Hollman & Plack, 2008).

Whereas, critical thinking in physical therapist students has been assessed using a number of different assessment techniques. Studies have looked at differing variables at

different times in physical therapist education. Only a few studies have shown any constancy looking at the same factors. Vendrely (2005) looked at physical therapist students who graduated between 1998 and 2001 from an entry-level master of physical therapist education program. These students were given the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) in the first week of their program and in the last week before graduation with the assumption that critical thinking would be developed during their time in the physical therapist education program. However, this study found no statistically significant difference in pre and post test scores. The author suggested that developing a different tool to assess critical thinking while in PT school would be beneficial to showing critical thinking in students (Vendrely, 2005). Data gathered in this study was part of a larger that was published in 2007. In this second study, additional variables, clinical education performance and academic performance in physical therapist education, were considered in addition to scores on the CCTST. The author found that that the relationship between critical thinking, academic performance and success on the NPTE was not clear (Vendrely, 2007).

Huhn et al. (2011) used a different test, the Health Science Reasoning Test (HSRT) to assess critical thinking and establish the construct validity of the test. These authors used this test to discriminate between novice and expert physical therapists' critical thinking skills by administering this test to physical therapist education students at the beginning of their first year and experts identified at random from a list of physical therapist, who held a certification from the American Board of Physical Therapy Specialties (ABPTS) in geriatrics, neurology or orthopedics. This test was able to show a statistically significant difference between novice and expert physical therapists' critical

thinking skills. These authors followed the novice students and the HSRT was administered at two more points in their physical therapist education.

Huhn, Black, Jensen, and Deutsch (2013) was able to show that critical thinking changed significantly during the students' physical therapist education. These authors found that the greatest change in critical thinking was during the students' didactic portion of education versus during the clinical internships. This is divergent from the findings of Bartlett and Cox (2002) who found that the greatest change in critical thinking was during the clinical internship portion of Physical therapist education. Using the CCTST and CCTDI, these authors assessed a group of physical therapist students in their second year of physical therapist education, before the didactic portion, after the didactic portion and once they returned from clinical internships.

Zettergren and Beckett (2004) findings support those of Bartlett and Cox (2002). The authors found a significant increase in critical thinking in physical therapist students in a study examining the change in critical thinking over a three-year period of physical therapist education (Zettergren & Beckett, 2004). Using the CCTST, the students were tested in the third, fourth and fifth year of study. The most significant differences were found between the third year and the fifth year. The authors state that at the end of the fourth year, the physical therapist education students participated in an eight-week clinical internship, leading to experiential learning which enhance critical thinking skills. This study did not assess the CCTST at the beginning of the physical therapist education program, which may have shown an even greater change in critical thinking over the course of the physical therapist education.

Suckow et al. (2015) examined the association between critical thinking scores on the CCTST and the cumulative GPA of physical therapist education students with the

first time pass rate on the NPTE. They did not find any significant gains in students' critical thinking over the three-year physical therapist education program; however, they did find that the students that failed the NPTE had lower scores on the CCTST than the students that passed the NPTE. Their findings are consistent with a systematic review by Brudvig, Dirkes, Dutta, and Rane (2013). Five articles specific to physical therapy and critical thinking skills were reviewed and the authors reported that small sample size and poor statistical power, showed mixed results in attainment of critical thinking skills.

In 2016, Brudvig, Mattson and Guarino were able to show that the Health Science Reasoning Test (HSRT) identified clinically important changes in students' critical thinking skills during their physical therapy education. This study took place over a two and half years with the first assessment of HSRT at the beginning of the program, the second assessment at the end of the first didactic year, a third after their first full time clinical internship in their second year and the last at their graduation of the program. The authors found a statistically significant increase in HSRT scores from the first and fourth assessment related to deduction and inference.

Summary

Critical thinking and higher order thinking have been defined many ways in the literature and with these many definitions there are differing ways to assess these skills. Assessment of these skills has become a focus in professional medical education. Examinations such as the MCAT, the PCAT and the DAT are gauging the levels of critical thinking and higher order thinking of their applicants prior to admission to their programs because it is felt that these skills should be part of a well-rounded healthcare provider.

Using the definitions of critical thinking proposed by Facione (1990) and higher order thinking proposed by King, Goodson, and Rohani (1998), this study used a modified e-Delphi technique to determine which of these skills were seen as most essential. This was determined by a panel of experts made up of physical therapist who have published literature in the field of critical thinking and program directors of physical therapist education program. This information could then be used as part of an entrance examination similar to those used by the medical, pharmacy and dental educational programs. To date, no other studies have been performed that look at this particular topic.

Chapter 3

Methodology

Introduction

With an increased demand for physical therapists, physical therapist education programs are seeing an influx of students applying for positions in these programs (Landry et al., 2016, U. S. Department of Labor, 2015, CAPTE, 2015b). Current admission processes vary from program to program causing logistical difficulties for the students. This variability also causes difficulties for the programs to determine which students will be successful both in the program as well as successful passing of the NPTE (APTA, 2015a). One solution that has been proposed by a task force is to implement a standardized entrance examination which would assess these students' level of preparation for entrance into physical therapist education programs (APTA, 2015a). Therefore, the purpose of this modified e-Delphi study was to determine which critical thinking skills and higher order constructs should be included on a standardized examination, if such an examination were required for admission to entry-level DPT education programs (Donohoe, Stellefson, & Tennant, 2012; Hasson & Keeney, 2011; Holloway, 2012). Thus, the following research questions guided this research:

- 1) Based on the expert opinions of physical therapist educators, which higher order thinking constructs are specific to the practice of physical therapy?
- 2) Based on *The Delphi Report*, which critical thinking skills should be measured on a discipline specific pre-admission examination?

This chapter covers the methodology used in this study that is the modified e-Delphi method. In the section on research design, the history of the Delphi method, modifications to this method, strengths and weaknesses, and finally reliability and

validity concerning the Delphi method are discussed. This chapter also includes specific sections on the sampling design and how the experts for the modified e-Delphi method were selected. Next, the chapter reviews how the surveys used were pilot tested, the procedures for data collection in each round, and finally, the data analysis procedures.

Research Design

The Delphi method is a valued research technique used in many disciplines (Baker, Lovell, & Harris, 2006; Gordon, 1992; Williams & Webb, 1994). The Delphi method is part of a research body known as futures methods (Baker et al., 2006; Merriam & Simpson, 1995). This type of research looks at what might be (Gordon, 1992). The Delphi method was created in the 1960s by Helmer and Dalkey for use to predict military priorities, and was named for the predictive oracle on the Greek island of Delphi (Baker et al., 2006; De Villiers, De Villiers, & Kent, 2005; Gordon, 1992). Via the Delphi method, forecasting events is achieved by surveying a group of experts to obtain a consensus (Mead & Moseley, 2001). This method allowed groups of experts to anonymously give opinions on a subject or question (Fink, Kosecoff, Chassin, & Brook, 1984; Goodman, 1987). The Delphi method eliminated the concern of one voice dominating as might happen if these experts were put into one room and asked the same question (Gordon, 1992).

The Delphi method is used to obtain and structure expert opinion from a group of individuals generally in a widespread geographical area (Custer, Scarcella, & Stewart, 1999; Fink et al., 1984; Merriam & Simpson, 1995; Portney & Watkins, 2008; Powell, 2003; Williams & Webb, 1994). The traditional procedure used in the Delphi method is “distributing a series of questionnaires, known as rounds, to participants” (Sumsion, 1998). In the first round, an open-ended questionnaire or survey is given to a panel of

selected experts inquiring about specific information or topics (Powell, 2003). This information is compiled, analyzed and distributed back to the panel by a central researcher, looking for specific themes in order to create a second questionnaire or survey (Fink et al., 1984; Powell, 2003). The results from the first round, which are more specific, are then sent back out to these experts for a second round, and they are asked to rank the information (Custer et al., 1999; Powell, 2003). Generally, a third round or fourth round is indicated to achieve a consensus of opinion (Custer et al., 1999; Keeney, Hasson, & McKenna, 2006), but Hasson, Keeney, and McKenna (2000) state that this process “is ongoing until no further consensus can be reached” (p. 1012).

This process is highly flexible and has been adopted and modified to meet the need of the discipline using it (Custer et al., 1999; Hasson et al., 2000; Sumsion, 1998). The modified Delphi method adopts the process of the traditional Delphi procedure by using a series of questionnaire rounds with experts, with the intent to reach a consensus on a topic, however round one is modified (Custer et al., 1999; Sumsion, 1998). In 1999, Custer’s modified Delphi method changed the initial process by replacing the open-ended questions, “with a set of carefully selected items...drawn from...the literature” (para. 6). Duffield (1993), when studying competencies expected in first-line nurse managers, also consulted the literature to arrive at the 168 competencies to submit to the panel of experts for the first round.

The e-Delphi is a form of the Delphi that incorporates the methods of the traditional Delphi but uses email and online survey formats (Donohoe, Stellefson, & Tennant, 2012; Hasson & Keeney, 2011; Holloway, 2012). An internet-platform such as Survey Monkey or Qualtrics is used to organize, regulate and facilitate transmission of information between the expert panel and researcher (Donohoe et al., 2012). This has

made the Delphi method more accessible to researchers as well as making it more cost effective and convenient (Donohoe et al., 2012). Holloway (2012) found that the e-Delphi allowed better support and follow up with her panel of experts as well as fostering a higher level of engagement. This method of the Delphi also can decrease the time commitment from the expert panel, which can enhance participation and improve the response rate.

All of the Delphi methods have inherent strengths and weaknesses. A strength of this method is that, geographically, these experts do not have to come together in one location (Linstone & Turoff, 2002; Fink et al., 1984). The survey can be sent to where ever the expert is located, and then the expert completes the survey and sends it back to the researcher compiling the information (Custer et al., 1999; Fink et al., 1984; Merriam & Simpson, 1995; Portney & Watkins, 2008; Powell, 2003; Williams & Webb, 1994). Another strength of this method is anonymity, which allows for statements and opinions to be given without bias (Domholdt & Domholdt, 2000; Hasson et al., 2000; Mead & Moseley, 2001; Merriam & Simpson, 1995; Williams & Webb, 1994) or “influence by peer pressure or other extrinsic factors” (Goodman, 1987, p. 730). This anonymity encourages a more honest opinion on the question or topic (Mead & Moseley, 2001). Because these experts have anonymity, there is concern that answers could be given without thought (Goodman, 1987; Vernon, 2009). However, this is not generally the case since the expert panel is chosen based on their vested interest in the content and contribution to the topic (Goodman, 1987; Hasson et al., 2000).

A Delphi method survey can be cost effective since it is performed remotely versus face to face (De Villiers, De Villiers, & Kent, 2005; Linstone & Turoff, 2002; Vernon, 2009). Prior to use of the Internet for survey distribution, the costs surrounding

this type of study were time, stationary and postage (Vernon, 2009). Time to complete a Delphi study could take months to years (Facione, 1990; Keeney, Hasson, & McKenna, 2006; Scheffer & Rubenfeld, 2000), however use of electronic communications can cut time and cost (De Villiers et al., 2005). The Delphi method used should also be transparent and detailed. This means that criteria for how consensus is reached, the definition of expert, and the procedures of the study are clear to allow replication to show agreement or a change in opinion (Mead & Moseley, 2001). The validity of this method is strong because it allows surveying a larger group than might be brought together face to face, which increases statistical significance (Williams & Webb, 1994).

Weaknesses or limitations to this method include defining the expert panel, sampling issues, the meaning of consensus, response rate, generalizability and validity and reliability. A major criticism to the Delphi method is the lack of definition of what is an expert (Baker et al., 2006; Custer et al., 1999; Hasson et al., 2000; Keeney et al., 2006; Williams & Webb, 1994). Mead and Moseley (2001) give a variety of ways to define an expert:

...they may be a group defined by their position in a hierarchy..., or by reference to certain experience...They may be publicly acknowledged experts, such as those who have published or lectured widely on a topic, or they may be experts in the eyes of some group of people under study. (p. 10)

Experts in the panel are described by Fink et al. (1984) as those who can represent their profession and would not be questioned as an expert. Vernon (2009) writes that the level of expertise is based on the necessities of the study and can vary widely. Because of this wide variety of definitions of expert, Baker et al. (2006) suggests that further research is needed to define who the expert in a Delphi study is.

In traditional research, a sample should be representative of the population being sampled; however, for the Delphi method, this sample does not need to be a representative of the population (Mead & Moseley, 2001). It should be made up of experts who “are willing and able to make a valid contribution” (Powell, 2003, p. 379) and those who have worked in the area or with the subject matter (Powell, 2003; Sumsion, 1998).

The next weakness is sampling issues. A homogeneous panel of experts is one that has a narrow definition of expert with a specific skill set, whereas a heterogeneous panel would have larger and more encompassing definition and incorporate individuals with more diverse background (Baker et al., 2006; Vernon, 2009). If a panel of experts is too homogeneous, then this could produce skewed data, therefore having experts in the panel with varying degrees of experience with the topic may produce a consensus with merit (Mead & Moseley, 2001). Goodman (1987) cites that a heterogeneous panel is needed to define broader issues and a homogeneous panel is needed for more specific topics.

The number of members needed in the panel has been ambiguous and disputed (Powell, 2003; Sumsion, 1998; Vernon, 2009; Williams & Webb, 1994). With a larger sample size, there is more data generated, increasing resources needed to analyze this data (Hasson et al., 2000; Sumsion, 1998). Sumsion (1998) advocates using numbers that will best reflect the topic of the study and will be manageable with the resources available to the researcher. Also, the number chosen has to be justifiable by the researcher (Sumsion, 1998).

There are no absolutes when defining a consensus in a Delphi study (Keeney et al., 2006; Williams & Webb, 1994). Consensus helps a researcher choose what items are

moved forward to subsequent rounds and which are excluded. Fink et al. (1984) define a consensus as “a convergence of opinion or when a point of diminishing returns [*sic*] is reached” (p. 980). Powell (2003) finds that setting a percentage level for inclusion is a common way of establishing a consensus. Williams and Webb (1994) found that many researchers did not set a pre-study level of consensus, which they found to make the consensus process arbitrary and subjective. In their article on the Delphi method, they chose to use 100% agreement as the criterion for consensus (Williams & Webb, 1994). Keeney et al. (2006) suggest 75% as the criterion, but if a different number is chosen that it should be done before beginning the study.

The consensus findings harness the collective wisdom of experts in an area of uncertainty or lack of empirical evidence (Powell, 2003). However, this consensus still represents expert opinion versus fact (Hasson et al., 2000). It also does not mean that everyone agrees. If a consensus is reached at 75%, 25% of the panel does not agree with the majority (Keeney et al., 2006). Panel members may also change their view based on the feedback given, suggesting that opinion can be swayed toward consensus versus a true agreement (Goodman, 1987). Also, a consensus does not necessitate that the conclusion is fact and can be generalized. A consensus only identifies topics or areas that are deemed important by one group of experts as opposed to a sample representing the entire population (Mead & Moseley, 2001).

The last issues with the Delphi method have to do with reliability and validity. Hasson and Keeney (2011) point to the many different interpretations of the Delphi method as one of the reasons that reliability and validity are in question concerning the Delphi method. These authors cite Keeney (2009) as identifying ten different types of Delphi methods (Hasson & Keeney, 2011). This method traditionally uses a qualitative or

a mixed method approach, with trustworthiness used as methodological rigor versus the quantitative rigor of validity and reliability. However, a 2005 study by Day and Bobeva, argue that both quantitative and qualitative methods of rigor can be used.

Williams and Webb (1994) state that “there is no evidence that the Delphi method is reliable” (p. 182). This is based on the idea that two groups of experts selected using the same criteria may not give the same results (Hasson, Keeney, & McKenna, 2000; Williams & Webb, 1994). Reliability in a Delphi study is said to be improved through the anonymity of the expert panel and the ability of the experts to think without group influence (Hasson & Keeney, 2011). A smaller panel of experts or a lower number of rounds may decrease the reliability of findings, whereas reliability can be enhanced through a larger panel and repeated surveying of these experts (Fink et al., 1984). However, the time commitment of weeks, months, or years to a Delphi study may cause subject attrition due to panel fatigue which can potentially skew data in later rounds (Hasson et al., 2000; Sumsion, 1998).

Content and face validity of the Delphi is questioned in the literature. The results developed from an expert group opinion is assumed to validate the study; however, if the number of experts and the level of expertise is questionable, then validity is also compromised (Hasson & Keeney, 2011). Another issue is the traditional approach of a first-round open-ended question that may lead to broad, confusing statements that will eventually cause bias. This can be countered using a closed-ended, modified Delphi (Hasson & Keeney, 2011).

Modified e-Delphi. Since the intent of this study was to find consensus and not, as the original intent of a Delphi study, futures forecasting, the modified e-Delphi method using a Qualtrics survey was the process undertaken for this study (Baker et al., 2006;

Merriam & Simpson, 1995). Surveys are a type of quantitative data collection technique which are composed of a questionnaire that helps to describe “current practices, attitudes and values, or characteristics of specific groups” (Portney & Watkins, 2009, p. 325). This approach was used due to several advantages. First, it reduces bias from interaction with the researcher, such as interviewer bias. This is where the researcher could interpret information differently than was reported by the participant (Portney & Watkins, 2009). Second, surveys can also provide anonymity which helps yield more complete data returned to researcher. This is because the participant feels more able to answer questions without fear of repercussions. Final advantages of using a survey include ease of access to a wide geographic area, economy of use, and faster turnaround in data collection (Creswell, 2013; Fink, 1995; Merriam & Simpson, 1995; Portney & Watkins, 2009; Wright, 2005).

Using the critical thinking sub-skills developed from Facione’s (1990) work and the higher order thinking processes from King, Wood, and Mines’ (1990) work, these skills and constructs were submitted to the first-round experts via a Qualtrics email survey questionnaire. Duffield (1993) found that providing definitions to the experts can significantly reduce the time invested in completing the Delphi. Providing the experts with items gained through the literature has been reported as strengthening the Delphi method (Day & Bobeva, 2005). Gordon (1992) defines experts as those individuals “identified through literature searches—to find those who have published on the subject matter under study” (p. 29).

The first-round experts completed the survey, where the skills and constructs are ranked. The data was analyzed by the primary researcher and feedback was provided to the first-round experts. For the second-round, the experts were provided the analysis from

the first-round and then asked to complete a similar survey where the skills and constructs have been pared down based on scores. This data was again be analyzed and sent to the experts for a third-round until a consensus is reached. Anything more than three rounds can cause participant fatigue and lower the response rate (Keeney et al., 2006). The final, third-round analysis of data was provided to the experts once it is disseminated in a formal paper.

Sample and Expert Panel

A total of 246 physical therapists was invited to participate in this study. The following inclusion criteria was met to participate: 1) physical therapists who have publications on critical thinking or higher order thinking in the last 20 years; 2) program directors of accredited physical therapist education programs; and 3) hold a current physical therapy license in the United States. Opting out of the informed consent or the survey process, or if a participant partial completed the survey excluded them from study.

The purposeful sample was used in this study. A purposive sample is a sampling technique where subjects are chosen on the basis of certain criteria as described above (Portney, 2009). The population that this sample represents is the body of physical therapist educators at universities and institutions that would use a pre-admission examination to screen applicants for entrance into a physical therapist education program. This sample was assumed to be a heterogeneous panel because of the diverse backgrounds in physical therapy, such as clinical practitioners, educators and researchers. A larger number of panelists was needed due to these various backgrounds, as well as, yielding enough participants to have an adequate response rate (Baker et al, 2006; Vernon, 2009).

Response rates between 20-47% have been shown by the literature as a typical response rate for online surveys (Nulty, 2008; Cho, Johnson & VanGeest, 2013). Fink (2003) reports that it is not unusual for the first survey distribution to have a 20% response rate. In order to achieve this response rate, the significance of the study and its implications was included in the introductory letter (Appendix A). Providing this information can lead the experts to feel more a part of the study and also informing the experts that each round of the study is built from their input has been found to decrease attrition in Delphi studies (Keeney et al., 2006; Roberts, 2010).

Fifty-six (56) physical therapists completed the entire first round of the study, yielding a 23% response rate. The second survey for round two was sent to 56 participants. Thirty-five (35) participants completed round two of the survey for a response rate of 63%. The final survey was sent to the 35 panel members who completed round two. With a response rate of 80%, 28 panel members completed the final round of this survey. (Table 1)

Table 1. Participants

| | Round 1 | Round 2 | Round 3 |
|-----------------------------|----------|----------|----------|
| n | 246 | 56 | 35 |
| Responded (Response Rate %) | 56 (23%) | 35 (63%) | 28 (80%) |
| Gender (F/M) | 40/16 | 27/8 | 21/17 |
| PDs/Faculty/Other% | 80/11/9 | 77/11/12 | 78/11/11 |
| Published CT/HOT (%) | 20 (36%) | 12 (34%) | 9 (32%) |

Notes: PD= Program Directors, CT= critical thinking, HOT= higher order thinking

Description of the expert panel. Of the 246 invited to participate, nineteen were physical therapists identified as experts in critical thinking and higher order thinking. These physical therapists, through their research, have demonstrated that they have knowledge and expertise in critical thinking and higher order thinking, which increased

their likelihood to complete the Delphi process (Keeney et al., 2006). The remaining 227 experts were program directors from CAPTE accredited U.S. physical therapy programs.

These program directors acted as proxy for the admissions committee and faculty members, or the program director may have designated a faculty member to participate in this study because of their familiarity with the subject. This population was selected because they represent the experts in physical therapist education, therefore have insider knowledge of what critical thinking skills and higher order thinking needs to be in place prior to admission. Program directors are defined by CAPTE standards as licensed physical therapists with a minimum of 6 years of full-time experience in higher education and at least 3 years of full-time experience in physical therapist education. They must also hold at least the rank of associate professor and an earned academic doctoral degree (CAPTE, 2015c).

Currently there are 236 accredited physical therapist education program in the U. S. A list of the 236 accredited physical therapist education programs and program directors in the U.S. was obtained and checked against the individual university or institutions' webpage (CAPTE, 2017). Of the 236 accredited programs, viable email addresses were obtained for 227 program directors. Attempts were made to obtain the missing email addresses by phoning or emailing the programs. Seven programs did not respond to phone or email messages and two programs had interim program directors who were not physical therapists.

The demographic information obtained from the survey included number of years as a physical therapist, age, gender, highest degree, entry level degree, number of years in physical therapist education, number of years interested in critical thinking and higher order thinking and if they have published in critical thinking and higher order thinking.

The gender identity of the panel for all three rounds was predominantly female, which is representative of this majority female profession. (Table 1) The age range was from 35 to 74 years of age. For all three rounds, most members of the expert panel have been physical therapists for more than 30 years, and the majority reported the highest degree earned was a terminal doctorate such as a Ph.D., Ed.D., or law or medical degree. The greater part of the panel reported a Bachelor's degree as their entry-level professional degree.

Consistently over three rounds, most of the expert panel have been involved in physical therapist education between 21 and 25 years with a range of six years to more than 30 years. The percentage of physical therapists who had published on critical thinking or higher order thinking was around 34% for all three rounds. (Table 1) The number of years of interest in critical thinking and/or higher order thinking ranged from one year to thirty-plus years with a mode for each round at 16 to 20 years.

Instrument

Because there has not been a study assessing critical thinking and higher order thinking in the admissions process for physical therapist education, a survey was developed to assess this information. The survey was pilot tested for construct validity, ensuring that it measures what it was anticipated to measure (Litwin, 1995). Face validity was established by having a colleague on faculty at the researcher's university who has published in the realm of critical thinking, but is not a physical therapist, assess the survey. In this capacity, the colleague is able to inform the researcher if "the items look OK to them" (Litwin, 1995, p. 35). Changes to the initial survey were made based on this feedback.

Content validity is measured by how appropriate the items are to a group of reviewers who have knowledge of the subject matter, in this case physical therapists on faculty that teach at a physical therapist program (Goodman, 1987; Litwin, 1995). A second survey was created in Qualtrics to assess content validity. In the introduction to the content validity survey, the purpose statement of the modified Delphi study was given, and then the content validity survey asked the group of experts a series of questions related to each of the modified Delphi survey questions. The first query asked whether the question was clearly stated, the second asked whether the question or statement was related to the purpose of the study, the third asked whether the question or statement answered one of the research questions, and the final query asked the experts for their comments about each question. Changes to the survey questions were made based on the feedback from this group of experts that resulted in the current survey.

The initial questions in the first round in this survey collected demographic information as described in the previous section. These experts completed round one of the Delphi by ranking each of the 16 critical thinking skills and the five higher order thinking constructs using a Likert scale. The critical thinking skill and definition were given and the expert used a five point Likert scale as suggested by Vernon (2009) to rank the skills from 0= Not Important, 1= Little Importance, 2= Average Importance, 3=Very Important, and 4= Absolutely Essential.

The higher order thinking constructs were assessed using the same technique. The survey took no longer than twenty minutes to complete and had a completion date two weeks after initial e-mailing. Follow up communication to encourage these experts to complete the survey was sent to those that had not responded after one week and then again two days before the survey closed (Keeney et al., 2006). Thank you emails were

sent to participants who had completed the survey at each round. Once the surveys were returned, analysis was completed, and results returned to the experts for a second and third round of the Delphi. The second and third survey took less time to complete and also had a return date two weeks after the date sent.

Data Collection

The University of Tennessee Health Science Center (UTHSC), where the primary researcher holds a full time faculty position as an assistant professor, allows faculty and staff use of the web-based survey tool Qualtrics (UTHSC, 2013). Online survey tools save money, avoiding the cost of recording equipment, travel, telephone and postage (Wright, 2005). This tool was chosen because of this access, as well as, prior experience using Qualtrics for surveys developed for other uses. This survey tool has a survey wizard and templates that allow for ease of use and professional appearance. Qualtrics generates a link that allows for access to the survey or it can use an email database to send out a survey. It also has integrated statistical tools, or if needed, data can be downloaded to statistical software package (UTHSC, 2013).

Survey pilot. Because the survey was developed by the researcher exclusively for this study, the survey was evaluated through a pilot process in late spring of 2017. The survey was sent to a group of 16 healthcare faculty members at a local health science university where the primary researcher is employed. Over a four-week period, the three rounds of the modified e-Delphi were completed. Using the consensus percentage of greater than or equal to 85% agreement at level three (3) (Very Important), the critical thinking skills and higher order thinking constructs were reduced in round one. The second round survey was only sent to those who had completed round one. The consensus level was 90% agreement at level three (3) (Very Important). Respondents

from round two were included in round three and the percentage was again 90% agreement at level three (3) (Very Important) to decide which critical thinking skills and higher ordering thinking constructs would be retained or eliminated.

The initial round of the pilot survey allowed participants to make comments or recommendations concerning the survey. One such recommendation was to include a status bar to indicate to the survey participant how far along they were in the survey. Another participant did not discern from the instructions that the survey was attempting to identify critical thinking skills and higher order thinking constructs *prior* to entrance into physical therapist education program rather than current physical therapy students. It was suggested that it be emphasized more in the survey instructions. Both recommendations from pilot participants were used to modify the study survey.

The pilot survey attempted *a priori* settings, however in each round modifications were made so that some skills were be eliminated. The modifications also allowed the participants to feel that they had contributed, and since they received feedback between rounds, this was another way to ensure continued participation in the pilot survey. For the study survey, the pilot helped to establish the criterion percentages that are outlined in the next section.

Study survey. The UTHSC has a well-outlined institutional review board (IRB) process. UTHSC IRB approved this project in the spring of 2017 and because of the cooperative agreement between UTHSC and the University of Memphis (UM), this project could move forward with data collection at that point. Data collection began in the summer of 2017.

An introductory letter was sent via email to each of the 246 experts, disclosing the intent, significance, and methods of the study as well as operational definitions pertaining

to this study. Once interested in participating, a secure hyperlink to the Qualtrics survey was selected. This hyperlink was specific to the individual so that it cannot be forwarded to anyone else. Once the experts accessed the Qualtrics survey program via a link in the introductory letter, an informed consent was the first document they were required to complete (Appendix B). Included in this standard consent document was the purpose of the research, how the participants were selected, risk involved and assurance that the participant could withdraw at any time. The participant would be excluded from the study if the participant does not agree to the informed consent, does not hold a current PT license, or does not live in the United States. Participation in this study was voluntary. The format through Qualtrics allowed the experts to respond anonymously.

Data from the survey was accessed only through the lead researcher's password protected computer using a secure internet connection via The University of Tennessee Health Science Center. The identity of the expert panel was anonymous to other panel members but was known to the primary researcher, so true anonymity was not guaranteed (Keeney et al., 2006). However, confidentiality was maintained within the limits allowed by law. Qualtrics allowed each email address to have a separate confidential identifier. Responses were tracked using this and a follow up communication was sent to the participants who had not responded on two occasions, once week after the survey opened and two days before the survey closed. This encouraged these experts to complete the survey (Keeney et al., 2006). A thank you email was sent at the end of each round to those who had completed the survey. All written documents and electronic information related to this research remained secure, and only accessible to the investigator and her advisor.

Variables and data analysis. Demographic information for each set of experts was analyzed. Each critical thinking skill and higher order constructs are variables, but there was no manipulation of these variables. As such, these variables were reported in the data analysis using means generated from ranking by each expert in each round. Skills and constructs in all rounds were eliminated by a process outlined first in Murphy's 1982 dissertation and subsequently used by Duffield (1993). This is a process of retaining items when certain percentage of the responding expert panel agrees to skills with a certain mean score.

In the first round, a skill was retained if 90% of the panel selected a skill with a score of two (2) or higher. A score of two (2) represented the point where a skill or construct was seen as having *Average Importance*. The second survey was sent out and the expert panel had a survey similar to the first round. In the second round, 75% of the experts had to agree that a skill has a mean score of at least three (3) (Very Important) for the skill to be retained for round three. The scores from the first and second rounds were analyzed and reported to the expert panel. In the last round, 75% of the experts had to agree that a skill or construct had a mean score of at least three (3) (Very Important) for this skill or construct to be view as significant enough to be included in an admission exam for physical therapist education.

Reliability and Validity

Keeney et al. (2011) point out two ways to establish reliability with the Delphi method. One has to do with a test-retest process. The test-retest approach was not possible due to time constraints of the author. However, a large heterogeneous expert panel ensured that data collected is reliable. The resemblances and differences in the data obtained from expert panel members demonstrates that this study could be repeated

(Linstone & Turoff, 2002). This is because the data should echo the opinion of those familiar with critical thinking from different points of view. This then contributes to the consensus process (Hasson & Keeney, 2011; Linstone & Turoff, 2002).

The second way Keeney et al. (2011) maintain reliability is through avoiding bias. Researcher bias and subjectivity was avoided in this study due to the heterogeneous mix of physical therapists that participated in taking the survey. This type of bias can be an issue with the Delphi method since the researcher could pick an expert panel that would fall in line with the view of the researcher (Vernon, 2009). The primary researcher had limited interaction with participants eliminating interviewer bias. Since the expert group was anonymous and was not in contact with one another, group bias was eliminated as well (Hasson & Keeney, 2011; Portney & Watkins, 2009).

Another way to assess reliability is through the qualitative method of trustworthiness. Trustworthiness or goodness is an aspect of reliability and should be outlined to ensure credibility (Hasson & Keeney, 2011). This is done by showing the detailed decisions in the methodology to address the problem, how the experts are selected, how data are collected, how levels of consensus are established and how information is dissemination (Powell, 2003). The methods used to determine which critical thinking skills and higher order constructs are outlined previously in this chapter, as well as the method of choosing the experts. The procedures for collecting data from the Qualtrics survey, the methods for maintaining confidentiality, and the consensus levels have been established prior to collection of data. These procedures are essential for maintaining the study's credibility.

Validity of this study can be influenced by response rates (Hasson et al, 2000) and online surveys tend to have a lower response rates versus paper based survey processes

(Nulty, 2008). However, this is addressed through selection of experts who have an investment in physical therapist education and critical thinking. Outlining the time requirement and the importance of this issue also helped minimize natural loss. Using an online tool to distribute the survey was the most practical and economic way to reach a large audience for this survey.

Content validity was strengthened through face validity assessment of the survey prior to deployment making sure that the survey was evaluating the research questions, and through the consensus established from group opinion and not an individual (Cross, 1999). With the many iterations of the Delphi technique, situations threats such as number of rounds, feedback provided, consensus and timing can threaten internal validity. The current study addressed each of these, *a priori*, with specific considerations and descriptions so that this information could be generalized as much as possible. According to Linstone and Turoff (2002), the criteria that guides selection of the expert panel assures that the population is reliable and valid. Validity is established through a clear definition of the problem and content. It was maintained through the heterogeneity of the expert panel because these experts are all physical therapists.

Chapter Summary

This chapter described the methods used in this study. A discussion of the history and use of the Delphi method was introduced as well as the strengths and weakness of this type of research. This was followed by a description of which Delphi method was chosen for this study. The specific procedures for choosing the expert panel, and collecting data were outlined. The chapter ended with an overview of data analysis was presented along with details about validity, reliability and bias.

Results of each round found from the modified e-Delphi Study are reported in Chapter 4, and the findings were also described in that chapter. A discussion of the findings, conclusions and recommendations for further research was detailed in Chapter 5.

Chapter 4

Data Analysis and Results

Introduction

Chapter 4 provides the results and a detailed analysis of the data from this three-round modified e-Delphi study. The purpose of this study was to specify which critical thinking skills and higher order constructs are the most important to assess on a discipline-specific admission examination prior to entrance into a physical therapist professional education program. The requisite skills were identified by surveying a group of expert physical therapists. The critical thinking skills used in this study were outlined in Facione's (1998) *The Delphi Report*, and the higher order thinking constructs were found in King, Goodson and Rohani's (1998) manuscript *Higher Order Thinking Skills*. This chapter includes a summary of the summary results and the analysis of the consensus items are stated.

Summary of Survey Results

In the initial round, the expert panel answered 21 questions; 19 questions involved critical thinking skills and five related to higher order thinking. Using a five-point Likert scale, the expert panel was directed to choose the importance of a critical thinking skill or higher order thinking construct that could be assessed by a discipline-specific examination prior to physical therapist education. The range on the Likert scale was 0= Not Important, 1= Little Importance, 2= Average Importance, 3=Very Important, and 4= Absolutely Essential. Analysis of the data from round one, eliminated one critical thinking skill and two higher order thinking constructs. Round two eliminated nine critical thinking skills, along with a single higher order thinking construct. Analysis of

round three data eliminated one critical thinking skill and no higher order constructs were eliminated.

Detailed analysis. The initial round began June 19, 2017, and closed July 17, 2017. Initially, each round was to be two weeks in length; however, round one data collection period was extended two weeks. A highly-attended national conference of the American Physical Therapy Association was held during the last week of the survey. A summer holiday also fell in the middle of the third week of data collection. Respondents received two reminder emails in the first two weeks and those who had not completed a survey after the first two weeks received another introductory letter and a single follow-up email.

Round one quantitative data from the expert panel was collected from Qualtrics at the close of round one on July 17, 2017. The skills were only retained if 90% of the expert panel (n=56) scored the skill at level two (Average Importance) or above. The critical thinking skill eliminated was *analyzing arguments* (89%). The higher order thinking constructs eliminated were *metacognitive thinking* (89%) and *creative thinking* (89%). Higher order constructs retained were *critical thinking*, *logical thinking*, and *reflective thinking*. Critical thinking skills retained included *categorization*, *decoding significance*, *clarifying meaning*, *examining ideals*, *detecting arguments*, *analyzing arguments*, *assessing claims*, *assessing arguments*, *querying evidence*, *conjecturing alternatives*, *drawing conclusions*, *stating results*, *justifying procedures*, *presenting arguments*, *self-examination*, and *self-correction*. *Presenting arguments* scored the lowest retained agreement rating of 95% and *stating results* earned the highest agreement score, 100%.

The round two survey opened on July 17, 2017, and was active for two weeks. Participants, who completed round one, received a reminder email after one week if they had not completed the survey and again two days before the survey closed. Data analysis from round two of the survey began on July 30, 2017. For this round, skills were retained when the expert panel (n=35) had a 75% consensus at level three (3) (Very Important) or above. Retained were seven critical thinking skills: *categorization*, *clarifying meaning*, *assessing claims*, *assessing arguments*, *stating results*, *self-examination*, and *self-correction*. As in round one, the critical thinking skill *stating results* (88%) had the highest consensus rating. Eliminated in this round were the critical thinking skills of *decoding significance* (63%), *examining ideals* (74%), *detecting arguments* (70%), *querying the evidence* (63%), *conjecturing alternatives* (46%), *drawing conclusions* (74%), *justifying procedures* (74%), and *presenting arguments* (74%). A single higher order thinking construct was eliminated in this round, *reflecting thinking* (69%), with *critical thinking* and *logical thinking* remaining.

The third and final survey launched on July 31, 2017, and ended August 13, 2017. The same format of reminder emails was used again in the third iteration of the survey. Once a survey was completed in each round of the study, participants received a thank you email. The final round data analysis began August 14, 2017. Skills were retained with a 75% consensus at level three (3) (Very Important) or above. A single critical thinking skill was eliminated in this round, *categorization* (62%), and no higher order thinking constructs were eliminated leaving *critical thinking* and *logical thinking*. Critical thinking skills retained in this final survey were *clarifying meaning*, *assessing claims*, *assessing arguments*, *stating results*, *self-examination*, and *self-correction*. In total, ten critical thinking skills and three higher order thinking constructs were eliminated over

three rounds of the modified e-Delphi. Specific skills retained or eliminated are found in Table 2.

Table 2. Retained or Eliminated Skills

| Skills | Round 1 (n=56) | Round 2 (n= 35) | Round 3 (n= 28) | Retained |
|---------------------------|-------------------|---------------------|--------------------|----------|
| Categorization | 95% | 77% | 62% | |
| Decoding Significance | 95% | 63% | | |
| Clarifying Meaning | 95% | 86% | 76% | ✓ |
| Examining Ideals | 98% | 74% | | |
| Detecting Arguments | 98% | 70% | | |
| Analyzing Arguments | 89% | | | |
| Assessing Claims | 98% | 83% | 79% | ✓ |
| Assessing Arguments | 96% | 77% | 79% | ✓ |
| Querying the Evidence | 95% | 63% | | |
| Conjecturing Alternatives | 95% | 46% | | |
| Drawing Conclusions | 98% | 74% | | |
| Stating Results | 100% | 88% | 93% | ✓ |
| Justifying Procedures | 98% | 74% | | |
| Presenting Arguments | 93% | 74% | | |
| Self-Examination | 98% | 77% | 90% | ✓ |
| Self-Correction | 95% | 86% | 79% | ✓ |
| Critical Thinking | 96% | 80% | 89% | ✓ |
| Logical Thinking | 98% | 80% | 83% | ✓ |
| Reflective Thinking | 96% | 69% | | |
| Metacognitive Thinking | 89% | | | |
| Creative Thinking | 89% | | | |

Notes: Shading indicates the skill was not carried into the next round,
 ✓ = retained skills over all three rounds.

Answering research question one (RQ1), the higher order thinking constructs selected by an expert group of physical therapists that are specific to physical therapy and should be assessed prior to entrance into a physical therapist education program are *critical thinking* and *logical thinking*.

The second research question (RQ2) asks which critical thinking skills as defined by The Delphi Report should be measured by a discipline specific pre-admission examination. Using the same panel of expert physical therapists, the critical thinking skills are *clarifying meaning, assessing claims, assessing arguments, stating results, self-examination* and *self-correction*.

Chapter Summary

This modified e-Delphi study was three rounds in length with an expert panel comprised of physical therapists who were program directors of physical therapist education programs, or who published in the realm of critical thinking and/or higher order thinking. Of the 246 invitations to participate in this study, 56 physical therapists completed round one. Thirty-five physical therapists completed round two of this study, and 28 completed round three. The critical thinking skills of *clarifying meaning, assessing claims, assessing arguments, stating results, self-examination, and self-correction* and the higher order thinking constructs of *critical thinking* and *logical thinking* emerged as the consensus items to be assessed in a discipline-specific examination prior to entrance into a physical therapist education program.

Chapter 5

Conclusions and Discussion

Introduction

The purpose of this chapter is to present a summary of the study, and the framework of the methods. Key results and conclusions derived from Chapter 4 are discussed in relation to the research questions. The chapter also introduces new literature pertinent to the findings of this study. The chapter concludes with a discussion of the possible implications found from the survey and make recommendations for further research.

Study Summary

The purpose of this study was to determine which critical thinking skills and higher order thinking constructs would be selected by an expert panel of physical therapists. The frame for the assessing the research questions is bounded by Facione's (1998) *The Delphi Report*, and King, Goodson and Rohani's (1998) manuscript *Higher Order Thinking Skills*.

Methods Summary

The modified e-Delphi was used as the method for this study because of the economic value, time effectiveness, the flexibility, and the wide range of people it can reach, as well as, the information it can focus on (Custer et al., 1999; De Villiers, De Villiers, & Kent, 2005; Hasson, Keeney, & McKenna, 2000; Sumsion, 1998). Using an e-Delphi survey process mitigated the opportunity for one voice to over-power other voices concerning this topic (Domholdt & Domholdt, 2000; Hasson et al., 2000; Mead & Moseley, 2001; Merriam & Simpson, 1995; P. L. Williams & Webb, 1994). This particular survey allowed a specific sample of experts to anonymously narrow down a list

of 16 critical thinking skills and five higher order thinking constructs to answer research questions stated in the previous section. The expert panel (n= 246) consisted of program directors from physical therapist education programs and physical therapists who had published on critical thinking and/or higher order thinking in the past 20 years.

A survey, using a Likert scale, was developed that allowed the expert panel to rank if a skill was seen as 0= Not Important, 1= Little Importance, 2= Average Importance, 3=Very Important, or 4= Absolutely Essential to assess prior to entrance into physical therapist education program. Over three rounds, critical thinking skills and higher order thinking constructs were reduced based on an *a priori* consensus level established in Chapter 3 of this manuscript.

Summary of the Results

Round one, with a 90% agreement of the experts at level two (2) (Average Importance) or above, eliminated one critical thinking skill and two higher order thinking constructs. Nine critical thinking skills and one higher order thinking construct were eliminated in round two due to scoring below a 75% consensus level set at level three (3) (Very Important) or above. The final round only eliminated a single item, a critical thinking skill, again at 75% agreement and level three (3) (Very Important) or above. The remaining skills and constructs were the source for answering the research questions that guided this study. Therefore, the higher order thinking constructs that answered RQ1 are *critical thinking* and *logical thinking*, and the critical thinking skills that answered RQ2 are *clarifying meaning*, *assessing claims*, *assessing arguments*, *stating results*, *self-examination* and *self-correction*.

Discussion of the Results

Higher order thinking. The expert panel of physical therapists narrowed down the higher order thinking constructs to critical thinking and logical thinking. From the lens of King, Goodson and Rohani's (1998) work, logical thinking is the ability to identify problems in your or others' thinking (Moore, 2010). Critical thinking is the ability to use recent and longstanding knowledge, and modify it to solve for answers to complex situations (Lewis & Smith, 1993).

The selection of critical thinking as an important construct is congruent with the focus in higher education and several of the professional health education accrediting bodies including the Commission on American Physical Therapist Education (CAPTE, 2015a). The Association of American Medical Colleges, the American Association of College of Pharmacy and the American Dental Association have all in the past five years modified their respective discipline-specific entrance examinations to include more rigorous assessment of critical thinking (AAMC-HHMI, 2009; ADEA, 2011; Speedie, 2012). However, Zettergren and Beckett (2004) suggested that the higher order thinking skills of reflective thinking or metacognitive thinking would make a more successful physical therapist student. Metacognitive thinking was eliminated in the first round of the survey with 89% of the expert panel agreeing that this construct was of Average Importance or above (level 2, 3 or 4). Reflective thinking was eliminated in the second round of the survey with only 69% of the expert panel giving this a score of Very Important or above (level 3 or 4).

Critical thinking skills. The critical thinking skills chosen through the three rounds of the modified e-Delphi were *clarifying meaning, assessing claims, assessing arguments, stating results, self-examination* and *self-correction*. *Clarifying meaning* is a

subskill of interpretation, previously defined as the ability to understand and convey the significance of an experience. *Assessing claims* and *assessing arguments* are the only two subskills of evaluation. Evaluation was defined in Chapter 2 as a decision if an argument or statement is credible, logical or plausible. *Stating results*, a subskill of explanation, is performed when accurate statements are presented that maybe used to form a decision. This critical thinking skill consistently had the highest agreement percentage in all three rounds and was the only skill to have over 50% agreement that it was Absolutely Essential (level 4) in round two and three.

The last two subskills of *self-examination* and *self-correction* make up self-reflection. Self-reflection occurs when all the other critical thinking skills are used to assess at one's analysis, judgment or evaluations, and if error is seen, correction can be made. Self-examination and self-correction are types of metacognitive activity, and though metacognitive thinking was eliminated as a higher order construct, the expert panel agreed these skills were important enough to warrant assessment prior to physical therapist education.

Assessment techniques and study results. As previously discussed, the Health Sciences Reasoning Test (HSRT) and the California Critical Thinking Skills Test (CCTST) are types of critical thinking assessments developed with Facione and based around *The Delphi Report* (Cox & McLaughlin, 2014). Both assessments have been used in the literature to support the statistically significant changes associated with the development of critical thinking skills in physical therapist students (Brudvig, Mattson & Guarino, 2016; Huhn, Black, Jensen, & Deutsch, 2011; Huhn, Black, Jensen, & Deutsch, 2013; Suckow, Braehler, Donahoe-Fillmore, Fisher, & Anloague, 2015; A. Vendrely, 2005; A. M. Vendrely, 2007; Zettergren & R. Beckett, 2004).

Bartlett and Cox (2002), using the CCTST, reported all critical thinking skills assessed had significant changes including those skills under evaluation: *assessing claims* and *assessing arguments*. The expert panel in the current study found both of these skills were vital to assess in applicants for physical therapist education. However, other studies using the HSRT or the CCTST do not support this study's finding. In Brudvig, Mattson & Guarino's (2016) study using the HSRT, student physical therapists showed significant findings between entrance into the program and their third year of school. The skills of *drawing conclusions*, *conjecturing alternatives* and *querying the evidence* fall under inference (Facione, 1990b), and none of these skills were chosen by the expert panel as important to assess prior to entrance into physical therapist education programs. A possible difference between the findings of this study and the findings of Brudvig, Mattson & Guarino's study is the critical thinking skills falling under *inference* are facilitated through the actual didactic and clinical context of physical therapist education compared to what the student has before entering the program.

The other area scored in Brudvig, Mattson & Guarino's study is, deduction. Deduction relies on logic, context, rules, procedures, principles, values, and beliefs to draw a precise conclusion. It is not one of the core critical thinking skills described by *The Delphi Report*, and on the HSRT, it is a more encompassing area scored (Insight Assessment, 2016).

In 2011, Huhn, Black, Jensen, and Deutsch assessed the difference in the critical thinking of novice (first-year students) versus expert (at least five years of experience and clinical specialization) physical therapists. This study found that analysis, which includes *examining ideals*, *detecting arguments*, and *analyzing arguments*, was significantly different in the novice and expert groups. All of the analysis skills were also eliminated

by the expert group in the current study. The deduction component of the HSRT was also found to be significant.

The GRE and study results. The analytical writing section of the GRE measures the ability for the test taker “to articulate complex ideas clearly and effectively; to support ideas with relevant reasons and examples; to examine claims and accompanying evidence; to sustain a well-focused, coherent discussion; to control the elements of standard written English” (ETS, 2017, para. 5). If this definition is compared with the critical thinking skills delineated in *The Delphi Report*, “to articulate complex ideas clearly and effectively” and “to support ideas with relevant reasons and examples” would fall under the category of *interpretation*. Specifically the subskill of *clarifying meaning* would encompass the statement “to articulate complex ideas clearly and effectively” and *categorization* would promote “to support ideas with relevant reasons and examples.” “To examine claims and accompanying evidence” falls under the skill of *analysis*. The last two components of the ETS definition would not be supported by the skills in *The Delphi Report* (Facione, 1990a).

One of the six retained critical thinking skills from the current study appear to be assessed by the GRE. *Clarifying meaning*, a subskill of interpretation, was found by the expert panel to be important to assess prior to entrance into a physical therapist education program. Though the critical thinking skills referenced above have similarity to the critical thinking skills described on the GRE, literature as to the framework these critical thinking skills was derived from was not evident in the search performed by the researcher.

The skills measured on the GRE are without a healthcare-related focus, which may not show an applicants’ true grasp of critical thinking (Huhn & Parrott 2017; Kuncel

et al., 2001). Many applicants have been preparing for physical therapist education throughout their undergraduate career, either by majoring in exercise science, kinesiology or a STEM program and by observing or working in a physical therapy clinic. Taking an examination, void of the healthcare context in which they have submerged themselves in for years, could put these applicants at a disadvantage. The inconclusiveness of the literature supporting the use of the GRE predicting success supports this view (Andrews et al., 2006; Hinds 2014; Huhn & Parrott (2017).

Implications

A focused group of experts selected the most important critical thinking and higher order thinking skills, in their opinion, that need to be present for a student to be successful in physical therapist education. A partnership formed by physical therapist educators, examination developers and physical therapist experts in critical thinking, clinical reasoning, and clinical decision-making could use the results of this study to form the basis for the critical thinking portion of a discipline-specific admission examination for physical therapist education. Following rigorous assessment, the examination tool would become an admission standard, meeting the goals set forth by Admissions Task Force of American Counsel of Academic Physical Therapy in 2014 and the American Physical Therapist Association in 2015.

In 2016, at the Education and Leadership Conference for the Education Section of the American Physical Therapy Association (APTA), the APTA presented results of an unofficial survey to determine if physical therapist educators (n=156) would welcome a physical therapy specific exam or if they were content with their admission *status quo*. The data indicated 51% of physical therapist education programs are open to the idea of a valid and reliable physical therapy-specific exam, 25% are not sure about this idea and

13% are not likely to support this type of exam. This data supports the current study's aims that a discipline specific-examination should be developed as an admission standard for entrance into physical therapist education (APTA, 2016b).

Limitations

This study was subject to several limitations. Poor response rates in the first round of the survey distribution were due to numerous factors. The initial survey was distributed at the beginning of a major physical therapist conference; therefore, a decision was made to leave the survey open. Originally, it was to be open for a single additional week but because a major holiday fell in that week, the survey was left open for two weeks. Another cause of poor response rates was due to spam filters or firewalls at universities. The email sender for Qualtrics is a "do_not_reply@" address, and many times this type of sender is immediately diverted to spam or blocked by a firewall.

Program directors also are inundated by surveys and many have no interest in participating in yet another survey. The primary researcher had several inquiries from potential participants asking which university the researcher was from and for the official IRB status. Reaching out personally to the group members prior to survey deployment to ensure participation would have boosted response rates as well as decreasing attrition. Therefore, response rates would have been higher if the same type of study was conducted with a smaller, targeted group.

Another limitation that affects validity was the change of percentages from pilot to actual study in order to eliminate skills. The pilot sample was made up of a small number of faculty members from different types of health professions. According to feedback, there was confusion about what and when these critical thinking skills would

need to be assessed. This led to altering the percentages to eliminate skills to allow the Delphi to proceed to the next round.

The last limitation was the overall status of critical thinking of students admitted into physical therapist education programs. On the HSRT, the composite score, or total scores, indicates to the level of critical thinking of the test taker (Cox & McLaughlin, 2014). Huhn et al., (2011) in the study of novice versus expert, assessed critical thinking student physical therapists in their first year of education. These students' mean composite score was 22.49. In another study, Huhn et al. (2013) assessed the HSRT over three years of physical therapist education. The first assessment was at entrance to the program and the mean composite score was 22.39. In Brudvig, Mattson and Guarino's 2016 study, the composite score for the first of four times taking the HSRT was reported as a mean of 23.26. All three of these scores on the HSRT indicates strong critical thinking abilities (21-25) (Facione & Facione, 2013). This concludes that these physical therapist students, at the beginning of their education in physical therapy already, demonstrated strong critical thinking skills.

Recommendations for Further Research

Many Delphi techniques use a true mixed methods approach with an open-ended initial survey. An alternate way to gain knowledge related to critical thinking and higher order constructs in physical therapist education, would be to use a Delphi study that presented the differing definitions of critical thinking and allowed a similar expert panel to openly respond with their interpretation. This initial qualitative survey would be followed by thematic analysis to pull information to develop a quantitative survey the second and third rounds.

This study identified similarities between critical thinking skills assessed by the GRE and skills that an expert panel felt were important to screen in candidates applying for physical therapist education. A study specifically looking at the analytical aspect of the GRE compared with successful completion in physical therapist education programs or a successful score on the NPTE would help determine if the GRE is meeting the needs of admissions teams in physical therapist education programs. Alternatively, conducting a study comparing the results of the HSRT and the analytical portion of the GRE administered prior to physical therapist education program would validate if critical thinking were influenced by context.

Another avenue of future research would evaluate the difference in the critical thinking between two groups of physical therapist education applicants. The first group, made up of students who have transitioned from undergraduate education directly into the Doctor of Physical Therapy program would be compared to a second group of applicants considered traditional adult learners. Based on the researcher's experience in the classroom, students who have moved straight from undergraduate into graduate education are predominantly millennial students, and have yet to take "on the social, psychological and/or economic roles typically expected of adults" (Kasworm et al., 2010, p. 14). Most have not yet lived independently, and many of these students are still under the care/responsibility of their parents. For the most part, their scope of experience is confined to their undergraduate education, however they have a need for personal and professional development. Contrast this to the "non-traditional" adult learner. They have potentially made a life-changing decision to change careers and go back to school. They have to learn to balance family schedules, spousal/partner needs, part time jobs, etcetera with academic requirements. They may bring work experience, military experience or the

perspective of their role as a parent to a group of students that has not had experience with these barriers and issues. Based on life experiences leading to critical thinking, would there be a difference in the critical thinking abilities between these two groups?

Conclusions

As the demand for physical therapist increases, physical therapist education programs must find ways to identify the best students who will be successful in passing the licensure examination and will excel in the profession. In this point in time, there is variability of factors that schools assess in potential students, such as GRE, GPA, clinical observation hours, letters of recommendation, and prerequisite course work. None of which has shown as strong predictors of academic or clinical success (Vendrely, 2007).

Admissions Task Force of American Counsel of Academic Physical Therapy (ACAPT) has stated there is a dearth of consistency across all 236 accredited physical therapist education programs (ACAPT, 2014). A separate task force launched in 2015 by the American Physical Therapy Association (APTA) made a recommendation that there should be established a standardized entrance examination similar to other professional medical programs. Examinations such as the Medical College Admissions Test (MCAT), the Pharmacy College Admission Test (PCAT), and the Dental Admissions Test (DAT) assess the prerequisite knowledge, as well as, a new focus of critical and higher order thinking. The Commission on American Physical Therapist Education, the accrediting body for physical therapy education program, has a focus of critical thinking as part of the programmatic accreditation. Excellence in critical thinking would allow the physical therapist student to utilize current evidence to reduce errors and improve patient-related outcomes (Brudvig, Dirkes, Dutta, & Rane, 2013; CAPTE, 2015a).

Critical and higher order thinking are skills that are part of the process of clinical reasoning. This allows medical professionals to recognize all options, consider other ways of thinking, assess diverse values, and analyze multiple social and ethical behaviors (CAPTE, 2015a; Cervero, 1988; Higgs, Jones, Loftus, & Christensen, 2008; Huhn, Black, Jensen, & Deutsch, 2013; Simpson & Courtney, 2002). Though studies show a statistically significant increase in critical thinking skills scores either over the duration of the physical therapist education process or a novice compared with an expert physical therapist, none have assessed these critical thinking skills as an admission tool to determine which applicants to admit into physical therapist education programs. The American Physical Therapy Association has explored this topic through task forces and presented data that supports the idea of an entrance examination (APTA, 2015a; APTA, 2016b). Assessing critical thinking prior to entrance into a physical therapist education program has also been proposed in the literature by Domenech and Watkins (2015) and Suckow, Brahler, Donahoe-Fillmore, Fisher, and Anloague (2015). The results of this modified e-Delphi study can be a foundation for the start of a more standardized process for entrance into physical therapist education programs.

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Appendix A

Hello, my name is Shannon Hughes, and I am a doctoral candidate at the University of Memphis. You have been selected to participate in this study as an expert because you are either a physical therapist education program director knowledgeable about admissions and/or critical thinking and higher order thinking, or you are a physical therapist who has published in the area of critical thinking and higher order thinking.

With an increased demand for physical therapists, physical therapist education programs are seeing an influx of students applying for positions in these programs. Current admission processes vary from program to program causing logistical difficulties for the students. This variability also causes difficulties for the programs to determine which students will be successful both in the program as well as successful passing of the NPTE. One solution, proposed by an APTA appointed task force, is to implement a standardized entrance examination that would assess these students level of preparation for entrance into physical therapist education programs.

An examination specific to physical therapy which has critical and higher order thinking as part of its focus would help standardize the admissions process, as well as help programs select applicants who show the most promise of success in the physical therapist education program and the National Physical Therapist Examination (Domenech & Watkins, 2015). Therefore, the purpose of this modified e-Delphi study is to determine which critical thinking skills and higher order constructs should be included on a standardized examination, if such an examination were required for admission to entry-level DPT education programs.

In this survey, you will be asked some demographic information such as years as a physical therapist, age, gender, highest degree attained and entry level degree. You will then read over criterion describing critical thinking skills and higher order constructs. Using a Likert scale, you will be asked to choose which skills are essential **PRIOR** to admission to physical therapist education programs.

This information will be used to complete my dissertation, as well as contribute to a growing body of research in physical therapist education. Should you have any concerns or questions please email me at ehughes9@uthsc.edu or my dissertation chairperson, Dr. Donna Menke, djmenke@memphis.edu.

Appendix B

Consent to Participate in a Research Study

Critical and Higher Order Thinking Skills Required for Admission to Physical Therapist Education Programs: A Modified e-Delphi Study

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

You are being invited to take part in a research study about critical thinking and higher order constructs in the admission process to physical therapist education programs.

WHO IS DOING THE STUDY?

The person in charge of this study is *Shannon Hughes*, a doctoral student at the University of Memphis, Department of Leadership. She is being guided in this research by *Donna Menke, PhD*.

WHAT IS THE PURPOSE OF THIS STUDY?

By doing this study, we hope to learn which critical and higher order constructs should be adopted into a pre-admission exam, if such an examination is adopted for use for admission into physical therapist education programs.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

None

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted at The University of Tennessee and The University of Memphis through an online Qualtrics survey. The study should last approximately two to three months.

WHAT WILL YOU BE ASKED TO DO?

This is the first of three surveys, where you will be asked to rank the critical thinking skill and higher order construct that you feel is the most essential to be tested prior to admission to physical therapist education programs. The internet questionnaire should take approximately ten to twenty minutes to complete. Other questions included in this initial survey will ask demographic information including gender, age, educational information, number of years as a physical therapist and number of years of interest in critical thinking and higher order constructs.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

None

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

You will not get any personal benefit from taking part in this study.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer.

You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you do not want to be in the study, there are no other choices except not to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify you to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We will publish the results of this study; however, we will keep your name and other identifying information private.

This study is anonymous. That means that no one, other than the researcher, will know that the information you give came from you.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study.

The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you, if they find that your being in the study is more risk than benefit to you, or if the agency funding the study decides to stop the study early for a variety of scientific reasons.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. If you have concerns or questions about this study, please contact Shannon Hughes at 901-448-2498 or eshughes@memphis.edu or Dr. Donna Menke, 901.678.1477 or djmenke@Memphis.edu

at in the University of Memphis Department of Leadership, Adult and Higher Education.

If you have any questions about your rights as a volunteer in this research, contact the Institutional Review Board staff at the University of Memphis at 901-678-2705.

By beginning this survey, you acknowledge that you have read this information and agree to participate in this research, with the knowledge that you are free to withdraw your participation at any time without penalty.

Appendix C

CT and HOT

Q1 Consent to Participate in a Research Study Critical and Higher Order Thinking Skills Required for Admission to Physical Therapist Education Programs: A Modified e-Delphi Study

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH? You are being invited to take part in a research study about critical thinking and higher order constructs in the admission process to physical therapist education programs.

WHO IS DOING THE STUDY? The person in charge of this study is Shannon Hughes, a doctoral student at the University of Memphis, Department of Leadership. She is being guided in this research by Donna Menke, PhD.

WHAT IS THE PURPOSE OF THIS STUDY? By doing this study, we hope to learn which critical and higher order constructs should be adopted into a pre-admission exam, if such an examination is adopted for use for admission into physical therapist education programs.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

None

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The research procedures will be conducted at The University of Tennessee and The University of Memphis through an online Qualtrics survey. The study should last approximately two to three months.

WHAT WILL YOU BE ASKED TO DO? This is the first of three surveys, where you will be asked to rank the critical thinking skill and higher order construct that you feel is

the most essential to be tested prior to admission to physical therapist education programs. The internet questionnaire should take approximately ten to twenty minutes to complete. Other questions included in this initial survey will ask demographic information including gender, age, educational information, number of years as a physical therapist and number of years of interest in critical thinking and higher order constructs.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS? None

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY? You will not get any personal benefit from taking part in this study.

DO YOU HAVE TO TAKE PART IN THE STUDY? If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES? If you do not want to be in the study, there are no other choices except not to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE? There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE? We will make every effort to keep private all research records that identify you to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information we

have gathered. You will not be personally identified in these written materials. We will publish the results of this study; however, we will keep your name and other identifying information private. This study is anonymous. That means that no one, other than the researcher, will know that the information you give came from you.

CAN YOUR TAKING PART IN THE STUDY END EARLY? If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study. The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you, if they find that your being in the study is more risk than benefit to you, or if the agency funding the study decides to stop the study early for a variety of scientific reasons.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS? Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. If you have concerns or questions about this study, please contact Shannon Hughes at 901-448-2498 or eshughes@memphis.edu or Dr. Donna Menke, 901.678.1477 or djmenke@Memphis.edu at in the University of Memphis Department of Leadership, Adult and Higher Education.

If you have any questions about your rights as a volunteer in this research, contact the Institutional Review Board staff at the University of Memphis at 901-678-2705.

By beginning this survey, you acknowledge that you have read this information and agree to participate in this research, with the knowledge that you are free to withdraw your participation at any time without penalty.

- Yes, I AGREE to participate in this study. (1)
- No, I DO NOT agree to participate in this study. (2)

If No, I DO NOT agree to parti... Is Selected, Then Skip To End of Survey

Q5 How many years have you been a physical therapist?

- 0-1 years (1)
- 1-5 years (2)
- 6-10 years (3)
- 11-15 years (4)
- 16-20 years (5)
- 21-25 years (6)
- 26-30 years (7)
- 30+ years (8)

Q2 Gender?

- Male (1)
- Female (2)
- Choose not to answer (3)

Q3 What is your age?

- Under 18 (1)
- 18 - 24 (2)
- 25 - 34 (3)
- 35 - 44 (4)
- 45 - 54 (5)
- 55 - 64 (6)
- 65 - 74 (7)
- 75 - 84 (8)
- 85 or older (9)

Q4 What is the highest degree or level of education you have completed?

- High school graduate (1)
- Completed some college (2)
- Associate degree (3)
- Bachelor's degree (4)
- Completed some postgraduate (5)
- Master's degree (6)
- Ph.D., law or medical degree (7)

Q9 What is your entry level physical therapy degree?

- Certificate (1)
- Bachelor's Degree (2)
- Entry- level Master's Degree (3)
- Entry-level Doctoral Degree (4)

Q6 Are you a physical therapist education program director?

- Yes (1)
- No (2)

Answer If Are you a physical therapist education program director? Yes Is Selected And

If you are not a program director, please indicate your role. Faculty member Is Selected

Q8 How many years have you participated in physical therapy education?

- 0-1 years (1)
- 1-5 years (2)
- 6-10 years (3)
- 11-15 years (4)
- 16-20 years (5)
- 21-25 years (6)
- 26-30 years (7)
- 30+ years (8)

Q7 How many years have you been interested in critical thinking and higher order thinking/constructs?

- 0-1 years (1)
- 1-5 years (2)
- 6-10 years (3)
- 11-15 years (4)
- 16-20 years (5)
- 21-25 years (6)
- 26-30 years (7)
- 30+ years (8)

Answer If Are you a physical therapist education program director? No Is Selected

Q10 If you are not a program director, please indicate your role.

- Clinical practice (1)
- Faculty member (2)
- Other (3) _____

Q13 In the next sections, you will be presented with the critical thinking skills and the sub skills defined in Facione's (1990), The Delphi Report. Please read the definition of the critical thinking skill, and in your opinion which skill is the most important to have **PRIOR** to entrance to a physical therapy program. Please keep in mind, these are the skills that you feel a student should possess **BEFORE** beginning physical therapy school.

Q11 Interpretation is the ability to understand and convey the significance of an experience. The skills that make up interpretation are:

Categorization: Occurs when experiences or beliefs are framed for better understanding

Decoding significance: The situation or experience is described in relation to affective attitudes or the motive behind situation

Clarifying meaning: Restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion

Q14 Categorization: Occurs when experiences or beliefs are framed for better understanding

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q15 Decoding significance: The situation or experience is described in relation to affective attitudes or the motive behind situation

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q16 Clarifying meaning: Restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q17 Analysis is when concepts or situations are examined, and relationships are identified. The skills that make up analysis are: Examining ideals: When ideas are compared and contrasted, and problems with the idea are identified and broken down
Detecting arguments: Determining if an idea or situation has reasons to support or refute it
Analyzing arguments: A complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected

Q18 Examining ideals: When ideas are compared and contrasted, and problems with the idea are identified and broken down

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q19 Detecting arguments: Determining if an idea or situation has reasons to support or refute it

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q20 Analyzing arguments: A complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q21 Evaluation is assessing the credibility of perceptions and logic of the relationships by assessing claims or arguments. The skills that make up evaluation are:

Assessing claims: Recognizing factors that make the source of information credible

Assessing Arguments: Judging if an argument is plausible or false

Q24 Assessing claims: Recognizing factors that make the source of information credible

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q23 Assessing Arguments: Judging if an argument is plausible or false

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q25 Inference uses querying evidence, finding alternatives and drawing conclusions to identify what is needed to make conclusions, or form hypotheses. Skills that make up inference are:

Querying evidence: Occurs when additional support information is needed to develop or reinforce an argument and how to find that additional support information

Conjecturing alternatives: Creating other alternative ways to ask a question, multiple ways resolve an issue or project consequences

Drawing conclusions: Ensues when hypothesis are tested or opinions are compared to determine what to do or believe

Q26 Querying evidence: Occurs when additional support information is needed to develop or reinforce an argument and how to find that additional support information

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q27 Conjecturing alternatives: Creating other alternative ways to ask a question, multiple ways resolve an issue or project consequences

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q28 Drawing conclusions: Ensues when hypothesis are tested or opinions are compared to determine what to do or believe

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q44 An explanation is to declare or justify reasoning by stating the results, justifying the procedures and presenting arguments based on the context. The skills that make up explanation are:

Stating Results: Giving accurate statements

Justifying Procedures: presenting the evidence behind a decision

Presenting Arguments: Giving reasons to accept a claim or decision

Q29 Stating Results: Giving accurate statements

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q30 Justifying Procedures: presenting the evidence behind a decision

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q32 Presenting Arguments: Giving reasons to accept a claim or decision

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q45 Self-regulation applies the “skills in analysis and evaluation” (p. 10) to monitor one’s own cognitive activities through self-examination and self-correction. The skills that make up self-regulation are:

Self-examination: Looking at the reasoning used, and opinions created, as well as “motivation, values, attitudes and interests” that determine the outcome

Self-correction: Occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake

Q31 Self-examination: Looking at the reasoning used, and opinions created, as well as “motivation, values, attitudes and interests” that determine the outcome

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q33 Self-correction: Occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q46 Like critical thinking, higher order thinking has been defined in the literature several ways because of the many ways to view this topic (Lewis & Smith, 1993; Williams, 1999). Lewis and Smith (1993) feel that the differences in definitions have to do with the bodies the definitions arise from. From a philosophical lens, higher order thinking is part of thinking and uses cognitive skills to explain reasons for behavior or action (Lewis & Smith, 1993). From this perspective, Facione (1990) and King et al. (1998) defines higher order thinking as an umbrella term that includes other complex ways of thinking. This perspective elevates higher order thinking as the overarching term, and critical thinking as well as creative thinking, metacognitive thinking, reflective thinking, and logical thinking fall under higher order thinking (King et al., 1998). Using this frame, please indicate which higher order thinking constructs are needed **PRIOR** to entering physical therapist education program.

Q34 Critical Thinking: the "purposeful, self-regulatory judgment, a human cognitive process... [where] a person forms a judgement about what to believe or what to do in a given context" (Giancarlo & Facione, 2001, p. 30)

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q35 Logical Thinking: "identifying reasoning fallacies in one's own and in others' thinking" (Kirby, Goodpasture and Levine as cited in Moore, 2010).

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q36 Reflective Thinking: "the ground or basis for a belief is deliberately sought and its adequacy to support the belief examined" (Dewy, 1910)

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q37 Metacognitive Thinking: "mental process of being aware of monitoring, supervising, organizing, and making executive decisions about one's own thinking process (Crowl et al., cited in King et al., 1998)

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Q38 Creative Thinking: "generating and producing ideas through brainstorming, visualizing, associating relationships, making analogies, inventing, inferring and generalizing" (Fogarty & McTighe cited in King et al., 1998)

- Not Important (1)
- Little Importance (2)
- Average Importance (3)
- Very Important (4)
- Absolutely Essential (5)

Appendix D



Institutional Review Board
910 Madison Avenue, Suite 600
Memphis, TN 38163
Tel: (901) 448-4824

January 26, 2017

Shannon Hughes, PT, DPT
UTHSC - COHP - Physical Therapy
2243 930 Madison Building
930 Madison Avenue
Memphis, TN 38163

Re: 16-05037-XP UM
Study Title: CRITICAL AND HIGHER ORDER THINKING SKILLS REQUIRED FOR
ADMISSION TO PHYSICAL THERAPIST EDUCATION PROGRAMS: A MODIFIED E-
DELPHI STUDY

Dear Dr. Hughes:

The Administrative Section of the UTHSC Institutional Review Board (IRB) has received your written acceptance of and/or response dated 01/12/2017 to the provisos outlined in our correspondence of 12/28/2016 concerning the above referenced project. The IRB determined that your application is eligible for expedited review under 45 CFR 46.110(b)(1), category (7). The IRB has reviewed these materials and determined that they do comply with proper consideration for the rights and welfare of human subjects and the regulatory requirements for the protection of human subjects. Therefore, this letter constitutes full approval by the IRB of your application (version 1.1) as submitted including:

- Survey consent form, dated 1/9/2017;
- CT/HOT Survey, dated 11/7/2016; and
- Recruitment letter, dated 1/11/2017.

All of the above were stamped IRB-approved 1/26/2017. You must use the date-stamped versions of study documents. Date-stamped materials are available in the *Informed Consent* and *Other Project Documents* folders of iMedRIS.

The UTHSC IRB acknowledges receipt and review of the following:

- Individual Investigator Agreement, dated 1/25/2017; and
- CV for Donna Menke, dated 1/13/2017.

Approval of this study will be valid from January 26, 2017 to December 21, 2017.

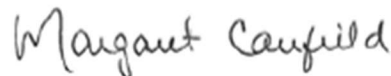
This study may not be initiated until you receive approval from the institution(s) where the research is being conducted.

In accord with 45 CFR 46.116(d), informed may be altered, with the cover statement used in lieu of an informed consent interview. The requirement to secure a signed consent form is waived under 45 CFR 46.117(c)(2).

In the event that subjects are to be recruited using solicitation materials, such as brochures, posters, web-based advertisements, etc., these materials must receive prior approval of the IRB. Any revisions in the approved application must also be submitted to and approved by the IRB prior to implementation. In addition, you are responsible for reporting any unanticipated serious adverse events or other problems involving risks to subjects or others in the manner required by the local IRB policy. Lastly, you must request to close your project when you have completed data analysis. All of the above should be submitted to the IRB via the appropriate form in iMedRIS.

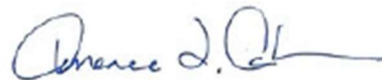
Re-approval of your project is required by the IRB in accord with the conditions specified above. You may not continue the research study beyond the time or other limits specified unless you obtain prior written approval of the IRB.

Sincerely,



Signature applied by Margaret H Caufield on 01/26/2017 10:22:52 AM CST

Margaret Caufield, M.Ed.
Regulatory Specialist
UTHSC IRB



Terrence F. Ackerman, Ph.D.
Chairman
UTHSC IRB

Appendix E

PRO-FY2017-316 - Initial: Approval - Expedited

irb@memphis.edu

Mon 2/27/2017 2:57 PM

Inbox

To: Donna J Menke (djenke) <djenke@memphis.edu>; Emily Shannon Hughes (eshughes) <eshughes@memphis.edu>;



Institutional Review Board
Office of Sponsored Programs
University of Memphis
315 Admin Bldg
Memphis, TN 38152-3370

Feb 27, 2017

PI Name: Emily Shannon Hughes

Co-Investigators:

Advisor and/or Co-PI: Donna Menke

Submission Type: Initial

Title: Facilitated Review - UTHSC --- CRITICAL AND HIGHER ORDER THINKING SKILLS REQUIRED FOR ADMISSION TO PHYSICAL THERAPIST EDUCATION PROGRAMS: A MODIFIED EDELPHI STUDY

IRB ID : #PRO-FY2017-316

Facilitated Review - UTHSC

Expedited Approval: Jan 26, 2017

Expiration: Dec 21, 2017

Approval of this project is given with the following obligations:

1. This IRB approval has an expiration date, an approved renewal must be in effect to continue the project prior to that date. If approval is not obtained, the human consent form(s) and recruiting material(s) are no longer valid and any research activities involving human subjects must stop.
2. When the project is finished or terminated, a completion form must be submitted.
3. No change may be made in the approved protocol without prior board approval.

Thank you,

James P. Whelan, Ph.D.

Institutional Review Board Chair

The University of Memphis.