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An Interpretive Phenomenological Study of Adult Students' Subjective Theories of Critical Thinking in Anatomy and Physiology

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Walden University

College of Education

This is to certify that the doctoral study by

Elizabeth Dubofsky-Porter

has been found to be complete and satisfactory in all respects,
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the review committee have been made.

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Walden University
2020

Abstract

An Interpretive Phenomenological Study of Adult Students' Subjective Theories of Critical Thinking in Anatomy and Physiology

by

Elizabeth Dubofsky-Porter

MS, University of New Hampshire, 2012

BA, Boston University, 2007

Project Study Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

May 2020

Abstract

Critical thinking is a vital skill for the success of recent graduates, both to increase academic success and improve employability after graduation, especially in health science fields. However, many adult students fail to engage in critical thinking, especially in core courses such as anatomy and physiology (A&P). The purpose of this interpretive phenomenological qualitative study was to better understand adult students' subjective theories regarding critical thinking and how adult students perceive the use of and any barriers or challenges to critical thinking in A&P while enrolled at Technical University. The theoretical framework that grounded this study was the Paul-Elder theory of critical thinking. Three research questions guided this study involving adult students' subjective theories regarding critical thinking along with their perceptions of any barriers or challenges to critical thinking in A&P. Data from one-on-one semistructured interviews with 12 adult health science students who recently completed their first term of A&P were analyzed to identify common codes, categories, and themes. Results showed that the majority of adult students' subjective theories regarding critical thinking aligned with the Paul-Elder definition of critical thinking, but their examples of critical thinking were actually examples of cognitive elaboration. Barriers included lack of time management, lack of note-taking skills, and didactic course structure inhibiting critical thinking in A&P. A faculty development workshop was designed to increase faculty's understanding of students' subjective theories regarding and barriers to critical thinking along with methods to mitigate barriers and develop course materials to encourage critical thinking in courses. An increase in critical thinking may improve student retention and clinical performance, contributing to better patient care and level of employability.

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January 2020

Dedication

I would like to dedicate my capstone to my family. Craig, you are an amazing husband who has supported and pushed me to succeed throughout many challenges. Violet, I love you so much and you make me work to be a better person each day. Thank you for showing me the wonder each day brings.

Acknowledgments

I wish to thank all those who helped me succeed through this process. First to my family, especially my husband, who pushed me to succeed and not give up during the process. You are my best cheerleader. Without your patience throughout this process and working with me to figure out how to keep my other commitments, this never would have been finished. Thank you to my daughter who learned how to sleep through the night so I could finish my doctorate. Also, to my parents and my in-laws, without whose support I wouldn't have found the time and energy to finish writing. Your unwavering belief motivated me to keep going through the hard days.

To my colleagues at work and school, thank you for providing me with the companionship and encouragement to continue writing. A special thanks to Deb Lundin and Rebbecca Silva for helping me work through hard times and hard sentences.

Finally, I wish to thank my committee, Dr. Joanna Karet and Dr. Janice Long, for their continued support and invaluable advice throughout this process. Without your support and advice, my doctoral research would not be the research it is today. Thank you for pushing me to think in new ways and approach the study with clear eyes.

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Section 1: The Problem

The Local Problem

Critical thinking is a vital skill for the success of health science students, both during their schooling and after graduation during their careers (Swart, 2017). Despite the importance of this skill, many students fail to recognize the importance of engaging in critical thinking (Azizi-Fini, Hajibagheri, & Adib-Hajbaghery, 2015). The development of critical thinking skills (CTS) requires time and practice (Azizi-Fini et al., 2015; Huber & Kuncel, 2016). Incorporation of CTS into entry-level courses such as anatomy and physiology (A&P) increases the success of students in school and the field (Azizi-Fini et al., 2015; Bryant, Goud, Srinivasan, & Vijayalakshmi, 2016; Jeffreys, 2007; Sturges & Maurer, 2013). Given the impact CTS have on success, students should engage in critical thinking early and often, especially in introductory courses. However, this is not the case for adult students enrolled in A&P at Technical University, a pseudonym for an accelerated 2-year technical institution in the northeastern United States.

This study addressed the problem of lack of engagement in critical thinking for adult students enrolled in A&P at Technical University. Several professors in the Biological Science Department (BSD) responsible for teaching this course have noted a lack of engagement in critical thinking (Assistant Professor in BSD, personal communication, April 30, 2018; BSD Chair, personal communication, April 1, 2018). In addition, an assistant provost at Technical University noted a lack of health science student engagement in terms of critical thinking (personal communication, March 9, 2018). The nursing department chair at Technical University also expressed concerns

about the lack of critical thinking shown by nursing students, as the Accreditation Commission for Education in Nursing requires nursing students to be taught CTS (personal communication, March 15, 2018). Nursing students at Technical University are given an introduction to critical thinking in their first term nursing courses but fail to use critical thinking throughout their program at Technical University (Nursing Department Chair, personal communication, March 15, 2018). Further, one of the objectives of Technical University is to "help students to develop skills in problem solving and in thinking logically, flexibly, and critically" (Technical University, 2017, para. 3), indicating that the institution views acquisition of CTS by adult students is a key aspect to prepare students for their future careers and should be used during their time at Technical University.

In addition to faculty and administrators at Technical University, local employers have noted a lack of CTS as a problem. In a focus group of six local employers, five indicated that critical thinking is one of the most lacking skills in new graduates (Governor's Workforce Board Healthcare Industry Partners, 2014). In a survey of local employers, 89% identified critical thinking as not only the top skill desired in new employees but also the most deficient quality in job applicants (McCaffery, 2016). Nationally, the Association for Talent Development surveyed employers, 58% of whom identified a lack of CTS as a contributing factor to the skills gap (Fyfe-Mills, 2015).

To address this gap in CTS, A&P courses are undergoing redevelopment to incorporate critical thinking (Bryant et al., 2016; Entezari & Javdan, 2016; Johnston et al., 2015). Students exhibit the ability to think critically when they identify issues and

assumptions, recognize relationships, evaluate information, and draw conclusions to answer questions or direct actions (Hersulastuti, 2017; Paul & Elder 1999, 2008). However, students often struggle to apply A&P content to clinical experiences, failing to perceive the relationship between A&P and patient care (Entezari & Javdan, 2016). This lack of critical thinking is often due to students' reliance on memorization rather than understanding and application of A&P to clinical situations and their future careers (Brown, Bowmar, White, & Power, 2017; Bryant et al., 2016; Paterson, 2017). Understanding how adult students define, identify, and perceive barriers or challenges to critical thinking may enable faculty at Technical University to increase CTS in A&P.

Rationale

The problem addressed in this study is that despite the importance of critical thinking, many adult students fail to engage in critical thinking in A&P at Technical University (Assistant Provost, personal communication, March 9, 2018). The institution under study enrolls approximately 150 adult students in A&P taught in the BSD. One BSD faculty member stated that 78% of adult students answered assessment questions requiring critical thinking incorrectly on a recent A&P exam (Assistant Professor in BSD, personal communication, April 30, 2018). Further, when students in A&P discuss questions requiring critical thinking with faculty, they often argue that they were not taught the answer, failing to make the connections between the course content and its applicability in real world situations (BSD Chair, personal communication, April 1, 2018).

If faculty understand adult students' subjective theories regarding critical thinking, along with how they perceive engagement in and barriers or challenges to critical thinking, it may enable them to better facilitate student acquisition of CTS. Without this knowledge, the ability of faculty to increase the use of critical thinking in students presents multiple challenges. One challenge involves differing definitions students and faculty may hold regarding what constitutes critical thinking and how to engage in critical thinking (Azizi-Fini et al., 2015; Swart, 2017). In addition, without knowledge regarding barriers or challenges students face when using CTS, faculty are limited in their ability to mitigate these barriers or challenges (Pfahl, McClenney, O'Banion, Sullivan, & Wilson, 2010; Swart, 2017).

The purpose of this study was to better understand adult students' subjective theories regarding critical thinking in A&P, how they identify their use of critical thinking in A&P, and what barriers or challenges they perceive when asked to engage in critical thinking in A&P. Semistructured one-on-one interviews were used to understand perceptions of students. A better understanding of students' perceptions may benefit future curriculum and course development aimed at increasing the use of critical thinking.

Definitions of Terms

Active learning: A method of learning in which the faculty acts as a facilitator of learning experiences, providing opportunities to explicitly engage with course content to understand its relevance while also providing targeted feedback (Goodman, Barker, & Cooke, 2018).

Adult student: An individual enrolled in school at a nontraditional age or who is engaged in social, psychological, and/or economic roles expected of adults (Hansman & Mott, 2010).

Cognitive elaboration: Forming connections between prior knowledge and new material to integrate the two sets of information and organize knowledge into a coherent structure (Kalyuga, 2009). Cognitive elaboration is a different skill from critical thinking; however, it is required in order to build CTS (Kalyuga, 2009).

Critical thinking: The ability to actively select, conceptualize, evaluate, apply, analyze, synthesize, or infer using information previously obtained through observation, experience, reflection, reasoning, or communication as a guide to answer questions and direct actions (Hersulastuti, 2017; Paul & Elder, 1999, 2008).

Gatekeeper course: A course that determines a student's ability to proceed through a selected program of study; without successful completion of this course, a student cannot move onto the next required course for the chosen major (Entezari & Javdan, 2016; Hull, Wilson, Hopp, Schaefer, & Jackson, 2016; Sturges & Maurer, 2013).

Problem-solving: The ability to use knowledge to answer a question or find the solution to a complex issue. Problem-solving is a different skill than critical thinking; however, it builds on and requires CTS (Paul & Elder, 1999).

Skills gap: Differences in the level of preparation of students upon graduation and the level of preparation needed to obtain or retain a position in the workforce (Hart Research Associates, 2016).

Significance of the Study

This study addressed a local problem by focusing on adult students' subjective theories regarding critical thinking in A&P, how they identify their use of critical thinking in A&P, and what barriers or challenges they perceive when asked to engage in critical thinking in A&P. To date, no studies have been conducted at Technical University regarding student perceptions or subjective theories regarding critical thinking (Assistant Provost of Health Science Programs, personal communication, March 9, 2018). In addition, this project provides a unique perspective because published studies on the incorporation of critical thinking in A&P begin by teaching the students about critical thinking and its importance (Cone et al., 2016; Swart, 2017). Swart (2017) indicated faculty would be better able to provide effective instruction if provided with additional insights regarding the student perspective on engagement in critical thinking during A&P. The results of this study should provide these much-needed insights. Understanding adult students' subjective theories regarding critical thinking in A&P, including their identification of the use of critical thinking in A&P and what barriers or challenges are perceived when asked to engage in critical thinking in A&P, may support curriculum and course development to increase the use of CTS. The results of this study and the curriculum or course development it triggers may foster positive social change by supporting student retention while also increasing clinical performance during school and after graduation, contributing to better patient care (Brown et al., 2017; Bryant et al., 2016; Entezari & Javdan, 2016; Paterson, 2017; Swart, 2017). In addition, local employers cite a lack of CTS as one of the main reasons for their inability to fill open

positions (McCaffery, 2016). This study may foster social change through increasing the incorporation of critical thinking as perceived by adult students into A&P through curriculum and course development, improving graduate success in positions requiring critical thinking.

Research Questions

Employers have indicated that one of the most sought-after yet often deficient skills in new graduates and employees is the ability to think critically (Hart Research Associates, 2016; McCaffery, 2016; Robles, 2012; Wagner, 2015). To address this skills gap, the curriculum and courses must incorporate critical thinking. However, to effectively increase the acquisition of CTS, faculty must be aware of adult students' subjective theories regarding critical thinking as they relate to their coursework. This qualitative study explored the problem of adult students' failure to engage in critical thinking while enrolled at Technical University using the following research questions:

RQ1: What are adult students' subjective theories regarding critical thinking in A&P?

RQ2: How and in what ways do adult students identify the use of their subjective theories of critical thinking in A&P?

RQ3: What barriers or challenges do adult students perceive when asked to engage in subjective theories of critical thinking in A&P?

Review of the Literature

Theoretical Framework

The theoretical framework that grounded this study is the Paul-Elder theory of critical thinking. Paul and Elder (1999, 2008) defined critical thinking as the ability to

actively select, conceptualize, evaluate, apply, analyze, synthesize, or infer using information previously obtained through observation, experience, reflection, reasoning, or communication as a guide to answer questions and direct actions. The Paul-Elder model of critical thinking divides critical thinking into three stages that must be mastered to be considered a critical thinker: elements of reasoning, intellectual standards, and intellectual traits (Paul & Elder, 1999, 2008; Sullivan, 2012).

The elements of reasoning provide a general method to allow logical reasoning and include determining the purpose, question, and point of view; gathering information, concepts, and assumptions; interpreting and inferring data; and determining implications and consequences (Paul & Elder, 1999, 2008). The elements of reasoning must be mastered for each content subject, as a basic knowledge of the subject is required to allow the gathering of information, concepts, and assumptions (Paul & Elder, 1999). During this stage of critical thinking, students perform cognitive elaboration, integrating prior knowledge with new content (Kalyuga, 2009). Without forming these connections, content mastery would be limited and students would be unable to master levels of reasoning. Because critical thinking depends on content knowledge, a student must be introduced to and practice critical thinking for all subjects (Paul & Elder, 1999, 2008; Sullivan, 2012).

As a student masters the elements of reasoning, he or she can move to the next stage of critical thinking, developing intellectual standards (Paul & Elder, 2008). Intellectual standards are the components of reasoning which a person uses to evaluates the quality and completeness of reasoning (Paul & Elder, 2008; Sullivan, 2012).

Intellectual standards include clarity, accuracy, precision, relevance, depth, breadth, logic, and fairness of thought (Paul & Elder, 1999, 2008; Sullivan, 2012). As with the elements of reasoning, intellectual standards must be mastered for each content area (Paul & Elder, 1999, 2008; Sullivan, 2012). Without mastery of intellectual standards in a specific subject, a student will be unable to determine whether he or she has met the intellectual standards and move to the third step in the development of CTS (Paul & Elder, 1999, 2008; Sullivan, 2012).

The third step in developing CTS is the acquisition of intellectual traits. Intellectual traits determine the level of insight and integrity with which a person thinks and include intellectual courage, intellectual empathy, intellectual autonomy, intellectual integrity, intellectual humility, confidence in reasoning, perseverance, and fair-mindedness (Paul & Elder, 1999, 2008; Sullivan, 2012). As with the other levels of thinking, intellectual traits must be practiced in each content area because determining the ability to meet these standards, such as confidence in reasoning with two different topics requires practice in a specific field. Once an individual has mastered all three levels of thinking in a specific field, he or she is capable of critical thinking (Paul & Elder, 1999, 2008; Sullivan, 2012) and course content can be internalized and applied to current situations to answer questions and guide actions (Paul & Elder, 1999).

Relevance to the study. The problem addressed in this study is that adult students fail to engage in critical thinking in A&P. To study the lack of use of critical thinking and barriers or challenges to critical thinking, the study must be grounded in a theory which addresses and allows for the development of CTS, such as the Paul-Elder model of

critical thinking. The focus on the development of CTS in a specific subject, such as A&P, is supported by the Paul-Elder model of critical thinking, which requires practicing CTS in each subject (Paul & Elder, 1999, 2008; Sullivan, 2012).

Learning and critical thinking from individual experiences involves subjective, learner-centered study (Cadorin, Bagnasco, Rocco, & Sasso, 2014), leading to research questions which place the students' perceptions at the center of the research. The research questions were designed to elucidate perceived barriers or challenges that may limit the ability of adult students at Technical University to master critical thinking, guiding the choice of the Paul-Elder model of critical thinking. Both the research questions and the grounding theory guided the development of the interview protocol. The Paul-Elder theory of critical thinking led to interview questions focused on examples of and barriers to critical thinking. Interview questions were developed directly from the three stages of critical thinking in the Paul-Elder theory.

In addition, the Paul-Elder theory of critical thinking played a key role during data analysis. The definitions and examples of critical thinking given by adult students at Technical University were compared to concepts and standards of critical thinking given in the Paul-Elder model, helping to evaluate if students have a view of critical thinking as required for their future career. In addition, barriers and challenges expressed by students were compared to Paul-Elder requirements for critical thinking. Determining barriers and challenges presented by students allowed the project developed through the results of this study to appropriately address them.

Review of the Broader Problem

Overview of topics. To support the purpose of this qualitative study regarding students' subjective theories regarding critical thinking, I conducted an analysis of current peer-reviewed research. Related literature presents the problem in a broader context and examines how this study may lead to social change. There are seven main sections of this literature review. The first section focuses on the search strategy used to conduct the literature review. Each subsequent section focuses on an associated topic: adult students, the skills gap, critical thinking, critical thinking in higher education, anatomy and physiology, and critical thinking in anatomy and physiology.

Search strategy. The literature review was conducted using Education Source, ERIC, SAGE journals, and ScienceDirect databases as well as Google Scholar. In addition, the reference section of each article was reviewed for related studies. Three groups of search terms were used, grouped by topics critical thinking, anatomy and physiology, and adult students. The search terms related to critical thinking were *critical thinking* and *Paul-Elder model of critical thinking*. This set of search terms was used independently and in conjunction with the second and third sets of search terms, both independently and combined. The second set of search terms, relating to anatomy and physiology, were *anatomy and physiology*, *anatomy*, *physiology*, *health care*, *health sciences*, and *allied health*. This set of search terms was used individually and in conjunction with the third set of search terms. The search terms related to adult students were *post-secondary education*, *tertiary education*, *higher education*, *university*, *college*, *adult student*, and *nontraditional student.*

Adult students. Over the past 30 years, the number and proportion of adults participating in formal tertiary education has been steadily increasing and is expected to continue rising (Chen & Hossler, 2017; Hansman & Mott, 2010; Osam, Bergman, & Cumberland, 2017; Pfahl et al., 2010; Warden & Myers, 2017). The increase of adult students in higher education may be attributed to individuals working longer throughout their life while also working a variety of different jobs (Johnston et al., 2015; Rogers, 2018). In 2015, 36% of enrollments in higher education institutions were students of nontraditional age (25 years old or older; National Center for Education Statistics, 2018). However, if factors other than age are included in determining the proportion of adult students, 73% of students enrolled in higher education may be viewed as nontraditional students (Bohl, Haak, & Shrestha, 2017; Bryant, Rust, Fox-Horton, & Johnson, 2017; Chen & Hossler, 2017; Ross-Gordon, 2011). As adults return to school, the higher education student population has become more academically, ethnically, and age diverse (Bryant et al., 2017; Jeffreys, 2007; Johnston et al., 2015).

As the higher education student population diversifies, so do the characteristics of adult learners. The primary characteristic which defines an adult student is enrollment in higher education one or more year(s) after high school graduation, which means an older chronological age than what is typically expected upon enrollment (Bryant et al., 2017; Chen & Hossler, 2017; Hansman & Mott, 2010; Jeffreys, 2007; Osam et al., 2017; Rogers, 2018; Ross-Gordon, 2011). Age is not the sole characteristic of adult students; if a student attends school at a traditional age but fulfills other life roles while enrolled, he or she may be considered an adult student (Hansman & Mott, 2010; Rogers, 2018). Roles

which may define an adult student despite chronological age include acting as a caregiver, working full-time, being financially independent, or attending school part-time in order to continue working (Chen & Hossler, 2017; Hansman & Mott, 2010; Jeffreys, 2007; Osam et al., 2017; Rabourn, BrckaLorenz, & Shoup, 2018; Ross-Gordon, 2011; Warden & Myers, 2017). Another characteristic of nontraditional students is having a GED rather than a high school diploma (Chen & Hossler, 2017; Jeffreys, 2007; Rabourn et al., 2018; Ross-Gordon, 2011). Possessing any combination of these characteristics results in students taking on social, psychological, and economic roles typically expected of adults. As adult students engage in formal education, it creates a unique set of assets and challenges which must be understood and accommodated by faculty (Chen & Hossler, 2017; Rabourn et al., 2018).

One of the most common assets among nontraditional students is the amount of accumulated knowledge and experience they bring to their schooling (Bryant et al., 2017; Howard, Tang, & Austin, 2014; Rabourn et al., 2018; Ross-Gordon, 2011). Many adult students state that faculty and institutions should acknowledge and value their prior knowledge and experience, incorporating prior knowledge and experience into courses and programs (Bryant et al., 2017; Rabourn et al., 2018). This is a challenge faced by both faculty and institutions, as they may want to give adult students credit for prior learning and experiences, but they may not be relevant to the student's current field of study or may be challenging to assess (Bryant et al., 2017). When institutions grant credit for prior knowledge and experience through prior learning assessments, adult student graduation rates increase (Bryant et al., 2017; Finch, 2016; Ross-Gordon, 2011; Steele &

Erisman, 2016). Overall, 58% of adult students surveyed by the Council on Adult Experiential Learning who were offered a prior learning assessment graduated compared to 27% of adult students who were not offered a prior learning assessment (Ross-Gordon, 2011). The impact of prior learning assessments is higher in terms of graduation rates of adult minority students: 47% of adult Hispanic students and 40% of adult Black students who were offered a prior learning assessment graduated compared to 6% of adult Hispanic students and 17% of adult Black students who were not offered prior learning assessments graduated (Ross-Gordon, 2011). Providing clear policies regarding prior learning assessments including forms accepted in addition to processes and standards to earn prior learning assessments have been shown to improve adult student completion rates (Steele & Erisman, 2016).

Prior experiences of adult students have enabled these students to engage in critical thinking, but the critical thinking abilities of adult students vary greatly (Chan & Wang, 2018; Hyytinen, Toom, & Postareff, 2018; Peterson, 2015). Adult students' belief that they enter higher education with CTS is based on the ability of adult students to connect current learning experiences with preexisting real-life experiences (Bohl et al., 2017). However, forming connections between prior knowledge and new material to integrate is cognitive elaboration rather than critical thinking (Kalyuga, 2009; Zheng, Xu, Li, & Su, 2018). As cognitive elaboration is required in order to build CTS, adult students who enter with strong cognitive elaboration skills are better able to develop CTS (Hyytinen et al., 2018; Kalyuga, 2009; Zheng et al., 2018).

Another asset of many adult students is that they often return to school to achieve

a specific goal, resulting in higher intrinsic motivation and more self-directed learning (Hansman & Mott, 2010; Howard et al., 2014; Rabourn et al., 2018). Adult students attend school to do what is necessary to achieve a specific goal. Higher intrinsic motivation and self-directed learning along with a want-to-finish attitude results in learners more likely to use critical thinking and problem-solving skills along with increased academic achievement (Howard et al., 2014; Rabourn et al., 2018). At the same time, these characteristics of adult students contribute to their desire for immediate application of new knowledge to their goal. If the students fail to see the connection between the new knowledge and their goal, the content is often dismissed as extraneous (Hansman & Mott, 2010; Pfahl et al., 2010; Rabourn et al., 2018). This may lead to boredom during classes due to faculty reliance on passive learning and limited application (Entezari & Javdan, 2016; Singh, Mahajan, Gupta, & Singh, 2018). Adult students need courses which emphasize student engagement with content and interactions in the classroom, allowing them to become partners in the learning process (Bryant et al., 2017; Pfahl et al., 2010; Rabourn et al., 2018; Ross-Gordon, 2011). A technique which may be used to emphasize student engagement is learning course content in context with relevancy to future careers through assignments which require critical thinking (Bilton, 2018; Chan & Wang, 2018; Finch, 2016; Peterson, 2015).

The adult students' need for immediate application and active learning are not the only challenges which adult students face in the classroom. Nontraditional students have differing levels of preparation and familiarity with technology, often associated with an extended absence from the education system (Hansman & Mott, 2010; Johnston et al.,

2015; Pfahl et al., 2010; Rabourn et al., 2018; Rogers, 2018; Steele & Erisman, 2016). Reduced preparation levels and increased time spent out of school results in limited study skills, increased levels of concern regarding failure, and increased feelings of being overwhelmed (Johnston et al., 2015; Osam et al., 2017). Offering interventions such as faculty and peer-mentoring or workshops on technology, study skills, stress management, and test-taking may help students manage these challenges and improve success (Jeffreys, 2007; Osam et al., 2017; Rabourn et al., 2018). Additionally, offering adult students workshops with explicit instructions regarding CTS helps to develop their CTS and academic success (Edwards, 2017; Howard et al., 2014; Hyytinen, Holma, Toom, Shavelson, & Lindblom-Ylänne, 2014).

Another challenge faced by adult students is the allocation of time and resources (Chen & Hossler, 2017; Osam et al., 2017; Rabourn et al., 2018; Ross-Gordon, 2011; Warden & Myers, 2017). Often, nontraditional students underestimate the demands of returning to school, especially in health science programs, while overestimating their support system, resulting in too many demands on their time (Jeffreys, 2007; Yusufov, Nicoloro-SantaBarbara, Grey, Moyer, & Lobel, 2018). Students must balance these demands, with school work and studying often receiving the insufficient remainder of the time, leading to a reduction in school performance, measured by both GPA and degree completion rate (Chen & Hossler, 2017; Osam et al., 2017; Warden & Myers, 2017). The limited time that adult students are able to dedicate to studying negatively impacts their ability to learn using critical thinking. This stems from the fact that learning via critical thinking requires additional time and effort as opposed to memorization (Cadorin et al.,

2014; Swart, 2017). One cause of limited time occurs when adult students return to school part-time while working full-time, creating a conflict between work and school schedules. Students must then choose between attending classes and working (Entezari & Javdan, 2016; Jeffreys, 2007; Jones, Park, & Lefevor, 2018; O'Donnell & Blankenship, 2018). In addition to reduced attendance negatively impacting success, working while pursuing an undergraduate education is negatively correlated with persistence and graduation (Entezari & Javdan, 2016; Hull et al., 2016; Jones et al., 2018; McKinney, Novak, Hagedorn, & Luna-Torres, 2018). However, many adult students do not have the option to stop working to attend school; they must still meet their other financial obligations. Costs of continuing education, along with other financial responsibilities of adults often create financial difficulties which increase adult student attrition (Destin & Svoboda, 2018; Entezari & Javdan, 2016; Hansman & Mott, 2010; Herzog, 2018; Jones et al., 2018).

To accommodate challenges associated with time allocation, institutions may offer distance learning courses or programs (Osam et al., 2017; Rabourn et al., 2018; Ross-Gordon, 2011). Distance learning courses provide students the flexibility to choose when to complete schoolwork, reducing conflicts with work schedules (Rabourn et al., 2018). However, distance learning courses may not be appropriate for all courses or programs. Instead, intuitions may offer workshops that provide students with resources to help with time and financial management (Chen & Hossler, 2017; Jeffreys, 2007; Jones et al., 2018). Challenges faced by adult students result in a higher proportion of nontraditional students suffering from study delays or attrition than traditional students

(Bossema, Meijs, & Peters, 2017; Denning, Brannan, Murphy, Losco, & Payne, 2018; Jeffreys, 2007; Markle, 2015; Steele & Erisman, 2016). Faculty must be aware of these challenges and work to mitigate their impact on adult students.

Skills gap. One of the primary objectives of adult students returning to higher education is to graduate with the skills required to obtain and retain employment (Bellaera, Debney, & Baker, 2016; Edwards, 2017; Hansman & Mott, 2010; Johnston et al., 2015; Osam et al., 2017; Pfahl et al., 2010; Rogers, 2018). However, the skills that students believe they need and acquire from higher education are often different from abilities that future employers see in recent graduates, resulting in a skills gap (Hart Research Associates, 2016; Hartley, Routon, & Torres, 2018). Technical skills that students gain through higher education are enough to warrant an interview or employment but the majority of success in interviews and employment is dependent on an individual's soft skills (Adhvaryu, Kala, & Nyshadham, 2018; Hart Research Associates, 2016; McCaffery, 2016; Pang, Wong, Leung, & Coombes, 2018; Paterson, 2017; Robles, 2012). While employers look for knowledge of theory, the focus is often on how graduates apply theories and think through problems (Paterson, 2017). Employers feel that graduates need to have both technical and soft skills, including problem-solving and CTS (Adhvaryu et al., 2018; Hart Research Associates, 2016; Pang et al., 2018; Wagner, 2015). While both faculty and students identified critical thinking as a crucial employability skill (Paterson, 2017), 86% of employers stated that recent college graduates are not prepared to apply knowledge and skills in real-world settings using critical thinking (Bellaera et al., 2016; Hart Research Associates, 2016; Hartley et al.,

2018; Pang et al., 2018; Wagner, 2015).

Locally, five of six employers interviewed identified CTS as lacking in potential employees (Governor's Workforce Board Healthcare Industry Partners, 2014). In a separate study, 89% of local employers indicated that problem-solving and CTS are the top skills needed, yet lacking, in potential employees (McCaffery, 2016). Overall, employers feel that improvements need to be made to higher education to ensure that graduates have the required skills (Bellaera et al., 2016; Governor's Workforce Board Healthcare Industry Partners, 2014; Hart Research Associates, 2016; Hartley et al., 2018; McCaffery, 2016; Pang et al., 2018).

Critical thinking. The skills gap due to a lack of critical thinking is not a new concept. Glaser (1941) found that "public education has not resulted, however, in the development of a sufficient proportion of citizens who can evaluate critically *what* they read" (p. 5). Critical thinking is viewed as a skill vital to not only personal and professional success but also to responsible citizenry in the US (Glaser, 1941; Goodwin, 2017; Grussendorf & Rogol, 2018). Despite agreement on the importance of critical thinking in daily life, there is disagreement on both the classification and definition of critical thinking. Critical thinking has been classified as a skill set, attitude, or process in addition to being classified as a combination of all three (Grussendorf & Rogol, 2018).

While there are innumerable definitions of critical thinking, the definitions often contain overlapping elements (Cargas, Williams, & Rosenberg, 2017). For example, Glaser (1941) defined critical thinking in three parts: an attitude which considers problems thoughtfully, a knowledge of methods of inquiry and reasoning, and the skill to

apply these methods while Hooks (2010) defined critical thinking as ascertaining the who, what, when, where, and how to determine what matters. Paul and Elder (1999, 2008) defined critical thinking as a three-stage skill set which results in the ability to actively select, conceptualize, evaluate, apply, analyze, synthesize, or infer using information previously obtained through observation, experience, reflection, reasoning, or communication as a guide to answer questions and direct actions. With all three definitions, there is an emphasis on the individual determining what previously acquired knowledge or additional information should be used to answer a question or direct an action.

As such, critical thinking and cognitive elaboration are inexorably linked. Cognitive elaboration is defined as forming connections between prior knowledge and new material to integrate the two sets of information and organize knowledge into a coherent structure (Kalyuga, 2009; Zheng et al., 2018). Without the ability to perform cognitive elaboration, students are limited in their ability to think critically (Roelle, Nowitzki, & Berthold, 2017). Cognitive elaboration helps an individual transfer knowledge to new contexts to guide their actions or answer questions (Siswati & Corebima, 2017). When engaging in critical thinking, students need to be able to monitor their thinking process and determine if progress is being made towards answering the question or directing an action (Harrison & Vallin, 2017; Magno, 2010). Without the ability to perform cognitive elaboration, students would be unable to perform the processes required of critical thinking (Harrison & Vallin, 2017; Roelle et al., 2017).

As individuals begin to encounter circumstances in which critical thinking is

required, they begin to develop subjective theories regarding the definition of critical thinking. Subjective theories, often referred to as commonsense, implicit, intuitive, lay, naïve, or folk theories, are theories an individual develops at an abstract, global level with little testing or specialized knowledge (Dale & Dale, 2018; Gelman & Noles, 2010; Moll, Pieschl, & Bromme, 2014). Construction of subjective theories begins in early childhood continues throughout life as additional knowledge is acquired and integrated with previous knowledge, causing revision and elaboration of the subjective theory (Busch, Watson-Jones, & Legare, 2018; Chalik & Rhodes, 2014; Gelman & Noles, 2010). The purpose of subjective theories is to help individuals identify relevant context in the current environment and the underlying causes to make predictions (Chalik & Rhodes, 2014; Dale & Dale, 2018). When individuals are asked to elaborate on concepts prior to any formal education in the topic, the resulting data are subjective theories regarding the concept (Mesci & Schwartz, 2016). When analyzing these data, the subjective theories should be compared to accepted scientific theories or definitions (Mesci & Schwartz, 2016; Moll et al., 2014). When studying a topic with a wide range of accepted definitions, such as critical thinking, this need is even more pervasive (Cargas et al., 2017).

Critical thinking in higher education. As the majority of employers not only identified CTS as one of the most necessary skills in new employees but also the most lacking (Hart Research Associates, 2016; Pang et al., 2018), it is vital for higher education to increase the incorporation of critical thinking into the curriculum. The majority of faculty concur, advocating that teaching CTS is one of the most important

concepts in and the primary objective of higher education (Azizi-Fini et al., 2015; Grussendorf & Rogol, 2018; Hersulastuti, 2017; Howard et al., 2014; Huber & Kuncel, 2016). The inclusion of critical thinking in higher education is associated with increased academic success and fewer negative real-world experiences after graduation (Grussendorf & Rogol, 2018; Howard et al., 2014).

While learning via critical thinking leads to increased performance academically and professionally, it is often limited in its explicit incorporation into higher education courses. Courses which emphasizes the teaching of CTS in addition to content application to situational problems have the largest impact on student learning (Cargas et al., 2017). Many students and faculty shy away from this method of content mastery because it requires additional time and effort by both students and faculty (Cadorin et al., 2014; Swart, 2017). However, this form of learning allows the students to integrate the knowledge not only with previous experience but also into their performance and practice in the field to direct actions and provide high-quality patient care (Cadorin et al., 2014; Eleazer & Kelso, 2018). Despite evidence that CTS are essential for all fields of study and professional success (Grussendorf & Rogol, 2018; Hersulastuti, 2017), the only accrediting body which requires the explicit inclusion of CTS in its criteria is the Accreditation Commission for Education in Nursing (Huber & Kuncel, 2016).

The lack of inclusion of CTS in accreditation requirements has led to a global absence of inclusion of critical thinking in courses (Azizi-Fini et al., 2015; Bellaera et al., 2016; Huber & Kuncel, 2016). Rather, accreditation bodies have focused on ensuring appropriate content is covered (Bellaera et al., 2016; Huber & Kuncel, 2016), creating an

over-reliance on lecture and multiple-choice questions while limiting opportunities for students to develop CTS (Azizi-Fini et al., 2015; Dehghanzadeh & Jafaraghaee; 2018). However, there is a trade-off between teaching CTS and covering content. Not all content can be taught through critical thinking; some factual information must be included to provide students with the technical skills required for employment (Huber & Kuncel, 2016; Robles, 2012). Despite the limited amount of time dedicated to the explicit development of CTS, some CTS are acquired by attending university (Huber & Kuncel, 2016). However, the gains in CTS acquired by attending university have decreased over time (Huber & Kuncel, 2016). Students entering university tend to exhibit reduced readiness, preparation, and willingness to develop CTS, causing increased struggles to apply course content in practice (Huber & Kuncel, 2016; Paterson, 2017). This decreased in preparation is often attributed to changes in the K-12 curriculum, primarily the implementation of the No Child Left Behind Act (NCLBA; Howard et al., 2014; Paterson, 2017). The NCLBA has resulted in K-12 students being taught to the test with a focus on the transfer of factual information (Howard et al., 2014; Paterson, 2017).

The best way to address the lack of inclusion of CTS in higher education is to incorporate critical thinking into all courses (Hersulastuti, 2017; Howard et al., 2014; McCaffery, 2016; Wagner, 2015). The explicit inclusion of CTS in all courses should emphasize the importance of CTS to students while allowing complete development of CTS. Ideally, the inclusion of CTS would begin in the K-12 curriculum, better preparing students for the expectations of critical thinking in higher education and the workplace (McCaffery, 2016). However, higher education institutions have a limited impact on the

K-12 curriculum (Flores, Park, & Baker, 2017; Perna & Armijo, 2014). Therefore, faculty must ensure that CTS are fully integrated into foundational courses to create a solid footing for future coursework (Cone et al., 2016; Howard et al., 2014; Robles, 2012; Swart, 2017). The incorporation of CTS into foundational courses should be explicit and students should be made aware that CTS are equally as important as the foundational knowledge (Cone et al., 2016; Robles, 2012; Swart, 2017). CTS may be incorporated through a reduction in passive learning or lecture with a corresponding increase in student-centered, active learning requiring students to solve problems or determine appropriate actions based on course content (Blissitt, 2016; Cone et al., 2016; Hersulastuti, 2017; Lumpkin et al., 2015). Some content from lectures may be retained, but the focus of higher education classes should move from assessments designed to test recall and memorization to one which incorporates higher levels of Bloom's taxonomy (Blissitt, 2016; Howard et al., 2014; Lumpkin et al., 2015). As adult students learn best using active learning and application-based courses, this would positively impact adult student success (Blissitt, 2016; Bryant et al., 2017; Hart Research Associates, 2016; Hersulastuti, 2017; Howard et al., 2014).

In addition to the inclusion of CTS in foundational courses, CTS must also be incorporated into major-specific courses. The integration of CTS into major-specific courses requires students to use a specific set of knowledge and skills associated with their future career (Hersulastuti, 2017; Huber & Kuncel, 2016). The CTS associated with a specific career require subject-specific knowledge and form with practice and experience (Huber & Kuncel, 2016; Hull et al., 2016; Paul & Elder, 1999, 2008). This

requires that all major-specific courses incorporate CTS to allow students sufficient time and opportunity to develop field-specific CTS (Howard et al., 2014; Huber & Kuncel, 2016; Hull et al., 2016; McCaffery, 2016; Paul & Elder, 1999, 2008; Swart, 2017; Wagner, 2015). The earlier CTS are incorporated into the curriculum and courses, the more developed the CTS become, increasing the impact CTS have on student success (Swart, 2017).

One field in which CTS must be integrated into all courses is health sciences. Health science majors require CTS not only for academic and professional success but also to ensure appropriate patient care (Azizi-Fini et al., 2015; Blissitt, 2016; Bossema et al., 2017; Cone et al., 2016; Swart, 2017). CTS allow health care providers to problem-solve and make decisions regarding the best way to approach patient care through the integration and development of knowledge (Azizi-Fini et al., 2015; Swart, 2017). Despite the importance CTS play in patient care, practicing health care providers and health science students have underdeveloped CTS (Azizi-Fini et al., 2015; Monagle, Lasater, Stoyles, & Dieckmann, 2018; Tretheway, Taylor, & O'Hara, 2017; Williams, Perlis, Gaughan, & Phadtare, 2018). Without CTS, many health science students revert to memorizing content, making content unavailable for application or patient care (Blissitt, 2016; Sturges & Maurer, 2013). Students need continued practice using CTS in health science courses to understand its importance in their future careers.

Anatomy and physiology. One course that all health science students are required to take is human A&P. Anatomy is the study of structure of the human body while physiology is the study of function of the human body. A&P is typically broken

into units based on the body system studied, e.g. the cardiovascular system or urinary system. A&P is often taught in a different department from major-specific courses, leading to students viewing A&P as a non-major course and failing to see its relevance (Entezari & Javdan, 2016). Despite this view, A&P provides the foundational knowledge for all health science majors (Brown et al., 2017; Entezari & Javdan, 2016; Hull et al., 2016). As a foundational course, A&P acts as a gatekeeper course. Without successful completion of A&P, a student cannot move onto the next required courses for his or her major (Brown et al., 2017; Bryant et al., 2016; Entezari & Javdan, 2016; Hull et al., 2016; Page, Meehan-Andrews, Weerakkody, Hughes, & Rathner, 2017; Sturges & Maurer, 2013). In addition to being a gatekeeper course, A&P is the most content-dense and conceptually challenging course a health science major will take (Entezari & Javdan, 2016; Johnston et al., 2015), resulting in the highest rates of failure and withdrawal of all courses taught at the undergraduate level at any given institution (Hull et al., 2016; McKinney et al., 2018). Many students do not expect such a challenging prerequisite course and underestimate the time commitment required to successfully complete the course (Eleazer & Kelso, 2018; Hull et al., 2016; Sturges & Maurer, 2013). A&P students not only have to master course content but also must also see the relevance of the material to their future career and begin to develop CTS using A&P content, a necessary skill as the students move in health care settings (Bryant et al., 2016; Entezari & Javdan, 2016; Johnston et al., 2015). When combined, the attributes of A&P result in a course that is positively correlated with degree completion and the passing of accreditation exams (Cone et al., 2016; Entezari & Javdan, 2016; Hull et al., 2016; Jeffreys, 2007).

Therefore, increasing student success in A&P will positively impact student performance through their schooling, accreditation, and career.

The most effective way to increase student success in A&P is to incorporate critical thinking into the course (Eleazer & Kelso, 2018; Page et al., 2017). Due to the content-dense nature of A&P, many students default to memorizing the content to pass course assessments (Page et al., 2017; Sturges & Maurer, 2013). While memorizing the material allows students to pass the course, it results in increased struggles in future courses and clinical experiences when students are unable to integrate A&P into the current context. This allows students to complete the first step in the Paul-Elder model of critical thinking and use content to answer questions or direct actions (Hull et al., 2016; Paul & Elder, 1999, 2008; Sturges & Maurer, 2013). The reliance on memorization is partially due to the increased number of students enrolled in and cost associated with A&P (Hull et al., 2016; Johnston et al., 2015; Lakshmipathy, 2015). As cohorts have increased in size, universities have defaulted to didactic lectures, based in theory rather than active learning (Brown et al., 2017; Hull et al., 2016; Johnston et al., 2015). Despite using didactic and theory-based teaching, faculty expect students to incorporate A&P content into their knowledge base and use it to perform critical thinking (Page et al., 2017). However, without practice and feedback regarding critical thinking with A&P content, students struggle to understand and incorporate fundamental concepts in A&P with prior knowledge and clinical experiences (Brown et al., 2017; Hull et al., 2016; Johnston et al., 2015; Page et al., 2017; Sturges & Maurer, 2013).

Students enrolled in A&P courses with an emphasis on active learning and critical thinking retain more content and generate a deeper understanding of the material, allowing students to meet faculty and employer expectations (Bryant et al., 2016; Hull et al., 2016; Page et al., 2017). Successful students in A&P build upon previous knowledge and integrate course content to solve problems or direct actions during clinical experiences (Page et al., 2017; Sturges & Maurer, 2013). Multiple studies regarding student perspective of the efficacy of A&P courses have shown that students perceive A&P is more accessible and important when its clinical application is emphasized (Johnston et al., 2015; Lakshmipathy, 2015; Page et al., 2017; Sturges & Maurer, 2013). Further, students express disappointment when A&P instructors fail to integrate practical applications, including the use of critical thinking, into the courses (Brown et al., 2017). If A&P courses emphasize the application of the content to clinical scenarios, the ability of students to critically think using A&P content is enhanced (Hull et al., 2016). As success in health care requires the ability to understand how diseases alter A&P and how treatment protocols return A&P to normal, critical thinking using A&P content is vital to the success of health care professionals (Brown et al., 2017).

Critical thinking in anatomy and physiology. In a content-dense course, such as A&P, one of the challenges is determining when and how much critical thinking to incorporate. In reality, critical thinking can, and should be, embedded into the study of each body system. Incorporation of critical thinking into A&P provides students opportunities to practice and develop the CTS required in clinical care settings (Fredricks & Wegner, 2003; Johnston et al., 2015). During A&P, students are introduced to and

expected to recognize normal structure and function of organs. However, during clinical experiences, students and practicing clinicians are expected to understand how disease, defects, or trauma change the structure and function, resulting in illness (AlMohanna et al., 2018; Miller, Perrotti, Silverthorn, Dalley, & Rarey, 2002). The ability to understand the influence of these changes is not gained by exposure to solely factual information regarding their structure and function but instead through the use of CTS during A&P class (Fredricks & Wegner, 2003; Hull et al., 2016; Johnston & McAllister, 2008; Johnston et al., 2015; Miller et al., 2002).

The first step of incorporating critical thinking into A&P is to help the students perform cognitive elaboration. This allows students to understand course material and integrate it with previous knowledge in a meaningful way to create deeper understanding of the content (Eleazer & Kelso, 2018; Hull et al., 2016). In addition, the performance of cognitive elaboration in A&P will support the retention of course content throughout the course and into clinical practice (Cone et al., 2016; Entezari & Javdan, 2016; Hull et al., 2016). Without the ability to understand the normal structure and function, one cannot determine how it has changed or the influence the change will have on the body system. Once students have integrated content into their knowledge base, the students can then apply A&P content to determine how abnormal structure and function influence the body.

There are a variety of ways in which critical thinking can be incorporated into A&P courses. Methods that have been shown to incorporate critical thinking into A&P courses include the use of case studies; process oriented, guided inquiry learning; concept or affinity mapping; comparisons between dissected non-human organs with human

organ models; and discussions, quiz, or exam questions which emphasize clinical application over naming or memorized content (Brown, 2010; Eleazer & Kelso, 2018; Gannon & Abdullahi, 2013; Johnston & McAllister, 2008; Miller et al., 2002; Scurlock-Evans, Upton, Rouse, & Upton, 2017; Singh et al., 2018). Regardless of the method used to incorporate critical thinking into A&P, the best use of critical thinking in A&P is to allow students to explore difficult concepts and clarify misconceptions (Eleazer & Kelso, 2018; Entezari & Javdan, 2016; Johnston et al., 2015). The use of critical thinking to help students master difficult concepts allows students to better understand the material while enabling instructors to identify to identify topics on which students need further instruction or clarification (Eleazer & Kelso, 2018; Johnston & McAllister, 2008).

The most prevalent method to incorporate critical thinking and address difficult concepts in A&P is through the use of case studies (Eleazer & Kelso, 2018; Johnston & McAllister, 2008; Scurlock-Evans et al., 2017). Case studies take real life examples of dysfunction in the human body and ask students to answer questions and determine actions based on both provided information and previous knowledge (Eleazer & Kelso, 2018; Scurlock-Evans et al., 2017). Case studies not only provide an opportunity for students to engage in critical thinking but also allow for contextualization of the content and demonstration of its relevance to future careers (Entezari & Javdan, 2016; Fredricks & Wegner, 2003; Johnston & McAllister, 2008; Scurlock-Evans et al., 2017). Use of case studies helps to clarify why specific procedures and treatments are performed in clinical settings (Hull et al., 2016). Case studies may be written in various manners, requiring

students to draw upon current course content, prior course content, or previous courses in order to fully answer the questions or determine actions to be taken.

Process-oriented guided inquiry learning is another common method used to incorporate critical thinking and address difficult concepts in A&P. In this three-step learning process, students explore a model (such as a graph, illustration, or text) using pre-written questions (Brown, 2010; Walker & Warfa, 2017). From these questions, students develop an understanding of the concept underlying the model and apply the concept to answer questions or solve additional problems (Brown, 2010; Walker & Warfa, 2017). Use of process oriented guided inquiry learning requires students to think critically as students select, conceptualize, evaluate, apply, analyze, synthesize, and infer using information obtained through the activity to answer questions and direct actions (Hersulastuti, 2017; Paul & Elder, 1999, 2008; Vanags, Pammer, & Brinker, 2013; Vishnumolakala et al., 2018; Walker & Warfa, 2017). This process requires students to progress beyond cognitive elaboration as simply understanding and connecting the information will not allow students to complete the assignment (Walker & Warfa, 2017). Not only does process oriented guided inquiry learning improve students' CTS, its use also results in an improvement in both exam and overall scores in A&P along with long-term retention of the content and higher passing rates on accreditation examinations (Brown, 2010; Gannon & Abdullahi, 2013; Roller, & Zori, 2017; Vanags et al., 2013; Vishnumolakala et al., 2018; Zori, Roller, & Lyons, 2018). Further, this method of learning better prepares students for subsequent medical courses which build upon foundational courses through the development of CTS (Vishnumolakala et al., 2018).

Despite the numerous ways to incorporate critical thinking into A&P, many instructors and students shy away from its use as inclusion of critical thinking requires additional time and effort (Cadorin et al., 2014; Farkas, Mazurek, & Marone, 2016; Swart, 2017). However, critical thinking plays a significant role in the relevance of A&P to students' future careers. Students lacking the ability to use A&P content when thinking critically in health care settings will have limited abilities to determine the appropriate course of action to take when treating patients (AlMohanna et al., 2018; Fredricks & Wegner, 2003; Johnston et al., 2015; Miller et al., 2002). It takes students time and experience to develop CTS using A&P content, making its incorporation into foundational A&P vital.

Implications

The results of this study provide insight on adult health science students' subjective theories regarding critical thinking, how they identified their use of critical thinking, and what barriers or challenges they perceived when asked to engage in critical thinking in A&P while enrolled at Technical University. Understanding the perspective of adult students at Technical University during their postsecondary education will better enable the higher education faculty to meet adult student needs, allowing these students to better attain their goals of economic prosperity and social equity. Based on the results of this study, a faculty development workshop focused on understanding the students' subjective theories regarding critical thinking was developed. This faculty development workshop may be used to improve both curriculum and course development by enabling instructors and students to have clear guidelines as to what constitutes critical thinking

and its incorporation into A&P. In addition, the faculty development workshop may allow both instructors and instructional designers to mitigate barriers and challenges students perceive as impeding critical thinking. After implementation of the faculty development workshop and incorporation of its tenets into curriculum and courses, students may show improved CTS and clinical performance.

Summary

A local problem is that many adult students at Technical University fail to engage in critical thinking in A&P. This problem persists despite the importance of CTS to providing high-quality patient care in future careers. In addition to being a local problem, recent studies have shown that the lack of CTS in the workforce is a national problem. Section 2 describes the research design and methodology that was used to collect data for this basic qualitative study as well as the data analysis results. Section 3 presents a literature review supporting the development of a faculty development workshop to address the results of this study as well as an overview of the workshop. Section 4 discusses the strengths of the project, alternative methods to resolve the problem, and future applicability of this study. In addition, Section 4 describes what was learned from this study on a personal level.

Section 2: The Methodology

Introduction

The purpose of this study was to better understand adult students' subjective theories regarding critical thinking in A&P, including how they identify the use of and barriers or challenges to subjective theories of critical thinking in A&P while enrolled at Technical University. Using an interpretive phenomenological qualitative methodology, semistructured one-on-one interviews were conducted to provide a robust understanding of adult health science students' subjective theories regarding critical thinking in A&P. Abductive thematic analysis with constant comparison was used to analyze the data.

Qualitative Research Design and Approach

I used an interpretive phenomenological qualitative methodology. Results from interviews provided an in-depth understanding of adult students' subjective theories regarding critical thinking along with perceived use and barriers or challenges to subjective theories of critical thinking in A&P before any formal training in critical thinking. Quantitative studies include the use of closed questions that do not provide the full perceptions of participants (Babbie, 2017). Qualitative research involves investigating participants' perceptions of a phenomenon, allowing more in-depth understanding of the phenomenon under investigation (Percy, Kostere, & Kostere, 2015; Ravitch & Carl, 2016). To investigate these perceptions, I conducted semistructured interviews with adult students, allowing them to elaborate on subjective theories and use of critical thinking along with any barriers or challenges they encountered. The semistructured qualitative approach allowed for probing or clarifying questions to ensure

the reseracher's full understanding of the phenomenon (Rubin & Rubin, 2012). One-on-one interviews focus on personal experiences and limit the influence of others in terms of responses given (Rubin & Rubin, 2012). In addition, participants may be more willing to disclose personal details in one-on-one interviews than surveys or focus groups (Rubin & Rubin, 2012).

Other qualitative methods were considered, including ethnography, case studies, and grounded theory. Ethnography focuses on issues of power, empowerment, and inequality relating to specific ethnic groups (Creswell & Poth, 2018). As I did not study the culture of a specific ethnic group but rather the perspectives of students in general, an ethnographic study would not be aligned with the research questions. Case studies are an in-depth investigation of one occurrence of a phenomenon using multiple data sources (Percy et al., 2015). This study addressed multiple occurrences of one phenomenon (critical thinking) using one data source (interviews); therefore, the case study design was not appropriate for this study. The goal of grounded theory is to develop an explanatory theory regarding a phenomenon (Percy et al., 2015). Developing an explanatory theory was not a goal of this study as the Paul-Elder theory of critical thinking appropriately defines critical thinking and the processes individuals must undertake to develop CTS (Paul & Elder, 1999, 2008; Sullivan, 2012). Instead, the goal of this study was to determine the barriers and challenges students face which prevent student progress using the Paul-Elder steps for critical thinking.

Based on these factors, I chose an interpretive phenomenological methodology. The basis of interpretive phenomenological analysis is understanding a phenomenon from

an individual's perspective while recognizing that the researcher's interpretations will influence the results (Smith & Eatough, 2012). Interpretive phenomenological analysis developed from a combination of phenomenology and hermeneutic inquiry (Smith & Eatough, 2012). The phenomenological component of the design involves the lived experiences of individuals, including experiences or barriers that influence the individual's perspectives (Percy et al., 2015). Phenomenology appropriately addresses research questions involving how adult students identify use of and barriers to critical thinking in A&P but is limited in its ability to interpret students' subjective theories regarding the definition of critical thinking. To interpret students' subjective theories regarding the definition of critical thinking, hermeneutic inquiry is appropriate. Hermeneutic inquiry focuses on how language provided by the participant and how the researcher interprets it and compares it to both existing data and data collected from other participants (Smith & Eatough, 2012).

Interpretive phenomenological analysis involves in-depth qualitative analysis and abductive approaches to data analysis (Smith & Eatough, 2012). Because there are existing definitions of critical thinking, and this study aims to understand students' subjective theories regarding critical thinking, an abductive approach in which the students' definitions are compared to each other and existing definitions was appropriate. This methodology emphasizes data collection via face-to-face semistructured interviews as participants are considered experts on their personal experiences (Smith & Eatough, 2012). Finally, during data analysis, interpretive phenomenological analysis emphasizes the importance of not only parallel and converging themes but also opposing themes

(Peterson, 2015). This focus on opposing themes highlights the importance of discrepant cases to further develop the researcher's understanding of the data (Peterson, 2015).

Participants

A purposeful sample of 12 health science students was selected from Technical University after the conclusion of their first term of A&P. A&P students were chosen from a variety of majors, including respiratory care, surgical technology, medical administration and assisting, physical therapist assistant, and occupational therapy assisting. Nursing students were excluded as their program defines critical thinking and discusses its applicability in the first term. Students previously or currently enrolled in a course with me as the instructor were excluded from participation in the study.

Twelve interviews were conducted. Guest, Bunce, and Johnson (2006) indicated that a sample of 12 is sufficient when describing "a shared perception, belief, or behavior among a relatively homogeneous group" (p. 76) to achieve data saturation. Data saturation is evaluated to ensure a study has thoroughly addressed a phenomenon (Guest, Bunce, & Johnson, 2006; Hennink, Kaiser, & Marconi, 2017). Each interview was analyzed after its completion, and the emergence of new themes was assessed. If no new themes emerge after interview data are analyzed, data saturation occurred and additional interviews would provide limited results (Guest et al., 2006; Hennink et al., 2017). Data saturation occurred after eight interviews, and therefore data collection stopped after 12 interviews.

Upon approval from Walden University's Institutional Review Board (IRB) and Technical University's Human Subjects Review Board (HSRB), I requested current

professors of students who just completed their first-quarter A&P course at Technical University post an online request for participation in the study (see Appendix B). The online request explained the purpose of the study, how data were collected and used, the time commitment required for participation, and the voluntary nature of the study with a request to contact the researcher via email if the individual was interested in participating in the study. Upon receipt of responses from interested students, additional emails were sent to arrange an interview at the participants' convenience. Students currently enrolled in their first quarter were selected to allow time for the organization of interviews shortly after the conclusion of their first term. Fewer than 12 students volunteered after the first round of recruitment; this procedure was repeated the following three quarters until sufficient participants had been recruited.

I began establishing the researcher-participant working relationship by allowing participants to select the date, time, and location for each interview. This relationship was further developed by ensuring that interview sites were prepared and participants were not seated in a position that made them feel ill at ease. Each interview commenced with a discussion of the role the participant plays in this study. Informed consent was reviewed to ensure that each participant was aware of his or her rights. Rubin and Rubin (2012) stated that the research-participant relationship may be fostered through the disclosure of personal details about the researcher that relevant to the study or participant. Therefore, as each interview proceeded, relevant personal details were disclosed to participants. Displaying empathy and sensitivity toward participant helps researchers promote supportive relationships (Rubin & Rubin, 2012). One way to display empathy and

sensitivity is to ask broad questions and allow participants the choice of how to address an issue (Rubin & Rubin, 2012). The structured interview questions were broad in nature to provide participants the ability to decide how to best answer the questions while remaining comfortable with the interview process.

To ensure the protection of participants' rights, pseudonyms were given to participants during data transcription and analysis. In addition, other details that may identify participants such the location of the study were removed. Data will not be used for any purpose outside of this research project. Hard copy data are kept secure in a locked file cabinet located at the reseracher's home. Consent forms are kept separately from interview data to maintain confidentiality. Digital data were collected using a password-protected iPhone that only the researcher could access. After data collection, interview transcripts were uploaded and kept on a password-protected computer. In addition, each file was separately password-protected so that only the researcher had access. After data were transferred to the researcher's computer, interview recordings were removed from the iPhone. Transcripts are stored on the same password-protected computer for at least 5 years, as required by Walden University.

Data Collection

Data collected in this study are qualitative data representing students' perspectives. The data were collected using recorded, semistructured, one-on-one interviews using an interview protocol (see Appendix C). The qualitative methodology is best suited for research investigating individuals' perceptions of a phenomenon (Babbie, 2017). An interpretive phenomenological qualitative methodology provides a

methodology aligned with collecting adult student perspectives regarding their experiences (Smith & Eatough, 2012). The focus of this study was to develop an understanding of the adult students' subjective theories regarding critical thinking along with its perceived use and barriers or challenges in A&P while enrolled at Technical University. Without the use of interviews, it would have been challenging to collect sufficient data to answer the research questions. One-on-one interviews were selected to reduce the influence of others on students' responses (Rubin & Rubin, 2012). Further, students may hesitate to admit personal details in front of others or on a survey (Rubin & Rubin, 2012). Given these factors, semistructured and one-on-one interviews are the best methodology for collecting this study.

Data Collection Instrument

Data for this study were collected using semistructured one-on-one recorded interviews. An interview protocol (see Appendix C) guided the interviews. The semistructured format of this interview protocol was developed to encourage thorough exploration of the students' perspective. The use of a fully structured interview would limit the researcher's ability to ask probing questions and ensure that the participant's meaning was accurately understood by the researcher (Tracy, 2013). The use of an interview protocol ensured that all interviews used similar questions while also providing participants the opportunity to view some of the questions before the interview (Merriam & Tisdell, 2016). I developed the interview protocol to answer the research questions that evolved from suggestions for future research found during the literature review. When developing the interview protocol, each interview question was designed to answer a

component of the research questions. In combination, all interview questions contributed to answering the research questions in full, as shown in Table 1.

Table 1

Alignment of Interview Questions to Research Questions

Interview Questions	Research Questions RQ1	RQ2	RQ3
a. How do you define critical thinking?	X		
i. If the participant cannot provide a definition of critical thinking, the interviewer will state "We can revisit this question later."			
b. What are some examples of how you have engaged critical thinking in your life outside school?	X		
i. What, if any, are some examples of times people have praised your use of critical thinking?	X		
ii. What made this example critical thinking?	X		
iii. What, if any, are some examples of times people have suggested you use critical thinking?	X		
iv. Why do you think the use of critical thinking was suggested in this circumstance?	X		
c. How important do you think critical thinking is to success in school? In the workplace? Why?		X	
d. What are some examples of how you have engaged in critical thinking while enrolled at Technical University?		X	
i. Which courses do you feel have promoted the use of critical thinking? How?		X	
ii. Which courses do you feel have limited use of critical thinking? How?		X	
e. What are some examples of how you have engaged critical thinking in A&P at Technical University?		X	
i. If you do not have any examples, why do you think this is so?		X	
f. What barriers or challenges have impacted your ability to engage in critical thinking in your courses at Technical University?			X
i. Has anything a faculty or classmate done helped reduce these barriers or challenges?			X
ii. Has anything a faculty or classmate done increased these barriers or challenges?			X
g. What barriers or challenges have impacted your ability to engage in critical thinking in A&P at Technical University?			X
i. Has anything a faculty or classmate done helped reduce these barriers or challenges?			X
ii. Has anything a faculty or classmate done increased these barriers or challenges?			X
h. What do you feel that the faculty may do to encourage or discourage the use of critical thinking in A&P?			X
i. What do you feel that the faculty may do that discourages the use of critical thinking in A&P			X
j. Now that we have discussed examples of critical thinking, I would like to revisit your definition of critical thinking. How would you define critical thinking at this point?	X		
i. What would you add or remove from your initial definition of critical thinking?	X		

Collection of Data

Data were collected through semistructured one-on-one interviews. Each interview was recorded via the iPhone's Voice Memo app. Audio recordings of the interviews were transferred to a password-protected computer and each file was password-protected. Recordings were then removed from the iPhone. Transcripts of interviews were generated using Amazon Transcribe and saved in Microsoft Word, with each interview saved as a separate, password-protected document. After the transcription has been completed, the researcher simultaneously reviewed the transcription and audio recording of the interview to check for accuracy. After transcripts were determined to be accurate, they were uploaded into Atlas.ti for coding. All codes, categories, and themes were developed and defined in Atlas.ti. A Microsoft Excel spreadsheet was used to store information regarding dates data were handled and content of communication with participants.

Data Management

A Microsoft Excel spreadsheet was used for tracking the dates data were handled and content of communication with participants while Atlas.ti was used to track emerging understandings as data were analyzed, including the development of codes, categories, and themes. The Microsoft Excel spreadsheet tracked data using the participant's alias to maintain confidentiality. There were no notations connecting the participants' alias to their real name. The Microsoft Excel spreadsheet tracked the following data: date of initial email, date of receipt of consent form, date of interview, date interview sent for

transcription, date transcript received from transcription service, date(s) of analysis, and date(s) and content of additional communication.

Each interview was recorded as a separate file on a password-protected iPhone using the Voice Memos app. After completion of the interview, the audio recording was uploaded onto the researcher's personal password-protected computer and removed from the iPhone. Each audio recording was individually password-protected and named based on the following convention: Audio_Recording_ParticipantAlias_YearMonthDate (of the interview). All interview audio recordings were stored in one folder. Upon receipt of the transcripts from the transcription service, each transcript was given a name based on the following convention: Transcript_ParticipantAlias_YearMonthDate (of the interview). After the researcher determined the transcript as accurate, it was uploaded into Atlas.ti for coding. All codes, categories, and themes were developed and defined in Atlas.ti. All reflection on coding and emerging understandings were recorded in the memos section of Atlas.ti.

Procedure for Gaining Access to Participants

Upon approval from Walden University's IRB and Technical University's HSRB, the researcher requested current professors of students who completed their first-quarter A&P course at Technical University post an online request for participation in the study (see Appendix B). The online request explained the purpose of the study, how data were collected and used, the time commitment required for participation, and the voluntary nature of the study with a request to contact the researcher via email if the individual was interested in participating in the study. Upon receipt of responses from interested

students, additional emails were sent to arrange an interview at the participant's convenience. Fewer than 12 students volunteered after the first round of recruitment; this procedure was repeated the following three quarters until sufficient participants have been recruited. Consistent with best practices and ethical considerations, individuals previously or currently enrolled in a course with the researcher as the instructor were thanked for volunteering, but their participation was declined.

Role of the Researcher

The role of the researcher in the study setting is as an assistant professor in the BSD. As an assistant professor, the researcher has been responsible for teaching a variety of biology classes, including A&P (both lecture and laboratory classes), microbiology, introductory biology, and pathophysiology. In this role, the researcher interacted with many students taking A&P. To avoid ethical challenges and reduce bias introduced by prior interactions with participants, no participants previously or currently enrolled in a course taught by the researcher was interviewed. Therefore, interactions between the researcher and study participants before the interview was minimal. If students had been enrolled in a course taught by the researcher, there would be an increased risk that students would answer questions the way they felt the researcher wanted rather than in a manner which accurately represents their perceptions (Ravitch & Carl, 2016). In addition, participants may be unwilling to disclose opinions about barriers if previously enrolled in a course the researcher taught, as the instructor may be a barrier to engagement in critical thinking.

A bias that developed during the researcher's tenure as an assistant professor in the BSD at Technical University is that many students underestimate the importance of critical thinking in their future career. In addition, the researcher is biased that many faculty fail to provide students opportunities to engage in critical thinking, both in general and in A&P, reducing the opportunities students to engage in critical thinking. As the study is conducted, the researcher must account for these biases and ensure that the participants fully expressed themselves rather than being guided. While awareness of these biases and experiences does not eliminate their impact on the study, awareness increases the ability of the researcher to mitigate the influence of these biases and experiences on the study results (Ravitch & Carl, 2016). These potential biases, in addition to ethical considerations, were further justification to limit interactions with study participants before interviews.

Data Analysis

After each interview was completed, interview transcripts were transcribed via a commercial transcription service, specifically Amazon Transcribe. After the transcription was completed, the researcher simultaneously reviewed the transcription and audio recording of the interview to check for accuracy. After ensuring the accuracy of the transcripts, the transcripts were coded using a qualitative software analysis program, specifically Atlas.ti.

Use of Atlas.ti allowed analysis of transcripts to be completed in a central location while organizing codes, categories, and themes and allowing for more in-depth interpretations and organization of the data. The data were analyzed using abductive

thematic analysis with constant comparison. In this coding methodology, each interview was analyzed as the transcript as received, allowing the development of codes, categories, and themes as data are collected (Percy et al., 2015). Using an abductive coding procedure allowed for data to determine codes, categories, and themes while allowing the comparison of the data to existing codes, categories, and themes, or definitions (Haig, 2005; Hyytinen et al., 2014; Timmermans & Tavory, 2012; Ward, Clack, & Haig, 2016). This allowed the students' subjective theories regarding the definition of critical thinking to be compared to both existing definitions of critical thinking and the other participant's definitions.

Coding data using an abductive thematic analysis with constant comparison also allowed for iterative coding, as it required returning to each set of data after additional data are collected and analyzed (Percy et al., 2015). The iterative process of thematic analysis with constant comparison allowed codes, categories, and themes to evolve and develop to explain the data, resulting in a more comprehensive understanding of the data (Percy et al., 2015).

In addition to organizing the coding of the transcripts, the memo feature of Atlas.ti was used to record all reflections on coding and emerging understandings. While these memos were not analyzed, the content of these memos is vital for creating a deeper understanding of the data when the results and discussion sections of the capstone were written (Ravitch & Carl, 2016). Use of the memo feature ensured that the data were available for use during writing of the results and discussion section while preventing others from accessing the data.

To ensure accuracy and credibility of the findings, peer debriefing was conducted. In peer debriefing, an individual who is less involved in the collection and analysis of the data was asked to review all notes, materials, and data pertinent to the study (Ravitch & Carl, 2016). Using peer debriefing indicated if codes, categories, and themes produced during data analysis were appropriate to the data collected, helping to ensure the credibility of the findings. A fellow doctoral candidate at Walden University, who has no affiliation with Technical University, acted as the peer debriefer.

Discrepant cases are cases with findings that differ from or disagree with the current patterns or understandings of the data (Ravitch & Carl, 2016). The existence of discrepant cases helps to ensure that a researcher does not force data to conform to preconceived notions or biases but rather interprets the data as it emerges (Ravitch & Carl, 2016). Discrepant cases were used to challenge preconceived notions and the codes, categories, and themes developed from data. Using discrepant cases to challenge codes, categories, and themes developed helps encourage complete understanding of the data (Ravitch & Carl, 2016). Upon discovery of discrepant cases, the researcher contacted the peer debriefer to request that he review and code the discrepant case. The use of a second researcher to code the same data helped ensure that the codes developed for the discrepant case are valid (Ravitch & Carl, 2016). Once the codes were validated by a second researcher, the codes were incorporated into the data to encourage the development of more complex themes and a deeper understanding of the phenomenon.

Limitations

The applicability of this study is limited to nonnursing health science students enrolled at accelerated 2-year institutions after completion of their first quarter of A&P. While A&P acts as a gatekeeper course and is vital for student success in health science, the applicability of this study to other gatekeeper courses and non-health science majors is minimal. In addition, the results of this study are limited to adult students and are not applicable to traditional students. This study is further limited by is sample size. While sampling shall continue until saturation occurs, additional interviews and a larger sample size would likely continue to provide additional information. Finally, the researcher may also become a limitation of the study. Participants may limit critical comments regarding the barriers presented by faculty, as the researcher is the faculty members' colleague and the students may not want their opinions on the faculty known. While assurances will be made regarding anonymity and confidentiality of results, participants may still limit their responses.

Data Analysis Results

The purpose of this qualitative study was to better understand adult students' subjective theories regarding critical thinking, how they identify their use of critical thinking, and what barriers or challenges they perceive when asked to engage in critical thinking in A&P while enrolled at Technical University. In order for study results to impact social change, data analysis was performed to align with the goals of the study and answer the research questions. An abductive thematic analysis with constant comparison of the data was performed to allow for iterative coding of each transcript.

This allowed for the evolution of codes, categories, and themes to better answer the research questions.

Data Analysis

Data were collected over a 10-month period from 12 different health science students using the interview protocol (see Appendix C). Participants included students majoring in respiratory care (n = 2), surgical technology (n = 4), medical laboratory technician (n = 2), medical assisting and administration (n = 1), physical therapist assistant (n = 1), and occupational therapy assisting (n = 2). Each interview was recorded and transcribed using a commercial transcription service, at which point each participant was assigned an alias. The completed transcription was then evaluated for accuracy by listening to the recording and reading the transcript simultaneously. Codes were used to identify portions of each interview relevant to the research questions. In addition, the coding of transcripts allowed isolation of participants' subjective definitions of critical thinking, allowing the comparison to existing definitions of critical thinking. As data were coded and analyzed, categories developed as a method to summarize data. Themes developed from the categories to describe topics to be addressed in the faculty development workshop developed from the results of this study. Data saturation was reached after eight interviews; however, all 12 interviews were conducted. Occurrence of data saturation was determined by the lack of additional themes emerging after analysis of the eighth interview.

Research Findings

The study was completed at Technical University in the northeastern United States. The findings of this study provided adult students' perspective on their perception of and engagement in critical thinking in A&P at Technical University. The study was conducted in response to the problem that faculty and administrators at Technical University and local employers perceive a lack of engagement in critical thinking by adult students enrolled in A&P at Technical University. The findings are presented in a manner to answer each research question based on the themes which emerged during data analysis. During data analysis, five themes developed from the participants' responses. The five themes were subjective definitions of critical thinking, importance of critical thinking, barriers to critical thinking, factors which decrease critical thinking, and factors which increase critical thinking.

Theme 1: Subjective definitions of critical thinking. During data collection, all participants were able to provide a definition and examples of critical thinking. However, only 11 of the 12 participants were able to define critical thinking when asked initially. In addition, while all of the participants were able to provide perceived examples of critical thinking, many of the examples provided did not meet the Paul and Elder (1999, 2008) definition of critical thinking. Eleven of the 12 participants described the importance of critical thinking in school, work, and personal life environments. The student who was unable to define critical thinking initially did not feel that critical thinking is important in school, work, or personal life. This case was considered a discrepant case and is discussed in detail after the themes which emerged from data analysis.

When evaluating the participants' subjective definitions of critical thinking, the focus was on determining if they contained the overlapping elements found in multiple definitions. The key aspect of critical thinking used to determine if participants correctly defined critical thinking was an emphasis on determining what information should be used or sought to answer a question or guide an action. Of the 12 participants, three participants (Alanna, Faith, and Henry) had the aspect essential to critical thinking in their initial definition. Faith's definition of critical thinking was "taking all aspects of say an event or a question and trying to incorporate all the data into one kind of answer" while Alanna's definition was "just using all the information from a certain period of time and just using all that to answer a question." Henry's definition was "using skills given to work your way out of a problem."

Four of the participants (Bethany, Dennis, Josh, and Kiara) focused on approaching a challenge or question from various angles and thinking about all the aspects, with an emphasis on looking beyond the initial impression. Other participants (Charlotte, Eliza, and Liam) defined critical thinking in a manner that is more in line with the definition of cognitive elaboration while Henry focused on using skills rather than knowledge.

One student was completely unable to define critical thinking; when asked for the definition, Grace's response was "I don't know. I've never actually thought about it." While Grace was the only participant who did not attempt to define critical thinking, another student's definition of critical thinking failed to provide a definition but instead

was a description of when a person would engage in critical thinking. According to Isabelle:

> Critical thinking is something everyone uses on the daily-- whether it be driving your car, listening to music, just like anything. I think that even to do sports you need critical thinking, in all aspects. So, I believe that everyone uses it on a daily basis.

While Isabelle provides insight into her use of critical thinking, she does not provide a definition to compare to published definitions of critical thinking.

Throughout interviews, participants were asked to provide examples of critical thinking. The participants tended to provide examples of times when they felt critical thinking was used rather than specific examples of critical thinking use. Students stated that they used CTS while driving, playing sports, and raising children. An example of how critical thinking is used when raising children was provided by Faith, who said:

> The kids get in a fight and you're like, Okay, well, he hit me, she hit me, he did this, she did that. And then you have to try and decipher exactly what happened and how they're reacting to how you're looking at them and asking them questions and then you can kind of figure out what happened. Especially if you know the personalities and you're like, You're the one that causes all the trouble.

Following this example, Faith stated that it would require critical thinking to determine the sequence of events and to determine how she should react and what actions to take. In this example, Faith expressed the use of previous knowledge in order to determine what

actions she should take (disciplining the children); therefore, this example fits the Paul and Elder (1999, 2008) definition of critical thinking.

In addition, participants described instances they used critical thinking while at Technical University. Participants felt that registering for classes, determining a timetable for studying or completing schoolwork, and figuring out what questions to ask faculty all used their CTS. There were also several classes that students felt required them to use CTS, including English, math, physics and kinesiology, in addition to anatomy and physiology. Liam said:

> Lab is more like, all right, what are you going to do with the facts? So, lab is definitely, what are you going to do with the information you currently have? Here's a problem to solve with that. Think about what you've learned previously and figure this out. So definitely lab is more critical than lecture.

While a part of this example is based in cognitive elaboration, Liam's example required him to take the new content, build it onto the old content, and then figure out how to answer questions and solve problems. While problem solving is not solely based on critical thinking, it does require the use of critical thinking in order to be accomplished.

At the conclusion of the interview, students were asked to define critical thinking a second time. Of the 12 students interviewed, four had substantial changes to their definition of critical thinking by the end of the interview. Participants had additional aspects that they felt were part of critical thinking; none of the participants felt that their initial definition was incorrect or contained incorrect information. For example, Henry initially defined critical thinking as "using the skills that are given to you to work your

way out of the problem." At the end of the interview, Henry defined critical thinking as "thinking outside the box, and still seeking out that information you don't know and figuring out the answer to a problem," adding a need to seek out additional information to his definition of critical thinking. Grace went from not being able to define critical thinking at the start of the interview to defining it as "when something is going wrong with patients, and you have to instantly think five steps ahead on now what you're going to do for this person." While Grace did not explicitly reference her reliance on previously obtained information, she was able to express the second half of Paul and Elder's (1999, 2008) definition of critical thinking which references using the information to direct actions.

Charlotte added "finding solutions to problems and ways that you might not have thought before" to her initial definition which primarily focused on acquiring and applying knowledge. As with Grace, Charlotte's definition of critical thinking lacked key words from the accepted definition of critical thinking and was more in line with the accepted definition of cognitive elaboration. Similarly, Eliza's initial definition of critical thinking, "thinking about multiple things that go into one unit that will kind of branch off of each other and help you formulate one understanding of something," is more closely related to cognitive elaboration than critical thinking. However, at the end of the interview process, Eliza described critical thinking as:

> Learning something and then being able to apply it somewhere else and just kind of knowing that certain messages can be conveyed in different ways and hearing it and realizing, Okay, this same question can be asked three different times and

> three different ways but it means the same thing and it'll have the same answers. So, if you had to have to know all the information so you can decipher it no matter how it's portrayed. I think that it's kind of like putting together a puzzle.

While the beginning of her second definition of critical thinking again reflects the concept of cognitive elaboration, the end of this definition emphasizes the use of her previous knowledge to answer questions and is therefore more in line with the Paul and Elder (1999, 2008) definition of critical thinking.

While Eliza's definition of critical thinking was more in line with that of cognitive elaboration, three students who initially defined critical thinking in a way that meets the standards of Paul and Elder's (1999, 2008) definition of critical thinking, described instances of cognitive elaboration as critical thinking. For example, Josh said:

> Professors will ask you those leading questions where it's not a yes or a no. You have to turn your brain on, you have to start thinking and be like, Well, this-- you think about the concepts that we're working on, and you kind of draw your own connections.

This example, while described as critical thinking by Josh, clearly describes the action performed as forming connections between prior knowledge and new content, the fundamental concept behind cognitive elaboration. Faith also provided an example of cognitive elaboration rather than critical thinking, saying:

> You learn right from the beginning of how things build upon each other, it makes you think differently. When you look at people, it's like, Wow. And then when

> people say things, you think back, Oh, okay. Now I get it because the cell and the this and the that, and it all kind of ties in together.

Despite the fact that these students were all able to provide accurate definitions of critical thinking at the beginning of the interview, these examples show that the students often confuse cognitive elaboration and critical thinking.

Theme 2: Importance of critical thinking. When discussing the importance critical thinking is to success in school, 11 of the 12 participants felt that it was vital to success at Technical University, especially in the health science programs. Kiara said:

> Critical thinking is like the backbone, kind of in school, in my opinion. Because you, obviously, you have to use your mind in all sorts of way to be able to accomplish passing the classes, doing the right things, having respect, all of that.

Bethany, referencing the importance of critical thinking in school, said:

> If you're presented with something and you learn some information and then you're given a question that's sort of related but not really, you can take that information and think about it and how it relates to all the other stuff you know and then maybe figure out the problem without being told what the answer is.

Eleven of the participants interviewed had similar views on the importance of critical thinking in school and felt that its absence would prevent their success in school and after graduation. The students felt that the use of critical thinking would allow them "to change, adapt, and work, roll with the punches" and its use at Technical University would help to prepare them for their future work.

Eleven of the 12 participants felt that critical thinking was a key factor in employment after graduation. Josh said:

> I think [critical thinking is] very important only for the fact that nothing ever-- so just because nothing in this life happens the way it's supposed to whether it be out of work or in work. Adversity happens. And if you aren't thinking critically, then life is going to happen to you rather than you adapting and making situations work.

Additionally, participants felt that the content knowledge from A&P was vital for use in critical thinking once employed in the healthcare field. Charlotte said:

> No body is alike. No two people are the same. And, when you get inside of the cavities of the body, you might feel like, Well-- I mean, Yes. The anatomy is still correct. But, I mean, if there's a tumor-- so you just need to be able to think critically and stop for a second to like, Okay. Here's the information in front of me. What do I need to do?

The variation in human bodies was referenced by multiple students, especially as it changes when a person is ill. The participants commented that they needed to be able to take the current situation and their knowledge of A&P and use it to direct both their actions and those of the patient in order to help them recover from injury or illness. Faith said:

> You have a medical emergency, are you going to focus on the little stuff with this or are you going to go right into the big stuff like blood pressure and vitals and all

that… You're not going to worry about that stuff. You're going to get there to save the patient.

Despite the majority of participants expressing the belief that critical thinking was necessary to succeed both in school and work, several participants said that they rarely used critical thinking during school. There were three main reasons participants gave as the reasons for not using critical thinking while enrolled in A&P. The first reason was the ability to "just do whatever is easier, and I'm not really thinking about what would be best at that moment." The students have access to the answers, either in their textbook or online, and often defaulted to copying the answers from their textbook or an internet search. Several students expressed that they felt access to the answers was what prompted them to not attempt to figure out the process and they could just finish and go home early. However, the same students also stated that at some points during the class, having access to the answers encouraged them to think through the process as they knew they could see if the answers were correct after completing the assignment.

A second reason that students gave for not engaging in critical thinking at Technical University was due to the course structure. According to the participants, the majority of their classes focused solely on content acquisition and did not require the use of critical thinking. In addition, the students felt that the focus on content acquisition prevented them from thinking critically, as the structure of the class focused on the teacher imparting knowledge and the students regurgitating it on multiple choice assessments. The final reason that participants gave as a reason for not using critical thinking while enrolled in A&P was the lack of content knowledge or experience.

Participants also cited this reason as a cause of not using critical thinking at work or in clinical experiences.

The most frequently cited instance where participants indicated they should have used critical thinking and did not was when they made mistakes. Another common comment regarding when they should have used critical thinking was when they reacted rapidly, rather than taking time to formulate a response. In both cases, participants felt that using critical thinking would have allowed them to create a more positive result.

Multiple students also commented that they felt the need to use critical thinking in order to create a schedule for their schoolwork. Bethany said:

> You have to consider all of the factors involved. For one, yourself, your mental health, your physical health and then what's directly around you. I have to think about my dog and my car and school and stuff. So, there's just so many things that can happen. You have to be aware of that and be ready to respond to it.

The participants felt that they needed to use all their knowledge in order to direct their actions to prepare for school, which meets the Paul and Elder definition of critical thinking.

Theme 3: Barriers to critical thinking. The next theme that emerged was the variety of barriers to critical thinking encountered while enrolled in A&P at Technical University. Students perceived that the cause of the barriers to critical thinking revolved around two major factors: the volume and difficulty of course content along with a lack of time. Grace stated:

> Am I learning the content? Because it's 10 weeks. That's it. And they're cramming I mean, literally, a 4-hour lecture and a 4-hour lab. It's 7 days and you have to learn everything you can about the heart or the blood that we just did last week, that we just took tests on. And this week, it's going to be the heart and it's so quick that to me, it's just more about how much can you remember?

The students felt, based on the overwhelming volume of content in the course, they had no choice but to simply memorize the material in order to pass the next assessment. Eliza stated, "just how am I going to put all of this into my brain?", exemplifying the view of all students interviewed. They felt that the accelerated pace of the course prevented critical thinking, as the students must first understand the content before it can be used to think critically. Further, students felt that, while faculty members were able to break down the content so that students could understand it, the difficulty of the content became overwhelming when outside of the classroom. The students felt that the overwhelming nature of the content prevented them from performing both content elaboration and critical thinking with information. In addition, the students perceived that the courses focused too much on "teaching to the test," as commented by Dennis. There was little or no encouragement to perform cognitive elaboration and link the current content with experiences outside of the classroom.

Another factor which students perceived acting as a barrier to critical thinking was the lack of a formal definition of and training in critical thinking. Students felt that they are being asked to think critically without any guidance on how to do so or what critical thinking entails. Finally, while not expressed as the most common barrier to

critical thinking, several students commented that the faculty member's attitude toward the class and course preparation created an additional barrier to critical thinking. Professors who presented contradictory content, were disorganized, or discouraged questions in class created barriers to the student's ability to engage in critical thinking.

Theme 4: Factors which decrease critical thinking. The most commonly referenced factor responsible for decreasing critical thinking in A&P was the perceived focus on memorization. Ten of the twelve participants noted an emphasis on learning content at the expense of understanding the content or using it to think critically. Dennis stated "I'm just kind of reading the information and trying to retain it and not really understanding it fully like I'm supposed to. I'm just going to thank God for multiple choice" while Charlotte commented that "it's just straight memorizing." Liam stated that passing A&P requires "just cramming facts in as much as I can and hoping I remember it." When asked for their perception of why they felt there was such a focus on memorization in A&P, six of the students expressed the belief that it was due to the volume of content taught in A&P. The students felt that this was also exacerbated by the rapid nature of the course, required by the accelerated time of the program.

The overwhelming nature of the content covered in A&P was the second most common factor referenced as a cause of decreased critical thinking. Participants felt that knowledge acquisition was emphasized over the understanding or critical thinking. Alanna felt that the only way to succeed in the course was to take "what our professor's telling us for fact" and that "there's not a lot to really think about. It's kind of just like, 'That's how it is'." However, the majority of the participants expressed the same belief as

Eliza in that “the extensiveness of the course” was at fault for a decrease in critical thinking but “there's really not much that you can do about that. You can't change the human body and say, ‘Well, we're going to rename this something easier’.” Students also perceived that faculty believe too much content is required in the course.

The final component that the students emphasized as a factor causing a decrease in critical thinking was the format and organization of the course. The participants had different aspects of course format or organization that negatively impacted their critical thinking; however, all examples given by students cited the lack of interaction or engagement between faculty and students. Specific comments included statements such as “it's not so much an environment for discussion,” “all of the information was on the slides and our teacher was just reading from the slides,” or class is “just blah, blah, blah, blah, blah or here’s the lab, take a test.” In addition, the assessment structure of the class was also a cause for reduced critical thinking. The majority of the assessments were multiple choice questions with obvious answers. Dennis commented that “when you use your critical thinking skill, it kind of bites you in the butt because you're kind of overthinking the situation” and that it would cause him to answer the questions incorrectly. Others felt that the access to answers in the textbook, such as on homework or laboratory assignments, reduced their critical thinking.

Theme 5: Factors which increase critical thinking. Participants identified three categories of factors which could increase critical thinking: course factors, professor actions, and student behavior. Of these categories, the course factors were most commonly cited as the most impactful method to increase critical thinking while student

behavior was the least commonly cited method to increase critical thinking. While there was variation in how impactful participants felt each factor would be on increasing CTS, all participants mentioned at least one factor from each of the three categories.

Course factors which may increase critical thinking. One aspect of course structure at Technical University that is different from a traditional, non-accelerated university, is the standardization of course structure and assessment. While the institution typically is responsible for determining how often a class meets and the duration of each meeting, at Technical University it is taken a step further. The institution specifies exactly what content must be covered in each course along with the methods to assess student comprehension, to the point of providing all lecture and assessment materials. The institution's reasoning behind determining these aspects of the course is that the students enrolled in health science majors are taking these courses to prepare them for an accreditation exam after graduation. The institution mandating not only the content to be covered but also how to assess student comprehension is used to ensure that graduates will be as prepared as possible for their accreditation exam.

One of the most common statements regarding how to adapt the course to increase critical thinking related to the amount of content covered in the time allotted. Participants felt that the time allotted to the course restricted the learning opportunities as it emphasized covering content over active learning. However, students did not feel that each class period should be lengthened, as students felt that the duration of the lecture created challenges to remain focused through its entirety. Henry stated that if the professors "give us a break, like a little five-minute bathroom break, which I think is

great. I think that helps a lot." Rather, participants expressed the opinion that A&P should be lengthened to a three-quarter series rather than its current two-quarter series. Another option that students felt would be viable would be to increase the number of times the course met per week; currently the courses either meet twice a week for 2 academic hours or once a week for 4 academic hours. Alanna stated that if "we had four days to discuss the information that's going to be on it [the assessment], it would be a lot easier to understand and think critically about it."

Another aspect of the course structure that students expressed changes could be made to increase critical thinking was to transition from a traditional didactic lecture focused on memorization to an active learning environment focused on understanding, application, and critical thinking. Every participant interviewed for this study expressed a desire to see increased active learning and content application in the form of critical thinking in A&P lecture. As part of increasing active learning, several students expressed the desire to have an increased number of ungraded activities to allow them (and their instructor) to check on student progress. Active learning methods that students mentioned clicker questions using programs such as Kahoots! or Quizlet, or even simply having students vote on questions by raising their hands. In addition, students felt that increasing group work and discussions in class would provide opportunities to engage in critical thinking. Finally, students expressed the belief that case studies, which rely on the students taking the content from the course along with a provided scenario to answer questions, would provide them the opportunity to think critically. In addition, the use of

case studies also helps to show students how the current content may relate to their future career, increasing their perceived value of the content.

Students also expressed the belief that the topics in A&P should be organized in a manner that allows the cognitive elaboration between various topics in the course. In addition, students expressed a desire for more connection between the content in lecture and lab. Isabelle stated that she "felt like there were two different classes. I feel like they should definitely correspond in a way where it's like, yeah. This class you'll have a lot of labeling, but kind of be the backbone of the other class." The participants stated that without these connections, they are less able to use the content to think critically.

The final component of the course structure that could impact the student's ability to critically think revolved around the students enrolled in the course. However, all of these components had participants advocating for both methods of assigning courses. The three suggestions regarding who to enroll in each class were to separate students based on traditional versus nontraditional status, those with and those without CTS, and the students' major.

Several students stated that the traditional and nontraditional students should be separated and placed into different sections of A&P. The impetus for this separation had little to do with critical thinking but rather due to the belief that the nontraditional students need more flexibility in their course structure due to increased commitments outside of school when compared to traditional students. However, other participants felt that a more inclusive classroom composed of both traditional and nontraditional, would improve their critical thinking. These students advocated for the mixed student

composition as they felt that the students could learn from each other, as the life experiences between traditional and nontraditional students differ greatly. Several of the adult students interviewed perceived that while traditional students do not frequently have the work experience associated with nontraditional students, they contribute to the thought process all students engage in when thinking critically. This was attributed to the fact that the traditional students are coming directly from high school and know the best ways to study and master content in order to facilitate critical thinking.

The second method that several participants mentioned as a way to increase critical thinking based on student population is to separate the students who already possess CTS from those that do not. The theory behind this division would be to allow those without CTS more focus on developing their CTS. At the same time, this would allow students who already possessed CTS to enroll in a course that focused on using the CTS rather than learning how to think critically. However, as the majority of the participants perceived the development and use of CTS a lifelong process, division of students based on their previous acquisition of CTS would not facilitate the use of critical thinking.

The third method to increase critical thinking based on the student composition in the class is to separate the students based on their major. Several students advocated for assigning students of each major an A&P section. This would allow the A&P instructor to tailor the content and examples of its use to their specific major. However, students also advocated for individuals of different majors in order to see how various majors

apply the content. In addition, the students of different majors have different methods of approaching problems, which can improve students' ability to think critically.

Professor actions that impact critical thinking. The most commented action that a professor can take which students perceive will increase their CTS is to check-in with the students during each class period, to "make sure that everybody else understands… you [the professor] see that everybody else is on the same page." The participants emphasized that the action of checking-in to ensure comprehension was not sufficient but required professors to take the next step if the students did not understand and re-explain or elaborate on the content until the students comprehend the content. As part of helping students comprehend the information, professors should encourage students to ask questions if they do not understand the content or have questions about applicability.

In addition, the method professors use to present the content can have a significant impact on students' ability to think critically. The professors should focus on the process or application of the content rather than focus on covering the content and student memorization of the information. Liam said:

> Some of them [the professors] say, we'll go over it for an hour if we have to until you understand what the concept is and how to do it. So, it's really helpful in that way you don't feel rushed and that you just have to rush on with the assignment because they have a deadline. You don't hear them [the professors] say, Oh, we got to be out of here in an hour. It doesn't matter if you don't know.

The professor's focus on understanding of the content will allow the students to use the information to think critically with the content in the future. In addition, participants

expressed a belief that the method the professor uses to present the content will also impact their understanding and ability to use the information to think critically. One method that participants felt professors could use to improve comprehension and the ability to think critically is to "chunking things up a little bit more instead of throwing all the information at once. Maybe chunk it up into tiny, bite-sized pieces for us to understand before moving onto the next thing." The other method professors could use to improve comprehension and critical thinking is to "break down the thought process and how to get to this answer and why this answer makes sense." Three participants stated that the method of content presentation, via PowerPoint, was key to their understanding. Referencing PowerPoint presentations which facilitated the students' understanding of and ability to critically think with the content, Alanna said:

> [The professors whose] PowerPoints don't have that much on them. Yeah. They have a lot of sentences every now and then. But they're not very wordy. Whereas for quarter one, they were a lot. It was all like a lot, a lot, a lot. And I was like, Oh. My God.

Josh felt that PowerPoints that included "very broad, general statements on the slides" facilitated learning as it required the professor to elaborate or provide examples to explain the content. Josh stated that as "my teacher's explaining it, she's drawing out diagrams, so I think that more so gets our brains thinking and we're seeing the process develop instead of just seeing it as a whole, which really helps." Isabelle expressed the same sentiment in that "everything needs to be broken down. You kind of need to understand something you go to the next. It all adds up" and if the professor "just read

really fast trying to cover it" without checking in with the students or fully explaining the content, there is limited comprehension and no opportunity to engage in critical thinking.

Participants also expressed the opinion that the lecture, and associated PowerPoint, should be logically organized. When the PowerPoints are not logically organized, students struggle to understand the content. Faith said:

> Confusing and discombobulated and then she'd be on this and then that. And she'd do a PowerPoint and would be on slide 12 and then, oh, no, no, no, no, no. Go back to slide 2 and then go back to 15, and we'd be sitting there like we-- I was completely lost.

The students felt that if the professors look the time to organize the course content and PowerPoint, their content comprehension and ability to think critically would be increased.

The last action that professors can take to increase critical thinking by their students is to create an atmosphere in which students are comfortable learning. The first aspect of this environment, as perceived by students, is the professor encouraging students to ask questions or seek clarification when they are struggling. As part of this, the professor should foster an environment in which students are aware that they are still learning the content and that it is acceptable to have the wrong answer. Bethany said that at other institutions, she has experienced "teachers or instructors just being awful when people get the wrong answer and making fun of them or making them feel like an idiot." Bethany felt exposure to this attitude has limited student's desire to interact with faculty.

If professors express an air of approachability and make students feel comfortable with not knowing the answers, the students may perceive that working with the professor one-on-one is an option that can help increase their CTS.

Student behaviors to increase critical thinking. Student behavior that that participants believed would improve their CTS included taking responsibility for their own learning, seeking tutoring or forming study groups, and improving study skills. Charlotte commented that the "she's [the professor] like, 'Here are the tools.' I feel like all teachers make sure we have the tools, but it's your responsibility to figure it out, which is great because it's going to be our responsibility when we're out working." Further, Kiara stated:

> You have to actually study, and do all the stuff in order to understand it. You can't just fly by it, and think you're going to pass it. It's a really hard class. And you really have to put in the work. So, I definitely think you use a lot of critical thinking in that.

Participants needed to fully understand the content in order to use it to critically think. In order to understand the content and use it for critical thinking, students felt that increased use of (not offering of) tutoring services would be vital. Alanna stated, "my professors are actually really fantastic about different resources available" while Charlotte commented that "there are so many resources to find if you're struggling but it's your responsibility to seek it out." In addition, Bethany stated that "there's so much support here, it's kind of hard to fail" and Eliza said, "there's lots of help when it comes to learning the information." Dennis felt that "working on-on-one with an instructor

would help a lot." When asked why he felt working with the instructor would be more useful than working with a tutor, he said because the instructor "knows exactly what she expects you to know, so if you go too deep or not deep enough, she can let you know."

Seven of the twelve participants felt that study groups help the students to master the content, a step required before they can use the content to think critically. Faith said she used study groups to:

> Quiz each other and go over our stuff. And it's good. And we all do text message groups. When we text message things when we're having trouble with homework, especially with the questions that aren't straight memorization. And we all try and work on it.

Josh uses the study group "explain my answers step by step to somebody who has an idea, so I know that I understand what I'm saying" while Isabelle feels that the groups allow her "to see the way others think" to allow engagement in critical thinking. Another advantage of study groups was expressed by Bethany who explained that study groups allow the students to check in with each other and "if I don't understand, I'm like, 'Did you understand what just happened in lecture?' And if multiple people don't understand, then it's nice because then we can all ask that question and get it answered."

Three of the participants, Alanna, Isabelle, and Josh, believe that improved study skills and time management would be helpful to improve their CTS. They relate this need to the requirement of content mastery before the ability to think critically. However, Isabelle stated that she uses critical thinking to determine the content she should include on a student-developed study guide. In addition, Isabelle stated that "while we're making

it [the study guide], before even studying, we're able to actually break down and understand what we're doing, what we're using in the study guide, why we're putting this, and why we're putting that, the importance of everything." While Alanna stated that she had access to sufficient resources regarding content, she felt that access to resources improving her study skills or time management would allow her to master the material so she would then be able to use it to think critically.

Discrepant cases. Discrepant cases are cases with findings that differ from or disagree with the current patterns or understandings of the data (Ravitch & Carl, 2016). The discrepant case provided valuable information regarding student perception of the use of critical thinking. The codes developed from the discrepant case were at odds with the majority of codes, categories, and themes which developed from the majority of the data. Analysis of this case was integral to the data analysis as the focus on opposing data helps to further develop the researcher's understanding of the data (Peterson, 2015). There was one discrepant case in this study. In this study, only one participant was unable to define critical thinking when first asked. In addition, the same participant was unable to describe any examples when asked initially. Further, this participant felt that critical thinking was not necessary for her planned career. However, as the questions became more specific (i.e. asking for examples of critical thinking use in the workplace or school), the participant was able to provide examples. At the conclusion of the interview, the same participant was able to provide a subjective definition of critical thinking.

While there was only one discrepant case, as this study collected data regarding student perceptions of actions that could help or hinder critical thinking, there were

several instances in which the data were in opposition. For example, two participants felt that the structure of the A&P laboratory class limited their ability to think critically while four participants felt that the A&P laboratory structure required critical thinking. Another example of two participants presenting contradictory suggestions on methods to increase critical thinking in A&P regarded the majors of the students registering for A&P. One participant felt that limiting A&P classes to a single major would increase critical thinking, as the course could be more tailored to their future career, while another felt that having multiple majors in the course would allow for broader application of and critical thinking with the content. The final course factor in which students presented opposing viewpoints on its impact on critical thinking in A&P was the use of multiple choice questions; several students felt that the use of multiple choice decreased their ability to think critically while others felt that increasing the number and use of multiple choice questions would increase the need for critical thinking.

Accuracy of Data Analysis Procedures

To ensure accuracy and credibility of the findings, peer debriefing was conducted. A fellow doctoral candidate at Walden University, who has no affiliation with Technical University, acted as the peer debriefer. In peer debriefing, an individual who is less involved in the collection and analysis of the data are asked to review all notes, materials, and data pertinent to the study (Ravitch & Carl, 2016). Using peer debriefing will indicate if the codes, categories, and themes produced during data analysis were appropriate to the data collected, helping to ensure the credibility of the findings. Upon

review of the notes, materials, and data from the study, the peer debriefer indicated that the codes, categories, and themes appropriately described the data collected.

Summary of Outcomes

Data analysis performed in this study involved coding and categorizing participants' perspectives collected during interviews regarding their subjective definitions of critical thinking along with examples of and barriers to critical thinking. In addition, students were given the opportunity to discuss how faculty can encourage the use of critical thinking in school. From these data, four themes were presented: subjective definitions of critical thinking, elaboration versus critical thinking, examples of critical thinking, how critical thinking is developed, and importance of critical thinking. As a result of the data collected in this study, a professional development curriculum and its associated materials have been developed.

Section 3: The Project

Introduction

Based on the results of this research, a faculty development workshop entitled *Developing Critical Thinking Skills* (see Appendix A) was designed so that faculty at Technical University may be provided with a clear understanding of student perceptions and subjective definitions of critical thinking, along with a consistent definition of critical thinking that aligns with published literature on the subject. In addition, this faculty development workshop will facilitate the development of course materials which encourage students to engage in critical thinking. The training includes four modules titled "Defining Critical Thinking," "Overcoming Barriers," "Materials and Methods to Encourage Critical Thinking," and "Implementation and Evaluation." Each module contains a purpose, goals, learning outcomes, and materials to support faculty's understanding of student perceptions of critical thinking and how to increase critical thinking in the classroom.

The findings of this study indicated that students at Technical University felt that they understood the definition of critical thinking and engaged in it while enrolled at Technical University; however, they primarily cited examples of cognitive elaboration rather than critical thinking. Participants detailed numerous methods through which critical thinking was impeded or could be improved. The goals for this project will be for faculty to (a) understand students' subjective definitions of critical thinking and their relationship with published definitions of critical thinking, (b) recognize barriers or challenges their students face regarding critical thinking and methods to mitigate them,

(c) learn how to develop course structure and materials to encourage critical thinking, and (d) implement and evaluate newly-designed course materials to engage students with critical thinking.

Rationale

In Section 1, the relationship between critical thinking and student achievement, both in school and in the workplace, was described. Without critical thinking, students are limited in their ability to be successful in their field of study after graduation. Based on the analysis of students' perspectives regarding critical thinking, a faculty development workshop focused on increasing awareness of student perceptions of and barriers or challenges to critical thinking as well as methods to mitigate these barriers or challenges through redevelopment of course content and structure was created. The overall structure of the faculty development workshop was based on what students indicated were definitions and examples of critical thinking.

The first module, "Defining Critical Thinking" was developed from student responses as well as the literature review in Section 1 detailing critical thinking. The next two modules, "Overcoming Barriers" and "Materials and Methods to Encourage Critical Thinking," were developed based on comments students made regarding aspects of courses that facilitated or hindered the use of CTS. The fourth and final module, "Implementation and Evaluation" was developed to allow for self-evaluation regarding the efficacy and impact that the faculty development workshop had on improvement and development of course materials and structure. The problem this study investigated was a perceived lack of engagement in critical thinking for adult students enrolled in A&P at

Technical University. This project will address this problem by ensuring that faculty understand definitions of critical thinking as well as students' subjective definitions of critical thinking, ensuring students and faculty have the same definitions. In addition, this faculty development program will facilitate the construction or improvement of materials to increase critical thinking in the classroom.

Review of the Literature

In Section 1, the literature review described the Paul-Elder theory of critical thinking (Paul & Elder, 1999, 2008; Sullivan, 2012) and the importance of critical thinking along with characteristics of the student population which participated in this study. In Section 3, the literature review supports the production of a faculty development workshop designed to facilitate development of course materials to increase critical thinking by students. To support the development of a faculty development program as the project genre for this study, the literature review is arranged to include how faculty may adapt aspects of courses to increase critical thinking. The literature review begins with a discussion of classroom presentations and is followed by details involving active learning, including which methods may be most effective in higher education and evaluate student learning. The literature review also details how time management and note-taking may be facilitated to increase cognitive elaboration of course content. Without time management skills, note-taking skills, and cognitive elaboration, students are limited in their ability to think critically.

To find relevant and current studies to guide the development of the faculty development workshop, a literature review was conducted using Education Source,

ERIC, SAGE journals, and ScienceDirect databases as well as Google Scholar. The reference section of each article was reviewed for related studies and Google Scholar was used to search for articles which cited articles found using the Walden University library. The search terms used for the project study literature review were *improving PowerPoint*, *creating PowerPoint*, *student time management*, *note-taking strategies*, *active learning*, *types of active learning*, *course assessment*, *ungraded assignments*, *low stakes assignments*, and *universal design for learning*.

Classroom Presentations

The most common program used to facilitate classroom presentations is Microsoft PowerPoint with more than 1 billion users (Moulton, Türkay, & Kosslyn, 2017) producing over 30 million slides each day (Kernbach, Bresciani, & Eppler, 2015). Approximately 67% of higher education faculty use Microsoft PowerPoint® and 97% of those use it all or most of the time (Baker, Goodboy, Bowman, & Wright, 2018). The majority of faculty use Microsoft PowerPoint as a method to structure the presentation rather than as a method to communicate with the students (Hertz, van Woerkum, & Kerkhof, 2015). Microsoft PowerPoint presentations should supplement, not substitute for, a presentation (Grech, 2018b). Due to the use of the default mode of bulleted points in Microsoft PowerPoint, presentations rarely promote learning and instead result in "Death by PowerPoint," characterized by boredom, fatigue, cognitive overload, and confusion (Nagmoti, 2017; Otter, Gardner, & Smith-Peavler, 2019). Development of Microsoft PowerPoint presentations which result in Death by PowerPoint is facilitated by pre-made presentations which textbook publishers provide, typically formatted in the

default manner (Baker et al., 2018). There is also a lack of training for higher education faculty in how to effectively use Microsoft PowerPoint due to hiring faculty based on research rather than teaching experience. Instead, most faculty learn via experiments or observing colleagues (Hertz et al., 2015).

Advantages of Microsoft PowerPoint. The most commonly cited advantage of using Microsoft PowerPoint to teach is that it increases the organization of the lecture by providing not only an outline but also key information and figures or images while summarizing important information (Baker et al., 2018). College students ranked content presented via Microsoft PowerPoint as more important than information not taught using a presentation (Baker et al., 2018). Further, college students believe this type of presentation helps them maintain their attention, as well as increasing their interest in and motivation to study the topic (Baker et al., 2018). Use of a Microsoft PowerPoint presentation by college faculty increases long-term test scores over a traditional "chalk and talk" method of teaching (Akgün, Babur, & Albayrak, 2016; Chou, Chang, & Lu, 2015). The ability of students, coworkers, and collaborators to rapidly share content with each other as well as presenting visual aids for complex topic are additional reasons professors use Microsoft PowerPoint in the majority of their lectures (Baker et al., 2018; Kernbach et al., 2015; Otter et al., 2019).

Disadvantages of Microsoft PowerPoint. There are multiple aspects of lectures conducted using Microsoft PowerPoint which limit student learning. Microsoft PowerPoint's default setting enables faculty to progress through slides quickly, requiring students to rapidly take notes and limiting the time they have to interpret graphics (Baker

et al., 2018; Hertz et al., 2015). Bullet points reduce comprehension due to the presentation of distilled facts and generalizations (Bolkan, 2018; Ricketts, 2018). The use of unnecessary images to increase the visual appeal of the slides distracts students from focusing on the slide content (Bolkan, 2018; Ricketts, 2018). In addition, redundant presentation of displayed text and images at the same time as the spoken words requires students to choose where to focus, often resulting in students focusing on the slides rather than the explanations of the presenter (Bolkan, 2018). Finally, the linear format of the presentation may fragment the narrative and limits faculty-student interactions and discussions, preventing active learning (Baker et al., 2018; Bolkan, 2018; Hertz et al., 2015).

Improving Microsoft PowerPoint presentations. Despite the numerous disadvantages associated with Microsoft PowerPoint presentations, the advantages that it provides justify reworking presentations in order to align with how the brain processes information to increasing learning (Nagmoti, 2017). Faculty training in the development of Microsoft PowerPoint can mitigate the disadvantages associated with Microsoft PowerPoint. Students understand content better when the concepts are illustrated with drawings or photos, videos, diagrams, flowcharts, table, or graphs in addition to text (Baker et al., 2018; Grech, 2018a, b; Ricketts, 2018). Mayer's multimedia learning theory can be used to develop Microsoft PowerPoint presentation which enhance learning. Mayer's theory indicates that students benefit more from spoken words and students reading slides while listening to a lecture results in cognitive overload and hinders comprehension (Grech, 2018b; Ricketts, 2018). The exclusion of extraneous materials

while highlighting essential material has been shown to improve comprehension (Akgün et al., 2016; Grech, 2018b; Ricketts, 2018). Finally, chunking content into small segments with time to process and active learning to reinforce the concept before moving onto the next topic helps students increase comprehension (Grech, 2018b; Ricketts, 2018).

Alternatives to Microsoft PowerPoint. There are two alternative methods of presentation typically compared to Microsoft PowerPoint, Prezi and traditional lectures (often referred to as chalk and talk). While there has been no difference in recall of content taught with either Microsoft PowerPoint or Prezi, both have shown significant improvement in student performance over students taught via traditional lectures (Akgün et al., 2016; Chou et al., 2015). Functionally, Prezi's structure aligns more fully with Mayer's multimedia principles, the application of which has been shown to facilitate student acquisition of knowledge (Baker et al., 2018; Grech, 2018a, b; Moulton et al., 2017; Ricketts, 2018**)**. Prezi increases conceptual learning by drawing explicit connections during a presentation, increasing and emphasizing cognitive elaboration (Akgün et al., 2016; Chou et al., 2015; Moulton et al., 2017). Students believe Prezi presentations are more effective, organized, and engaging than Microsoft PowerPoint (Moulton et al., 2017), making it a viable alternative for classroom presentations.

Active Learning

In active learning, rather than emphasize the expert-learner binary relationship, the faculty becomes a facilitator of learning experiences, providing targeted feedback and helping students to synthesize ideas (Goodman 2018). Faculty and students work together to understand the relevance of and explicitly engage with the course content (McFee,

Cupp, & Wood, 2018; Ricketts, 2018). Active learning can be broken down into three main categories: active, constructive, and interactive (Bailey et al., 2018). Interactive learning occurs when students talk to another person about the content and is considered the most effective active learning technique, producing the largest improvement in test scores (Bailey et al., 2018). Constructive learning occurs when students actively build a mental model of the system they are learning, requiring the resulting deliverable to contain ideas that go beyond the content explicitly presented in the learning materials (Chi, 2009). Active learning occurs when a student interacts with a computer system, pedagogical agent, or classmate to facilitate learning (Chi, 2009).

Increasing active learning methods in higher education improves not only student achievement but also reduces attrition (Brigati, England, & Schussler, 2019, Cavanagh et al., 2016, Goodman et al., 2018, Finelli et al., 2018). Incorporating active learning exercises particularly benefit populations traditionally underrepresented in science, technology, engineering, and mathematics (STEM) programs, specifically women and first-generation university students (Cavanagh et al., 2016; Goodman et al., 2018). Classrooms which promote active learning create a more inclusive classroom, facilitating the education of individuals with disabilities (Chen, Bastedo, & Howard, 2018; Goodman et al., 2018). Use of active learning is known to improve retention, comprehension, engagement, and application of course content (Finelli et al., 2018, Ricketts, 2018). While many students have a positive view of active learning, not all students perceive active learning methods facilitate and improve their learning (Brigati et al., 2019; Goodman et al., 2018).

In addition to the challenges presented by students, faculty also associate many challenges with increasing active learning in the classroom. Faculty are often pressed for class time and suffer from "coveritis," in which too much content must be covered in a given term (Finelli et al., 2018; Goodman et al., 2018). This is one reason faculty are hesitant to implement learning strategies that may reduce the volume of content covered in a term. A second reason faculty hesitate to implement active learning is that the development time required is seen as prohibitive, based on the number of commitments faculty tend to have at teaching institutions (Finelli et al., 2018; Goodman et al., 2018). Finally, the high comfort level both faculty and students have with traditional lectures makes faculty hesitate to change teaching methods (Finelli et al., 2018; Goodman et al., 2018). Faculty who have adopted active learning techniques are faced with student resistance; students view an excellent teacher as one who provides detailed notes so that they do not need additional resources (Finelli et al., 2018; Goodman et al., 2018). The students fail to understand the difference between learning and memorization and view active learning as busy work. This results in students refusing to participate or performing the task with minimal effort (Finelli et al., 2018; Goodman et al., 2018). Students also report increased anxiety when faced with increased work and a new instructional method (Brigati et al., 2019; Finelli et al., 2018). The increase in anxiety negatively impacts students' performance on exams, as they focus on worry and self-criticism rather than assessment content (Khanna, 2015; England, Brigati, Schussler, & Chen, 2019). These challenges can be mitigated if faculty acknowledge the challenges of learning via activities (rather than lecture), provide prompt feedback and support through the learning

process, and solicit student feedback on the activities (Finelli et al., 2018). Faculty do not have to completely revise their course all at once to incorporate active learning, rather they can slowly add active learning techniques and ensure alignment of the activities with other course assessments (Finelli et al., 2018). Finally, faculty explanating the types of active learning and advantages of active learning can positively improve students' perception of and participation in active learning (Brigati et al., 2019; Finelli et al., 2018).

When introducing the types of active learning to the students, faculty should keep in mind the methods they intend to use during the term. The variation in active learning techniques guarantee that the faculty member will not use all methods every quarter. Active learning techniques include classroom discussions (Brigati et al., 2019; Goodman et al., 2018; Ricketts, 2018), asking students questions (Brigati et al., 2019; Ricketts, 2018), case studies (Brigati et al., 2019; Goodman et al., 2018; McFee et al., 2018; Ricketts, 2018), problem-based learning (Berkhout, Helmich, Teunissen, van der Vleuten, & Jaarsma, 2017; McFee et al., 2018), peer instruction (Bailey et al., 2018; Ricketts, 2018), concept map development (Simon, 2015), writing minute papers (Finelli et al., 2018; Goodman et al., 2018), and think-pair-share activities (Bailey et al., 2018; Brigati et al., 2019; Finelli et al., 2018; Goodman et al., 2018).

Discussions are often viewed as an easy method to incorporate active learning into the classroom as they are low stakes and require little faculty preparation in advance (Brigati et al., 2019; Goodman et al., 2018; Ricketts, 2018). Despite the limited preparation required, inclusion of discussions increases student performance and motivation to learn while enhancing engagement and interest in the topic (Hew & Lo,

2018). Discussions begin as a question posed to the class which students debate in small groups. Asking students questions to which they respond to individually may also increase the active learning in a classroom. These questions can be answered using clicker technology, writing the answer on paper, or raising hands to indicate a response (Bailey et al., 2018; Brigati et al., 2019; Goodman et al., 2018). Of these methods, clickers are preferred by students, as they are able to see immediate results without being singled out (Walker et al., 2018). Clickers are more effective than non-technology-based response systems, such as raising of the hands (Walker et al., 2018). However, this type of low-stakes quizzing has been shown to improve the grades of the higher-performing students more than those of lower-performing students (Brigati et al., 2019).

A method that has been shown to have a greater impact on the grades of lower-performing students is bookending the lecture with questions (Brigati et al., 2019; Goodman et al., 2018). Bookending a lecture is done by asking questions or problems at the start of class and having students predict the answers (Goodman et al, 2018). Relevant content is covered during lecture and at the end of the lecture, students return to the original question or problem to correct their answers (Goodman et al., 2018).

Case studies are a method of active learning that are designed to supplement a more traditional curriculum (McFee et al., 2018). In case studies, the concepts are first presented in a traditional lecture and then a case study is presented. Students use course content to answer questions or solve a problem regarding the case study; requiring them to perform cognitive elaboration and critical thinking (McFee et al., 2018). Often case studies help strength links between interdisciplinary topics in health sciences, requiring

cognitive elaboration to occur between content from various courses and further improving student performance in classes (Goodman et al., 2018). Case studies are viewed as a positive addition to courses, providing the relevance of the course content to future careers (McFee et al., 2018). Problem-based learning is similar to case-based learning in that students are challenged with professionally relevant problems. However, in problem-based learning, the concepts are not presented to the students prior to receiving the problem (Berkhout et al., 2017). Instead students must explore and research the topic or problem presented, determining the information that they need to collect and seeking out the appropriate resources (Berkhout et al., 2017; McFee et al., 2018). This method of learning requires additional effort by students and may result in erroneous conclusions (McFee et al., 2018). Faculty should account for the possibility of erroneous conclusions as the assignment is developed and completion is assessed (McFee et al., 2018).

Another method of active learning is the use of peer instruction. When using peer instruction, it is important to require students to act both as the teacher and as the student. In peer instruction, students are provided with learning objectives for a unit and teach their partner(s) about the objectives without using notes (Bailey et al., 2018). The student should be instructed to ask high-level questions (Bailey et al., 2018). This method of active learning requires students to verbalize and question information in addition to performing cognitive elaboration, generating inferences, and correcting errors presented by their classmates (Bailey et al., 2018). While some students object to teaching each other content, studies have shown that having students tutor each other improves the

grade of the tutoring student (Bailey et al., 2018). Therefore, students should be sure to switch roles when using this type of active learning.

Evaluation of Student Learning

The assessing of student learning is vital to higher education as assessments are viewed as the main motivator for student learning (Wanner & Palmer, 2015). Research has shown that the content and quality of learning depends significantly on the type of assessment used (Lynam & Cachia, 2017; Thomas, 2018). Further, methods of assessment significantly influence the experiences of students in higher education (Thomas, 2018). The goal of learning is to understand, apply, and critically think with course content while creating independent learners who can evaluate their own learning (Dosa & Russ, 2016; Kaw & Yalcin, 2012; Thomas, 2018). The most common goal when evaluating student learning is to determine the student's ability to perform cognitive elaboration with content from various courses and apply the knowledge and skills in a method relevant to their future careers or work (Boitshwarelo, Reedy, & Billany, 2017). A meta-analysis examining the purpose of assessments found that 93% of assessments were used to measure student learning but that the remaining assessments were used as part of the learning process to improve the student's understanding of content (Brady, Devitt, & Kiersey, 2019). Students often miss the point of assessments and believe that the resulting grades are the main purpose of assessments (Lynam & Cachia, 2017). When developing assessments, faculty must ensure that assessments are aligned with the course objectives and with other learning activities (Wanner & Palmer, 2015).

During assessment development, faculty should consider the use of student-driven and flexible assessments (Wanner & Palmer, 2015). This is due to the fact that many students are also working or have commitments outside school which require flexibility in their learning (Wanner & Palmer, 2015). Research has shown that allowing students options in the method, timing, and criteria for assessments results in more effective long-term learning (Thomas, 2018; Wanner & Palmer, 2015). In addition, the use of assessments directly related to future careers, helping to provide context for course content, improves student success in a course (Levey, 2018; Wanner & Palmer, 2015). One of the most common methods for allowing student input into assessments is through Universal Design for Learning (UDL). In applying UDL to assessment, faculty allow students to demonstrate what they know in multiple ways through the use of flexible criteria (Evmenova, 2018). The focus on learning in UDL is on the contents' relevance and value to the learner's current or future needs (Rogers-Shaw, Carr-Chellman, & Choi, 2017).

While UDL is one method to allow flexibility in assessments, there are many other methods to assess student learning (Boitshwarelo et al., 2017; Mingo, Chang, & Williams, 2017). Many forms of active learning, such as problem-based learning, case studies, or presentations may be used to assess student learning (Boitshwarelo et al., 2017). However, many students struggle to understand the requirements of assignments, leading to difficulty in producing high-quality materials and limiting student learning (Thomas, 2018). Two methods may be applied to reduce this barrier. The first method is to provide students with examples at the start of the quarter, along with the evaluation

rubric, and require them to evaluate each example. The second method is to provide high-quality feedback that helps students understand how to improve while providing students the opportunity to act on the feedback in the current or future assignment (Thomas, 2018). In addition to the use of active learning techniques to evaluate student learning, faculty could also consider a qualitative method to determine broader conceptualizations of student learning, such as prompts which allow students to detail their understandings more fully (Dosa & Russ, 2016). This method of assessment shows the diversity in student thinking but is likely not comprehensive enough to evaluate the entire course and should be used in conjunction with more traditional assessment methods (Dosa & Russ, 2016).

The most traditional assessment method is the use of multiple-choice exams to evaluate student learning. The heavy reliance of the majority of higher education faculty on multiple-choice assessments is due to the ease of developing, administering, and grading multiple-choice exams (Mingo et al., 2017). Multiple-choice questions can be written at higher cognitive levels (such as analysis), which may promote longer retention and increased transfer of knowledge (Boitshwarelo et al., 2017; Goodman et al., 2018). However, multiple-choice assessments are most suited to assess the first three levels of Bloom's taxonomy (remember, comprehend, and apply) and rarely encourage or evaluate higher levels of learning or deeper processing of information (Boitshwarelo et al., 2017; McAllister & Guidice, 2012). When assessments include multiple choice questions that require higher levels of cognitive thought, the majority of students answer incorrectly (D'Sa & Visbal-Dionaldo, 2017). Therefore, multiple-choice questions tend to promote

memorization and surface learning, even when designed to test at higher levels of learning or if personalized feedback is provided (Hancock, Hare, Denny, & Denyer, 2018). Despite the limited impact of long-term knowledge retention from traditional multiple-choice exams, there are several methods which can be applied to these exams to promote longer retention of or critical thinking with course content.

The first method is to have students participate in the creation and evaluation of multiple-choice questions (Hancock et al., 2018; Teplitski, Irani, Krediet, Di Cesare, & Marvasi, 2018). In writing multiple-choice questions, students must think about the learning objectives for the course and how to create plausible distractors (Hancock et al., 2018). Creating plausible distractors forces the students to explore their misconceptions and interpretations of the content (Hancock et al., 2018). The evaluation of multiple-choice questions written by others requires students develop arguments to support their view regarding specific questions (Hancock et al., 2018).

A second method which may be used to improve content retention and critical thinking using multiple-choice exams is to have students take a multiple-choice test independently then work in small groups to discuss and answer the questions a second time (Goodman et al., 2018). While this method increases student comprehension and retention of knowledge, it can further enhance student learning if an online assessment or Immediate Feedback Assessment Technique multiple-choice form is used, both of which can provide immediate feedback regarding if the correct answer is provided (Goodman et al., 2018; Koh et al., 2019). When using Immediate Feedback Assessment Technique multiple-choice forms, students scratch off the answer they believe to be correct and it

revels if the correct answer was selected (Goodman et al., 2018). This technique also allows faculty to determine which questions the students had challenges with, as multiple answers would have been scratched off (Goodman et al., 2018).

A third method of multiple-choice testing which may improve students' cognitive elaboration or critical thinking is to begin classes with an assessment of pre-class materials (Hew & Lo, 2018). Stimulating the recall of the pre-class material promotes connecting new content and using the prior content to direct actions and solve problem (Hew & Lo, 2018). Similarly, pre- and post-tests may show how student understanding of fundamental content from each course segment or term is improved (Kaw & Yalcin, 2012).

A fourth method to improve the efficacy of multiple-choice assessments is to create blended assessments (Boitshwarelo et al., 2017). In this assessment methodology, a case study is given for content and students must then answer the multiple-choice questions based on the case study (Boitshwarelo et al., 2017). This type of blended assessment has been shown to lead to deeper processing and understanding of information as well as increased retention of content (Boitshwarelo et al., 2017).

Finally, frequent assessment of student learning, known as test-enhanced learning, improves long-term retention of course content and final exam grades (Khanna, 2015). However, the number of quizzes required to produce this result often lead to increased student anxiety and decreased performance on the quizzes (Khanna, 2015). To mitigate anxiety the quizzes should be ungraded and instead act as a method for students to assess their own progress and knowledge (Khanna, 2015).

Time Management

One common barrier described by participants is a lack of time management skills. Many students lack adequate time management skills to succeed in college and time-related demands are a serious problem for the majority of students (Farruggia, Han, Watson, Moss, & Bottoms, 2016; Häfner, Stock, & Oberst, 2015). Time management skills are associated with academic success (Farruggia et al., 2016). Time management skills are described as a combination of time assessment, goal setting, planning, and monitoring activities (Häfner et al., 2015). The first step that the majority of students fail to complete in time management is to prioritize tasks (Bast, 2016). After learning how to prioritize tasks, students may benefit creating to do lists, ritualizing tasks, and managing procrastination (Bast, 2016). To manage procrastination, students may break down large tasks into mini-tasks or use the Pomodoro technique of working in 20 minute chunks separated by 5 minute breaks (Bast, 2016). Finally, the methods a student uses to study may have a significant impact on time management abilities. Students should focus on studying concepts over facts. If students must study facts, techniques such as flashcards or mnemonic devices provide effective and rapid learning (Bast, 2016). Students should also be encouraged to study topics early and often, not waiting until just before the exam to begin studying (Bast, 2016).

Note-Taking

While note-taking was not directly mentioned by participants in this study as an area which could improve critical thinking, comments made by participants indicated that improved note-taking may mitigate barriers or challenges to critical thinking. For

example, the volume of content and speed of the presentation can be more easily managed if students have better note-taking skills. The quality and quantity of notes taken by students can be used as predictors of test performance and academic success. However, incorrect note-taking may lead to cognitive overload and reduced performance (Kim, 2018). Students have been shown to be ineffectual note-takers, only recording 30-40% of lecture points (Worthington & Levasseur, 2015).

Note-taking can be broken down into two components: encoding and external storage (Kim, 2018). Encoding is the action done during a lecture while external storage is reviewing notes after class has concluded (Kim, 2018). Encoding has a positive correlation to student success and can be done in a variety of manners (Bast, 2018, Kiewra, Colliot, & Lu, 2018; Kim, 2018; Moulton et al., 2017; Worthington & Levasseur, 2015). Students who take notes by summarizing or paraphrasing outperform students who take verbatim notes while students who use spatial methods outperform students who use linear methods (Kim, 2018; Moulton et al., 2017). Faculty may facilitate note-taking by providing access to either partial or full presentations ahead of time (Kim, 2018; Worthington & Levasseur, 2015). Providing partial presentations has a longer-term impact on student performance than providing full presentations (Kiewra et al., 2018; Kim, 2018; Worthington & Levasseur, 2015).

There are also methods of note-taking which may be taught to students. The Cornell note-taking method is a method in which wide margins are created on the left and bottom of the page (Bast, 2018). After the lecture has concluded, students should review their notes and record the major topics of the lecture in the left-hand margin while

summarizing each page in the bottom margin (Bast, 2018). Another method is the SOAR (select, organize, associate, and regulate) method (Kiewra et al., 2018). In this method, students select the content to be recorded in their notes, organize the notes into a graphic format after class to revel associations between lesson components, and evaluate their learning to determine what gaps remain (Kiewra et al., 2018). After determining the gaps, students fill in the gaps in their knowledge content (Kiewra et al., 2018). While each method of note-taking has advantages and disadvantages, they are highly specific to the students. Therefore, numerous methods of note-taking should be taught to students.

Actions that faculty take may also improve note-taking. Faculty may facilitate note-taking by providing note-taking cues, such writing terms on the board, providing written questions, stating that a point is noteworthy, pointing, or pausing after delivering a point (Kiewra et al., 2018). Another way faculty may facilitate note-taking is by providing breaks in the lecture and asking students to use the time to revise their notes and work with classmates to fill in blanks (Kiewra et al., 2018). Finally, faculty may control how students take notes. While many students use computers or tablets to take notes, they are distracted by other opportunities that these devices provide, such as checking email or surfing the internet (Kiewra et al., 2018). Controlling the use of technology and limiting the distractions that these devices provide can positively facilitate student note-taking (Kiewra et al., 2018).

Project Description

The project developed from the results of this study is a 3-day faculty development workshop. The faculty development workshop was created based on the

study findings and best practices as found in the literature review. The purpose of this faculty development workshop is to provide faculty at Technical University with the tools, techniques, and strategies to effectively incorporate critical thinking into classrooms. The goals of this faculty development workshop are for faculty to:

- understand the students' subjective definitions of critical thinking and its relationship with published definitions of critical thinking,
- identify examples and applications of critical thinking,
- describe the importance and relevance of critical thinking to students,
- recognize barriers or challenges their students face to critical thinking and methods to mitigate them,
- learn how to develop course structure and materials to encourage critical thinking, and
- implement and evaluate newly designed course materials to engage students in critical thinking.

The learning outcomes of the faculty development workshop are:

- faculty will be able to define critical thinking and compare it to student's subjective definitions of critical thinking,
- faculty will be able to provide examples and applications of critical thinking,
- faculty will be able to explain of the importance of critical thinking to students,
- faculty will be able to determine barriers or challenges students are facing to critical thinking,
- faculty will develop methods to reduce barriers or challenges to critical thinking,

- faculty will be able to design course materials to increase critical thinking,
- faculty will engage students in critical thinking, and
- faculty will be able to assess efficacy and usability of course materials in promoting the use of critical thinking.

Faculty Development Workshop – Module 1: Defining Critical Thinking

The first module will begin with a welcome from the facilitator, an introduction to workshop, and a summary of the four modules that compose the workshop. The module summaries will include a description of the structure, purpose, and objectives of the workshop as well as for each module. The goals for the first module are for participants to understand the students' subjective definitions of critical thinking and its relationship with published definitions of critical thinking, identify examples and applications of critical thinking, and describe the importance and relevance of critical thinking to students.

The workshop will start with a think-pair-share activity in which the participants describe their subjective theories regarding critical thinking. Participants will review student subjective theories regarding critical thinking and discuss if the students' subjective theories align with the faculty's subjective theories regarding critical thinking. Next, participants will brainstorm reasons that critical thinking is important followed by a sample of reasons that students gave regarding the importance of critical thinking. Examples of critical thinking that participants have used in their classroom as well as those students provided.

After these three discussions, the facilitator will provide the definitions of critical thinking, cognitive elaboration, and problem-solving. Workshop participants will compare and contrast their subjective theories regarding critical thinking from the beginning of the workshop with these definitions and engage in a discussion about their alignment. Workshop participants will then analyze the subjective theories from the students as well as the examples given by faculty and students to determine how closely they align to the definition of critical thinking.

Resources.

- Welcome and Module 1 PowerPoint
- Handout 1: Students' Subjective Definitions of Critical Thinking
- Handout 2: Students' Examples of Critical Thinking
- Handout 3: Venn Diagram Comparing Your Definition of Critical Thinking to the Paul-Elder Definition of Critical Thinking
- Handout 4: Venn Diagram Comparing Your Pair's Definition of Critical Thinking to the Paul-Elder Definition of Critical Thinking
- Handout 5: Venn Diagram Comparing the Group's Definition of Critical Thinking to the Paul-Elder Definition of Critical Thinking

Faculty Development Workshop – Module 2: Overcoming Barriers

The goal for the second module is for participants to recognize barriers or challenges students face when attempting to engage in critical thinking and develop mitigation strategies. Participants will begin by brainstorming barriers encountered when implementing critical thinking activities in the classroom and possible solutions. The

discussion will progress to barriers that participants see students encountering when attempting to use their CTS and methods to mitigate those barriers. The facilitator will present barriers students perceive to critical thinking, such as the volume and difficulty of course content, lack of time, lack of definition and training in critical thinking, faculty attitude, and course organization or format. After an introduction to the students' perceived barriers, faculty will discuss possible methods to mitigating these barriers.

The module will next address two skills that help students improve their knowledge acquisition: time management and note-taking strategies. The time management section will begin with a discussion of the importance of time management and what is involved. Various time management techniques, including creating to-do lists or mini-tasks, ritualizing tasks, using an unbreakable chain of dots, the Pomodoro technique, and interleaving, will be reviewed.

The note-taking section will also begin with a discussion about its importance and why it is addressed in a faculty development workshop. The components of effective note-taking will be reviewed as well as methods to encode notes. The methods reviewed will be using PowerPoints, revising notes, the outline method, the Cornell method, the charting method, and the mind map method. After an introduction to each method of note-taking, a short video will be shown for participants to practice each method followed by a discussion of its pros and cons. At the end, the efficacy of each method will be tested by workshop participants completing and grading a worksheet using only their notes. Participants will discuss the efficacy results from each note-taking method and which type they think would most benefit their students. The module will conclude with a

discussion of the actions that participants can take during a class to improve note-taking by students.

Resources.

- Module 2 PowerPoint
- Handout 6: PowerPoint Slides for Note-Taking
- Handout 7: How Effective was the PowerPoint Method with Revision? The Hardy-Weinberg Principle: Watch your Ps and Qs
- Answers to Handout 7: How Effective was the PowerPoint Method with Revision? The Hardy-Weinberg Principle: Watch your Ps and Qs
- Handout 8: How Effective was the Outline Method? Ancient Mammal's Ears Were Built for Chewing
- Answers to Handout 8: How Effective was the Outline Method? Ancient Mammal's Ears Were Built for Chewing
- Handout 9: How Effective was the Cornell Method? The Curious Case of Colic
- Answers to Handout 9: How Effective was the Cornell Method? The Curious Case of Colic
- Handout 10: How Effective was the Charting Method? The Woman Who Changed Drug Development
- Answers to Handout 10: How Effective was the Charting Method? The Woman Who Changed Drug Development
- Handout 11: How Effective was the Mind Map Method? How Antarctica Froze Over

- Answers to Handout 11: How Effective was the Mind Map Method? How Antarctica Froze Over

Faculty Development Workshop – Module 3: Materials and Methods to Encourage Critical Thinking

The goals for this module are for faculty to develop course materials and modify course format to encourage critical thinking through the implementation of the information from the last two modules. First, the facilitator will introduce different tools that can be used to help increase critical thinking in the classroom, beginning with how PowerPoint presentations can be adapted to incorporate critical thinking. Participants will brainstorm reasons that they use PowerPoint as well as what they like and dislike about the program. A brief review of the literature regarding the advantages and disadvantages of PowerPoint will be presented. Mayer's multimedia theory will be described as a method that may be used to improve presentations. An alternative method to facilitate presentations, Prezi, will be introduced along with its advantages and disadvantages. Workshop participants will then discuss different types of active learning and personal successes or failures when used in the classroom. The facilitator will provide a comparison of the three methods of teaching by providing an example PowerPoint, Prezi, and active learning activity for workshop participants to evaluate. The remaining time in the workshop will allow participants to update or develop course materials to increase critical thinking.

Resources.

- Module 3 PowerPoint

- PowerPoint on the Endocrine System
- Prezi on the Endocrine System
- Handout 12: Learning Activity on the Endocrine System

Faculty Development Workshop – Module 4: Implementation and Evaluation

The goal of this module is for participants to implement the newly designed materials into classes in the next term. This module is split into two different days; the first day is an introduction to the module. During the first day, the facilitator will discuss the expectations for participants to implement the materials they developed during Module 3. The main expectation is that the participants will make arrangements for their use of the newly developed materials to be recorded. Workshop participants will then complete an evaluation of the first three modules. Participants will also set a time for the final meeting during the next break between terms.

In the final meeting, the goal of the workshop is to evaluate the efficacy of the newly designed course materials. The entire meeting will be focused on watching and evaluating the implementation of materials designed in the third module. The faculty will then evaluate the workshop, providing information about the retention of content and usefulness of the workshop after they have implemented the tenets of the workshop in their classes.

Resources.

- Module 4 PowerPoint
- Program Evaluation I
- Program Evaluation II

Existing Supports

There are several existing supports at Technical University. An important resource for this project is the existing faculty development day, during which this workshop may be offered. Technical University requires all faculty to participate in at least two professional development days annually; however, the university reserves the right to request participation in up to five professional development days. The two primary professional development days are typically scheduled six months apart: once in July and once in January. However, in recent years, Technical University has allowed one professional development day, typically the January professional development day, to consist of individualized faculty development. In this method of faculty development, each faculty member determines the professional development most relevant to their area of expertise. Faculty may opt to participate in workshops offered by Technical University as a method to fulfil individual faculty development requirements. This provides an opportunity to require faculty to participate in this workshop.

Another resource is the Faculty Resource Center, a department at Technical University staffed with educational design specialists who help faculty re-develop materials as well offer development seminars. There are two ways this existing support could be used. The first is by allowing the Faculty Resource Center to offer this workshop as several seminars over an extended period of time, rather than several subsequent days. In addition, the Faculty Resource Center staff could be help facilitate the material development portion of the faculty development workshop. Faculty Resource Center staff could also assist faculty who need additional help after the workshop has

concluded. Further, the Faculty Resource Center staff can be used to record the implementation of the new course materials for analysis during the final workshop meeting.

Potential Barriers and Solutions

There are several barriers to implementation of this workshop including lack of faculty engagement, lack of time, and large groups. The structure of the faculty development workshop is such that it requires full participation of the participants to be most impactful. Without participation, there would be little occurring during the workshop and it would fail to meet its objectives. One way to encourage participant engagement is to ensure that the workshop is conducted with small groups and a skilled facilitator. The lack of time is likely one of the most challenging to overcome. One solution is to schedule all days of the workshop to occur during break from teaching. This will give faculty more time to dedicate to the faculty development workshop. A second solution could be to create an online version which can be completed asynchronously at the faculty member's convenience.

The potential barrier of large groups is due to the structure of Technical University's faculty development day. In general, the day begins with the entire full-time faculty, approximately 160 individuals, meeting for the introductory seminar. After the introductory seminar, the faculty are broken up into small groups in different rooms for the remainder of the day. The format of the developed workshop would not be feasible with the current structure of Technical University's faculty development day. One potential solution is to train other facilitators, such as staff from the Faculty Resource

Center or members of the Faculty Development Committee, and conduct the entire faculty development day in small groups.

Implementation Plan and Timeline

The implementation plan for this faculty development workshop will begin with meetings of the Faculty Development Committee. The Faculty Development Committee determines the topic faculty development days. As a member of the Faculty Development Committee, the research has the opportunity to suggest ideas for the faculty development day. Typically, planning for the July faculty development day begins in April of the same year. During the meetings held in April 2020, the researcher will present this faculty development workshop to the other committee members for consideration. Upon approval of the committee to implement this workshop during the faculty development day, the first two days of the workshop will be held July 9th and 10th, with the third date to be held later in the term, based on the implementation of the developed materials and participant availability.

Roles and Responsibilities of Students and Others

The researcher is responsible for facilitating the proposed faculty development workshop to the faculty development committee for implementation as well as conducting the faculty development workshop. The researcher is also responsible for training additional individuals to conduct the faculty development workshop. Workshop participants will be responsible for actively engaging in the faculty development workshop and bringing materials to be modified during the workshop. Participants are also responsible for scheduling the recording of the newly designed content with the

Faculty Resource Center and implementing the new material in their classroom. Finally, workshop participants are also responsible for determining the date for the final workshop meeting.

Project Evaluation Plan

As a result of this research, it was suggested that faculty need training regarding students' subjective definitions and engagement in critical thinking as well as methods to enhance student participation in critical thinking. A workshop was developed to focus on increasing faculty awareness of student perceptions of and barriers or challenges to critical thinking as well as the mitigation of these barriers or challenges through re-development of course content. The purpose of evaluating the faculty development workshop is to determine if the program addressed the outcomes and content delivery was effective (Caffarella & Daffron, 2013). A goals-based summative evaluation will be used to evaluate the overall success of the workshop in increasing faculty awareness of student perception of critical thinking along with methods which may be used to increase their critical thinking. The goals of this faculty development workshop are for faculty to:

- understand the students' subjective definitions of critical thinking and its relationship with published definitions of critical thinking,
- identify examples and applications of critical thinking,
- describe the importance and relevance of critical thinking to students,
- recognize barriers or challenges their students face to critical thinking and methods to mitigate them,

- learn how to develop course structure and materials to encourage critical thinking, and
- implement and evaluate newly designed course materials to engage students in critical thinking.

There will be two summative evaluations completed, the first at the conclusion of Module 3 and the second at the end of Module 4. This is due to the 10-week gap between the completion of these modules. The evaluation at the conclusion of Module 3 will provide immediate feedback regarding the efficacy of the workshop while the evaluation at the end of Module 4 will provide information regarding the retention of covered content as well as applicability of the content.

The stakeholders benefiting from the evaluation of the faculty development workshop are the faculty at Technical University. The faculty will be able to use the strategies presented in the workshop and those discussed during Module 4 to increase student engagement in critical thinking and improve student success. The results of the evaluation will also contribute to the improvement of this workshop for future.

Participants will complete a survey to evaluate the faculty development workshop. The survey will include questions using a 5-point Likert scale to determine if participants perceived that the goals of the faculty development workshop were met. Additionally, open-ended questions will be used to determine what participants believed were the strengths and weaknesses of the program as well as their perception of what they learned from the program and if they have any recommendations for program improvement.

Project Implications

The problem addressed in this study is that despite the importance of critical thinking, many adult students fail to engage in critical thinking in A&P at Technical University. Adult students at Technical University felt that they understood the definition of critical thinking and engaged in it while at Technical University; however, they primarily provided examples of cognitive elaboration rather than critical thinking. This problem and the resulting findings are addressed through a faculty development workshop designed to enhance faculty's awareness of tools, techniques, and strategies to effectively incorporate critical thinking into classrooms. Faculty will benefit from this project as it will provide them with the needed resources to implement critical thinking, rather than cognitive elaboration, in the classroom. This project focuses on enhancing the faculty's understanding of student perception, emphasizing the barriers and challenges the students perceive. This will allow faculty the ability to mitigate these barriers and challenges and improve student critical thinking.

Students at Technical University may also benefit from social change as a result of this workshop through an increase in understanding of critical thinking. As faculty incorporate content from the faculty development workshop into their classes, students' CTS will improve. As students engage more frequently in critical thinking, academic and clinical performance improve (Cargas et al., 2017). The improvement, both academically and clinically, may help students acquire and retain employment, helping to attain economic prosperity and social equity. In addition, once employed in the healthcare field, these students will be able to provide higher-quality patient care than students with

limited CTS (Cadorin et al., 2014; Eleazer & Kelso, 2018). Further, the results of this project will help local employers in hiring new employees. The lack of critical thinking is one of the contributing factors to the skills gap (Fyfe-Mills, 2015); this project may help to eliminate that gap.

Section 4: Reflections and Conclusions

Introduction

The purpose of this study was to better understand adult students' subjective theories regarding critical thinking in A&P, how they identify their use of critical thinking in A&P, and what barriers or challenges they perceive when asked to engage in critical thinking enrolled in A&P at Technical University. Data gathered from 12 interviews with adult students at Technical University were used as the basis for the project described in Section 3. This section presents the researcher's reflection on the strengths and limitations of this study as well as the research. Recommendations, the importance, implications, and applications of the study will also be discussed.

Project Strengths and Limitations

Project Strengths

The objective of this project was to better understand how adult students perceive and engage in critical thinking in A&P in order to facilitate an increase in critical thinking. One of the strengths of this project is that the faculty development workshop is centered on students' perspectives. Faculty participating in the workshop are able to see students' perspectives rather than someone's interpretation of them. In addition, the workshop allows for participants to reflect upon definitions and examples of critical thinking and compare them to published definitions, deepening their understanding of the student perspectives. Another strength of the faculty development workshop is that it is a workshop rather than a lecture. The highly interactive and collaborative nature of the workshop may expand participant's ideas and help to increase collaboration after the

workshop has concluded. In addition, the workshop allocates time for participants to develop course materials using workshop content. Participants have many demands on their time; providing time during the workshop to develop course materials increases the likelihood that the content from the workshop will be implemented. Designating time during the workshop also gives faculty practice developing course materials or designing course structures that allow for critical thinking when there are others who can provide a second opinion or help them work through challenges they encounter as they develop materials. Finally, using the scheduled faculty development day to offer this workshop means that faculty do not have to make time to attend a workshop at another time.

Project Limitations

The researcher views basing the workshop on student interviews as a strength; however, faculty may undervalue student perspectives presented in the workshop or disagree with the results, and this may result in faculty resistance to participating in the workshop. Limited participation by workshop participants would result in little occurring during the workshop and it would fail to meet its objectives. Another limitation is that, while the workshop does allocate time for faculty to develop course materials, there is a possibility that they will need more than the time allotted to completely develop materials. If the materials are not fully developed during the workshop and participants did not finish developing the materials, then the implementation of materials and the corresponding increase in critical thinking would not occur and the impacts of the study would be limited. In addition to the possibility of requiring additional time to complete the development of course materials, the faculty must put in time outside of the workshop

to implement and record the use of the newly-designed materials. The implementation of the newly developed content outside the workshop is a limitation of the project, as faculty may not want to engage in the effort required for implementation. This is a limitation as if the course materials are not implemented then the impacts on critical thinking would be limited. The final day of the faculty development workshop to discuss how the implementation progressed may help to reduce the likelihood of participants failing to implement the newly developed course materials. However, a final meeting at a later day introduces another limitation as not all faculty may attend the third and final day of the workshop. Lack of attendance on the third day limits the ability of the participants to evaluate the workshop. It also limits the quality of materials produced as workshop participants will evaluate and gain ideas for improvement of their materials. Finally, participants will need to consider the impact that newly-developed course materials will have on special accommodations for students with learning or emotional disabilities.

Participants who have students which require accommodations may be hesitant to participate and develop new materials as they may find it challenging to accommodate students' needs while implementing course materials which encourage critical thinking.

Recommendations for Alternative Approaches

Although the faculty development workshop was the method chosen to have the greatest impact on incorporating critical thinking into A&P at Technical University, there are alternative approaches that could be used to address the problem. One barrier was the number of student actions that negatively impacted critical thinking including not taking responsibility for their learning, failing to seek tutoring, poor study skills, and lack of

time management skills. While these barriers were addressed in the workshop, another way to address them would be to develop a curriculum. This curriculum would address the challenges students face to critical thinking by teaching them the skills to mitigate their barriers to critical thinking. A second approach that may be used would be to offer the proposed faculty development workshop as an online workshop rather than in person. An online workshop was not chosen as the goal was to implement the project during Technical University's existing faculty development days.

Scholarship, Project Development and Evaluation, and Leadership and Change

Scholarship

As a scholar, I learned how to conduct a continuous literature search through search alerts in Google Scholar, allowing saturation of literature reviews. When conducting the literature review, I discovered the importance of peer-reviewed articles and how to verify if the articles were peer-reviewed. Some articles which Google Scholar returned were not peer-reviewed, which I discovered after reading them. The difference in research quality between peer-reviewed and nonpeer-reviewed articles was apparent in the clarity of the writing and reporting of the results.

I also gained an ability to conduct doctoral-level research and understanding of how to collect and analyze data using ethical research standards. Determining how to recruit for interviews in an ethical manner was a challenge I faced when developing recruitment methods. I also had to maintain an ethical manner to recruit participants despite limited responses from students which resulted in a long data collection period.

Maintaining ethical standards helped me develop the patience required to complete research.

I developed an understanding of how to conduct qualitative data analysis. My previous research experience was completed using quantitative data; learning qualitative data analysis was a struggle and took significant effort. By continuously practicing the methods I learned during my qualitative data analysis class, I was able to develop the skills I needed to analyze the data from my research study. I discovered the importance of iterative coding in qualitative data analysis and found that my understanding deepened the more I reviewed the data. As part of the qualitative data analysis, I discovered the importance and challenge of finding the correct word to convey the appropriate meaning. I rediscovered the need for a good thesaurus in helping me articulate my thoughts.

Project Development and Evaluation

As I worked on developing the project for my doctorate, the iterative nature of developing a lecture came as a surprise; I found that I could always improve on what I had previously developed. I realized how flexible I needed to be in developing a project and how key the iterative process was to creating a polished workshop. As I developed the project, I had to respond to what study participants stated were their needs in order to create a faculty development workshop that addressed the problem in the context of the findings. The project had to result in a faculty development workshop that was applicable to the local site while including practical strategies and techniques to help solve the problem. It also became obvious as I was developing the workshop content that, while I had definite thoughts regarding types of course material each participant should create or

modify, a flexible project deliverable would be more appropriate, allowing faculty to gain the most use from the workshop. Due to the interactive and collaborative nature of the faculty development workshop as well as its goal to produce functional course materials, data from the evaluation of the workshop should be used to update the workshop each time it is offered. Evaluations should be reviewed for strengths, weaknesses, and suggestions for improvement to ensure that it is an effective workshop.

Leadership and Change

Throughout this project study, I developed new skills as a scholar-practitioner. I pursued a doctorate to help me advance my career but as I progressed through the program, my motives for completing my doctorate changed. In maturing as a scholar-practitioner, my motives for completing my doctorate began to focus on how my doctoral research could help me teach my students so that they became more confident and capable of learning and critical thinking. In addition, my research has made me create more opportunities for interactions with students during traditionally didactic courses and leave the expert-learner binary behind. This developed as I discovered what faculty actions participants viewed as challenges that reduced critical thinking as well as what the project's literature review revealed about presentation format and why it matters.

The process of completing my doctoral research has also emphasized that promoting positive social change is a slow process that requires commitment on a daily basis. I must learn to persevere and stick with the challenging teaching methods, even when lectures would be easier. I must also push the students to engage in active learning methodologies and look past memorization to application and critical thinking. The

iterative process is also a component necessary to influence social change and adapt my teaching. If the teaching method does not have optimal results the first time, I must adapt the materials and try it another way, keeping the goal of increasing critical thinking to promote social change in mind.

Reflection on Importance of the Work

As I reflected on all I have learned throughout my doctoral journey, the impact this study may have on social change became evident to me. One thing I have learned throughout this process is that creating social change is hard, one must work at it on a regular basis and must promote it among colleagues in order for social change to occur. The goal of this study was to determine methods to mitigate the barriers and challenges adult students face when attempting to use CTS in the classroom. Too many students are entering the workforce with a skills gap which leaves the graduates unprepared for the challenges of working in clinical settings. One component of the skills gap is the lack of CTS. Increasing adult students' CTS is vital to their development as practicing health care providers who are able to problem-solve and appropriately manage complex medical problems. Participating in the faculty development workshop will allow faculty to become more proficient in their ability to incorporate critical thinking into their classrooms and therefore improve the CTS of their students. The project will help provide faculty with the resources and collaboration necessary to develop these materials which promote critical thinking.

Implications, Applications, and Directions for Future Research

The potential impact for positive social change from this study can occur at the individual and community level. At the individual level, faculty may have an improved understanding of critical thinking as perceived by students and methods to increase the CTS used in their classes. Also at the individual level, this project may improve the social equity and economic prosperity of students. Social change at the individual level is possible if the students progressing through the program at Technical University are exposed to more critical thinking in their classes. Increased incorporation of active learning and critical thinking increases academic success, retention, and graduation rates of adult students. Increased exposure to and use of critical thinking may lead to better job prospects and performance, creating positive social change. At the community level, health care students who graduate with increased CTS are able to provide better patient care. Health care providers with CTS are better able to problem-solve and make decisions regarding the most appropriate patient care.

The study contributes to the base of knowledge regarding critical thinking in higher education, specifically in A&P. There are several studies that may develop from the results of this project. One future research project could investigate the subjective theories that the faculty at Technical University hold regarding critical thinking as well as their methods for and barriers to integrating critical thinking into classes. An additional way to build on the results of this study is by examining the incorporation of critical thinking into other gatekeeper classes or students in other majors.

Conclusion

The problem addressed by this study was that despite the importance of critical thinking many adult students fail to engage in critical thinking in A&P at Technical University. The purpose of this study was to better understand adult students' subjective theories regarding critical thinking, how they identify their use of critical thinking, and what barriers or challenges adult students perceive when asked to engage in critical thinking in A&P while enrolled at Technical University. After conducting semistructured one-on-one interviews with 12 students, adult students' perceptions regarding CT were described and used to develop a faculty development workshop. The faculty development workshop, entitled *Developing Critical Thinking Skills*, is designed to provide faculty at Technical University professional training to develop their understanding of critical thinking. The aim of faculty development workshop is to help faculty develop materials which encourage students to use CTS while mitigating the barriers and challenges students perceive they face when asked to engage in critical thinking. Increased engagement in critical thinking should help students graduate in the health sciences fields with improved CTS, allowing them to provide better patient care and increased employment opportunities. The increase in employment opportunities should provide graduated with improved economic prosperity and social equity.

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Appendix A: The Project

Agenda for Professional Development Workshop

Day 1

8:00-9:00: Welcome and Continental Breakfast

9:00-10:30: Welcome and Module 1 PowerPoint: Introduce the format of the workshop and the topics that will be covered over the course of the workshop. Elucidate faculty subjective theories regarding critical thinking and evaluate student subjective definitions of critical thinking.

10:30-10:45: Break

10:45-12:00: Welcome and Module 1 PowerPoint: Brainstorm reasons critical thinking is important, review reasons students gave regarding the importance of critical thinking, discuss examples of critical thinking faculty have used in class and examine examples that the students provided of critical thinking.

12:00-1:00: Lunch

1:00-2:45: Welcome and Module 1 PowerPoint: Introduce the definitions of critical thinking, cognitive elaboration, and problem-solving. Compare and contrast faculty and student subjective theories and examples of critical thinking with the published definitions.

2:45-3:00: Break

3:00-5:00: Module 2 PowerPoint: Brainstorm barriers faculty and students encounter when incorporating critical thinking into the classroom, review barriers perceived by students to critical thinking and discuss methods to mitigate these barriers.

Day 2

9:00-10:30: Module 2 PowerPoint: Introduce time management strategies and methods to encode notes. Practice all methods of note taking and review faculty thoughts regarding these note-taking methods.

10:30-10:45: Break

10:45-11:45: Module 2 PowerPoint: Evaluate the efficacy of each note-taking method and discuss actions that faculty can take during classes that improve note-taking.

11:45-12:45: Lunch

12:45-2:45: Module 3 PowerPoint: Review reasons PowerPoint is used by faculty as well as what the literature says about PowerPoint. Discuss Mayer's Multimedia theory and its applicability as well as Prezi and methods of active learning.

2:45-3:00: Break

3:00-4:45: Module 3 PowerPoint: Compare the three different methods of teaching a topic (PowerPoint, Prezi, and active learning) and develop or modify materials to increase critical thinking.

4:45-5:00: Module 4 PowerPoint: Discuss what faculty need to do to record the implementation of their new materials, set the date and time for the final meeting, and evaluate the workshop.

Day 3

9:00-10:30: Module 4 PowerPoint: Watch the videos of each faculty member implementing the new course material and discuss the strengths and weaknesses of the material and its implementation.

10:30-10:45: Break

10:45-12:00: Module 4 PowerPoint: Watch the videos of each faculty member implementing the new course material and discuss the strengths and weaknesses of the material and its implementation. Evaluate the workshop.

Appendix B: Request for Participation

January 1, 2018

You are invited to take part in a research study about adult students' perceptions of critical thinking in Anatomy and Physiology (A&P), including subjective theories on the definition of critical thinking, your identification of engagement in critical thinking, and any barriers or challenged you faced when engaging in critical thinking. You have been invited to participate in this study because you are a non-nursing health science major student who has recently completed your first term of A&P. If you were previously or are currently enrolled in a course taught by Elizabeth Dubofsky-Porter, you are not eligible for participation in this study.

If you agree to be a participant in this study, you will be asked to partake in a one-on-one interview with me that will last 30-45 minutes. At the conclusion of the interview, you will be given a $10 Dunkin' Donuts gift card to thank you for your time and participation in the research study. We can schedule the interview at a location of your choice on a day and time that is convenient for you. You will be asked to sign an informed consent that will inform you of your rights during the study, such as the voluntary nature of this study, that any data collected will be used for the sole purpose of this study at the start of the interview.

Should you decide to take part in this study, please reply to this email stating "I am interested in participating in this study."

Sincerely,

Elizabeth Dubofsky-Porter

Walden University doctoral candidate

Appendix C: Interview Protocol

A. Introductions

B. Purpose of the interview

    a. The purpose of this interview is to gather data regarding how adult students define critical thinking in A&P, how they identify their use of critical thinking in A&P, and what barriers or challenges they perceive when asked to engage in critical thinking in A&P.

C. Process of the interview

    a. The interview will be recorded using a digital device and then transcribed

    b. Individuals will be given an alias for data analysis and reporting

D. Ethical information

    a. Participation is voluntary

    b. The interview can be ended at any time and any data collected will be destroyed

    c. A transcript of the interview will be provided to the participant and you will be given the opportunity to provide corrections

    d. Informed consent will be obtained before the interview begins

E. Interview Questions

    a. How do you define critical thinking?

i. If the participant is cannot provide a definition of critical thinking, the interviewer will state "We can revisit this question later."

b. What are some examples of how you have engaged in critical thinking in your life outside school?
    i. What, if any, are some examples of times people have praised your use of critical thinking?
    ii. What do you think made this example critical thinking?
    iii. What, if any, are some examples of times people have suggested you use of critical thinking?
    iv. Why do you think the use of critical thinking was suggested in this circumstance?
c. How important do you think critical thinking is to success in school? In the workplace? Why? What are some examples of how you have engaged in critical thinking while enrolled at Technical University?
    i. Which courses do you feel have promoted the use of critical thinking? How?
    ii. Which courses do you feel have limited use of critical thinking? How?
d. What are some examples of how you have engaged in critical thinking in A&P at Technical University?
    i. If you do not have any examples, why do you think this is so?

e. What barriers or challenges have impacted your ability to engage in critical thinking in your courses at Technical University?
    i. Has anything a faculty or classmate done helped reduce these barriers or challenges?
    ii. Has anything a faculty or classmate done increased these barriers or challenges?
f. What barriers or challenges have impacted your ability to engage in critical thinking in A&P at Technical University?
    i. Has anything a faculty or classmate done helped reduce these barriers or challenges?
    ii. Has anything a faculty or classmate done increased these barriers or challenges?
g. What do you feel that the faculty may do to encourage the use of critical thinking in A&P?
h. What do you feel that the faculty may do that discourages the use of critical thinking in A&P?
i. Now that we have discussed examples of critical thinking, I would like to revisit your definition of critical thinking. How would you define critical thinking at this point?
    i. What would you add or remove from your initial definition of critical thinking?

F. Conclusion of interview

a. Thank you for your participation in this interview process. I will be contacting you via email in the next several weeks to provide you with the opportunity to review your interview transcript.
b. Providing of the gift card.
c. Please do not hesitate to contact me or my institution if you have any questions regarding this study.
d. If you would like to read the final conclusions of this study, please let me know so that I may provide the results to you.