ASSESSMENT OF CRITICAL THINKING AS A PREDICTOR OF SUCCESS IN COMPLETION OF AN ASSOCIATE DEGREE RESPIRATORY CARE PROGRAM

A thesis presented by
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to
The School of Education

In partial fulfillment of the requirements for the degree of

Doctor of Education

in the field of

Education

College of Professional Studies
Northeastern University
Boston, Massachusetts
December 2017
Abstract

The purpose of this study was to explore the relationship between assessment of critical thinking as admission criteria as a predictor of success in the completion of an associate degree respiratory care program. The research site was a community college located in the southern United States. The sample included 176 students who completed Health Sciences Reasoning Test (HSRT) as an admission criterion and were enrolled in the associate degree respiratory care program at the research site. Binary logistic regression models and univariate general linear regression models were completed to examine direct associations of select theoretically relevant variables as predictors of success. Direct associations tested in this study included critical thinking assessment at admission, along with student background information (age, gender, ethnicity, and admission GPA) were tested in various models, in relationship to successful completion (graduation status and final GPA) of an associate degree respiratory care program. Results indicated that the critical thinking assessment tool and strong academic standing are indicators to successful completion of the associate degree respiratory care program. Student background information (age, gender and ethnicity) was found to not indicate successful completion of the associate degree respiratory care program. Discussion focused on the use of critical thinking assessment as admission criterion, identifying other predictors of success, and possibilities for methodological replication.

Keywords: critical thinking, respiratory care, associate degree, critical thinking assessment
Dedication

I dedicate this work to my husband, James, this dissertation is as much yours as it is mine. Your interest, insight, honesty, love and patience throughout this journey has been everything to me. You believed in me throughout this entire process; without your support, encouragement and sacrifice over the last several years I would not have been able to reach this goal.

To our children Connor and Olivia - Thank you for giving me the time needed to complete this study. You cheered me on with every paper submission, at the end of every single term, and dissertation milestone through my doctoral studies. You guys listened to me even when it probably didn’t even make sense. You believing in me, kept me believing in myself.

I am grateful to my parents, Froilan and Lucita, for supporting me in every aspect of my education, career, and life. Thank you for seeing that I had far more potential to succeed than I ever could. I want to thank my sisters and extended family, the Bernardo Clan, for allowing me to vent, helping me see this through by pushing and challenging me, and finding ways to relieve stress.

Thank you to my work friends, colleagues, students and graduates: You all have supported, encouraged, and helped keep me sane throughout this project. Your advice and guidance helped to move me further and further until one day I finished.

Lastly, I want to dedicate Chapter 4 in memory of John D. W. Chambers. If you had not told me - in the middle of my kitchen - to believe in my work, I would not have moved forward with this study as soon as I did. I wish you were still here to have seen this to completion.
Acknowledgments

I would like to acknowledge Dr. Michael J. Dean for the never-ending support and guidance through this entire study. Also, to Dr. Christopher Unger and Dr. José D. Rojas for their feedback and contributions to this project.

I would also like to acknowledge the CPS advisors, librarians, and IRB department of Northeastern University for the work and support in the creation and completion of this thesis.
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Chapter 1: Introduction

Respiratory care educators prepare and train students to enter the workforce with the psychomotor ability, affective behaviors, and cognitive skills, including critical thinking, needed to deliver effective patient care as a practitioner (Hill, 2002; Kacmarek, Barnes, & Durbin Jr., 2012). With students’ minimal exposure to the health care environment and intensive science coursework, capturing an applicant’s critical-thinking ability for admission to an associate degree respiratory care program may reveal a relationship to successful study and completion of a program.

Problem Statement

The health care environment requires students, much like practitioners, to adapt to the constantly changing demands of a health care profession. To respond to the demands of practice in health care, students must develop and refine critical thinking skills to “gather, analyze, and process information to make sound, logical decisions” (Sharp, Reynolds, & Brooks, 2013, p. 2). How to evaluate critical thinking skills for program admission has been studied in various formats including interview processes, evaluation of coursework, and various entrance exams (Cox et al., 2013; Salvatori, 2001; Huhn, Black, Jensen, & Deutsch, 2011; Underwood, Williams, Lee, & Brunnert, 2013). Critical thinking ability has been compared against other admissions factors, such as GPA, relevant science coursework, and demographic information (Cox et al., 2013; Salvatori, 2001). Exam scores may be used for entrance to a program dependent on the health profession. Much of the relevant research conducted has been focused on nursing programs, with minimal study in the physical therapy and pharmacy professions (Cox et al. 2013; Huhn et al., 2011).
An associate degree is the minimum degree requirement for entry to the profession of respiratory care (Bureau of Labor Statistics, 2014). Approximately 85% of respiratory care programs within the United States award an associate degree from the community college setting (Commission on Accreditation for Respiratory Care, 2014). Yet much of the literature conducted within the profession of respiratory care has focused on baccalaureate degree programs or higher. Additionally, participants of such studies may have had already studied in the health sciences or have developed a certain level of critical thinking in the duration of their educational career (Wettstein, Wilkins, Gardner, & Restrepo, 2011). Scoring validated by studies may not be applicable as admission criteria for associate degree programs because incoming students have not had exposure to the skill and critical thinking development required to function effectively in the health sciences (Huhn et al., 2011).

The purpose of this research was to explore the use of a critical-thinking ability assessment for admission criteria as a predictor of success for completing an associate degree program in respiratory care. This study was designed to better understand critical-thinking ability as admission criteria for respiratory care associate degree programs. Based on the findings, program administrators may be able to evaluate current admission criteria and establish admission standards for entry-level practitioner programs.

**Significance Statement**

The significance of this research study is its examination of the assessment of critical-thinking ability as admission criteria in an associate degree respiratory care program. The study identified that the assessment of critical thinking as an predictor of success and can be used as part of the admission process to an associate degree respiratory care program. The research
found the assessment of critical thinking did reflect successful completion within a program of study.

The prevalence of an aging population and increased incidence of chronic disease have contributed to a global shortage of health care workers and influenced training provided to medical personnel and students (Pruitt & Epping-Jordan, 2005). Needs in the U.S. health care workforce are met in part by community college programs, which supply over 50% of nursing and allied health workers (National Commission on Community Colleges, 2008). With the assessment of critical thinking as an admission criterion to an associate degree respiratory care program, educators can develop critical thinking and students’ progression to completing a program (Robbins, 1988). Therefore, entry-level graduates contribute to the workforce with higher level cognitive skill and the ability to function within the environment.

Employers are concerned with workers’ ability to apply technical procedures and make decisions critically. When entering the workforce, a health care workers’ knowledgebase should include the ability to critically analyze a patient situation and react with appropriate, competent decisions independently. Novice practitioners may have knowledge, skill and the ability to perform competently, but those who are considered experts use their knowledge as a basis to understand and then take actions appropriate for an individual patient (Tyreman, 2000).

Associate degree health care program administration and faculty, when seeking students’ critical-thinking ability, can often discern if a student will persist to complete a program of study (Cox et al., 2013). Having the ability to distinguish students by assessing critical thinking is not only significant to program personnel for completion rates but also in generating new graduate practitioners who can function with the potential to become expert level practitioners. Critical thinking skills are necessary for practice within the patient
population in order to provide evidence-based, high-quality patient care (Ozturk, Muslu, & Dicle, 2008; Profetto-McGrath, 2005).

The results of this study may help in the determination of associate degree level admission requirements for respiratory care programs, to not only contribute to program admissions and identify student completion but also the development of critical thinking abilities to meet workforce demand. This study can influence the professional environment by producing graduate practitioners with the essential knowledge to make sound, competent patient decisions independently.

**Positionality Statement**

In this section I examine my positionality and bias as a researcher in the study of assessment of critical thinking for admission criteria as a predictor of success in an associate degree-level respiratory care program. I discuss how my upbringing, background, and role as both a respiratory therapist and educator relate to this area of research. I also elaborate upon my interest and biases in the topic of critical thinking as admission criteria. Lastly, I determine how I planned to approached the biases I encountered in my research.

**Background.** My mother and father earned baccalaureate degrees in nursing and engineering, respectively, at universities in Manila, Philippines. My parents, while understanding the importance of higher education, did not know how to navigate the U.S. higher education system. Being from a large family, I could not afford to attend a university. My parents wanted me to pursue a nursing degree. Thus, my higher education began in a community college, where I earned a certificate and subsequently an associate in applied science degree in respiratory care. That education gave me the chance to join the workforce, contributing to the changing needs of the patient population and the U.S. health care system.
Because I have experienced success in my career, which started with an education in the community college setting, I believe that all students that I encounter have the same potential and abilities that I developed during my education.

**Research interest in admission criteria.** After years of working in the hospital setting, I entered the educational aspect of respiratory care on a part-time and later full-time basis, and I progressed to a position of leadership for an associate degree program. I have encountered an increasingly changing student population in which educational processes have had to change to ensure graduates meet the professional standards of employers (Spencer & Jordan, 2001).

To ensure that the respiratory care program produces high-quality graduates, student selection has become increasingly stringent to identify the likelihood students will complete the program and enter the workforce as effective and competent therapists. An essential aspect of the practice of respiratory care is being able to use critical thinking skills at the patient’s bedside (Rye, 2011). With the need to identify the potential of students during the selection process, the program incorporated means to assess critical thinking. As part of the selection committee, I often would view application scores based on test scores, GPA, coursework grades, and such, without assessing the potential of the student through other means. Additionally, admission testing scores will have the potential to act as a stigma for a student, in that a student may be treated differently because of prior knowledge of a score that the student achieved during the application process. For example, I find that when a student has scored high on an admission test I do not teach as intensely as when I encounter a student with a low score. I assume top students will learn the material more quickly and with less help.

In examining scores collected about critical thinking, I tend to think that higher scores will result in successful completion and lower scores indicate that a student will struggle to
completion. I needed to acknowledge this thought process to ensure my positionality would not affect the capability to reveal other aspects regarding the topic of assessing critical thinking as admission criteria at the associate degree level within a respiratory care program.

Acknowledgment of biases. I entered the research with a bias that students with higher critical assessment scores will meet program completion; those with lower scores, I often assume, will struggle through or may not complete the program. I believe that my experience as a member of the student selection committee has a strong influence on this bias. The selection process occurs at the minimum of twice a year, and the committee continually discusses individual students’ application. With this constant repetition, I find myself, at times, examining applications from the view of this bias, thus influencing my opinion in the matter.

A second bias that I have developed is in relation to associate degree students and their baccalaureate counterparts. Having intimate knowledge of the curriculum and structure of the associate and baccalaureate degree programs found in the local area has played a role within this bias. The students who enter the baccalaureate programs do so with a greater number of prerequisite science courses. According to Wettstein et al. (2011), graduates with extensive science coursework have a higher level of critical-thinking ability. In general, the associate degree programs in the area have one to two science courses as program prerequisites and thus might have lower critical-thinking ability within respiratory care. This leads me to believe that students within associate degree programs likely develop critical thinking abilities during their enrollment as opposed to possessing those skills upon admission. Therefore, using a tool that assesses critical thinking as admission criterion may prevent students with the potential to succeed to be eliminated from program selection.
The last bias reflects my being a quantitative researcher in this area. Once statistical data were compiled, there was the possibility of bias in the interpretation. Statistical values can be misinterpreted or overlooked, affecting data analysis and conclusions.

**Overcoming biases.** My background as a respiratory care practitioner helped me to overcome potential biases because we are trained to be objective within our practice. While collecting patient data, I maintain objectivity when making bedside decisions. Meaning when data is collected decisions are based on the evidence presented. I conducted my research in the same manner. I grounded the thesis with previous literature in related topics. Even having the beliefs discussed, this study utilized institutional data, and was quantitative in nature which minimized bias in the results reported.

**Research Question**

The purpose of this quantitative ex post facto correlational study was to explore the use of assessment of critical-thinking ability for admission criteria as a predictor of success for completion of a respiratory care associate degree program. Past research in bachelor- and graduate-level degree health care programs had not addressed this area within the associate degree level or respiratory care education.

**Overarching research question:** To what extent do the five subskills found within critical thinking assessment: (a) induction, (b) deduction, (c) analysis, (d) inference, and (e) evaluation, when utilized as admission criteria predict student success in completion of an associate degree respiratory care program? (Insight Assessment, 2016)

**H0:** There is no significant relationship between the five subskills of critical thinking and the successful completion of an associate degree respiratory care program.
Definition of Key Terminology

This section defines terms used throughout the study. The definitions for the terms are from educational and medical literature.

Critical-thinking ability: Thinking skills that are based on purposeful, self-regulated judgment that results in interpretation, analysis, and evaluation that use supportive evidence criteria (P. A. Facione, 1990a). Critical thinking ability was assessed with the Health Sciences Reasoning Test (HSRT).

Respiratory care: An allied health discipline with a focused specialization of patient cardiopulmonary health and function. The profession includes services that assess, diagnose, and treat patients with inhibited heart and lung function. The scope of respiratory care practice encompasses testing and procedures that include measurements of lung function and capabilities, the operation, and maintenance of devices that deliver oxygen, medication therapy, and ventilation support to patients with breathing deficiencies. Also termed respiratory therapy (Kacmarek, Stoller, & Heuer, 2017)

Respiratory care practitioner (RCP): Credentialed individuals that apply principles of respiratory care to aid in the evaluation, diagnosis, and treatment of patients with heart and/or lung disease under the direction of a qualified physician. Also termed respiratory therapists. (Kacmarek et al., 2017)

Respiratory care program: Professional practice educational program in the practice of respiratory care in which a degree is awarded upon completion of program requirements. The minimum degree awarded is at the associate degree level, with baccalaureate and master’s programs available. Graduates are eligible to test for respiratory care credentials and practice.
Theoretical Framework

This research was guided by Astin’s (1984, 1993) input-environment-outcome (I-E-O) model as described within his student involvement theory. Astin’s model provides a lens when examining assessments conducted within the higher education setting. The primary objective of this study was to assess critical-thinking ability as a predictor of success for respiratory care program completion. Thus, this framework aligned measuring student data to determine the effects on outcomes.

Input-environment-outcome model. The student involvement theory suggests that desired outcomes in higher education are a result of how students change and develop within the college environment. By using the I-E-O model (see Figure 1) to examine student development, educators are not only able to identify areas or processes that are impactful but those that would require modification to achieve desired student outcomes (Astin, 1993; Astin & Antonio, 2012). Although evolved through refinements made in his research, the basic structure of Astin’s I-E-O model remains constant (Astin, 1962, 1970a, 1970b, 1975, 1977, 1984, 1993).

The theory and design of the model is based on three core elements: inputs, environments, and outcomes. Inputs are student characteristics, or the initial assessment of the student upon entry to the environment. Dependent on the design of the study, characteristics or inputs are inclusive measures that are present at the time of entry, such as initial GPA or standardized test scores. Astin (1993) described environment not as physical existence but exposure to the college experience such as educational programs, faculty, peers, and activities. Outcomes refers to students’ characteristics after environmental exposure. The I-E-O model measures a variable at two different points in time; both prior to and after exposure to the
studied environment. The purpose of the I-E-O model framework is to assess inputs and identify input differences found with exposure to an environment of which corrective actions or adjustments can be made to improve student outcomes (Astin & Antonio, 2012).

Figure 1. Astin's Input-Environment-Outcome model


This design was useful for studying relevant student input and the effects of the input or the environmental factors on student outcomes. The I-E-O model also suggests student inputs can be related to both environment and outcomes and that inputs may affect the relationship between outcomes and environment (Astin, 1993). While a relationship between inputs and outcomes can be observed, it can be limited in value without acknowledging simultaneous forces that can lead to the outcome (Astin & Antonio, 2012).

**Research application.** The I-E-O allows modification to the design for application of specific research questions or the assessment of specific attributes and outcomes while maintaining the basic premise of the framework. A key challenge for researchers is to identify
the inputs, environmental variables, and relevant outcomes to be assessed in a research problem (Astin, 1993). In this study, the inputs and environments indicated independent variables reflective of either pre- or postexposure and outcomes are viewed as dependent variable(s) (Astin & Antonio, 2012). A conceptual model (Figure 2) details modifications to the model to show how critical thinking was measured as a predictor of success for respiratory care program completion. For this study, the primary relationship were inputs of student admission criteria and the outcome of program completion. Environmental aspects, such as student status, contributed to the exploration of the input/output relationship.

Figure 2. Application of I-E-O model for critical thinking assessment of respiratory care program completion.

Note: Adapted from Assessment for excellence: the philosophy and practice of assessment and evaluation in higher education (p. 20), by A. W. Astin and A. L. Antonio, 2nd edition, Lanham, MD: Rowman & Littlefield Publishers. Copyright 2012; permission conveyed through Copyright Clearance Center, Inc.
Summary

To effectively function within the health care environment, practitioners must be able to make competent and appropriate decisions while caring for the patient population. A health care practitioner’s critical thinking abilities should include determining and recognizing a problem, interpreting data, and analyzing evidence. Practitioners must be able to make clinical decisions based on the analysis of the information, and, with reflection, determine if the judgments made were effective, competent, and safe (Hill, 2002).

Health care educators can influence the respiratory care profession with the education that is administered in students’ progression through educational programs and meet the needs of the workforce (Flanigan, 1985; Kacmarek et al., 2012). Determining appropriate admission criteria is necessary to assessing which applicants will most likely complete a program (Dietrich & Crowley, 1982; Salvatori, 2001). This study was designed to determine the impact of critical-thinking ability at the admission of a respiratory care program. To effectively build the basis of this study, a review of literature is presented in Chapter 2 addressing critical thinking skills in health care and the educational environment, admission criteria, and predictors of success in health care programs and the use of admission testing within the medical setting.
Chapter 2: Literature Review

The practice of respiratory care requires that practitioners possess not only technical skills and knowledge, but also the ability to critically assess a patient situation and make competent decisions in patient care (Mishoe, 2003; Wettstein et al., 2011). Employer expectations are that entry-level practitioners either possess, or at minimum, have the potential to build and refine characteristics of critical-thinking ability upon entering the workforce (Barnes, Gale, Kacmarek, & Kageler, 2010; Mishoe, 2003; Rye, 201; Tyreman, 2000). Respiratory care educators are instrumental in not only developing critical thinking skills but also meeting the demands of the workforce and department standards in which they are situated (Kacmarek et al., 2012). With the consideration that graduates of associate degree respiratory care programs are entry-level, program educators must determine which applicants have the capability to complete degree requirements, consequently, enter the workforce. Because critical-thinking ability is a relevant factor in respiratory care practice, it can be considered for admission criteria in educational programs as a determination of degree completion.

This literature review explores various aspects of critical thinking within health care and with emphasis on respiratory care. This review of literature is organized into the following sections: Critical Thinking, Admission Criteria, and Admission Testing. An exploration of critical thinking and its role in health care is included. Admission criteria and the evaluation of critical thinking as criteria are discussed. Admission testing into health care programs, with specific examination of critical thinking assessment, will be included in this analysis. Because of limited published work in reference to the profession of respiratory care and within associate-degree level health care programs, I provide a comprehensive review of critical thinking skills and ability, assessment testing, and admission criteria within other health care professions,
including medical school, nursing, pharmacy, physical therapy, and other health care professional areas.

**Critical Thinking**

**Definition of critical thinking.** Critical-thinking ability is a skill desired by employers of the U.S. workforce (U.S. Department of Labor, 2012). Workers with this ability add to high productivity, can assume high-skill jobs, and contribute to problem-solving and future planning within the workplace (Celuch & Slama, 1999). Industry professionals have encouraged the development of critical thinking skills in higher education as an objective for educators (Facione 2007; Kacmarek et al., 2012; Rye, 2011; Wettstein et al., 2011).

Sternberg (1986) suggested that critical-thinking ability is influenced by three traditional thought processes: educational, psychological, and philosophical. The modern definition of critical thinking, referred to as reflective thinking, is often traced to Dewey (1910), whose work incorporated each of these processes. Many of those that study the theory of critical thinking propose general definitions in which to reference the thought processes and concept which include Bloom, Dewey, Ennis, Glaser, Paul, Sternberg, and Scriven (see Table 1). A key theme among researchers in the study of critical thinking appears to be consistent; critical thinking is a continuous process that entails reasoning in both cognitive and affective realms of reasoning as opposed to an isolated method or skill that is not obtained and learned in any single learning moment (Scriven & Paul, 1987; Simpson & Courtney, 2002). An additional overall theme includes reflection upon an evaluation of one’s own knowledge or experiences, which can be theoretically devised or based on facts to make judgments and decisions (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Ennis, 1985; Facione, 1990a; Glaser, 1942; Lipman, 1987; Sternberg, 1986).
### General Definitions of Critical Thinking

<table>
<thead>
<tr>
<th>Author (reference)</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Dewey (1910)</td>
<td>Active, persistent and careful consideration of theoretical knowledge despite evidence supported and conclusions drawn.</td>
</tr>
<tr>
<td>Glaser (1942)</td>
<td>Consider thoughtfully about one’s experiences, with the ability to utilize and apply methods of inquiry.</td>
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<tr>
<td>Bloom, Englehart, Furst, Hill, &amp; Krathwohl (1956)</td>
<td>Ability to acknowledge fact from hypothesis, identify relevant information, how one idea relates to another, what underlying assumptions exist and extract themes in what is communicated.</td>
</tr>
<tr>
<td>Ennis (1985)</td>
<td>Reflective and reasonable thinking process that has focus on deciding what to believe or do.</td>
</tr>
<tr>
<td>Sternberg (1986)</td>
<td>Composition of knowledge, strategies used to solve problems, make decisions and in learning new concepts.</td>
</tr>
<tr>
<td>Lipman (1987)</td>
<td>Thinking process that is reflective and responsible, conducive to skillful decisions because it relies on criteria, situational context and is self-correcting.</td>
</tr>
<tr>
<td>Scriven &amp; Paul (1987)</td>
<td>An intellectually disciplined process conducted through observation, experience, reflection, reasoning, or communication that is further conceptualized, analyzed or evaluated.</td>
</tr>
<tr>
<td>P. Facione (1990a)</td>
<td>Purposeful, self-regulated judgment resulting in interpretation, analysis, and evaluation requiring explanation of supportive evidence criteria, concepts of methods.</td>
</tr>
<tr>
<td>Paul &amp; Elder (2001)</td>
<td>Mode of thinking in knowledge is improved with the use of analyzation and evaluation.</td>
</tr>
<tr>
<td>Hill (2002)</td>
<td>Reasonable, reflective thinking; necessitates the ability to recognize problems, gather relevant information, interpret and evaluate evidence, and assess lines of thinking that can contribute to logical, effective actions.</td>
</tr>
<tr>
<td>Mishoe (2002)</td>
<td>Described by logical reasoning, problem-solving, and reflection; ability to prioritize, anticipate, troubleshoot, communicate, negotiate, reflect, and make decisions</td>
</tr>
</tbody>
</table>
Although each definition approaches the concept in a similar way, several aspects require elaboration or lack content during development of their definition (Paul et al., 2010). Ennis (1985), in the use of “reflective” throughout his work, left ambiguity in its use, assuming readers have a clear understanding of rationality and the types of conditions in which decisions can be seen as reflection. Ennis (1985) stated that the way one internalizes critical principles, which include evidence, relevance, consistency and sensitivity of reason, over time becomes less of a conscious effort or as implied, a reflection. As part of the reflective process found in critical thinking, Paul and Elder (2001) continually emphasized the importance of asking quality questions, but fail to state what type of questions should be raised. The use of explanation within Paul and Elder’s work is lacking specificity to a solid definition, but rather implies to assess category, validation, degree motive and detail (Paul, Binker, Martin, Vetrano, & Kreklau, 2010) (Paul et al., 2010). Lipman’s (1987) definition provided a clear distinction between responsible and irresponsible thinking and encompasses the self-correction thought process, the correct use of criteria both in the thinking process and decisions and sensitivity to context. The definition falters in the sense that instances may meet the definition within a context but may be considered uncritical in an alternative situation (Paul et al., 2010).

This explanation of limitations in various definitions of critical thinking helps to relay that the concept may require the utilization of more than one definition while conducting research. Rather than working solely with one definition of critical thinking, retaining multiple definitions helps to maintain understanding of the various dimensions of the concept highlighted within those aspects and to be released from any limitations of a single definition that may hinder research being conducted (Paul et al., 2010).
**Critical thinking in health care.** Health care practitioners’ need to possess keen critical thinking skills is not only of concern for educators but also for employers who expect graduates to have, at minimum, the ability to develop such skills. Critical-thinking ability is necessary within the medical environment to the extent that it is being incorporated into models of practice for health care practitioners in various health care professions including nursing, pharmacy, clinical laboratory sciences, physical therapy, and respiratory care (Burke, et al., 2008; Goodfellow, 2001; Kenimer, 2002; Simpson & Courtney, 2002; Wessel & Williams, 2004).

Because of continuing evolvement of technology in health care and an increasingly changing, culturally diverse patient population, demands of working within the health care environment have become more complex (Goodfellow, 2001; Hill, 2002; Mishoe, 2003). To function as effective health care practitioners by making sound, competent decisions in patient care, critical thinking skills must be highly developed (N. Facione, P. Facione, & Sanchez, 1994; Mishoe, 2003; Wettstein et al., 2011).

Leaders in the health care environment widely accept that critical thinking skills are associated with the advancement or delivery of quality health care practice (Ozturk et al., 2008; Profetto-McGrath, 2005). Critical-thinking ability has become a necessary skill in the health care professions to the extent that establishment and incorporation of this skill is found within standards of practice. Standards established by the American Nurses Association set forth a framework which is applied in practice as a part of the nursing process (American Nurses Association, 2015). Within the practice of respiratory care, critical-thinking ability is considered essential, and therefore it has been incorporated into professional competencies required of graduates and practitioners. Areas in which critical thinking skills are necessary in
practice include disease management, evidence-based medicine inclusive of respiratory care protocols, patient assessment, and leadership (Kacmarek et al., 2012).

**Scope of critical thinking in nursing and respiratory care.** The American Psychological Association Delphi study (as cited in P. Facione, 1990a) consisted of 46 scholars, educators, and leaders who defined the concept of critical thinking as “purposeful, self-regulatory judgement [sic] that results in interpretation, analysis, evaluation and inference” (p. 2). The report further elaborated that critical thinking necessitates an explanation of evidence, concepts, criteria or methods in which judgment is made. After continued research, additional behaviors associated with critical thinking as described by P. Facione (2007) included asking questions, defining a problem, studying evidence, evaluating assumptions and biases, avoiding simplification, a reflection of interpretations, and tolerance of ambiguity.

Various dimensions of critical thinking can be found within the scope of specific health professions that are relevant to this study. The focus on this discussion of the various behaviors of critical thinking found within health care will pertain to both nursing and respiratory care. The rationale for this is that both professions spend an extensive amount of time at patients’ bedside requiring the use of critical-thinking ability (Tyreman 2000).

Critical thinking in the nursing profession is necessary for practitioners to keep attuned with a rapidly changing health care environment. Daly (1998) discusses that the practice of nursing is experiencing a paradigm shift from curative, task orientated and objective care. The current emphasis is toward more unbiased, holistic and autonomous care within clinical reasoning, therefore requiring an increase in the cognitive demand of nurses (Daly, 1998).

Simpson and Courtney (2002) studied critical thinking in the nursing profession. The various dimensions of cognitive critical-thinking ability were identified as interpretations,
analysis, inference, explanation, evaluation, and self-regulation. The skill of interpretation was described as interpreting problems, along with objective and subjective data accurately; the authors called analysis the ability to examine the ideas and arguments with related problems and data collected as well as choices related to patient care. Inference can be associated with questioning claims made, evaluating arguments, recognizing faculty reasoning and drawing appropriate conclusions. A practitioner will also hold the ability of explanation, which is explaining and defending any reasoning with presented conclusions and decisions. Simpson and Courtney (2002) described evaluation as examining information to determine credibility, trustworthiness, and relevance to specific patient care situations. With self-regulation, a practitioner is constantly monitoring and examining one’s own thinking using universal criteria such as clarity, precision, accuracy, consistency, logic, significance and subsequently correcting oneself as deemed appropriate when caring for the patient population (Simpson & Courtney, 2002).

In addition, because of the nature of the health care environment, an affective disposition involved with critical thinking includes being open-minded, inquisitive, analytical, systematic, and possessing self-confidence (N. Facione, 1994). Having these tendencies within one’s nature can be viewed as essential to reasoning, and with practice can stimulate a practitioner to critically think (N. Facione, 1994). Simpson and Courtney (2002) elaborated on these affective characteristics found in critical thinking. Being open-minded is to be able to accept varying perspectives, respect differences in opinions, and understand cultural diversity. Being inquisitive is having enthusiasm for attaining knowledge, and having the desire to understand processes even without innate information of the purpose of said process. Analytical thinking requires the verification of information, applying reason and evidence and
having the ability to have foresight regarding consequences. A systematic disposition is associated with having organized focus regarding complex issues; and self-confidence is trusting one’s reasoning to address problems (Simpson & Courtney, 2002).

To function in the complex health care environment, respiratory care practitioners require critical thinking skills with which to process and reason established new information. Critical thinking skills needed in the respiratory care profession should incorporate problem solving, logical reasoning, judgment, decision-making, scientifically based reasoning, reflection, and lifelong learning (Mishoe, 2003).

To progress the profession of respiratory care and as an aspect of strategic planning for graduating and future respiratory therapists beyond 2015, Kacmarek et al. (2012) surveyed educators and directors or managers of respective departments about a variety of competencies necessary for functioning respiratory therapists. Entry-level practitioners should have the ability to understand health care driven by evidence-based medicine. Within 66 competencies, there are various areas of practice, such as respiratory care protocols and disease management, in which practitioners will need to expand and refine critical thinking skills. In addition, critical-thinking ability is necessary to lead groups, collaborate with other health care professionals and participate in care planning and decision-making at the bedside (Kacmarek et al., 2012).

Mishoe (2003) identified the following as essential critical thinking skills found in bedside practitioners in respiratory care: anticipating, prioritizing, communicating, troubleshooting, negotiating, decision-making, and reflecting. A respiratory care practitioner who can foresee altering the current situation and develop a solution prior to and/or preventing a problem is acknowledged as anticipating. The ability to arrange unexpected incidents and
expected assigned tasks according to importance is referred to as prioritizing. Communicating is an essential skill of the respiratory care practitioner who needs to gather both verbal and nonverbal information with members of the health care team, such as physicians, nurses, and other practitioners, the patients, and their family. The nature of the practice of respiratory care is highly technical. Therefore, practitioners must have the ability to pinpoint and correct technical issues that present; this is known as troubleshooting. Respiratory therapists must have skills in negotiating when one is attempting to influence others in the care of the patient care and responsibilities. Negotiation does require some communication skills but differs from communication in that rather than sharing information; the practitioner is trying to affect the decisions and actions of others. Decision-making is described as the ability to make clinical judgment or reach a conclusion. In respiratory care, decisions made in practice are completed individually, through communication with physicians and nurses or with consultation with others inclusive of other respiratory therapists or health care team members (Mishoe, 2003).

Decision-making in respiratory care is considered a fundamental skill required to function within practice of the profession that requires critical-thinking ability of the respiratory care practitioner. Within the practice, critical thinking can be described as a process that is initiated with a problem or situation that presents within the care of patients. The respiratory therapist will encounter and recognize the problem, gather and evaluate clinical data, plan and act on information collected with clinical hypotheses, and assessment. The practitioner will determine through a reflection of the situation if clinical judgment was adequate and appropriate. When effective critical thinking occurs, it is the basis in the decision-making process that results in successful, appropriate, and safe medical intervention (Hill, 2002).
Critical thinking behaviors found in professions such as nursing and respiratory care research indicate that they are not solely based on cognitive ability but are also behavioral and affective and can be based on the situation and or context of a problem (Goodfellow, 2001). Identifying behaviors found in clinical practice provides a structure in which to determine problem solving, clinical decisions, and competencies required to perform adeptly in the health care environment (Goodfellow, 2001; Tyreman, 2000). With the knowledge of critical thinking behaviors and skills required for practice, assessing critical thinking in the application process of a health care program will help to identify the potential that applicants have in the progression and completion of a health care program (Pitt, Prowis, Levett-Jones, & Hunter, 2015).

**Admission Criteria**

There is a gap in the literature regarding admission criteria into associate degree programs in respiratory care compared to nursing, medical school, physical therapy, and pharmacy programs and at baccalaureate or higher-level degree programs. Admission requirements have the potential to play a significant role in student selection of a program. For program personnel, students who are projected to complete a program can be identified with predictors of success within admission criteria that contribute to retention and attrition while enrolled in health care programs (Gallagher, Bomba, & Crane, 2001; Jefferys, 2007; Shulruf, Wang, Zhao, & Baker, 2011). Fowles (1992) noted that programs assess criteria used for admission to discern what factors can be the best predictors of success for the student.

**Predictors of success.** A review of the literature to gain insight on students entering into a health care profession program of study suggests past emphasis on academic factors assessed during the application process that are found to determine predictors of success. Table
2 shows a synthesis of literature examined, as well as the admission criteria studied to predict success in a health-care-related program.

Table 2.

*Studies of Admission Criteria*

<table>
<thead>
<tr>
<th>Study</th>
<th>Program of Study</th>
<th>Sample Size</th>
<th>Criteria examined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen &amp; Bond (2001)</td>
<td>Pharmacy</td>
<td></td>
<td>Pharmacy College Admission Test (PCAT), interview, pre-pharmacy GPA, overall GPA, California Critical Thinking Skills Test (CCTST)</td>
</tr>
<tr>
<td>Alwan, Kushi, Tamim, Magzoub, &amp; Elzubeir (2013)</td>
<td>Medical Students, Clinical Laboratory Sciences, Emergency Medical Sciences, Respiratory Medicine (Saudi Arabia)</td>
<td>87</td>
<td>GPA, Final High School Mark, Saudi national achievement exam, Saudi national aptitude exam</td>
</tr>
<tr>
<td>Cox, Persky, &amp; Blalock (2013)</td>
<td>Pharmacy</td>
<td>329</td>
<td>Undergraduate GPA, Pharmacy College Admission Test (PCAT), Health Sciences Reasoning Test (HSRT)</td>
</tr>
<tr>
<td>Flanigan (1985)</td>
<td>Respiratory Therapy</td>
<td>39</td>
<td>Cumulative GPA, Science-Mathematics GPA, American College Test (ACT)</td>
</tr>
<tr>
<td>Jefferys (2007)</td>
<td>Nursing</td>
<td>112</td>
<td>Pre-nursing GPA</td>
</tr>
<tr>
<td>Salvatori (2001)</td>
<td>Physical therapy, Respiratory Therapy, Medical students, physiotherapy (Canada), Occupational Therapy</td>
<td></td>
<td>Pre-admission GPA, aptitude tests, interviews, written submission, letters of reference</td>
</tr>
<tr>
<td>Researcher(s)</td>
<td>Program</td>
<td>N/A</td>
<td>Description</td>
</tr>
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<td>---------------------------------------</td>
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</tr>
<tr>
<td>Timer &amp; Clauson (2011)</td>
<td>Nursing</td>
<td>249</td>
<td>Demographic information, application materials, interview scores, admission GPA</td>
</tr>
<tr>
<td>Underwood, Williams, Lee, &amp; Brunnert, (2013)</td>
<td>Nursing</td>
<td>184</td>
<td>HESI Admission Assessment</td>
</tr>
<tr>
<td>Ward, Downey, &amp; Thompson, (2010)</td>
<td>Dental Hygiene</td>
<td>156</td>
<td>Incoming college GPA, DH course GPA, DH final GPA, SAT program score</td>
</tr>
<tr>
<td>Whyte, Madigan, &amp; Drinkwater (2011)</td>
<td>Nursing, Paramedic, Nursing/Paramedic (double degree)</td>
<td>543</td>
<td>Bioscience GPA, overall GPA, clinical GPA</td>
</tr>
</tbody>
</table>

Grade point average (GPA) was found to be the most studied and commonly assessed for admission criteria for entrance to health profession programs. Additionally, researchers who examined preadmission GPA, cumulative GPA, or program correlation with professional exams found the best predictor of success was GPA (Allen & Bond, 2001; Alwan et al., 2013; Flanigan, 1985; Jefferys 2007; Salvatori, 2001; Shulruf et al., 2011; Timer & Clauson, 2011; Ward et al., 2010; Whyte et al., 2011).

The reflection of a student’s coursework prior to entering a health care program is viewed as a predictor of success within several health care programs. Jefferys (2007) found that tracking of academic entry, progression, graduation and licensure of nursing program students
revealed relationships to success in each component. The study includes the assessment of grade point average of academic courses taken as pre-requisites for the program in which a minimum GPA of 2.5 on a 4-point scale is required. The average GPA found was 3.07 with a defined range of 2.53-4.00. Science courses were examined separately as they were “identified as significant predictors of success” (Jefferys, 2007, p. 410). This finding can be perceived as a weakness in the study as there are variables that contribute to the reflection of grade point averages courses, such as instructor selection, the institution in which the course is taken, and content delivery.

Predictors of success in respiratory care programs. Study of admission criteria conducted within respiratory care education primarily focuses on academic performance, either during program enrollment or on national board exams administered by the National Board for Respiratory Care. Flannigan (1985) explained that poor academic performance within a respiratory care program also likely contributes to increased attrition. In quantifying admission criteria, which can be inclusive of grade point average and standardized test scores, predictors for improved academic and student performance can be identified.

Standardized testing, in the form of the American College Test (ACT) and the Watson-Glaser Critical Thinking Test (WTCTT), were used as predictors of success in academic performance within respiratory care education (Flanigan, 1985; Wettstein et al., 2011). Findings indicated that coursework, specifically within the biological sciences, serve as a better indicator of success within respiratory care academic performance. Regardless of the type of standardized testing, there are weak correlations to scores and academic success. Within respiratory care education, admission criteria should serve to meet the objectives of the respective program (Flanigan, 1985; Wettstein et al., 2011).
**Student admission interviews.** While it is essential to examine various admission criteria as predictors of success, studying critical thinking as admission criteria for health care programs has the potential to be an indicator of student performance and success. Health care professions apply alternative methods from quantitative measures in the admission process of respective programs of study (McDaniel, Thrasher, & Hiatt, 2013). For multiple health care programs, student interviews serve as admission criteria to assess varying characteristics for entrance into programs of study (Allen & Bond, 2001; Goho & Blackman, 2006; McDaniel et al., 2013; Salvatori, 2001; Romanelli et al., 2006; Timer & Clauson, 2011; Ward et al., 2010).

The intention of conducting interviews in an employment capacity is to be used as an instrument to measure the ability of a candidate to achieve success. In contrast to interviews for employment, when used in an educational capacity as a requirement for program entry, interviews should be used with caution. The reason being is that a student’s intention is to learn knowledge, while potential employees are applying acquired knowledge (Goho & Blackman, 2006). The use of admission interviews is observed to be utilized within various community college health care programs. While associate degree health care programs may not be held in the same regard as medical or graduate school, there is the notion that selection based on personal interaction may be necessary to understand an applicant better, actively recruit applicants or to clarify program expectations (Salvatori, 2001).

Program admission interviews have been assessed as a predictor of academic or clinical success in health care programs. Many biases may exist while conducting academic interviews, including gender, age, and race, as well as other characteristics related to personality or the impact of the first impression determined by interviewers (Goho & Blackman, 2006; Salvatori, 2001). Interview structure can help determine academic and clinical success. Interview design
categories can range from loosely structured to moderate and highly structured. Goho and Blackman (2006) found a weak correlation between interviews for selection in predicting academic performance and likely offer little practical value. In relation to clinical performance, where interpersonal skills are necessary, there is a moderate relationship, but interviews still hold limited practical value.

There is the suggestion that admission interviews have little to no effect on predicting academic and clinical success within health care disciplines (Goho & Blackman, 2006; Issenberg, 2011). The reasoning for this is that reliability and validity of selection interviews may contain bias due to the variability of interviewers and the structure of interviews (Salvatori, 2001). If the design of selection interviews holds more structure, and inter-rater reliability is ensured with interviewers; a stronger relationship of academic/clinical success can be found (Goho & Blackman, 2006; Salvatori, 2001).

Interviews for admission to a program of study is often conducted in conjunction with assessment of more quantitative measures such as grade point average, standardized testing or coursework (Allen & Bond, 2001; Salvatori, 2001; Romanelli et al., 2006; Timer & Clauson, 2011). Despite inconsistencies found, utilization of an interview process allows one to capture characteristics and clarify information from quantitative measures that will indicate successful progression through health care professional programs (Salvatori, 2001; Romanelli et al., 2006). Noncognitive factors determined during the interview process, such as critical-thinking ability, have been studied as predictors of success within health care programs. While student interviews are more subjective in nature, they can serve as a predictor of academic achievement and completion. Students who display strong personal attributes also may have the ability to
persist in health care related programs contributing to positive retention (McDaniel et al., 2013; Ward, Downey, & Thompson, 2010).

**Admission Testing**

**Novice versus expert thinking.** Tyreman (2000) and Wood (1998) described the variances between novice and expert thinking. The primary difference is that in expert thinking the application of critical thinking skills is applied. Experts in an area have greater knowledge base from clinical experience that is easy to recall because the information is organized and structured. Novices often depend on policies, rules, and step-by-step information as their knowledgebase to function. In addition, problem solving and decisions are based on memorized information and data are collected and analyzed superficially. In contrast, experts can recognize patterns and anticipate outcomes based on clinical experience and function almost instinctually.

Wood (1998) explained that two important processes are substantial in the discussion of novice versus expert thinking. The first is the occurrence of incubation; the person will focus on the problem, analyze thoughts and insights, and relate them to known variables within the problem. The other process in metacognition, which is a reflection of the thinking process that occurred. These two processes are components of the critical thinking process that involves the skill of self-regulation. An expert thinker will have a short incubation process and a more efficient metacognitive activity (Wood, 1998).

Tyreman (2000) discussed the dimensions of novice and expert thinking using the basis of two concepts found in medical knowledge: *techne* and *phronesis*. Techne is primarily instrumental in achieving specific desired outcomes. Techne is considered productive in that the knowledge has a recognized goal and productive outcome. In summary, techne refers to possessing the technical knowledge needed to function within the medical setting.
Phronesis is having the knowledge to act and respond to instances and challenges within the expectations of the medical profession. This knowledge also encompasses the values and practical mores of the profession; therefore, the practitioner will make moral judgments. Phronesis is essential in clinical practice because clinical decisions need to be made, and therapeutic actions need to be taken during structured situations found within uncertain context (Tyreman, 2000). This type of knowledge is required where set rules do not provide a clear decision to be made. Tyreman (2000) explained that novice thinkers will function on techne knowledge and in building clinical expertise and critical thinking skills, they will gain phronetic knowledge becoming experts within their practice.

Mishoe (2003) found that respiratory care practitioners relied on patient assessment skills, clinical experience and interactions with other clinicians in conjunction with critical thinking skills in their decision-making processes. These actions help to make clinical judgment become second nature in which the respiratory care practitioner develops into an expert thinker. Participants explained that their decision-making changed significantly with increased critical thinking and clinical exposure. This practical knowledge contributes to the dramatic change in decision-making processes with practitioners relying less on textbook knowledge. Expert respiratory therapists consider novice practitioners to heavily rely on textbook knowledge which in turn causes them to have the tendency to overlook patient issues. In addition, by practicing with the emphasis on formal theory, novices lose opportunities to gain more clinical experience from expert practitioners’ practical knowledge.

The desire to improve clinical reasoning and decision-making is progressing through changes in curricula in the health sciences. The progression and development of these skills in students and novice learners can at times be overlooked by educators, and the assumption is
made that students will naturally gain needed critical thinking skills during the progression of the educational program. The assessment of critical thinking status, either prior to admission or during the progression of a program, can help educators not only assess a starting point in students’ education but can shift teaching pedagogies to case- and problem-based thinking to improve outcomes (N. Facione & P. Facione, 2008).

**Admission testing into medical programs of study.** The use of standardized testing as admission criteria within medical programs of study has very early origins with the predecessors to the Medical College Admission Test (MCAT), the Scholastic Aptitude Test for Medical Schools, and the Profession Aptitude Test (Moss, 1930; Sanazaro & Hutchins, 1963; Young & Pierson, 1948). As medical professions evolved and established educational programs beyond medical school, various standardized tests were created and established for specific professions to capture varying characteristics for entry into programs of study.

Health care program administrators can use admission testing in various ways. Selecting a method in the incorporation of admission testing requires examination of admission criteria and development of interventions that best meet the needs of the program and students. With the wide range of aptitude tests available for each of the various medical professions, determining which tests to use is valuable in predicting student success in a specific area of study (Salvatori, 2001). Assessments should be formulated and tailored by the faculty to meet student population needs and should reflect the goals and objectives established by leadership (Dietrich & Crowley, 1982; Gallagher et al., 2001). The commitment and time program administration and faculty spend to establish a rigorous selection process is valuable not only to graduates but the future of respective professions. Recruitment strategies, including admissions
testing, should be accompanied by a selection process that is aligned with professional standards and is also humane, rational and ensures equity (Dietrich & Crowley, 1982).

The Medical College Admission Test (MCAT) is commonly used in the admission process. There have been five significant transitions in the content of the MCAT since the late 1920s to its current version. Each variation has entailed different definitions referencing medical education readiness in the test content, scoring, and use of scores. The definitions each measure the knowledge of a potential student in the biosciences, problem-solving abilities, communication skills, and general personality attributes. The test evolved first with the intention to ensure retention and success in medical schools with the early versions, then as a tool for admission criteria. The recurrent theme from past to present test versions is that the most predictive factors for medical school performance were undergraduate coursework grades and MCAT scores (McGaghie, 2002; Salvatori, 2001). When used together, effectiveness increases during the admission process (McGaghie, 2002).

In contrast, some have argued standardized testing may not be a beneficial admission criterion (Cahn, 2015; Gough et al., 1963; McGaghie, 2002). Limitations are found with using MCAT scores as an admission tool and many scholars that challenge this state that there should be more emphasis on personal qualities and interpersonal relations (Gough et al., 1963; Salvatori, 2001; Sanazaro & Hutchins, 1963). In review of the evolution of the MCAT, the core definition of the test centers on knowledge within the biosciences; the material that varied the most in the various versions of the exam are the more qualitative abilities such as verbal ability, and familiarity in the liberal arts and humanities (McGaghie, 2002). Study of the MCAT indicates that there is low reliability in the test and that assessing undergraduate achievement and science background do not encompass “independence, self-initiation and critical judgment
demanded of the professional” (Gough et al., 1963, p. 996). Despite extensive study of standardized testing into medical professions, continued research to determine validity of the practice is still required (Gough et al., 1963; Salvatori, 2001).

In a more recent study, Cahn (2015) found standardized testing as admission criterion could deter potential students from entering a health care program, affecting the diversity within a cohort. Cahn studied if using the Graduate Record Examination (GRE) is a barrier to increasing diversity in health profession programs, and consequently the workforce. Interestingly, the rationale for eliminating the GRE as admission criteria was not in response to or an attempt to increase program diversity. Instead, a correlation to scores and successful program completion is not being found. Exclusion of the GRE or comprehensive standardized admission testing may attract applicants who did not consider a graduate program, but its exclusion does not guarantee an increase in diversity (Cahn, 2015).

**Assessment of critical thinking.** The use of standardized testing as admission criteria is widely accepted across various professions. The selection of a standardized test is often dependent on either the profession or what a health science program desires to capture. Testing can range from profession-specific, such as the MCAT, HESI, and PCAT exams for medical school, nursing, and pharmacy, respectively, to generalized testing such as the SAT, ACT, and GRE (Allen & Bond, 2001; Cahn, 2015; Cox et al., 2013; Flanigan, 1985; Salvatori, 2001; Sanazaro & Hutchins, 1963; Underwood et al., 2013).

To capture critical-thinking ability, review of literature reveals various instruments that will assess critical-thinking ability within the allied health sciences. The college level tests to assess critical thinking include the Watson-Glaser Critical Thinking Appraisal (WGCTA) California Critical Thinking Skills Test (CCTST), and, more recently, the Health Sciences
Reasoning Test (HSRT). Although not directly written for health care practice, various health professions use each of the named tests for admission criteria, assessment and research.

The instruments listed to measure critical-thinking ability are based on subskills as described by Ennis (1985) and P. Facione (1990a). Ennis (1985) asserted that critical thinking comprises four areas or general ability identified as clarity-related, inference-related, abilities that establish a basis for inference, and problem-solving abilities. The subskills identified by a panel of APA Delphi experts was also reported and are relayed as interpretation, analysis, evaluation, explanation and inference (P. Facione, 1990a).

The WGCTA and associated tests are standard assessments for studying critical thinking and are widely used throughout health sciences, including respiratory care education and research (Hill, 2002; Shelledy, Gardner, Carpenter, & Murphy, 2004; Wettstein et al., 2011). The assessment contains 80-multiple choice items, with a total critical thinking proficiency score in which the subskills of problem identification, selection of relevant information to problem solution, acknowledgment of unstated assumptions, interpretation, evaluation of arguments and drawing conclusions and judgment based on inferences, are measured. In the measurement of critical-thinking ability, the test was studied and shown to be considered reliable and valid for assessment (Berger, 1985; Wilson & Wagner, 1981). Berger (1985) suggested that each of the individual subskills tested is not used as a basis for evaluation, but rather the total score. The total score is found to be considered reliable across various settings, and specifically at the college level (Watson & Glaser, 1980; Wilson & Wagner, 1981).

The CCTST is also commonly used within the health professions to assess critical thinking. The development of the CCTST was a result of the APA Delphi research project (P. Facione, 1990b; Jacobs, 1995). The CCTST is constructed using a bank of 200 multiple-choice
items that are based on research aimed to test reliability and validity of instruments used for the measurement of critical thinking (P. Facione, 1990b). The instrument is available as Form A and Form B, both of which assess the subskills identified by the APA Delphi report. Of the 200 items found within the constructed test bank, 34 items were selected to formulate Form A. Form B consists of altering 28 of the 34 items that appear on Form A, in which the items were changed by substituting different names, terms, contexts and concepts while attempting to maintain the particular critical thinking behavior and type of topic or problem. Regardless of which form is administered both report a total score and three subscores of analysis, evaluation and inference. The inference score is further segmented to scores for inductive and deductive reasoning. Although the intention of the various forms of the CCTST are equivalent, the modifications made the difficulty level of the two forms unequal due to inconsistencies and weak relationships found (Jacobs, 1995). Still, the test appears to hold substantiated content validity. The dissemination of scores provides a basis in which to differentiate test-takers.

From initial pre- and post-testing with the test, it was found that students taking courses designed with the intent to increase critical thinking showed improvement on CCTST scores (N. Facione, P. Facione, & Sanchez, 1994).

The HSRT is the most recently developed instrument designed to assess critical thinking skills for allied health students. It is derived from the Delphi study conducted that built the CCTST. The test is a 33-question exam that assesses the ability of the test-taker to analyze a problem, interpret and evaluate the problem and justify a conclusion. The questions developed for the HSRT require that the test-taker utilize the subskills of inference, and the ability to evaluate or justify the evaluation of inference. The overall score provides subscores for inference, induction, deduction, analysis and evaluation (Cox et al., 2013; Huhn et al., 2011).
According to the authors of the HSRT, a score of less than 15 is considered a poor critical thinking score while an overall score of greater than 24 is indicative of good critical thinking skills (N. Facione & P. Facione, 2007).

In the assessment of the construct validity of the HSRT, Huhn et al. (2011) found that the test is reliable in discerning novices and experts within a group of physical therapy students and practitioners. The critical thinking elements found within the instrument capture the difference between novice and experts. Experts likely performed better on the exam because of repeated clinical exposure to a variety of problems in which expertise was built. Cox et al. (2013) used the HSRT as an entrance exam along with other criteria for admission for a doctor of pharmacy program. The intent of the use of the exam was to admit students who have strong critical thinking skills or at minimum hold the capacity to develop critical thinking.

The findings of this study reveal a strong correlation of the HSRT to the PCAT entrance exam in the areas of reading comprehension, verbal, and quantitative analysis (Cox et al., 2013). The most significant finding was that there was little variance in common admission criteria and the scores found on the HSRT. With the intent of the administration of the HSRT exam in this manner, characteristics are captured beyond the admission criteria, and the most likely cause is the critical thinking skillset of the student (Cox et al., 2013).

**Summary**

Critical thinking skills have been incorporated into the educational environment (Facione, 1990a; Paul & Elder, 2001; Sternberg, 1986). Critical thinking ability has been identified in health care as a desired skill of competent, effective respiratory care practitioners and other medical professionals (Cox et al.; Hill, 2002; Kacmarek et al., 2012; Mishoe, 2003; Simpson & Courtney, 2002). Admission criteria and associated predictors of success vary
within the medical environment; selection of criteria is often based on the specific requirements of a discipline or professional program (Salvatori, 2001). The focus of standardized admission testing within the medical environment is found to reflect gained established knowledge but not entirely indicative of critical-thinking ability (Cox et al., 2013; Gough et al., 1963; Salvatori, 2001; Sanazaro & Hutchins, 1963). Standardized critical thinking assessment, particularly the HSRT, has evolved to gain emphasis within the health care educational setting (N. Facione, P. Facione, & Sanchez, 1994; Insight Assessment, 2016).
Chapter 3: Methodology

Critical thinking is necessary for those practicing respiratory care for making safe, effective, and appropriate clinical judgment in the care of patients (Hill, 2002; Kacmarek et al., 2012). A graduate who completes a degree in respiratory care is prepared to function in the workforce, and educators continually determine appropriate admission criteria to determine not only completion but successful integration into the discipline (Flanigan, 1985; Kacmarek et al., 2012). Utilizing critical thinking ability as an admission criterion is a method that educators have implemented in various allied health fields that have included respiratory care (Hill, 2002; Shelledy et al., 2004; Wettstein et al., 2011). This chapter discusses the methodology, including restating the purpose, research questions, and hypothesis, and elaborating upon the research methods used to measure critical-thinking ability upon admission.

Purpose of the Study

The purpose of this quantitative, ex post facto study was to determine if the assessment of critical thinking as admission criteria can serve as a predictor of success for completion of an associate degree respiratory care program. Current literature has been conducted in baccalaureate and graduate degree programs in nursing and allied health subject areas, such as physical therapy and pharmacy (Cox et al., 2013; Huhn et al., 2011). Assessing critical-thinking ability as an admission criterion could help to contribute to respiratory care program student selection criteria, as well as the critical thinking capabilities of graduates who enter the workforce.

Research Question

The study of the assessment of critical thinking as a predictor of success for completion of an associate degree, respiratory care program, was conducted based on subskills identified by
the APA Delphi study (P. Facione, 1990a). The research question for this study is “To what extent do the five subskills found within critical thinking assessment: 1) induction, 2) deduction, 3) analysis 4) inference, and 5) evaluation, when utilized as admission criteria predict student success in completion of an associate degree respiratory care program?” (Insight Assessment, 2016)

**Variables and Hypothesis**

The primary dependent variable in this study was successful completion of an associate degree respiratory care program. The independent variable during this study was the critical thinking score obtained on the HSRT. Additional independent variables for this study of admitting GPA, student demographics and program status were included to test and identify any other relationships found within this study.

An additional dependent variable, final GPA, was assessed during this study as a reflection of student performance. The hypothesis for the overarching research question and for this study as stated:

\[ H_0: \text{There is no significant relationship found between the five subskills of critical thinking and the successful completion of an associate degree respiratory care program.} \]

Assessment of critical thinking is often a component of the application among variables that could be considered for admission to a health care program of study. Admission criteria were examined to discern what factors served as predictors of success for potential health care students (Flanigan, 1985; Fowles, 1992). Various extraneous variables such as GPA, prerequisite coursework, interviews, and alternative admission tests could have served as independent variables to examine admission criteria and as a predictor of success in a program
of study. The focus of this study was on the critical-thinking ability of applicants to an associate degree program of study in respiratory care.

Past researchers had not examined admission criteria, specifically critical thinking, as a predictor of associate degree program completion in the profession of respiratory care. Various empirical studies have assessed critical thinking with alternative dependent variables such as national board exams, obtaining licensure, program retention, or attrition (Gallagher et al., 2001; Jefferys, 2007; Shulruf et al., 2011; Wettstein et al., 2011). While critical thinking can be a factor in success, different criteria often serve as more significant predictors of success (Jefferys, 2007; Wettstein et al., 2011). Regardless of the type of assessment, the criteria should meet the objectives of a health care program (Flanigan, 1985).

Research Design

This study was conducted using a nonexperimental, ex post facto research design to examine archived student data of a respiratory care associate degree program for the academic years of fall 2010 through fall 2015. With an ex post facto design, a researcher examines data in retrospect to determine the reason or results of differences within groups in which data cannot be altered during the research process as it has already occurred (Lord, 1973; Fraenkel, Wallen, & Hyun, 2015). The independent variable, the HSRT scores, already occurred during the admission process. In turn, the dependent variable of program completion status was examined retrospectively to observe its relation to the HSRT score.

In this design a relationship can be explored but it may not be the only or the most crucial relationship (Lord, 1973). Ex post facto design and correlational studies are considered associated research in attempting to explain a phenomenon without manipulation of the variables (Fraenkel et al., 2015; Lord, 1973). A correlational study is designed to analyze a
relationship that will be clear or that variables will always respond in a uniform way; ex post
facto research will explain rather than establish a cause-and-effect relationship (Lord, 1973).

A disadvantage of primary concern in the use of ex post facto design is that threats to
internal validity cannot be controlled. Therefore, caution needs to be taken in interpretation of
the results (Fraenkel et al., 2015; Lord, 1973). Threats to internal validity specific to this study
would include other admission criteria that may influence the prediction of program completion.
Additionally, since the data were examined retrospectively in their natural state, selection of
subjects could not be controlled (Lord, 1973).

**Research Site and Sampling**

This study focused on associate degree-level respiratory care programs; therefore, the
sample was drawn from students or graduates of such a program. The target population was
students who were admitted to and enrolled in an associate degree-level respiratory care
programs in the southern United States. Of the associate degree programs located within the
identified region, only one used the selected instrument, the HSRT, to assess critical thinking as
a factor in admission criteria. Because of this unique finding, the accessible and target
collection were the program students located at the research site.

The target population was students admitted to and enrolled in the program between fall
2010 and fall 2015. The sample did not include students who were denied entry to the program,
as the dependent variable was the completion or withdrawal from the program; therefore,
students included in the sample were admitted and enrolled into the respiratory care program.
Enrolled students as of December 2015 were designated as “in-progress” status and had not
withdrawn or terminated from the program were excluded. The selection process, including
admission criteria, was unchanged throughout the selected study period. All students chosen for
this study underwent the same admission processes to gain enrollment to the program. The HSRT was completed in the same manner through online assessment and without any changes to exam content made by the authors or publisher. Lastly, no significant admission criteria or curriculum changes occurred during the designated time that would have had an effect on progression through the program.

The anticipated sample size was 176 admitted students. The identified subgroups for examination were (a) students who had completed the program of study and graduated and (b) students who were terminated from the program of study. Students excluded from the sample were identified as “in-progress” status and were not officially withdrawn or terminated from the program as of December 2015.

Data Collection

Instrument. The selected instrument for this study was the HSRT, authored, administered, and maintained by Insight Assessment. The HSRT is specifically written to assess critical-thinking ability for potential students or trainees within health sciences programs (Insight Assessment, 2013). The 33-question exam provides an overall score inclusive of subscores: induction, deduction, analysis, inference, and evaluation. Questions are structured with a scenario that is read with options in selection to assess named subskill sets (Insight Assessment, 2013). Sample questions inclusive of all assessments offered by Insight Assessment are found on the product website.

Reliability and validity of the HSRT were provided by Insight Assessment in the user’s manual. As furnished by the HSRT manual, the areas of content, construct, and criterion (predictive) validity and reliability are described. Content validity refers to an instrument’s ability to capture needed variables within the intended area of study (Fraenkel et al., 2015). For
the HSRT, the domain of critical thinking is defined by the APA Delphi study in which an expert consensus on a definition and construct of critical thinking was determined by contributions of experts across various professional areas (P. Facione, 1990a). Content validity of the HSRT was further supported through selection of the exam by educators, researchers, and professionals seeking individuals with strong critical-thinking ability (Insight Assessment, 2016).

Construct validity assesses evidence of the theory in different variations (Fraenkel et al., 2015. For the HSRT, construct validity was achieved through correlations with other instruments that are inclusive of critical thinking or higher-order thinking as a component of the score or ratings. High correlations of the HSRT were found with college preparedness standardized tests such as the GRE. Additionally, some relationships were identified in a large multisite research study that included 50 programs within the health sciences assessing student critical-thinking ability (Insight Assessment, 2016).

Criterion validity is the ability of the instrument to relate or predict outcomes theoretically. In the instance of the HSRT, predicative validity, which is the ability of an instrument to predict outcomes as theoretically expected, is determined (Mujis, 2011). For the HSRT, the desired outcome would be to predict achievement in learning outcomes or successful transition to the workplace. The predicative value of the exam is reported in various published peer-reviewed studies supporting the exam within the health sciences (Insight Assessment, 2016).

Reliability for the HSRT was completed using internal-consistency method of the Kuder-Richardson approach, requiring an instrument to contain more than one item and does not require that all items are equally difficult (Fraenkel et al., 2015). For a test to be considered
internally consistent, the KR-20 minimum score is 0.70 (Mujis, 2011). The HSRT overall score is reported to meet or exceed the 0.70 criterion within validation and large model population samples. For test-retest reliability, the HSRT is said to meet or exceed .80 in samples retested 2 weeks later (Insight Assessment, 2016).

To assess the stated research questions, student enrollment status in the associate degree respiratory care program was collected through examination of student record enrollment and graduation data. Student demographics and academic information was collected from students’ transcript records maintained at the location of the research site. HSRT exam scores collected were a scale and representative of a students’ critical-thinking ability. The data set was collected through examination of preexisting scores within the secured website from student cohorts within the stated time period of fall 2010 to fall 2015.

The dependent variables for this study were consistent and remained in a manner in which a student left the program, either through graduation, or termination/withdrawal from the program. The independent variables were collected directly from the scores reported by the HSRT and included student overall score and each subskill set score of induction, deduction, analysis, inference and evaluation. To reach a sound conclusion, I considered other possible reasons that might have contributed to the results. To achieve an understanding of critical thinking as admission criteria, additional data were collected from faculty of regional respiratory care programs. This was achieved by distributing a series of open-ended questions in relation to the use of critical thinking assessment in the admission process and the contribution to program completion.

**Procedures.** Insight Assessment administered and maintained the test scores on a secured website with selective access to view scores. The publisher gave me permission to
access the website. Other identified variables related to student transcript data were collected from the research site with the permission of the IRB and administrators at the research site. Once approval was granted by the IRB, data was collected by using established access to student records and HSRT scores.

Following collection of quantitative data, I conducted formal interviews with regional respiratory care faculty to expand upon the quantitative findings (Creswell, 2012), specifically, faculty members’ views on critical thinking as admission criteria. Interview questions were directed in assessing the various subskills identified in the HSRT exam, relationships found within studied quantitative data, and in what way each subskill contributed to successful completion of an associate degree, respiratory care program. It took several weeks to collect and organize the data.

Threats to validity must be considered in the planning of a study; often some may not be avoided. By identifying possible threats to a study, a researcher can minimize or eliminate threats (Fraenkel et al., 2015). Identified threats can lie within instrumentation, the admission process, or data collection. The HSRT exam remained unaltered by the test publishers during the 5-year test period (Insight Assessment, 2016). The admission process and criteria for applicants to the program of study were unchanged within this time frame. If an applicant took the exam multiple times during the application period, the most recent time-stamped score was collected for the study, matching the policy followed during the admission process. Lastly, data could have been misinterpreted or collected incorrectly, distorting the data (Fraenkel et al., 2015). To avoid the risk of bias, all data were assessed objectively for students who met population criteria in review of records and scores. Data were analyzed objectively as soon as coded identifiers eliminated knowledge of student names after data were collected.
Data Analysis

The collected data consisted of a dichotomous variable that represents completion of an associate degree respiratory care program and continuous independent variable to reflect the overall HSRT score and each of the subskill scores of induction, deduction, analysis, inference and evaluation. The dichotomous variable was assigned nominal values: 1 = Graduate, 2 = Non-Graduate to identify student status at the time of the study. HSRT scores were collected from the secured website maintained by Insight Assessment and recorded to an Excel spreadsheet. The collected scores were identified as nominal scale variables. The continuous dependent variable, final GPA, was input as a scale variable and designated for select multiple regression tests. Student names were removed and replaced with anonymous identifiers prior to assignment to each variable. The Excel spreadsheet was organized in a manner that allowed the transfer into SPSS v. 23 for data analysis.

Once the data set was established, descriptive statistics were completed to obtain a general overview regarding the data. Selection of statistical test(s) for this study was needed to explain relationships found between HSRT scores and the nominal variable, completion or termination from an associate degree, respiratory care program.

Data analysis was conducted using both logistic and univariate general linear model analysis. In binary logistic regression analysis performed, the primary dependent variable was dichotomous in that it contained two categories (graduate or non-graduate). The probability of this variable was examined against the HSRT score, a continuous variable, associated subskill score, and student age, gender and ethnicity. Univariate general linear model analysis was used to assess the final GPA dependent variable, as a success indicator, in comparison to the overall
HSRT score and associated subskill scores, age, gender and ethnicity. Correlations were examined and presented with no negative correlations.

To determine if the overall model explained relationships found among the variables, several methods were used to test significance. First, the actual and predicted results for individual students were compared. Using logistic regression models, the examination for significance in the relationship of successful completion of the program in comparison to students’ demographics (age, gender, ethnicity) and critical thinking assessment results of the HSRT exam was performed. Second, univariate general linear model tests were completed using final GPA as a success indicator in comparison to the same variable in logistic regression studies. In doing so, significance was examined between the two models and a determination of which predictors were identified.

Data collected from interviews were transcribed and analyzed for broad themes. Upon transcription and initial readings, data was organized and coded to identify specific text or wording to ascertain themes. Findings of qualitative feedback that correlate to primary quantitative findings of the study were presented in brief narrative form (Creswell, 2012).

Validity, Reliability, and Generalizability

Internal validity. The most prominent threat anticipated in this study was to the internal validity of the results of the study. Internal validity implies that the observed differences in the dependent variable are directly related to the independent variables. For this study, the influence of other admission criteria serving as predictors of success was perceived as a threat to internal validity. To address this issue, I studied critical thinking assessment as a component of admission as opposed to definitive criteria. Validity of the instrument was ensured through the methods provided by the publisher of the HSRT. Maturation, during which
approximately 2 years of gained education have passed until graduation, can influence the critical-thinking ability of graduates and can be an additional threat to validity. Because the design of this study was ex post facto in which preexisting data were examined, no pre-post data or scores were considered (Fraenkel et al., 2015).

**External validity.** Considering that the sample selected was specific to a single respiratory care program, the results may not be generalizable to the target population of all associate degree respiratory care programs. The results help to determine if the assessment of critical-thinking ability was appropriate to the specifically studied program. Threats to external validity included representation of the target population and the conditions of admission. This sample may be considered homogeneous; all students had the same educational experience, considering that all programs are structured differently the results of this study may not apply to other associate degree, respiratory care programs. Admission criteria and testing procedures were unaltered in the timeframe in which the data were examined. The design of the study required examining student demographics to ensure that the target population was represented appropriately.

**Ethical Considerations**

Prior to obtaining and examining data, approval was obtained from the Institutional Review Board (IRB) of the community college in which the respiratory care program is located to identify any threats to ethical concerns (Fraenkel et al., 2015).

The role of the researcher required that student scores and records that indicate exiting the program either through graduation or termination was examined. Because of the specificity of the study sample, the researcher was granted secured access to records of scores and student
transcripts. To avoid potential bias, participants’ information were given identifiers that ensure anonymity prior to the review of data.

Because this study was conducted using preexisting data, the primary ethical concerns lay in the confidentiality and security of scores and records examined. Other ethical risks that could have presented included the possibility that data obtained through inadvertent examination by personnel other than the researcher. Data containing HSRT scores were obtained by accessing and recording scores downloaded from a secure website specific to the institution and respiratory care program. Indication of exit from the program was also obtained by examining archived records. All data were stored as electronic data on a password-protected USB drive, which is kept in the researcher’s possession. To ensure anonymity, all student names and identifying information were removed and replaced with designated coding for this research study. No archived data were shared with any other respiratory care program or institutional personnel. Finally, the approving institution and I will destroy all data 5 years after the completion of this thesis.
Chapter 4: Results

The purpose of this quantitative study was to explore the relationship between critical thinking assessment as an admission criterion to a respiratory care associate degree program as a predictor of successful completion of the program. This chapter presents the study results by providing the descriptive statistics of the study population and reporting of the findings of statistical analyses performed to address the research question with the testing of selected variables as predictors of successful completion of the program.

Data Cleaning and Transformation

Student data as well as online test results of the Health Sciences Reasoning Test (HSRT) from the participating research site was collected. The collected data consisted of both dichotomous and continuous values, and were transformed to effectively evaluate the research question, analytic strategy, variable types and definitions. Table 3 defines the variable type, definition, and values assigned to the variables included in this study.

Students who experienced a delay in degree progression and were either terminated or graduated after returning to the program were classified accordingly. HSRT exam scores and subscores, student GPA, and age, remained as scalar values. The GPA of students who transferred to the college prior to beginning the program was calculated according to the letter grade documented for courses. Seven students were admitted and enrolled to the program without taking the HSRT exam and were eliminated from the study. With data cleaning and transformation complete, data were uploaded to SPSS v. 23 for analysis of descriptive statistics, logistic regression, and univariate general linear model tests to address the research question.
Table 3.

**Variable Definitions**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measurement Level</th>
<th>Value</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduation Status</td>
<td>Nominal</td>
<td>0</td>
<td>Graduate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Non-Graduate</td>
</tr>
<tr>
<td>Overall HSRT score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSRT Induction score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSRT Deduction score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSRT Analysis score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSRT Inference score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSRT Evaluation score</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Nominal</td>
<td>1</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Not Reported</td>
</tr>
<tr>
<td>Race</td>
<td>Nominal</td>
<td>1</td>
<td>White, Caucasian, Anglo American</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Black, African American</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Asian, Asian American, Pacific Islander</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Hispanic, Latino, Mexican American</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Other</td>
</tr>
<tr>
<td>GPA at admission</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA in final semester with program</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required degree courses completed</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required degree science courses completed</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Descriptive Statistics**

The data were collected from a public, open-access community college in the southern United States. The sample consisted of all students from the associate degree respiratory care program at the research site who were enrolled during the fall 2010 semester and fall 2015 semester. Students in the sample fulfilled all requirements of the application process and were admitted and enrolled in the program. Excluded were students who did not enroll in the
program, did not complete the HSRT exam as admission criteria, or were still classified as in progress within the program at the end of the fall 2015 term.

Slightly more than 79% \((n = 140)\) of students who enrolled in the respiratory care program graduated; 20.5% \((n = 36)\) did not graduate. Of the 140 graduates 125 were on-time graduates and 15 were delayed graduation. Of the 36 non-graduates, 30 did not return after termination and six were terminated after readmission to the program. Table 4 presents the descriptive statistics of the sample in relation to graduation rate for the sample.

Table 4.

*Descriptive Statistics for Graduation Rate \((N=176)\)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Graduates</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>On-time Graduation</td>
<td>125</td>
<td>71.0</td>
</tr>
<tr>
<td>Delayed Graduation</td>
<td>15</td>
<td>8.5</td>
</tr>
<tr>
<td>Total Non-Graduates</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Terminated</td>
<td>30</td>
<td>17.0</td>
</tr>
<tr>
<td>Terminated after return to program</td>
<td>6</td>
<td>3.4</td>
</tr>
<tr>
<td>Total</td>
<td>176</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The sample was predominately female (79.5%) with an age range from 18 to 59 years of age. The largest race representation by a small margin are students that identified as Black/African-American represented 34.1% followed by those identified as White/Caucasian/Anglo-American representing 31.8% of the sample. Asian/Asian-American/Pacific Islander and Hispanic/Latino/Mexican-American students represented 13.1%
and 21% of the sample respectively. Table 5 and Table 6 detail the overall descriptive statistics of the demographics for the sample.

Table 5.

*Overall Descriptive Statistics (N = 176)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>36</td>
<td>20.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Female</td>
<td>140</td>
<td>79.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age in years</td>
<td>176</td>
<td></td>
<td>18</td>
<td>59</td>
<td>31.32</td>
<td>8.531</td>
</tr>
<tr>
<td>Valid N</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The largest gender/race representation within the sample were those identified as White/Caucasian/Anglo-American females which consisted of 27.3% of the total population. The second largest race/gender representation were those identified as Black/African-American females which represented 25.6% of the total population. The gender/race cross-tabulation is presented in Table 7.
### Table 6.

**Descriptive Statistics for Race (N= 176)**

<table>
<thead>
<tr>
<th>Race</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, Caucasian, Anglo American</td>
<td>56</td>
<td>31.8</td>
</tr>
<tr>
<td>Black, African American</td>
<td>60</td>
<td>34.1</td>
</tr>
<tr>
<td>Asian, Asian American, Pacific Islander</td>
<td>23</td>
<td>13.1</td>
</tr>
<tr>
<td>Hispanic, Latino, Mexican American</td>
<td>37</td>
<td>21.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>176</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

### Table 7.

**Gender-Race Representation (N=176)**

<table>
<thead>
<tr>
<th>Race</th>
<th>Female Count</th>
<th>% of Total</th>
<th>Male Count</th>
<th>% of Total</th>
<th>Total Count</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, Caucasian, Anglo American</td>
<td>48</td>
<td>27.3%</td>
<td>8</td>
<td>4.5%</td>
<td>56</td>
<td>31.8%</td>
</tr>
<tr>
<td>Black, African American</td>
<td>45</td>
<td>25.6%</td>
<td>15</td>
<td>8.5%</td>
<td>60</td>
<td>34.1%</td>
</tr>
<tr>
<td>Asian, Asian American, Pacific Islander</td>
<td>15</td>
<td>8.5%</td>
<td>8</td>
<td>4.5%</td>
<td>23</td>
<td>13.1%</td>
</tr>
<tr>
<td>Hispanic, Latino, Mexican American</td>
<td>32</td>
<td>18.2%</td>
<td>5</td>
<td>2.8%</td>
<td>37</td>
<td>21.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
<td><strong>79.5%</strong></td>
<td><strong>36</strong></td>
<td><strong>20.5%</strong></td>
<td><strong>176</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Student GPA recorded was identified at admission and upon leaving the program either through graduation or termination. The variables identified included the total HSRT score and each of the various subskills identified in the instrument. Table 8 details the descriptive statistics for the HSRT exam, individual subskills, and student admission and final GPA.

Table 8.

Descriptive Statistics for HSRT and GPA (N = 176)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSRT Overall</td>
<td>176</td>
<td>7.00</td>
<td>30.00</td>
<td>17.8409</td>
<td>4.14560</td>
</tr>
<tr>
<td>HSRT- Induction</td>
<td>176</td>
<td>2.00</td>
<td>10.00</td>
<td>6.6193</td>
<td>1.64490</td>
</tr>
<tr>
<td>HSRT - Deduction</td>
<td>176</td>
<td>0.00</td>
<td>10.00</td>
<td>4.8523</td>
<td>2.15693</td>
</tr>
<tr>
<td>HSRT - Analysis</td>
<td>176</td>
<td>0.00</td>
<td>6.00</td>
<td>3.2955</td>
<td>1.37037</td>
</tr>
<tr>
<td>HSRT - Inference</td>
<td>176</td>
<td>1.00</td>
<td>6.00</td>
<td>2.8807</td>
<td>1.03232</td>
</tr>
<tr>
<td>HSRT - Evaluation</td>
<td>176</td>
<td>0.00</td>
<td>6.00</td>
<td>4.1023</td>
<td>1.35258</td>
</tr>
<tr>
<td>GPA at admission</td>
<td>176</td>
<td>1.14</td>
<td>4.00</td>
<td>3.0487</td>
<td>.52520</td>
</tr>
<tr>
<td>Final GPA</td>
<td>176</td>
<td>0.00</td>
<td>4.00</td>
<td>3.0934</td>
<td>.54173</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Correlations

The HSRT exam scores were examined for correlations and reliability using the Cronbach alpha. According to the developer of the HSRT exam, the Cronbach alpha reports as reliable (> 0.7). In Table 9, the Cronbach alpha for HSRT subscores within this study were reported as 0.768, aligning with the developer’s findings and acceptable for internal reliability. Correlations were examined for reliability of scoring measuring the same characteristic, no
negative correlations were found within the scores, indicating the data included were reliable for study. Correlation findings are presented in Table 10.

Table 9.

Reliability Statistics for HSRT Subscores

<table>
<thead>
<tr>
<th>Cronbach's alpha</th>
<th>Cronbach's alpha based on standardized items</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.768</td>
<td>.775</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 10.

Inter-Item Correlation Matrix for HSRT Subscores

<table>
<thead>
<tr>
<th></th>
<th>HSRT Induction</th>
<th>HSRT Deduction</th>
<th>HSRT Analysis</th>
<th>HSRT Inference</th>
<th>HSRT Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSRT Induction</td>
<td>1.000</td>
<td>.390</td>
<td>.362</td>
<td>.333</td>
<td>.917</td>
</tr>
<tr>
<td>HSRT Deduction</td>
<td>.390</td>
<td>1.000</td>
<td>.655</td>
<td>.385</td>
<td>.313</td>
</tr>
<tr>
<td>HSRT Analysis</td>
<td>.362</td>
<td>.655</td>
<td>1.000</td>
<td>.183</td>
<td>.332</td>
</tr>
<tr>
<td>HSRT Inference</td>
<td>.333</td>
<td>.385</td>
<td>.183</td>
<td>1.000</td>
<td>.209</td>
</tr>
<tr>
<td>HSRT Evaluation</td>
<td>.917</td>
<td>.313</td>
<td>.332</td>
<td>.209</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Because of the number of items in the scale, the mean inter-item correlation value was examined. The mean inter-item correlation is 0.408 with a range of 0.183 to 0.917 reporting an acceptable relationship among items. Findings for the mean inter-item correlation are presented in Table 11.
Summary Item Statistics

<table>
<thead>
<tr>
<th>Inter-Item Correlations</th>
<th>$M$</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Maximum / Minimum</th>
<th>Variance</th>
<th>$N$ of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.408</td>
<td>.183</td>
<td>.917</td>
<td>.734</td>
<td>5.019</td>
<td>.046</td>
<td>5</td>
</tr>
</tbody>
</table>

Logistic Regression Analysis

To what extent do the five subskills found within critical thinking assessment: 1) induction, 2) deduction, 3) analysis 4) inference, and 5) evaluation, when utilized as admission criteria predict student success in completion of an associate degree respiratory care program? (Insight Assessment, 2016)

Logistic regression analyses were completed to test independent variables representing critical-thinking ability (HSRT overall score and associated subskills) at admission and completion of the program (graduate, non-graduate). The dependent variable was tested to represent program completion. Independent variables were entered into SPSS to study predictability. The HSRT-overall score was tested as a separate independent variable as it is the accumulation of the HRST subscores. The tests and models performed were to test for significance of HSRT values and successful graduation of the program.

Based on a simple model testing HSRT overall score to successful completion of an associate degree respiratory care program, the finding is significant ($Wald = 5.006, p = 0.025$). Table 12 presents the results for the logistic regression performed with HSRT overall score as an indicator of successful completion of the program.
Further study of the HSRT was completed to test if the exam is significant controlling for other predictors. The model includes examination of the relationship of the HSRT overall score with admission GPA, age, gender, and race to completion of the program. The model presented indicates that HSRT overall score, at alpha = .10, remained a significant finding (Wald = 3.107, p = .078). The population demographics (age, gender, race) were not found to have significant relationships to program completion. Table 13 presents the findings of the model discussed.

Logistic regression analysis of individual HSRT subskill scores was completed to examine relationships found to completion of the program. No significant relationships were found between individual HSRT subscores and completion of an associate degree respiratory care program. The findings of the analysis of this relationship are presented in Table 14.
Table 13.

*Logistic Regression for HSRT Overall Score, Age, Gender, and Race (N = 176)*

<table>
<thead>
<tr>
<th>Step 1a</th>
<th>HSRT Overall</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% CI for EXP(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-0.096</td>
<td>0.054</td>
<td>3.107</td>
<td>1</td>
<td>0.078</td>
<td>0.909</td>
<td>.817</td>
<td>1.011</td>
<td></td>
</tr>
<tr>
<td>Admission GPA</td>
<td></td>
<td>0.259</td>
<td>0.390</td>
<td>0.441</td>
<td>1</td>
<td>0.507</td>
<td>1.296</td>
<td>.603</td>
<td>2.786</td>
<td></td>
</tr>
<tr>
<td>Gender(1)</td>
<td></td>
<td>-0.054</td>
<td>0.490</td>
<td>0.012</td>
<td>1</td>
<td>0.913</td>
<td>0.948</td>
<td>.362</td>
<td>2.478</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td>4.994</td>
<td>3</td>
<td>0.172</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race(1)</td>
<td></td>
<td>-0.710</td>
<td>0.655</td>
<td>1.173</td>
<td>1</td>
<td>0.279</td>
<td>0.492</td>
<td>.136</td>
<td>1.777</td>
<td></td>
</tr>
<tr>
<td>Race(2)</td>
<td></td>
<td>0.527</td>
<td>0.531</td>
<td>0.986</td>
<td>1</td>
<td>0.321</td>
<td>1.694</td>
<td>.598</td>
<td>4.797</td>
<td></td>
</tr>
<tr>
<td>Race(3)</td>
<td></td>
<td>0.430</td>
<td>0.658</td>
<td>0.428</td>
<td>1</td>
<td>0.513</td>
<td>1.538</td>
<td>.424</td>
<td>5.582</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-1.535</td>
<td>1.810</td>
<td>0.719</td>
<td>1</td>
<td>0.396</td>
<td>.215</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Variable(s) entered on Step 1: hsrto, gender, age, gpa_adm, race.

Based on binary logistic regression, measurement of the predictability of critical thinking assessment as admission criteria. Given the results of binary logistic regression analysis, and in reference to the relationship of assessment of critical thinking and successful completion of the degree program, the null hypothesis was rejected: There was no significant relationship found between the five subskills of critical thinking and the successful completion of an associate degree respiratory care program.
Table 14.

*Logistic Regression on HSRT Subscores to Program Completion (N = 176)*

<table>
<thead>
<tr>
<th>HSRT Subskill</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% CI for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Induction</td>
<td>-.196</td>
<td>.305</td>
<td>.413</td>
<td>1</td>
<td>.521</td>
<td>.822</td>
<td>.452</td>
</tr>
<tr>
<td>Deduction</td>
<td>.014</td>
<td>.128</td>
<td>.013</td>
<td>1</td>
<td>.910</td>
<td>1.015</td>
<td>.790</td>
</tr>
<tr>
<td>Analysis</td>
<td>-.320</td>
<td>.190</td>
<td>2.821</td>
<td>1</td>
<td>.093</td>
<td>.726</td>
<td>.500</td>
</tr>
<tr>
<td>Inference</td>
<td>.068</td>
<td>.216</td>
<td>.099</td>
<td>1</td>
<td>.753</td>
<td>1.070</td>
<td>.701</td>
</tr>
<tr>
<td>Evaluation</td>
<td>.059</td>
<td>.358</td>
<td>.027</td>
<td>1</td>
<td>.870</td>
<td>1.061</td>
<td>.526</td>
</tr>
<tr>
<td>Constant</td>
<td>.403</td>
<td>.852</td>
<td>.224</td>
<td>1</td>
<td>.636</td>
<td>1.497</td>
<td></td>
</tr>
</tbody>
</table>

a. Variable(s) entered on step 1: hsrtind, hsrtd, hsrta, hsrtinf, hsrt.

**Linear Regression Analysis**

Further investigation was required to assess the research question. Regression analysis via univariate general linear model tested whether HSRT scores significantly predicted student final GPA upon leaving the program as a graduate or non-graduate. The dependent variable, final GPA, was viewed as a marker of success. The HSRT overall score was tested separately from each of the individual HSRT subskills. Variance performed included examination of not only HSRT overall score but also GPA at admission, age, gender, and race. Subskill scores were tested in a different model as the overall score was the accumulation of the subskill scores. Univariate analysis of Table 15 presents the results of the tests.
Table 15.

*HSRT Overall Score, Admission GPA, Demographics to Final GPA (N = 176)*

Dependent Variable: Final GPA

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>ηp²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>15.631a</td>
<td>10</td>
<td>1.563</td>
<td>7.219</td>
<td>.000</td>
<td>.304</td>
</tr>
<tr>
<td>Intercept</td>
<td>5.732</td>
<td>1</td>
<td>5.732</td>
<td>26.474</td>
<td>.000</td>
<td>.138</td>
</tr>
<tr>
<td>HSRT - Overall</td>
<td>1.637</td>
<td>1</td>
<td>1.637</td>
<td>7.560</td>
<td>.007</td>
<td>.044</td>
</tr>
<tr>
<td>Admission GPA</td>
<td>8.373</td>
<td>1</td>
<td>8.373</td>
<td>38.671</td>
<td>.000</td>
<td>.190</td>
</tr>
<tr>
<td>Age</td>
<td>.130</td>
<td>1</td>
<td>.130</td>
<td>.599</td>
<td>.440</td>
<td>.004</td>
</tr>
<tr>
<td>Gender</td>
<td>.113</td>
<td>1</td>
<td>.113</td>
<td>.522</td>
<td>.471</td>
<td>.003</td>
</tr>
<tr>
<td>Race</td>
<td>.460</td>
<td>3</td>
<td>.153</td>
<td>.708</td>
<td>.548</td>
<td>.013</td>
</tr>
<tr>
<td>gender * race</td>
<td>.412</td>
<td>3</td>
<td>.137</td>
<td>.634</td>
<td>.594</td>
<td>.011</td>
</tr>
<tr>
<td>Error</td>
<td>35.726</td>
<td>165</td>
<td>.217</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1735.471</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>51.357</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. $R^2 = .304$ (adjusted $R^2 = .262$)

Analysis of the model presents that the HSRT overall score is significant to the final GPA as a success indicator. The relationship of HSRT overall score to final GPA ($F = 7.56, p = .007$) was found to be significant but with a small effect size ($ηp² = .044$). The effect size reported conveys that the relationship explains only 4.4% of the variance. Another significant finding is the relationship between admission GPA ($F = 38.671, p = .000$) and final GPA. In the
test completed, admission GPA was found to be significant to predicting student final GPA. The effect size ($\eta^2 = 0.19$) shows that 19% of the variance is explained by this relationship.

In comparison of remaining independent variables (age, gender and race) there were no findings to be significant. Based on the findings of Table 15 in reference to the overall HSRT score, which is the accumulation of the five identified subskills, and final GPA as a success indicator, as well as the relationship of admission GPA to final GPA, the null hypothesis is rejected. Thus, HSRT and admission GPA are significant predictors of final GPA after controlling for the other predictors included in the model.

Additional tests to investigate relationships found include HSRT subskill scores to final GPA. Table 16 presents the findings of the test performed. There were no significant relationships found for each of the individual HSRT subskills to the final GPA of the population. The admission GPA was again found to have a significant finding ($F = 35.823, p = .000$) in relationship to the final GPA variable. Given the results of univariate linear regression model testing in the relationship between the five identified subskills of the HSRT exam and final GPA as a success indicator, the null hypothesis was rejected:

$H_0$: There was no significant relationship found between the five subskills of critical thinking and the successful completion of an associate degree, respiratory care program.
Table 16.

*HSRT Subskill Scores to Final GPA (N = 176)*

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>ηp²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>16.034a</td>
<td>14</td>
<td>1.145</td>
<td>5.220</td>
<td>.000</td>
<td>.312</td>
</tr>
<tr>
<td>Intercept</td>
<td>5.256</td>
<td>1</td>
<td>5.256</td>
<td>23.955</td>
<td>.000</td>
<td>.130</td>
</tr>
<tr>
<td>Admission GPA</td>
<td>7.859</td>
<td>1</td>
<td>7.859</td>
<td>35.823</td>
<td>.000</td>
<td>.182</td>
</tr>
<tr>
<td>HSRT - Induction</td>
<td>.002</td>
<td>1</td>
<td>.002</td>
<td>.007</td>
<td>.932</td>
<td>.000</td>
</tr>
<tr>
<td>HSRT - Deduction</td>
<td>.118</td>
<td>1</td>
<td>.118</td>
<td>.538</td>
<td>.465</td>
<td>.003</td>
</tr>
<tr>
<td>HSRT - Analysis</td>
<td>.219</td>
<td>1</td>
<td>.219</td>
<td>.997</td>
<td>.320</td>
<td>.006</td>
</tr>
<tr>
<td>HSRT - Inference</td>
<td>.246</td>
<td>1</td>
<td>.246</td>
<td>1.122</td>
<td>.291</td>
<td>.007</td>
</tr>
<tr>
<td>HSRT - Evaluation</td>
<td>.042</td>
<td>1</td>
<td>.042</td>
<td>.193</td>
<td>.661</td>
<td>.001</td>
</tr>
<tr>
<td>Age</td>
<td>.051</td>
<td>1</td>
<td>.051</td>
<td>.232</td>
<td>.630</td>
<td>.001</td>
</tr>
<tr>
<td>Gender</td>
<td>.180</td>
<td>1</td>
<td>.180</td>
<td>.821</td>
<td>.366</td>
<td>.005</td>
</tr>
<tr>
<td>Race</td>
<td>.426</td>
<td>3</td>
<td>.142</td>
<td>.648</td>
<td>.585</td>
<td>.012</td>
</tr>
<tr>
<td>gender * race</td>
<td>.370</td>
<td>3</td>
<td>.123</td>
<td>.562</td>
<td>.641</td>
<td>.010</td>
</tr>
<tr>
<td>Error</td>
<td>35.322</td>
<td>161</td>
<td>.219</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1735.471</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>51.357</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Dependent variable: final GPA

a. $R^2 = .312$ (Adjusted $R^2 = .252$)
Quantitative Summary

The descriptive statistics analysis was completed to provide an overview of the study population’s graduation rates, demographics, and student performance on the HSRT exam at admission and through progression of the program studies. Descriptive statistics relayed that the study population was predominately female; the largest subgroup included those who self-identified as Black/African-American. The largest race/gender representation was identified as White/Caucasian/Anglo-American females.

In quantitative analysis of the research question, there were several significant findings. Admission GPA was found to be a significant finding in linear regression studies in the relationship to final GPA as a success indicator. In logistic regression study, the admission GPA was found to not have a significant relationship to graduation status. There was a difference in the findings from between the two models. The admission GPA as a significant finding in linear regression explains more of the variance in the model. Meaning, the model explained how the dependent variable (final GPA) changed according to the changes in the independent variable, admission GPA.

HSRT overall scores were found to have a significant relationship in both logistic and linear regression study. Although the finding was significant in linear regression models, the effect size was reported to be small, explaining only 4.4% of the variance. The HSRT overall score better explains the relationship with final GPA, but less so in the logistic model due to the high (79.5%) graduation rate. Gender, age, and race had no significant findings in both logistic
and linear regression studies. In both logistic and linear regression studies, the individual HSRT subskill scores showed no significant relationships.

Given the findings of quantitative analysis of the research question using logistic regression, the null hypothesis was rejected; the HSRT overall score was a significant predictor of successful completion by graduation from an associate degree respiratory care program. Through multiple linear regression testing, admission GPA and HSRT overall scores were found to reject the null hypothesis as significant predictors of final GPA.

**Faculty Perspective**

The nature of the research question required further investigation to understand the use of critical thinking assessment as an admission criterion for respiratory care programs. The investigation was conducted by interviewing respiratory care faculty who actively participate in the selection process of potential students. Participants were interviewed in a private location, in which a detailed explanation was given and signed informed consent obtained. All interviews were recorded, transcribed, and coded for analysis. Additionally, the findings of quantitative analysis were shared to explore the components of the HSRT exam, significant relationships found, and how the exam and study results would be relevant to the selection of potential students. Findings from analysis of participant interviews follow.

**Critical-thinking ability.** Participants believed that professional practitioners’ critical-thinking ability is important for performing their jobs successfully and safely. Findings indicate that critical-thinking ability cannot be generalized on student demographic qualities as it often varies among each individual. Interviewees suggested the ability to critically think is not a teachable skill but one that students already possess. With further exploration, this generalization is based on participants’ observations and exposure communicated by working
with the target population. Regardless of student demographics, in this study identified as primarily age and student’s status as a second career, those who appeared to have stronger critical thinking and reasoning skills are often found to have varied experiences on which to base decision-making and critical-thinking ability. Interviewees suggested that the more life experience students and practitioners gained, the higher the level of critical thinking ability; critical-thinking skills are developed with life or work experience rather than students’ academic career prior to entering a respiratory care program. Students who display critical thinking attributes often seem to have the capability to apply and develop respiratory care knowledge throughout program enrollment.

**Critical thinking as admission criteria.** The participants interviewed all had assessed critical thinking as an admission criterion. The practice of critical thinking assessment as admission criteria was viewed more as potential that an applicant has in developing critical thinking skills in the respiratory care learning environment as opposed to a definitive score that will guarantee success.

Critical-thinking ability was consistently perceived to be important for functioning within the profession. The participants emphasized that practicing as a respiratory care practitioner requires higher levels of critical-thinking ability. This holds especially true when students and practitioners are placed within an environment that include high levels of patient acuity requiring focus and reasoning capabilities to make effective, safe decisions. In implementing the practice of critical thinking assessment in the admission process, faculty considered applicants’ potential to grow when evaluating applications.

When questioned on the preparedness of student critical-thinking ability upon entering a respiratory care program, each faculty member conveyed they thought most students are ill
prepared. Students who do possess what is considered a strong level of critical-thinking ability are able to build upon their current level of thinking as they progress through a program. One faculty member stated, “Decision-making skills are inherently difficult to teach. If they have them coming in already, it makes it a lot easier for the instructors and the student.” Other participants conveyed that preparedness of a student upon entering is not dependent on demographics but on previous life/work experiences and current level of critical thinking. Discussion on the topic of student preparedness as related to previous academic performance reveals that regardless of applicants’ academic career, if they had not developed critical thinking abilities, it is difficult to develop as a student progresses in a respiratory care program.

HSRT score indicators. Respiratory care program faculty members were asked about their perceptions during the admission process to a respiratory care program. Questions were based on the importance of the five subskills assessed in the HSRT exam: (a) induction, (b) deduction, (c) analysis, (d) inference, and (e) evaluation from the viewpoint of. Additionally, the overall HSRT exam score which is the accumulation of the scores of each of the text, is explored with the significance found to student success.

Faculty members discussed assessing critical thinking with the HSRT exam. One said, “The scores for our tests specifically are not matched to the student's ability either positively or negatively.” A different faculty member communicated that scores are often not correlated with applicants who are admitted to a program and results are referenced retrospectively when “outliers” surfaced. Outliers referred to students who score well on admission testing but then struggle when progressing through the program by demonstrating the inability to problem solve. Again, in the context of how admission scores relate to critical-thinking ability, scores are not
correlated, and student critical-thinking ability and performance varies from student to student throughout the target population.

When focused specifically on individual subskill scores as admission criteria, discussions related to those subskills that reflect or support decision-making ability among students. Faculty members suggested critical thinking is part of a practitioner’s decision-making ability. At the forefront of conversation are two subskills, deduction and inference, both of which assess drawing conclusions and skills that allow for decision-making.

As defined by the HSRT exam, deduction assessment includes thinking skills that allow for decision-making within the context of rules, conditions, beliefs, values, procedures and principles to determine an outcome (Insight Assessment, 2016). Participants who emphasized the importance of critical thinking and its role in decision-making suggested deduction is important when assessing applicants to a respiratory care program. In reference to deduction as a subskill assessed, one faculty member stated, “Deduction, because decision-making. We have to make quick decisions. We have to make important decisions. We have to make life altering decisions. They need to be able to, to draw on different things to make that decision.” A different participant stated, “I think that there's procedures and values that you need to have, and principles that you need to have to be able to help your future patients.” The focus of deductive thinking skills and its role in respiratory care practitioners’ critical-thinking ability is prevalent in discussions, primarily for patient safety and outcomes as opposed to student academic success.

Inference in the context of the HSRT exam is the ability to draw a conclusion form evidence or reasons (Insight Assessment, 2016). This subskill was also viewed with importance by participants with the intention that conclusions drawn based on evidence contribute to the
decision-making process which is dependent on critical-thinking ability. A faculty member stated the importance of inference as an assessment for admission criteria in that students “need to be able to draw conclusions based on the information given. . . It’s important for patient care . . . for taking board exams.”

Each of the identified subskills of the HSRT exam holds some importance in the admission process, but deduction and inference enable students to form good conclusions and enhance decision-making processes. Participants thought students who enter into a program with existing critical-thinking ability can progress in enhancing each subskill as respiratory care knowledge, skills, and experience are gained compared to those who have what is perceived as weaker critical thinking skills. Overall, with student progression through the program, skills will develop due to the gained knowledge over the course of study in respiratory care. The variance will be seen in the rate of progression in knowledge and skills gained. The thoughts are again relayed that progression and development of critical-thinking ability is varied throughout the student population and dependent on students’ individual performance.

**Significant predictors.** Results of the quantitative study were discussed as part of the faculty perspective interviews. The significant findings discussed included the HSRT overall score, admission GPA as predictors of final GPA was presented to interviewees. In discussing the significance of the overall HSRT score as a predictor of success, it was conveyed to have a small effect size, explaining a small percentage of the variance. Each faculty member suggested the finding does hold relevance in the admission process. The perception is that with the higher HSRT overall score a student will have the critical-thinking ability to succeed and complete the program. One participant said that although the relationship may be relevant that bedside performance as a practitioner may not be reflective of the score. In discussions of the admission
GPA as a significant predictor, participants said they can understand the relationship of stronger academic performance to student success, but do communicate that students’ may apply with a higher GPA simply by taking courses which are perceived as from “easier” instructors. One faculty member stated that “basic academics does not teach them critical-thinking skills.”

**Summary**

In this chapter, the results of this study are presented which include, the descriptive statistics of the sample, statistical analyses, and perspectives from faculty members on admission testing of critical-thinking ability. The sample included 176 students enrolled in an associate degree respiratory care program who completed the HSRT exam as admission criterion. The target population was predominately female. The largest race comprised those who self-identified as Black/African-American. Students were enrolled in and left the program at the research via graduation or attrition between the fall 2010 and fall 2015 semester.

Two variables, overall HSRT score and admission GPA, were significant predictors of success in and associate degree respiratory care program. The HSRT overall score was found to be predicative of successful degree completion and final GPA in both logistic and linear regression models. Albeit, the effect size of HSRT to final GPA was small. Admission GPA was not found to be a significant predictor in logistic model testing but was found to be significant in predicting student final GPA. No other variables, such as student demographics and HSRT subskill scores, were found to be statistically significant. The null hypothesis was rejected; HSRT overall score and admission GPA were significant predictors of successful completion of an associate degree respiratory care program.

Faculty members suggested that critical-thinking ability is relevant as admission criteria but will vary with student performance and progression through a program. Faculty thought
critical-thinking ability should be considered when determining which students should be admitted, and as vital in developing respiratory care practitioners. This is especially true in critical patient care as well as decision-making processes in bedside practice. Faculty observed students who were determined to have established critical-thinking ability could progress and develop better as respiratory care practitioners as they gained knowledge and skills. Although individual subskills were not found to be statistically significant, the perception of the HSRT subskills identified several important skills. Identified skills included deduction and inference as related to critical-thinking ability and as an influence on the decision-making process. This perception holds significance to patient care and safety.
Chapter 5: Discussion of Research Findings

This study investigated the assessment of critical thinking as a predictor of success for completion of an associate degree respiratory care program. The research site was a community college found in the southern United States in which applicants to an associate degree respiratory care program completed the Health Sciences Reasoning Test (HSRT) as an admission requirement to enrollment in the program. Binary logistic regression and univariate linear models were used to examine associations between student demographic information, HSRT overall and subskills scores as indicators of successful completion of the studied respiratory care program. The following chapter discusses the results presented in Chapter 4, implications of the findings, and suggestions for further research needed in this area of study.

Results and Discussion of Research Question

The research question tested whether the assessment of critical thinking as admission criteria utilizing the Health Sciences Reasoning Test (HSRT) overall and subskill scores were predictors of success for completion of an associate degree respiratory care program. The overall HSRT score was significantly related to student graduation status and student final GPA as an indicator of success. The effect size was very small, explaining only 4.3% of the variance found in the relationship of the HSRT overall score as a significant predictor for student final GPA. The second significant predictor was the admission GPA in relation to student final GPA. Other variables including HSRT individual subskills scores, student demographics, and academic performance did not have a significant relationship with successful completion of a respiratory care program.

Findings in prior literature (Salvatori, 2001; Timer & Clauson, 2011; Whyte et al., 2011) indicated that admission GPA, specifically science GPA, was found to be a significant predictor
of success in health care programs. The findings of this study align with this literature indicating admission GPA as a predictor of success in a respiratory care program. In addition, research suggests standardized testing used to predict academic success produced weak correlations. The significant finding in this study supports the finding of weak correlations because of the small effect size found in the relationship between the HSRT overall score and final GPA. Consistent with Berger (1985), the individual subskills of critical-thinking ability identified in assessment via the HSRT exam did not display indications of successful completion of an associate degree respiratory care program. Instead, in this study a total score as opposed to individual subskills was shown to be a more reliable source as a variable.

Assessing critical-thinking ability from faculty members’ perspective reveal that the potential of student performance on critical thinking assessment is considered, but not absolute in the selection of future students. Respiratory care professionals require critical-thinking ability not only in bedside practice but also in leadership roles and in interactions with the health care team (Kacmarek et al., 2012).

In a study on critical thinking in the respiratory care profession, Mishoe (2003) identified the role of various skills to function as a practitioner. The emphasis in the literature on decision-making as a fundamental skill for practice in health care is supported by the current findings. Faculty communicated that critical thinking ability and the identification of this skill was also identified to factor in the ability to function within the profession. Identification of critical-thinking ability revolves around the decision-making process that a student and eventually practitioner develops.
Implications

The purpose of this study was to explore the relationship between the assessment of critical-thinking ability as a predictor of success for the completion of an associate degree respiratory care program. The findings are relevant both for practice and research within the educational aspect of and the profession of respiratory care. By implication, respiratory care faculty and program personnel may need to develop or alter admission criteria to their programs. The implications for research are evident for contributing to study of admission criteria at the associate degree level for respiratory care programs as well as using a replicable methodological approach.

Implications for practice. From the perspective of associate degree respiratory care faculty and leadership, the study provided meaningful results. For faculty members and leadership, the admission process should focus on examining the student from a holistic perspective. The findings suggest that assessing critical thinking via a standardized test serves as a component of the selection process as opposed to an absolute in student selection.

Because of the small effect size, selection committee members should use overall HSRT score, but admissions committees should also examine past academic performance or degree completion requirements. As determined within this study, admission GPA was a significant predictor and will help to determine, as admission criteria, academic performance throughout enrollment. A consideration, though, is the rigor in which courses were taken to determine successful outcomes. Although not studied statistically, the number of general education courses a student completes might be considered, as the workload for the student enrolled within an intense course of study could be decreased.
By determining students’ critical-thinking ability at the start of a program, faculty are able to assess and adjust according to student performance throughout the progression of study. Many programs nationwide at the associate, baccalaureate, and graduate level are concerned with critical thinking development during program progression, as it is a factor in national board exams taken by graduates. Identifying a student’s critical-thinking aptitude will contribute to program success and success as identified by national board exam performance.

Identifying student critical-thinking ability potential also has influence in the profession of respiratory care. Not only would students successfully complete programs in which they are enrolled, the knowledge and critical thinking skills they develop can influence new graduates’ bedside practice. Enhancing existing critical thinking skills in new respiratory care practitioners will enable safe, effective practice when entering the field.

Implications of research and future research considerations. More research is needed to understand the relationship of the assessment of critical-thinking ability as a predictor of success in associate degree respiratory care programs. The methodological approach used in this study should be replicated to test other variables that would assess admission criteria and standardized testing that would indicate successful completion of an associate degree for a respiratory care program. Additionally, future research should include variables that could be considered as success indicators. Future research conducted is important for practitioners as admission criteria to associate degree respiratory care programs are developed or altered.

Future researchers should consider other variables derived from admission criteria that can serve as predictors of success for associate degree respiratory care programs. Programs currently incorporate various methods to assist in selection of students during the admission
process. The varying criteria often assess various aspects of students’ ability, such as critical thinking, decision-making, personal interactions, and academic performance. Researchers have shown that student success is related to courses in the biological sciences (Flanigan, 1985; Wettstein et al., 2011). Thus, predictors related to sciences courses, such as science admission GPA or math assessment, as well as the number of science courses completed prior to admission, may improve the admission and selection process. Other variables such as student essays and interviews can be considered as well. One aspect to be considered is the subjectivity found with implementation of an interview process. Salvatori (2001) stated that those who complete interviews as an assessment for program entry must consider the subjectivity of the interviewers. Salvatori (2001) suggested interviewer training and rubric should be in place for interviews. Future research could be conducted on using the interview process as a critical thinking assessment as predictor of success for a respiratory care program.

Many standardized tests can assess critical thinking in the health care arena. The HSRT examined in this study was created in 2006. Since then, several versions of the exam have evolved, including an updated 2011 version of the assessment, the HSRT-Numeracy (HSRT-N), and the HSRT-Associate Degree (HSRT-AD). Each test listed includes assessing critical-thinking ability at varying levels for those utilizing the test. The HSRT-N focuses more on numeric and math critical thinking abilities and the HSRT-AD is written to assess critical-thinking ability at the associate degree level (Insight Assessment, 2016). With the development of other critical thinking tests, future researchers may want to consider the study of such assessments to determine appropriate implementation as admission criteria to a respiratory care program.
Future researchers can also consider other variables that would represent successful completion of associate degree respiratory care programs in relation to any predictors identified. The National Board for Respiratory Care (NBRC) awards credentials that enable graduates to practice as a respiratory care practitioner. The test includes the Therapist Multiple Choice (TMC) exam and the Clinical Simulation Exam (CSE). To earn the minimum credential to practice, the Certified Respiratory Therapist (CRT) graduates must pass the exam with a score of 88 or higher. To be eligible to take the CSE graduates must pass the TMC exam with a score of 94 or higher. To earn the highest credential, the Registered Respiratory Therapist (RRT), the CSE must be passed (National Board for Respiratory Care, 2017). The NBRC credentialing exams incorporate various levels of critical thinking content required to pass either of the exams. NBRC credentialing success is also considered as part of the standards by which all respiratory care programs remain accredited. Variables to be considered for comparison of critical-thinking ability assessment and student success include examining scores for graduates on the TMC first attempt, and the scores to obtain the CRT and/or RRT credentials.

Most degree programs have embedded in the curriculum methods to ensure students are successful on credentialing exam. Various assessment methods are used to test students’ potential in passing credentialing exams. Often these tests are administered to benchmark or determine students’ knowledgebase and capability to pass the credentialing exams in a capstone course. The scores obtained by students within this capstone course testing can be used in a future study as a variable indicating student success in the examination of the relationship of critical-thinking ability.

Due to the importance of critical-thinking skills within the profession of respiratory care, future research can include an examination of context specific admission criteria. Based on
faculty feedback from within this study, general critical-thinking skills identified surround decision-making processes. Additional study of critical-thinking ability specific to respiratory care can contribute to identifying more defined skills to be tested during application to a program.

An additional recommendation for future study includes not only the assessment of critical-thinking ability at admission, but also at the completion of a program of study. The examination of the change in students’ ability after exposure to content specific critical-thinking development can help to reveal if the use of critical-thinking assessment as admission criteria is useful. A study of this nature will help to explore how the critical-thinking ability of a student that enters a program will change with exposure to the profession.

Given the methodology of this study, a deeper qualitative aspect of the relationship of assessment of critical thinking as a predictor of success could be considered for future study. Examining what drives the successful completion of a respiratory care program would be beneficial for understanding the nature of persistence to completion. The population found in the community college environment differs from the university level. Barriers and student characteristics may or may not contribute to completion of the program; therefore, a qualitative examination of this relationship can give a different perspective on the population.

Limitations

The data were limited to information gathered in semesters beginning in fall 2010 and ending in fall 2015. The study included only students who took the HSRT exam as an admission criterion in the application process. This study focused on the assessment of critical thinking as admission criteria as a predictor of success for program completion.
The specific admission criteria at the research site may limit the generalizability to that of other respiratory care programs at other institutions. The study population may vary based on research site location, including rural versus urban environments. However, the key finding related to successful completion of the program, specifically the HSRT overall score, helps to support literature that critical-thinking ability does present the potential to develop once in a health care program. Admission GPA as a significant predictor can be generalized to other respiratory care programs regardless of the various identified pre- and co-requisite courses found among all respiratory care programs.

**Summary**

Within the profession of respiratory care, critical-thinking ability plays a large role in the decision-making process to deliver safe, effective, and competent bedside therapies. A concern for those who are involved in the selection process for associate degree respiratory care programs is identifying critical thinking abilities of potential students. Using Astin’s (1984, 1993) input-environment-outcome (I-E-O) model as described within his student involvement theory, the purpose of the study was to explore assessment of critical-thinking ability as admission criteria to be a predictor of success for completion of an associate degree respiratory care program. Prior literature primarily focused on baccalaureate or higher-level programs within professions, such as nursing, pharmacy, physical therapy, and professions other than respiratory care. Researchers used various admission criteria and critical thinking assessments to determine student success. The primary findings of this study indicated that admission testing can be a component considered during the admission process but not a definitive deciding factor in selection. The admission test in this study was the HSRT used as admission criteria for selection to an associate degree, respiratory care program. The sample included 176 students
who took the exam as part of the admission process and were enrolled in the respiratory program at the research site between fall 2010 and the fall 2015 semester.

Using logistic regression testing, the various components of the HSRT exam and select student demographics (age, race, gender, admission GPA, etc.) were tested to determine relationship to successful completion of a respiratory care program. The logistic regression models produced significant results within the relationship of the HSRT overall score and completion of the program. The individual subskills of the HSRT did not reveal significance as predictors of success. Student demographics (age, gender, and race) were not found to be predictive of success.

Univariate general linear models were completed using students’ final GPA as a variable to represent a success indicator within the respiratory care program. Variables tested against the dependent variable included student demographics, admission GPA, the HSRT overall score, and the individual subskill scores of the HSRT. The results indicated the HSRT overall score is statistically significant but with a small effect size explaining the relationship within only a small percentage of the target population. The admission GPA was also found to be significant in this relationship. Student demographics, admission GPA and the individual subskills identified in the HSRT exam were not found to be statistically significant.

To further explore the relationship of critical-thinking ability as an admission criterion to an associate degree respiratory care program, faculty interviews were conducted to add to the context of the research question and results. From faculty perspective, critical-thinking ability is important to the profession and practice of respiratory care. Findings suggested that faculty viewed critical-thinking ability as an important component of the admission process but not as an absolute in the selection of students admitted to the program. Critical thinking ability helps
to view the potential of students’ to enhance additional critical thinking skills as respiratory care knowledge is gained. The individual subskills of the HSRT scores identified as pertinent in the admission process are, specifically, deduction and inference. The HSRT overall score was a significant finding with a weak effect size, but the finding should still be considered in the selection process.

The most important conclusion was that the individual subskills of the HSRT were less meaningful among the variables in the prediction of successful completion of a respiratory care program. From a program perspective, the HSRT overall score was a predictor of success and thus is useful as a component in assessing whether potential students should be admitted to a program. The finding that admission GPA is a significant predictor of student success aids in the selection process. If a student cannot perform in academic courses prior to admission, student performance throughout enrollment could be problematic as well.

The results of this study should encourage practitioners to view not only just an admission score but the whole profile of student applicants. This will aid in selection of higher quality students into a program of study, thus developing students to graduate and perform as high functioning respiratory care practitioners. Respiratory care practitioners who have high critical-thinking ability are more likely to perform decision-making processes in an effective, safe, and ethical manner, therefore influencing the profession as a whole to raise the level of care given to the patient population.
References


Cahn, P. S. (2015, Spring). Do health professions graduate programs increase diversity by not requiring the Graduate Record Examination for admission? *Journal of Allied Health, 44*(1), 51-56.


Salvatori, P. (2001). Reliability and validity of admissions tools used to select students for the health professions. *Advances in Health Sciences Education, 6*(2), 159-175.


Appendix A: Participant Recruitment Letter/Email

Dear Participant,

I am inviting you to participate in a research project exploring respiratory care faculty perceptions of critical thinking in respiratory care education. I am a doctoral student with the Department of Education in the College of Professional Studies through Northeastern University. I am conducting this research as partial fulfillment of my Ed.D degree with a concentration in higher education administration.

This study is exploring perceptions regarding the assessment of critical thinking as admission criteria into a respiratory care program. This study will provide respiratory care educational leaders with valuable information to help them in identifying ideal admission criteria to respective programs.

We are using faculty interviews to assist us in identifying your perceptions regarding the characteristics of critical thinking of applicants and students to your program. Your participation in this study is completely voluntary and confidential. Your participation is entirely voluntary.

Your contribution to this study would be greatly appreciated. If you would like to volunteer for this study or learn more, I would be happy to discuss any aspect of this study. I may be reached via email campbell.f@husky.neu.edu or via phone (713) 530-2580.

Sincerely,

Fiona B. Campbell MS, RRT-NPS
Doctoral Candidate, Department of Education
College of Professional Studies
Northeastern University
campbell.f@husky.neu.edu
(713)530-2580
**Appendix B: Signed Informed Consent Document**

<table>
<thead>
<tr>
<th>Northeastern University, College of Professional Studies</th>
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<tbody>
<tr>
<td><strong>Names of Investigators:</strong> Principal Investigator, Dr. Michael J. Dean; Student researcher, Fiona B. Campbell</td>
</tr>
<tr>
<td><strong>Title of Project:</strong> Assessment of Critical Thinking as a Predictor of Success in Completion of an Associate Degree, Respiratory Care Program</td>
</tr>
</tbody>
</table>

**Informed Consent to Participate in Research Study**

We are inviting you to take part in a research study. This form will tell you about the study, but the researcher will explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the researcher if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

**Why am I being asked to take part in this research study?**

You have been asked to participate because you have an active role in the selection process of potential students to your respiratory care program.

**Why is this research study being done?**

The purpose of this interview is to explore the perceptions from Respiratory Care faculty of the utilization of critical thinking assessment as a component of admission criteria for applicants to a respiratory care program in relation to the findings of the primary quantitative study.

**What will I be asked to do?**

The researcher will ask you to participate in an interview that will be audio recorded. Your participation is voluntary and you can opt out at any time.

**Where will this take place and how much time will it take?**

The interview will last 30 to 45 minutes. Interviews will be conducted at the time and place that is convenient for you.

**Will there be any risk or discomfort to me?**

There are no significant risks involved in being a participant of this study.

**Will I benefit by participating in this research?**

There are no direct benefits to you. However, potential benefits include the opportunity to reflect on the role that critical thinking can play within the admission process to your respective program.

**Who will see the information about me?**

Your participation in this study will be confidential. Only the researchers on this study will see the information about you. No reports or publications will use information that can identify you in any way as being of this project.
Your name will be given an alias if direct quotes are utilized. All data will be stored on a secured, password protected USB device and will be in possession of the student investigator at all times; if not on the person, the USB device will be secured in a locked drawer. Upon completion of the study, all data will be permanently deleted after three years after study completion.

<table>
<thead>
<tr>
<th>If I do not want to take part in the study, what choices do I have?</th>
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<tr>
<td>You are not required to take part in this study. If you do not want to participate, you do not have to sign this form.</td>
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<tr>
<th>What will happen if I suffer any harm from this research?</th>
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<tr>
<td>There are no significant risks involved in being a participant in this study.</td>
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<tr>
<th>Can I stop my participation in this study?</th>
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<tbody>
<tr>
<td>Participation is voluntary, and participation or lack of participation will not in any way affect other working relationships (i.e.- work, school, etc.). You may discontinue your participation in this research program at any time without penalty or costs of any nature.</td>
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<tr>
<th>Who can I contact if I have questions or problems?</th>
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<tbody>
<tr>
<td>If you have any questions about this study, please feel free to contact Fiona B. Campbell, the person primarily responsible for the research at (713) 530-2580 (mobile) or email: <a href="mailto:campbell.f@husky.neu.edu">campbell.f@husky.neu.edu</a>. You can also contact Dr. Michael J. Dean, the principal investigator at (646) 404-2433 (mobile) or email: <a href="mailto:m.dean@northeastern.edu">m.dean@northeastern.edu</a>.</td>
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<tr>
<th>Who can I contact about my rights as a participant?</th>
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<tr>
<td>If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, Mail Stop: 560-177, 360 Huntington Avenue, Northeastern University, Boston, MA 02155. Tel: (617) 373-4588, Email: <a href="mailto:n.regina@neu.edu">n.regina@neu.edu</a>. You may call anonymously if you wish.</td>
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<th>Will I be paid for my participation?</th>
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<td>There is no compensation for participation in this study.</td>
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<tr>
<th>Will it cost me anything to participate?</th>
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<tbody>
<tr>
<td>There is no cost to participate in this study.</td>
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</table>

I have read, understood, and had the opportunity to ask questions regarding this consent form. I fully understand the nature and character of my involvement in this research project as a participant, and the potential risks. I agree to participate in this study on a voluntary basis.

______________________________________  _______________________
Research Participant Signature               Date

______________________________________
Research Participant Printed Name

______________________________________  _______________________
Fiona B. Campbell (Student Investigator)               Date
Appendix C: Interview Protocol Form

Interview Protocol

Interviewee (Title and Name): Respiratory Care Program Faculty Member

Interviewer: Fiona B. Campbell

Date:

Interview Location:

Introduction:

Part I: Introductory Question objectives: Build rapport, describe the study, answer questions, review and sign IRB protocol and form for audio recording.

You have been selected to speak with me today because you have been identified as someone who has a great deal to share about the admissions processes and critical thinking within your program. This research project focuses on the assessment of critical thinking as an admission criterion serving as a predictor of success in completion of an associate degree respiratory care program. Through this study, we hope to gain more insight into how critical thinking plays a role in the admission of associate degree level applicants. We hope this will allow us to identify specific critical thinking skills that can serve as a component of admissions to associate degree respiratory care programs that can be recommended for replication at other schools and institutions.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio record our conversation today. I will also be taking written notes during the interview. I can assure you that all responses will be confidential and only a pseudonym will be used if quoting from the transcripts. The tapes will be transcribed by a transcriptionist, but the pseudonym will be used to label the audio files. I will be the only one privy to transcripts and information, and the files will be destroyed after they are transcribed.

To meet our human subjects’ requirements at the university, you must sign the form I have with me (provide the form). Essentially, this document states that (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm (allow time to review form). Do you have any questions about the interview process or this form? I would also like to audio record this interview and have a consent form related to this as well (provide form).

We have planned this interview to last approximately 30 to 45 minutes. During this time, I have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning. Do you have any questions at this time?
Introduction to Interview:

A. Interviewee Background: My name is Fiona Campbell and I am a doctoral student at Northeastern University. I am currently working on my dissertation. I am also the interim Program Director for the Respiratory Care Program located at Lone Star College – Kingwood Campus. Prior to my time at LSC-Kingwood I was a full-time Respiratory Care Practitioner at Texas Children’s Hospital and adjunct faculty for Houston Community College.

B. The purpose of this interview is to explore the perceptions of Respiratory Care faculty in the utilization of critical thinking assessment as an admission criteria for applicants to a respiratory care program in relation to the findings of the primary quantitative study. For this study, critical thinking is defined in the measurement of identified subskills

- **Induction**: Skills used when drawing conclusions on what could be true based on previous experience, analogies, patterns found in similar or past events, or intrinsic behaviors.
- **Deduction**: Thinking skills that allow for decision-making within the context of rules, conditions, beliefs, values, procedures and principles to determine an outcome.
- **Analysis**: the ability to identify reasons or assumptions and determine the interaction within a problem.
- **Inference**: the ability to draw a conclusion from evidence or reasons.
- **Evaluation**: having skills that can assess the credibility of information presented, and the strengths or weaknesses of a presented problem

Interview:

1. Do you feel it is important to utilize critical thinking as an admission criteria to your specific program? Why/Why not?
2. Please identify the subskill(s) of critical thinking (analysis, inference, evaluation and deduction) from most to least useful as admission criteria with respect to predicting program completion. Please explain your reasons in which you ranked the subskills of critical thinking.
3. Based on the finding of the quantitative study, the HSRT overall score, and admission GPA were identified to have significant relationships to completion of the program.
4. Based on your experience, in general, do you find students prepared to think critically upon entrance your respiratory care program?
5. For each identified subskill of critical thinking, indicate to what extent students upon admission, are prepared?

Interview Closing

This concludes our interview. I want to thank you for your insight to critical thinking as an admission criteria and participation in this study. Should you have any other questions regarding this research project please feel free to contact me at any time.