ABSTRACT

AYANGMA, ALAIN LEGER. Predicting Student Success in Online Postsecondary Career and Technical Education: Engaging with Peers, Faculty, Content and Work-Based Learning. (Under the direction of Dr. James E. Bartlett, II.)

Globalization, technology, labor market demands and economic growth have created the need for a skilled workforce. Community colleges serve as a pivotal player in the fight to meet workforce development needs through their offerings of Career Technical Education (CTE) courses. So doing, community colleges play a key role as a developer of human capital. Online learning is a growing trend among higher education institutions. In community colleges, where students need the flexibility offered by the online mode of course delivery, it allows for the reach of a larger student population, and the attraction of a new generation of digital learners, in an attempt to increase the pool of skilled workers.

How students interact with peers, faculty, and content in online courses has been shown to impact student success. However, there is currently a lack of empirical evidence to understand how online courses, and specifically, the interactions in online postsecondary CTE courses, in regards to student-to-student, student-to-instructor, student-to-content and student-towork-based learning interactions relate to student success.

The purpose of this quantitative study is to identify the interactions in online CTE courses and then explore the relationships among interactions and student success outcomes in the context of an online postsecondary CTE environment. The theoretical framework of the present study combines socio-cultural theory, social information processing theory, social constructivism, and Kirkpatrick's four-level training evaluation model.

The data collection was done through a survey instrument and relied on Dillman's Total Design Method (TDM) as a model to ensure the highest response rate possible. The research

instrument utilized for this study is a combination of survey items developed by Sher (2009) and includes survey items from Hiltz (1994), Arbaugh (2000), and Johnson, Aragon, Shaik, and Palma-Rivas (2000). It also includes items developed by Strachota (2006). The survey measures student-to-student interaction, and student-to-instructor interaction, student-to-content interaction, student-to-work-based learning interaction, student satisfaction, perceived learning, academic success, and perceived transfer of learning. Control variables, including gender, age, ethnicity, previous online courses taken, and Internet experience served to minimize threats to validity and to isolate the effects of the independent variables.

The survey instrument was sent to community college students taking online CTE courses in the spring 2020 semester. Factor analyses and multiple regression analyses were performed to analyze the hypotheses.

The study revealed that student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interactions were all positively correlated with student satisfaction, perceived learning and perceived transfer of learning. However, student-to-work-based learning interaction was the only interaction to explain student retention into and completion of the program, and none of the interactions explained student achievement as measured by GPA and grade in the last online course.

© Copyright 2020 by Alain L. Ayangma

All Rights Reserved

Predicting Student Success in Online Postsecondary Career and Technical Education: Engaging with Peers, Faculty, Content and Work-Based Learning

by Alain Léger Ayangma, II

A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Education

Adult and Community College Education

Raleigh, North Carolina 2020

APPROVED BY:

Dr. James E. Bartlett, II Committee Chair Dr. Michelle E. Bartlett

Dr. Bobbie E. Frye

Dr. Carrol Warren

ProQuest Number: 28122867

All rights reserved

INFORMATION TO ALL USERS The quality of this reproduction is dependent on the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 28122867

Published by ProQuest LLC (2020). Copyright of the Dissertation is held by the Author.

All Rights Reserved. This work is protected against unauthorized copying under Title 17, United States Code Microform Edition © ProQuest LLC.

> ProQuest LLC 789 East Eisenhower Parkway P.O. Box 1346 Ann Arbor, MI 48106 - 1346

DEDICATION

I would like to dedicate this work to my late father, Mr. Simon Pierre Ayangma, who has been more than a father figure to me my entire life. Words cannot express how happy I am to carry your name to the highest highs. You were there for me every step of the way, from kindergarten until last year; and although I wish you were here to celebrate this accomplishment with me, I know you are even happier than I am. I thank you for nurturing my passion for knowledge and excellence, and always supporting and encouraging me to reach as far as my dreams would take me. The values you instilled in me are things I will pass on to the next generation. This one's for you.

To my mother, Mrs. Georgette Marceline Ayangma. Thank you for your graceful strength and nurturing love throughout the years. You have always believed in me, even when I didn't believe in myself. I could not have asked for a better mom.

To my better half, Anne Evelyne. I appreciate your love and support throughout this process and beyond. Thank you for listening to my frustrations without ever complaining, but always pushing me to stay strong and finish what I had started. I couldn't have done it without you.

To my son, William Adriel, this is also for you, to show you that it is possible to achieve whatever you put your mind to. My hope is that one day, you can get inspired by what your dad was able to accomplish, and use it as a fuel to push the limits of your imagination.

To my brothers and sister, Francis, Daniel, Elie Paul and Blanche. Thank you for putting up with me all these years. I feel lucky to have you all.

BIOGRAPHY

Alain Léger Ayangma II was born in France and grew up between France and Cameroon (West Africa). After earning a B.S. in Mathematics, a B.S. in Mathematics Education, and a M.S. in Mathematics from the University of Yaoundé 1, he taught Mathematics at the secondary and postsecondary levels in Cameroon and France, before moving to the U. S. where he has taught college Mathematics for over a decade. Additionally, he held various positions at fortune 500 companies including: Samsung Electronics, TD Bank and BMW. He is currently an Assistant Professor of Mathematics in the Mathematics and Physics department at Wake Technical Community College in Raleigh, NC, where he also serves as the lead faculty for Brief Calculus (MAT-263). He has presented at several conferences on topics ranging from how to bridge the gap between the mathematics curricula and CTE students' career paths, to the leveraging of improvement science in educational settings.

Alain was the recipient of the 2018-2019 Anderson-Glass fellowship from North Carolina State University's College of Education. He also was a 2019 Achieving The Dream fellow, and is a 2020 ECMC postsecondary CTE research fellow. Additionally, he is a member of North Carolina State University's chapter of the Phi Kappa Phi honor society.

ACKNOWLEDGMENTS

I would like to extend my sincere gratitude to those who from near and far have contributed to making this project come to fruition. In particular, Dr. James Bartlett, whose support, guidance and mentorship were instrumental in helping me not only to complete this project, but to get exposed to a multitude of opportunities for growth as a scholar and practitioner. I also want to thank Dr. Michelle Bartlett for her candid insights and suggestions throughout my journey as a doctoral student. Your cheers and words of encouragement really lifted my spirit up each time. I am also indebted to Dr. Bobbie Frye, who helped me cement my understanding and mastery of several quantitative research methods through her availability to answer my never ending questions while teaching these courses. Last but certainly not least, I would like to express my gratitude to Dr. Carrol Warren for her availability and assistance throughout the program, and her commitment to ensuring that students were always ahead of the curve in regards to all administrative requirements. It definitely made a difference for me.

Finally, I am forever grateful to have been given the opportunity to be a part of one of the top doctoral programs around the nation: The Community College Leadership Doctoral Program (former Adult and Community College Education Program) at North Carolina State University. It has been a true life changing experience that equipped me with the tools I needed to be in a position to make a difference.

TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF FIGURES	X
CHAPTER 1: INTRODUCTION	1
Introduction	1
Problem Statement	
Purpose Statement	
Theoretical Framework	9
Conceptual Framework	
Research Questions	
Significance of the Study	
Limitations	
Delimitations	
Definition of Terms	
Summary	
CHAPTER 2: REVIEW OF LITERATURE	
Introduction	
History of the Community college	
The Community College as a Developer of Human capital	
History of Career and Technical Education	
Role of Community College in CTE	
The Expansion of Online Learning in the Community College	
Online Career and Technical Education	
Development of Research on Interactions in the Online Environment	
Student-instructor interaction as the most important dimension.	
Student-student interaction as the most important dimension.	
Student-content interaction as the most important dimension	
All interaction dimensions as equally important.	
Four Dimensions of Interaction	
Student-to-instructor interaction.	
Student-to-student interaction.	
Student to work based logging interaction	
Student-to-work-based learning interaction	
Student setisfaction	
Student looming	
Student leaning.	/ 4 / ۸۷
Student perceived transfer of learning	40 18
Summary	40 10
CHAPTER 2. DESEADCH DESIGN AND METHODS	
UNAFIEK 3: KESEAKUN DESIGN AND METHUDS	
Introduction	50
Research Design	

Participants	
Instrumentation / Variables	
Independent variables.	
Dependent variables	
Covariate variables	
Data Collection	
Data Analysis	
Pre-data analysis.	
Factor analysis.	
Descriptive analysis.	
Multiple regression analysis.	
Hypotheses	
Hypothesis 1	
Hypothesis 2	
Hypothesis 3	
Hypothesis 4	
Validity and Reliability	
Summary	
CHAPTER 4: RESULTS	
Introduction	71
Pre-data Screening	72
Descriptive Statistics	73
Factor Analysis	
Multiple Regression Analysis	
Hypothesis 1	
Hypothesis 2	
Hypothesis 3	
Hypothesis 4	
Summary	
CHAPTER 5: DISCUSSION	
Conclusions	94
Conclusions	
Discussion	
Implications for policy	
Recommendations for policy.	
Implications for practice	
Recommendations for practice	
Implications for research	
Recommendations for research	
Summary	
DEFEDENCES	
A DDENDICES	
Appendix A: Instrument	

vi

Appendix B: Mean	and Standard Deviation	n of Cte Online S	Student Outcomes	

LIST OF TABLES

Table 1	Correlations Between CTE Online Student Interactions with Content, Instructor, Students, and Work-based Learning	.72
Table 2	Correlations Between CTE Online Student Outcomes of Satisfaction, Perceived Learning, Perceived Transfer of Learning, Intent to Complete, and Achievement	.73
Table 3	Age of Survey Respondents	.73
Table 4	Ethnicity of Survey Respondents	.74
Table 5	Pell Eligibility of Survey Respondents	.74
Table 6	Employment Status of Survey Respondents	.74
Table 7	Program Area by Full or Part Time Status of Survey Respondents	.75
Table 8	Component Loadings for first factor analysis	.77
Table 9	Reliability of Survey Scales and Items for First Factor Analysis	.78
Table 10	Component Loadings for Second Factor Analysis	. 80
Table 11	Reliability of Survey Scales and Items for Second Factor Analysis	. 81
Table 12	Mean and Standard Deviation of CTE Online Student Interactions with Content, Instructor, Students, and Work-based Learning	. 82
Table 13	Regression Analysis to Explain Student Satisfaction with Four Types of Interaction in Online CTE Courses	. 84
Table 14	Regression Analysis to Explain Student Perceived Learning with Four Types of Interaction in Online CTE Courses	. 86
Table 15	Regression Analysis to Explain Student Perceived Transfer of Learning with Four Types of Interaction in Online CTE Courses	. 87
Table 16	Regression Analysis to Explain Student Intent to Remain Enrolled and Complete with Four Types of Interaction in Online CTE Courses	. 89
Table 17	Regression Analysis to Explain Student Academic Achievement with Four Types of Interaction in Online CTE Courses	s 90

Table 18	le 18 Regression Analysis to Explain Student GPA with Four Types of Interaction in	
	Online CTE Courses	91
Table 19	Regression Analysis to Explain Student Grade in Last Course with Four Types	
	of Interaction in Online CTE Courses	91

LIST OF FIGURES

Figure 1.1	Bartlett's Model for Engaging the Online Learner	7
Figure 1.2	Vygotsky's Zone of Proximal Development	10
Figure 1.3	Kirkpatrick's Four-level Model of Training Evaluation	13
Figure 1.4	Conceptual Framework	15
Figure 1.5	Overall Plan of the Study	15

CHAPTER 1: INTRODUCTION

Introduction

Today's workforce development is greatly challenged by rapid changes in technology and the expanding and increasingly competitive labor pool resulting from globalization (Dychtwald, Erickson, & Morison, 2006). Thus, the United States' (U.S.) reliance on human capital to ensure their competitiveness in the global economy is more evident today than ever before (Gordon, 2000). Community colleges are at the forefront of the battle to enhance the United States' economic competitiveness by producing the highly skilled workforce needed to strive in an interconnected world (Rephann, 2007). In that respect, community colleges serve as human capital development entities (Lannan, 2009). Further, it was predicted that by 2020, 65% of jobs will require some form of postsecondary education including certificates, credentials, and associate degrees (Carnevale, Smith & Strohl, 2013). In North Carolina, the MyFutureNC commission created an attainment goal that by 2030 2 million North Carolinians (25-44) will have a high quality postsecondary degree or certification (MyFutureNC, 2019).

Understanding how much global competitiveness depends on a well-educated citizenry, the U. S. have spurred an impressive expansion of community colleges, who today provide access to over 10 million students each year, equating to almost half of the nation's undergraduates (Bailey, Jaggars & Jenkins, 2015). D'amico, Sublett, and Bartlett (2019) contend that community colleges serve more than 40 percent of U.S. undergraduates and are a critical piece of the higher education and economic landscapes. Postsecondary Career and Technical Education (CTE), specifically through the community college, remains pivotal to preparing students for specific jobs in the workforce. According to the Association for Career and Technical Education (ACTE) (2019), in the 2013-2014 school year, there were 3,948,554 postsecondary CTE participants and 121,952 adult CTE participants, or students who took at least 1 credit of CTE. The National Center for Education Statistics (NCES), which uses a different criterion, puts the number of undergraduates enrolled in career education programs in 2011-2012 at 15.2 million: 8.4 million seeking a subbaccalaureate credential and 6.8 million seeking a bachelor's degree. More recently, in their overview of the impact of postsecondary CTE, Advance CTE and Higher Learning Advocates (2019) reported that in the 2017-2018 academic year, approximately 2.6 million postsecondary learners were enrolled in CTE programs, with about 40 percent of CTE postsecondary students considered economically disadvantaged and 40 percent being students of color.

Over the course of the past decade, CTE has increasingly been viewed as a viable mean to boost and sustain the American economy through the impending skills gap (D'Amico, Morgan, Katsinas & Friedel, 2015). For instance, in highlighting the various ways CTE impacts the economy across the nation, ACTE (2019) states that: (1) In Wisconsin, taxpayers receive \$12.20 in benefits for every dollar invested in the technical college system; (2) Oklahoma's economy reaps a net benefit of \$3.5 billion annually from graduates of the Career Tech System; and (3) Colorado Community College System alumni in the workforce contribute \$5.1 billion annually to the state economy. Similarly, in North Carolina, for every dollar invested in the community college system by taxpayers, they gain \$4.10, which equates to a \$21.5 billion economic impact on North Carolina's economy (Williamson, 2017).

CTE works for businesses by addressing the needs of high-growth industries and helping close the skills gap. Accordingly, ACTE (2019) contends that: (1) Half of all STEM jobs call for workers with less than a bachelor's degree ; (2) healthcare occupations are projected to grow 18 percent by 2026, adding more than 2 million new jobs; (3) 3 million workers will be needed for

the nation's infrastructure in the next decade, including designing, building and operating transportation, housing, utilities and telecommunications; (4) almost half of the energy workforce may need to be replaced by 2024, and demand for solar and wind energy technicians will double; and (5) more than 80 percent of manufacturers report that talent shortages will impact their ability to meet customer demand. Consequently, the successful achievement of postsecondary CTE credentials is important to create a competitive workforce that can satisfy labor market demands.

Johnson et al. (2004) reported that 76.3 percent of community colleges were offering CTE courses via distance learning, primarily via the internet; and about 45 percent of community colleges offered CTE programs online. Furthermore, (Githens, Crawford, & Sauer, 2010) reported a slight increase in the percent of community colleges offering CTE programs online (47.5%). The past decade saw a dramatic expansion of online course offerings at the postsecondary level, including community colleges (Allen & Seaman, 2015; Lokken & Mullins, 2015; Seaman, Allen, & Seaman, 2018). More recently, Garza Mitchell (2017) states that online education has become an accepted, and even expected form of teaching and learning in community colleges. Studies from the National Center for Education Statistics (NCES) revealed that the highest participation rate in distance education for undergraduate students (22%) occurred at community colleges (Radford & Weko, 2011), and 96% of community colleges offer at least one online course (Parsad & Lewis, 2008). Over the past decade, online learning has "accounted for nearly all student enrollment growth at community colleges" (Lokken, 2016, p.5). The increasing prevalence of online learning in postsecondary education and in workforce training offers opportunities to incorporate online learning into CTE degrees, credentials, and certificates. However, there has been very little empirical work conducted with regards to

specifically understanding student success in online CTE in community colleges (Benson et al., 2008; Garza Mitchell, 2017; Oliveira & Rumble, 1982; Zirkle, 2003). Hence, the increasing numbers of students completing courses online and the limited research of online postsecondary CTE courses create a need for a greater understanding of the implications of using online technologies to deliver instruction with students, institutions, and the workforce.

Problem Statement

The forces driving the need for postsecondary CTE, from over ten years, included current workforce inadequacies, lack of workforce readiness and gaps in skilled labor (Rephann, 2007). In 2020, community colleges are still a critical component in the educational systems that develop this workforce. With moving to more online education, it is critical this instruction prepares students for the workforce and is effective in increasing student learning. For almost 20 years, the literature has called for the need of critical thinking skills that can be applied to on-the-job applications in the twenty-first century and creates a need for new approaches to teaching and learning (Gordon, 2000). Online instruction is an approach to prepare individuals for the workforce that has been increasing in prevalence and significant components in online courses include the content, faculty, and students and how they interact with each other. If this is not understood, it will be difficult to prepare the workforce and improve student outcomes.

How students interact with peers, faculty, and content in online courses has been shown to impact student success (Ali, 2018; Alston, 2014; Arbaugh, 2000; Sher, 2009; Strachota, 2006). Research has shown that students in online courses often have lower course completion rates, have lower satisfaction with courses, and don't complete overall programs at the same rate (Ashby et al., 2011; Fike & Fike, 2008; Urtel, 2008; Xu & Jaggers, 2011). However, the findings related to student success are not consistent. Literature has expressed that there are significant differences between students that are seeking to transfer and those in CTE programs (Alfonso et al., 2005; Bailey et al., 2004). However, there is currently a lack of empirical evidence to understand how online courses, and specifically, the interactions in online postsecondary CTE courses, in regards to student-to-student, student-to-instructor, student-to-content and student-to-work-based learning interactions relate to student success. If this area is not explored, it is not possible for community colleges to understand how interactions in online courses could be used to strategically improve student success. Without the results from this type of study, faculty and instructional designers won't know the types of interactions that would be critical to improve student success and the types of interactions, and student success outcomes.

According to Warwick and Kershner (2007), the use of new technologies in education lacks association with an adequate understanding of the pedagogical implications related to technology implementation. In a study of teachers' professional development, Warwick and Kershner (2007) found that the use of technology in the classroom must move beyond focusing solely on technical skills to involve a discussion of learning. Even though this was called for over 10 years ago, there is a limited understanding regarding the impact of online learning in postsecondary CTE. Research on online instruction in postsecondary CTE is relatively limited and outdated (Benson et al., 2008; Garza Mitchell, 2017; Oliveira & Rumble, 1982; Zirkle, 2003). Most of this research has been descriptive in nature and has provided a picture of the landscape of what is being delivered in CTE disciplines online. While online courses are the most common form of distance education to deliver CTE at community colleges (Johnson, 2003), there have not been studies to explore the interactions in this instructional delivery method from the CTE students perspective. It is critical for online CTE instruction to be effective since, community colleges appear as catalysts for human capital development, by providing skilled workers through CTE (Lannan, 2009).

Research suggests that student performance levels remain equal between web-mediated and traditional delivery educational formats; however, limited research exists on how the media affects student performance (Glenn, Jones & Hoyt, 2003). Additionally, little empirical evidence exists to support the design and management of successful web-based courses in general and more specifically in CTE. Pethodoukis (2002) contends that the growing popularity and use of such courses warrants the need for increased scholarly research; and data is needed to help leaders make decisions on resources and support. Furthermore, it is important to understand the CTE courses since they are often significantly different than more traditional academic courses. Few studies have examined the relationship between student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interaction, and student success outcomes. Several learning theories stress how important interaction is in the learning process. The Model for Engaging the Online Learner, developed by Bartlett (2017), emphasizes the importance of seven variables that impact online learners' engagement levels:

- Course engagement, defined as student's perceived level of connectedness to the course material;
- Peer engagement, defined as student's perceived level of connectedness to their peers;
- Instructor engagement, defined as student's perceived level of connectedness to the instructor;

- Program engagement, defined as student's perceived level of connectedness to the program of study;
- 5. Community engagement, defined as student's perceived level of connectedness to the community (eService learning, internships, job shadows, etc.)
- 6. Technology efficacy, defined as student's perceived level of ability to use the technology needed to navigate the course successfully;
- Applicability, defined as student's perceived level that skills gained through activities (assignments, required readings, group projects, discussion forums) will be applied outside the classroom.





Figure 1.1. The Model for Engaging the Online Learner (On the basis of Bartlett (2017)).

Similarly, Sher (2009) identifies interaction as being a major determinant of learning outcomes in online education. There is a need for further research that explores design principles needed to accommodate and support learning outcomes in an online setting (Smith, 2003).

Further, previous research pointed to the need for a comparative study within community college CTE to increase the understanding of how interaction relates to student success outcomes (Sher, 2009). Although there seems to be an agreement among scholars on the importance of interaction, and more specifically, interpersonal interaction on student success outcomes in online CTE courses, the divide stems from identifying the specific types of interaction that positively impact student success. Furthermore, most previous studies investigating interaction in online postsecondary CTE settings focused solely on students' perceived learning and satisfaction as measures used to gauge the impact interaction has on course outcomes. An increased understanding of the specific interaction dimensions promoting student success outcomes in online CTE courses will result in the creation of environments favoring engaged, active learning (Arbaugh, 2001). There is a need for a study that investigates the specific interaction dimensions that positively impact student success outcomes in online postsecondary CTE courses, while moving beyond the reliance on perceived learning and satisfaction as accurate measures of learning and academic success.

Purpose Statement

The present study focuses on online CTE courses offered at a large urban community college in the eastern part of the country. The purpose is to identify the interactions in online CTE courses and then explore the relationships among interactions and student success outcomes in the context of an online postsecondary CTE environment. This study aims to extend the current body of knowledge on the impact of interactions in online courses, and explore the online postsecondary CTE courses in three ways: first, by investigating the impact of two additional interaction dimensions (student-content and student-work-based-learning) on students' success outcomes; second, by moving beyond a reliance on perception (students' perceived learning) as

the only measure of student learning, to include actual students' self-reported GPAs as a measure of learning and academic success; third, by incorporating the dimension of perceived transfer of learning in an attempt to capture student success outcomes more accurately.

More specifically, the study explores the relationship between student-to-student, student-to-instructor, student-to-content, student-to-work-based learning interactions and student perceived learning; the relationship between student-to-student, student-to-instructor, student-tocontent, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-to-instructor, student-to-content, student-to-work-based learning interactions and student academic success as reflected by self-reported GPAs; and the relationship between student-to-student, student-to-instructor, student-to-content, student-towork-based learning interactions and student perceived transfer of learning.

Theoretical Framework

The theoretical framework of the present study combines socio-cultural theory, social information processing theory, social constructivism, and Kirkpatrick's four-level training evaluation model.

Socio-cultural theory views learning as a social process and society and culture as the origins of human intelligence. More importantly, socio-cultural theory contends that social interaction plays a fundamental role in the development and facilitation of learning (Vygotsky, 1978). Vygotsky (1978) believed that there are two levels at which cognition occurs: first, through interaction with others, before being integrated into the individual's mental structure. Accordingly, he stated: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to

logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals." (p.57)

Furthermore, Vygotsky's (1978) framework included an area of exploration, namely the Zone of Proximal Development, for which the learner is cognitively prepared. However, help and social interaction are necessary in order for the learner to fully attain his/ her potential. This help would come from a teacher or a more knowledgeable student in the form of scaffolding to support the learner's evolving level of understanding and development of complex skills. Some of the recommended strategies include: discourse, modeling, scaffolding and collaborative learning (Vygotsky, 1978). Figure 1.2. represents Vygotsky's zone of proximal development.



Figure 1.2. Vygotsky's Zone of Proximal Development (On the basis of Vygotsky (1978)).

Similarly, Social Information Processing Theory (SIPT) focuses on relationship development in online learning (Walther, 2008). SIPT was developed by John Walther in 1992 to explain how individuals use Computer-Mediated Communication (CMC) to develop interpersonal impressions and to advance relational communication over time online. SIPT focuses on how communicators adapt to the absence of nonverbal cues when using a medium that is generally limited to textual symbols. The theory also states that the information processing of such code systems requires more time than face-to-face communication in order to attain similar levels of interpersonal relationship development, but may have positive interaction impacts over time (Walther, 2008). It actually goes further to contend that with enough time, CMC can become as effective as traditional face-to-face communication, in the development of interpersonal relationships (Walther & Burgoon, 1992).

Additionally, social constructivism theory states that learners cocreate understandings and achieve learning through collaboration (Taylor, Lucas, & Watters, 1999). Thus, learning is viewed as a social and cultural process occurring in the context of human activity and relationships. This represents a demarcation from the traditional view of cognition as being situated in autonomous individuals' heads and bodies, and for whom the learning process is essentially a personal and solitary activity. In fact, social constructivism learning theory differs from psychological conceptions of learning with regards to what is learned, where and how it is learned, and where what has been learned is kept. What is learned is mainly about participation in various communities, which is where meaning resides, since people tend to make sense from specific cultural perspectives. In this view, knowledge is being constructed in the social context, which in turn is part of what is learned (Cole, 1996). Where and how it is learned refers to the deeply social and cultural aspects of learning. Thus, learning does not occur in solitary in individuals' minds, but through coordinated action within a participatory framework (Lave & Wenger, 1991). Moreover, learning is in relations among people who engage in coordinated activities in, with, and emerging from the socially and culturally constructed world (Lave & Wenger, 1991). Where learning is kept refers to the social/ cultural practices present throughout

people's actions as they participate in cultural activities, using cultural tools that were created as part of the practices. As McDermott (1993) pointed out, learning does not belong to individuals, but to the different cultural activities and practices of which they are part. Along the same lines, Robbins (2005) contends that learning is distributed across people as they participate in culturally relevant activities.

Kirkpatrick's four-level training evaluation model goes beyond using simple reaction questionnaires in evaluating programs by focusing on four dimensions: reaction, learning, behavior and results (Kirkpatrick & Kirkpatrick, 2006). In the model, each successive level represents a more precise measure of the effectiveness of a training program. The first level, that of *reaction*, is used to measure how satisfied participants are with the training, by inquiring about how valuable they perceive the training to be, as demonstrated by their engagement and participation levels. In short, level 1 measures the degree to which participants find the training favorable, engaging and relevant. Level 2 is that of *learning*, and targets the measurement of what learners have and have not learned. It measures the degree to which participants gained the purposive skills, attitudes, knowledges, confidence and commitment from participating in the training. Level 3, the behavior, measures how well the learners apply their newly acquired knowledge once back on the job, and is to occur long enough after the training has ended. Level 4, that of *results*, involves analyzing the results of the training. It is about measuring how well intended learning outcomes were met (Kirkpatrick & Kirkpatrick, 2006). Figure 1.3 represents Kirkpatrick's Four-level Model of Training Evaluation.



Figure 1.3 Kirkpatrick's Four-level Model of Training Evaluation (Kirkpatrick & Kirkpatrick, 2006)

The current research project focuses on learning facilitated through interaction. This study examines four types of interaction: student-to-student interaction, student-to-instructor interaction, student-to-content interaction, and student-to-work-based learning interaction. The literature review revealed student satisfaction and perceived learning as two student outcomes, and the researcher used the Kirkpatrick's four-level training evaluation model to incorporate two more outcomes: academic success to attend to part of the *learning* level (level 2), and perceived transfer of learning to attend to the *behavior* level (level 3). Level 1 and the other part of level 2 were captured by student satisfaction and perceived learning respectively. The results level (level 4) was not attended to, due to the time limit constraining this research project. This study aims to identify the relationship between student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interaction, and student satisfaction, perceived learning, academic success, and perceived transfer of learning.

Conceptual Framework

A review of the literature on the relationship among student-to-student, student-toinstructor, student-to-content, student-to-work-based learning interactions and student outcomes, allowed the development of hypotheses (Arbaugh, 2000a; Hiltz, 1994; Johnson et al., 2000; Sher, 2009). The following conceptual framework serves as a map to warrant coherence to the empirical inquiry of the study. Globalization, technology, labor market demands and economic growth drive increases in the need for skilled workers (Dychtwald, Erickson, & Morison, 2006; Gordon, 2000; Rephann, 2007). There is an increased demand for the community college system to provide up-to-date training that will sustain the United States workforce through the impending skill shortage, technological changes and shifts in the global economy. At the same time, institutions of postsecondary education experience an increase in the adoption of online Career Technical Education courses (Johnson & Benson, 2003). Online courses provide the increasing population of independent and highly networked students with the flexibility they need to meet their different professional and personal commitments. Such an increase sparks a need for more online postsecondary CTE course offerings, which in turn creates the need for empirical research (Dede, 2004; Miller Lewis, 2011; Sher, 2009; Tapscott, 2009). Online learning is an effective medium for skills training that, once incorporating aspects of interaction that drive improved students' learning, satisfaction, success and behavior, allows CTE to produce skilled workers. These different factors combine to warrant the need for research focused on online CTE (Miller Lewis, 2011). Figure 1.4. represents the conceptual framework of the study and figure 1.5. depicts the overall plan of the study.



Figure 1.4. Conceptual Framework



Figure 1.5. Overall Plan of the Study (Adapted from Miller Lewis, 2011).

Research Questions

The research questions for this study explore interactions and their relationship to student outcomes. The questions will describe the interactions and then explore the relationships between the level of interaction of the different types and the outcomes of students. Specifically, the questions are:

Q1: What is the level of interaction of students in online postsecondary CTE courses with other students, faculty, content, and work-based learning?

Q2: Does the level of interaction between students and other students, faculty, content, and work-based learning explain student satisfaction with the course, students perceived learning, student perceived transfer of learning and academic success as measured by GPA, grade in last course and students' intent to complete?

Significance of the Study

Research on the role of interaction in online postsecondary CTE courses increases the body of knowledge in this area. Further, an identification of interactions that relate to student success would guide targeted design features and interventions geared towards increasing student success in online postsecondary CTE courses. These also provide areas to drill down on for more in depth understanding. Thus, the identification of design features that promote positive interaction could improve student satisfaction, learning and overall success (British Columbia Ministry of Advanced Education, 2003). Among online postsecondary CTE students, decreased feelings of isolation, increased access to courses, and attraction of a new generation of learners could likely increase retention in postsecondary CTE courses, resulting in the production of a larger pool of skilled workers capable of satisfying future labor market demands (Miller Lewis, 2011). The present study will provide faculty and community college leaders with an

understanding of the importance of learner interactions in online postsecondary CTE courses (Alston, 2014). Moreover, the results from this study constitute an impetus for changes enacted by community college faculty members and geared towards enhancing opportunities for student interactions in their online courses. Administrators could be prompted to encourage professional development opportunities for faculty members to learn and incorporate alternative means of student interactions in their online courses with in mind the goal to improve retention and success (Ali, 2018; Alston, 2014). Improved student outcomes would allow community colleges to attract more online learners who would then enlarge the pool of American skilled workers upon graduation. Ultimately, an understanding of the interaction dimensions that positively impact student success would inform policy, practice and future research on the design features that improve students' success outcomes in online postsecondary CTE courses; and help North Carolina meet its attainment goal.

Limitations

Limitations are issues beyond the control of the researcher that may influence the results of the study (Ismail, 2006). One limitation for this study was that students might not be candid in providing information about certain variables such as background information or about questions concerning the instructor teaching the course. The other limitation might be that students might not finish or return the surveys in sufficient numbers. The willingness of the students to follow to completion by the given deadline is hard to gauge in advance. A third possible limitation is the study's lack of randomness, since students are not randomly assigned to courses. Due to this self-selection bias, the sample qualifies as a non-probability sample (Huck, 2004). Additionally, the study includes one institution at one point in time, causing its results to not be generalizable to other institutions, especially those with demographics different from those of the community college included in the study.

Delimitations

Delimitations are the factors that the researcher does have the ability to manipulate (Ismail, 2006). The first potential delimitation is the study's focus on CTE courses offered online at an eastern urban community college in a single semester. The study did not collect data regarding overall student satisfaction, perceived learning, perceived transfer of learning and academic success with online courses and/ or programs. Hence, students might have different interactions in other courses and with other faculty members that may influence the aforementioned course and program-level outcomes overall. The second possible delimitation was that the participants for the study are online CTE students. The interactions of these students with other online courses are not considered.

Definition of Terms

- 1. *Asynchronous Learning*: Distance learning allowing a student to work on lessons independently, at a time and place and for as long as they wish, with no need to parallel another student's pace (Maxfield, 2001).
- 2. *Career Technical Education*: Educational activities that can be applied directly or indirectly to a vocation or occupation specifically relating to the skills needed to accomplish the job (Thornburg, 1992).
- 3. *Community colleges*: Regionally accredited institutions of education that award associate of arts or associate of science as the highest degree (Cohen & Brawer, 2003).
- Distance Education: Institution-based, formal education where the learning group is separated (Simonson, Smaldino, Albright, & Zvacek, 2000).

- 5. *E-learning*: Used to describe any learning that is electronically mediated or facilitated by transactions software (Zemsky & Massy, 2004).
- 6. *Interaction*: Mediated communication between student and instructor, or between two or more students, which discusses some aspect of course content, assignment or student progress in the course (Sher, 2004). The exchanged message, cooperation, or the effects of more than one object on one another (Thurmond & Wambach, 2004).
- 7. *Online classes/ online learning*: Courses delivered completely on the Internet (Tallent-Runnels, 2006).
- 8. *Perceived Transfer of Learning:* Trainees' perception of the extent to which they apply the knowledge, skills, and attitudes they gained in training to their jobs.
- 9. *Satisfaction*: The level of pleasure or serenity (Strachota, 2006).
- 10. STEM: Science, Technology, Engineering, and mathematics.
- 11. *Interaction*: the exchanged message, cooperation, or the effects of more than one object on one another (Thurmond & Wambach, 2004).
- 12. Student-to-content interaction: Interaction with content which describes the ability of learners to access, manipulate, synthesize and communicate content. The content may be in the form of text, audio, video, CD-ROM, computer program or online communication (Moore, 1993). The non-human communication between a student and course materials. It may include interaction with course content, lessons, learning activities, videos, assignments, websites, and/or projects (Moore & Kearsley, 1996; Strachota, 2006).
- 13. *Student-to-instructor interaction*: Interaction with instructors which describes the ability of learners to communicate with and receive feedback from instructors. This may include the instructor delivering material, and providing feedback in addition to the learner

interacting through question asking or communication in regards to course activities (Moore, 1993). Human communication between a student and a faculty member (Moore & Kearsley, 1996; Strachota, 2006).

- 14. Student-to-student interaction: Interaction with classmates which describes the ability of learners to communicate with each other to create an active learning community, may take the form of group projects, or group discussion (Moore, 1993). Human communication between or among students (Moore & Kearsley, 1996; Strachota, 2006).
- 15. *Student-to-technology interaction:* the skill and know-how of the student with the technology used in an online course (Moore & Kearsley, 1996; Strachota, 2006).
- 16. *Synchronous Online Classroom:* Online classrooms where learning occurs simultaneously.
- 17. *Transactional Distance:* The intellectual and physical space between students and faculty members in a learning environment, especially in distance learning (Moore, 1991). The cognitive space between instructors and learners in an educational setting, especially in distance education (Moore, 1993). More than just the physical distance, transactional distance is "a psychological and communications gap, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Moore, 1991, p. 12).
- 18. *Transfer of learning:* The degree to which trainees apply knowledge, skills, and attitudes they gain in training to their jobs (Holton, Bates, Seyler, & Carvalho, 1997).

Summary

Economic growth, labor market demands, technology and globalization combine to generate the need for a skilled citizenry (Dychtwald, Erikson, & Morison, 2006; Gordon, 2000; Rephann, 2007). As a drivers of human capital development, community colleges supply skilled workers through Career Technical Education (Lannan, 2009). CTE increasingly takes center stage in discussions on ways to enhance the country's human capital development. Therefore, there is a pressing need for innovative instructional methods that can reach nontraditional student populations. The rapid growth of online learning in community college CTE programs has increased flexibility and expanded training opportunities for individuals from all backgrounds (Johnson & Benson, 2003). There is little empirical evidence regarding how online CTE courses support student success outcomes, specifically in regards to student-to-student, student toinstructor, student to-content and student to-work-based learning interactions. However, online CTE has displayed a steady growth across institutional sizes and geographical locations (Johnson & Benson, 2003). Interaction plays a central role in the facilitation of learning (Edwards, 2005; Poellhuber et al., 2008). Interaction in the online environment occurs through student-to-student interaction, student-to-instructor interaction and student-to-content interaction (Moore, 1993). The link between interaction and knowledge construction validates the exploration of these behaviors in the online environment (Shank, 2002). The next chapter includes a discussion of the literature pertaining to the history and development of the community college, Career and Technical Education, online learning and interaction in the online environment.
CHAPTER 2: REVIEW OF LITERATURE

Introduction

The purpose of this quantitative correlational study is to examine the relationship between a range of four types of student's interaction dimensions (student-instructor, studentstudent, student-content, and student-work-based learning) and student satisfaction, perceived learning, academic success and perceived transfer of learning in online postsecondary CTE courses. The framework of this study is based on a strong thematic organization relying on the social aspects of online learning using Vygotsky's (1978) socio-cultural theory, Walther's (2008) social information processing theory and Taylor et al.'s (1999) social constructivism theory on four types of interactions including (a) *student-instructor*, (b) *student-student*, (c) *studentcontent*, and (d) *student-work-based learning* as these lead to student satisfaction and, thus, success in the online postsecondary CTE courses. Current research has yet to find a strong relationship between social interactions and satisfaction, perceived learning, academic success and perceived transfer of learning in online postsecondary CTE courses. This study focused on two research questions:

Q1: What is the level of interaction of students in online postsecondary CTE courses with other students, faculty, content, and work-based learning?

Q2: Does the level of interaction between students and other students, faculty, content, and work-based learning explain student satisfaction with the course, student perceived learning, student perceived transfer of learning and academic success as measured by GPA, grade in last course and students' intent to complete?

The following literature review first explores the history of the community college, before taking a look at its impact from a human capital development lens. It then covers the evolution of CTE, and more specifically, the expansion of online education in the community college in general, and in CTE education in particular. Time is also spent reviewing research that examined the dimensions of student interactions (student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interactions) and student success outcomes (satisfaction, perceived learning, academic success, and perceived transfer of learning) in online learning environments, as those constitute the variables used in the current study.

History of the Community college

The existence of the community college dates back to the late 19th century. Back then, it consisted of six-year high school and two-year colleges based on the German "Gymnasium" model, and were designed to improve postsecondary degree attainment without impeding four-year universities. Community colleges experienced a steady growth through the 20th century (Cohen & Brawer, 2008). This growth is attributed to reasons ranging from meeting the needs of returning World War II veterans to affording increasing numbers of high school graduates an opportunity to pursue higher education to meeting business and industry workforce development needs to supporting the community's pursuit of prestige (Cohen & Brawer, 2008).

In the 1960s, Community colleges expanded greatly to take the form of "junior colleges" designed to meet the training needs of millions of returning World War II veterans through the GI Bill tuition vouchers program; as well as the baby boomer generation's educational aspirations (Bailey, Jaggars & Jenkins, 2015). That expansion is also attributed to a need to meet the 1960s' surge in high school graduation rates, while allowing these graduates the opportunity to experience higher education (Cohen & Brawer, 2008). These junior colleges were primarily designed to provide the first two-years of college to students who would transfer to four-year institutions upon graduation. At the time, the common belief was that community colleges

served to "relieve the university of the burden of providing general education for young people" (Cohen & Brawer, 2008, p. 7). Furthermore, community leaders, who saw in community colleges a way for their communities to achieve prestige, became their most important advocates.

The community college's mission then evolved to include vocational degree programs, continuing adult education programs, and workforce, economic and community development programs (Kane & Rouse, 1999). Today's community colleges still serve these purposes, and serve the most diverse student body with respect to age, race, ethnicity and socio-economic status. Moreover, Community colleges are present in every state throughout the U. S., and currently enroll about 12.1 million students aged 28 years old on average, with 36% of them who are first generation students, 17% single parents and 58% receiving some form of financial aid, with about half of them issued from minority backgrounds (AACC, 2015, AACC, 2018). As community colleges have matured, their mission has evolved to go beyond a focus on access to include student success and completion (Dassance, 2011). The community college serves as a catalyst for the education and training necessary to develop the 21st century workforce, positioning itself as a source of human capital development.

The Community College as a Developer of Human capital

The role of community colleges in developing human capital is supported by human capital theory. According to Becker's (1993) human capital theory, human capital encompasses an individual's knowledge gained, skills learned, attributes and values inseparable from the person. Moreover, he sees human capital as being essential to growth in the modern world, and states that investments in people are essential to economic growth. Likewise, Grubb (1997) thinks of human capital as an investment in education for the economic benefit it generates in the future.

There is a growing body of knowledge that emphasizes the human capital development impact of community colleges (Lannan, 2009). Several economists have emphasized the importance of the community college as a developer of human capital by pointing out the considerable attention paid to four-year institutions at the expense of their two-year counterparts in postsecondary research on the economics of human capital development (Rephann, 2007). For instance, Young (1997) contends that community colleges serve as an important source of "intellectual capital" for rural areas, the geographic location for many community colleges (p. 74). Similarly, Grubb (1997) asserts that the community college improves the human capital of students seeking general or specialized training.

Community colleges drive human capital development through their workforce development efforts. These efforts take the form of training, development programs at the prebaccalaureate level designed to increase individuals' usefulness in the labor market or workplace, including CTE offered by community colleges (Gray & Herr, 1998). Therefore, CTE provides important individual, organizational and societal benefits.

History of Career and Technical Education

Previously known as vocational education, CTE was viewed as training designed to respond to the need of a specific vocation, trade, agriculture or industry (Webster, 1993). CTE finds its roots in early Europe's apprenticeship programs consisting of on-the-job training and instruction carried by skilled workers sharing their skills with others (Gordon, 2014). Back then, the ruling class believed that the need for skilled tradesmen could be better met through apprenticeship instead of formal education (Gordon, 2014). Apprenticeship was a gateway for individuals to achieve value in the community through the acquisition of skills that would guarantee a job and a status. Later on, the distinction between those who learned and those who

worked was emphasized through influential scholars like Aristotle and Plato, and marked the distinction between education and the learning of a trade. For instance, according to Aristotle, education was a luxury reserved to the gifted, while those working with their hands were relegated to a status similar to that of slaves (Smith, 1998).

It was not until the 1500s that with the influence of Martin Luther, society started to recognize the value there is in learning by doing, and incorporating vocational training into the public education system (Ganss, 1910). The 1600s saw an evolution of Luther's ideas with Comenius who believed that learning of varied types, including hands-on learning, should occur at an early age, as apparent in his proposed model of children's education (Remko, 2004). In 1805, Johann Pestalozzi proposed a teaching method based on a series of hands-on activities designed to train children for everyday life, and influenced the course of education for the following three centuries (Remko, 2004). Thus, hands-on activities were not considered degrading, but were incorporated as part of visual learning activities (Smith, 1998). John Locke and Jean-Jacques Rousseau are among the influencers who promoted the idea of learning through hands-on activities (Remko, 2004; Smith, 1998).

The 1800s industrial revolution saw an important change in the American industry with the switch from an agrarian to an industrial-based economy (Davis, 2005; Krusi, 2005). Such a change greatly impacted all aspects of the American society, including education, as workers now needed to be able to read, write and critically reason in order to successfully operate machines (Davis, 2005). Vocational education was therefore given more attention, as many considered it the vital component needed to sustain the nation's growth (Krusi, 2005). Among them, Julian Smith Morill, the Vermont Senator, who in 1862 sponsored the Land-Grant College Act, later known as the first Morill Act. The Act favored the creation of land grant colleges offering training in agriculture and the mechanical trade. A second Morill Act provided funds to sustain these land-grant agricultural and mechanical trade colleges (NDSU, 2005). The intent was to educate citizens in agriculture, finance, mechanical arts, and other professions that were deemed practical.

Between 1900 and 1917, a total of 38 senate and house bills were offered that specifically catered to vocational education (Davis, 2005). The Smith-Hughes Act of 1917 was one of the most impactful ones, as it established vocational education as a federal program, and provided the form and much of the substance of vocational education as we have known it over the past 100 years (Camp & Crunkilton, 1985: Krusi, 2005). So doing, it truly set the stage for the expansion of CTE in the U.S. There is a general agreement that the Smith-Hughes act of 1917 is the single most influential event in the development of vocational and agricultural education in the U.S. (Camp & Crunkilton, 1985; Krusi, 2005). However, the act also emphasized a clear separation between vocational and general education curricula, besides the pronounced need for a reconciliation of these two educational sectors at the time. Up to that point, CTE was viewed as a way to meet industry needs, and excluded academics. It was not until the 1963's Vocational Act that CTE's goals shifted to include producing good citizens and lifetime learners.

The 1984 Carl D. Perkins Vocational Education Act sparked a redefinition of CTE to include social aspects, with a focus on academics. By the 1990s, the inclusion of academics in CTE translated into an expansion of the social and economic role of CTE.

The year 1998 was marked by another landmark event in the development of CTE with the passage of the Workforce Investment Act (WIA-P.L. 105-220). This act reformed adult education, vocational rehabilitation training, and federal employment to mark the creation of a comprehensive "one-stop" system for workforce development targeting adults and youths (Davis, 2005).

Throughout its history, education has evolved to understand the importance of hands-on learning, as demonstrated by the multiple attempts to incorporate such activities as part of general education curricula for some, or even developing a philosophical base for vocational education. A few examples of such attempts specific to industrial arts education include: Technology Analysis (Wagner, 1947), human needs analysis (Maley, 1978), the Industrial Arts Curriculum Project (Lux & Ray, 1971).

Role of Community College in CTE

CTE develops technical, academic and employability skills at all learner levels, from career exploration in the lower grades to specialized occupational education that leads to a recognized postsecondary credential. In total, an estimated 12.5 million high school and college students are enrolled in CTE across the nation (ACTE, 2017). Furthermore, CTE represents 94 percent of high school students and 8.4 million individuals seeking postsecondary crediticates and associate degrees in CTE fields (ACTE, 2018).

Community colleges serve a variety of missions, but their role in CTE has grown prominently since the 1960s, making these institutions the nation's primary resource for preparing workers for vocational careers (Dougherty & Townsend, 2006). Moreover, community colleges often emphasize the role they play in workforce preparation and economic development (Bumphus, 2017). Gray and Herr (1998) define workforce education as "that form of pedagogy that is provided at the pre-baccalaureate level by educational institutions, by private business and industry, or by government-sponsored, community-based organizations where the objective is to increase individual opportunity in the labor market or to solve human performance problems in the workplace" (p. 4). Such a broad definition of workforce development encompasses the inclusion of education at the pre-baccalaureate level that increases an individual's usefulness in the labor market or workplace, including CTE offered by the community college (Gray & Herr, 1998). Consequently, community colleges play an important role in the development and sustainability of CTE at the postsecondary level.

Community colleges are key players in assisting CTE to reach its workforce development goals. As such, community colleges support CTE by aligning the education and training they offer with the skills that employers are hiring for, and providing students of all ages with the academic and technical skills, knowledge and training necessary to succeed in future careers and to become lifelong learners. Thus, there is a need for community colleges to keep abreast of what constitutes employers' needs, in order to continually revive their workforce and development strategies (Rothwell & Gerity, 2017).

The Expansion of Online Learning in the Community College

The increase in non-traditional students in the early 1990s sparked a shift from traditional classroom settings towards online distance learning (O'Malley & McCraw, 1999). This group of students is made up of individuals over the age of 25, attending school part-time or not residing on campus. Because of the many commitments these students have to attend to, including family and professional responsibilities, they need increased flexibility, and online learning serves them well by increasing their access to courses and programs. While distance learning may refer to a variety of learning experiences away from the brick and mortar college campus (correspondence courses, apprenticeships, etc.), the term "online learning" refers specifically to a form of distance education in which class delivery occurs entirely over the Internet (Tallent-Runnels et al., 2006).

In distance education courses the web is the medium for instruction (Sher, 2009). Institutions promote the expansion of distance learning by drawing from a larger participant pool, with the most emphasis being placed on online learning as the source of distance education.

The recent spike in the number of online courses offered at colleges and universities provides increased flexibility in delivery. Through technology-enhanced teaching, learning is distributed across time, different media, and a variety of geographic settings (Tallent-Runnels et al., 2006).

Online Career and Technical Education

Initially, the expansion of distance learning did not include online CTE. However, the early 1990s' increase in non-traditional students (O'Malley & McCraw, 1999), coupled with the continued growth of technology use in the classroom (Educause, 2015) and the emphasis on CTE as a means to revamp the economy (D'Amico, Morgan, Katsinas & Friedel, 2015) sparked an impressive growth in online CTE course offerings. Recent figures report that 98% of community colleges offer online CTE courses and programs, and award 29% of postsecondary credentials in those fields (Garza Mitchell, Esthim & Dietz, 2016). Such a growth did not come without critics, including the lack of face-to-face interaction (Richardson, 2003), technical problems and isolation from instructor and fellow students (Gatta, 2005). The challenges stemming from teaching and learning in the online environment produce varied opinions within the academic community with regards to the adoption of online learning. There are both praises and critics towards the online community (Wyatt, 2005). Some critics point to the lack of face-to-face interactions as an impediment to student success in online learning (Richardson, 2003).

Online learning is a relatively new instructional delivery method, and as such, it warrants the need for research targeting a better understanding of the ways to attain student learning in such environments. Accordingly, Johnson and Benson (2003) reported that 86% of community colleges surveyed reported increases in online CTE enrollments, with a noticeable consistent growth across institutions' sizes and geographical locations. Increased online CTE enrollment drives the need to develop and research CTE online learning.

Development of Research on Interactions in the Online Environment

Some of the major critiques of online learning environments include: the lack of face-toface interaction among students and their instructors (Arbaugh, 2000a; Sher, 2009; Miller Lewis, 2011), the learners' feelings of isolation (Weller, 2007), lower completion rates in comparison to face-to-face courses (Keith, 2006) and high attrition rates (Dziuban et al, 2005).

Several researchers have emphasized the key role interaction plays in ensuring student learning and success in online learning environments. For instance, Shale and Garrison (1990) contend that the most fundamental form of education incorporates elements of "interaction among instructor, student and subject content" (p.1). Similarly, Moore (1993) pointed to the lack of interaction in the same physical and temporal space between instructors and learners as the cause of what he referred to as a *transactional distance* in distance learning environments. To that effect, he suggested reducing transactional distance by incorporating three types of interaction in distance education:

- Learner-content interaction: interaction with the content, which includes the different methods used by learners to access information from the course materials, to include texts, audio or videotape, computer program, or online communication.
- Learner-instructor interaction: interaction with the instructor, which can pertain to the instructor making the material available, encouraging the learner or providing comments

or feedback. Additionally, it may involve the learner asking questions to the instructor or communicating with him/ her regarding class activities.

• Learner-learner interaction: interaction among learners with the intent to collaborate and share knowledge. This may take the form of group projects or discussions.

Building on his theory of transactional distance, Moore (2013) presented dialogue, or the extent to which teacher and learner engage in constructive interaction that builds knowledge, as one of the key design features that define the nature of online education.

Additionally, Hiltz (1994) proposed to move away from an individualistic conception of online learning to embrace an active construction of knowledge, by incorporating design elements that allow students to interact with their peers and their instructors, in an effort to improve their performance in and satisfaction with the course. Similarly, Arbaugh (2000b) found a significant association between instructors' emphasis on interaction, ease of interaction, classroom dynamics, and students' perceived learning. Moreover, Young's (2006) study of students' views of the qualities of a good online instructor revealed an emphasis on areas of feedback provision, active involvement, adaptability to students' needs and multi-level interaction facilitation as the most valued characteristics for effective online instruction. Also, Jaggars and Xu's (2016) study of online course design features that positively influence student success revealed that interpersonal interaction was the only important predictor of student success in comparison to other design features such as technology use and overall course organization. Finally, Cox and Fox (2008) showed how the discussion board can foster the emergence of a community of learners in an online asynchronous learning environment. Their work provided evidence of some of the ways Computer Mediated Communication can improve social and instructional interactivity in online learning environments through the creation of

communities of learning that reduce geographical and socio-economic barriers between students engaged in online learning.

Broadly speaking, the literature reflects an agreement among researchers on the importance of quality interactions for success in online higher education settings. However, a closer inquiry reveals that empirical studies conducted previously have emphasized different aspects of interactions as being the most impactful in online learning environments. While to some researchers interaction between students and the faculty member was the most important, other researchers found interaction among students to be more valuable; and yet a third strand of work highlighted students' interaction with content or even technology as being the most critical dimension.

Student-instructor interaction as the most important dimension. Fredericksen et al. (2000) surveyed the State University of New York Learning Network participants in an asynchronous online course. Findings of their study revealed student-instructor interaction as the most significant predictor of perceived learning in online courses. Additionally, Askov and Simpson (2001) showed that online students can achieve high levels of interaction with their instructors and peers, provided there is a course structure that favors collaborative learning. They contended that course design that focuses on instructor guidance as well as interaction based events such as computer conferencing can address the need for interaction and engagement in online courses. This study pointed to the central role of collaborative environments in enhancing interpersonal interaction in online courses.

Sher (2009) used a web-based research instrument to assess students' perceptions of learning, satisfaction, student-to-student interaction, and student-to-instructor interaction. The study found both student-to-student interaction and student-to-instructor interaction to be

significantly associated with student learning and satisfaction, with student-to-instructor interaction displaying by far the strongest association. Similarly, a study conducted by Miller Lewis (2011) using survey instruments adapted from Hiltz (1994), Arbaugh (2000) and Johnson et al. (2000) found student-to-instructor interaction and student-to-student interaction to be significantly associated with student satisfaction and perceived learning. Moreover, student-toinstructor interaction was found to have the most important impact on the two student outcomes.

Sebastianelli, Swift and Tamimi (2015) examined how six factors related to content and interaction affect students' perceptions of learning, satisfaction, and quality in online master of business administration (MBA) courses at a private university. They estimated structural equation models to explore these relationships empirically, using survey data from MBA students. A significantly positive relationship was found between student-instructor interaction and satisfaction, whereas student-instructor interaction and perceptions of quality did not exhibit any association. However, there was a significantly positive relationship between student-student-student interaction and perceptions of quality.

Student-student interaction as the most important dimension. Bernard et al. (2009) conducted a meta-analysis of the three types of interaction present in distance education. Their study uncovered the differences in outcomes from online interventions that increased those three types of interaction, with student-student interaction as the most critical.

Ali (2018) conducted a quantitative correlational study to examine the relationship between four types of student's quality of interactions (student-faculty, student-student, studentcontent, and student-technology) and student satisfaction in first year online mathematics, English, and information technology courses at a community college. The study found no statistically significant relationships between student-faculty, student-student, and studenttechnology interactions and student satisfaction in the online English course. However, an inverse relationship was found for students in the online English course between level of studentstudent interaction and student satisfaction. Likewise, Kurucay and Inan (2017) investigated the effects of learner-learner interactions on students' perceived learning, achievement, and satisfaction in an online undergraduate course. Using a quasi-experimental research design, the researchers created a control and treatment group from a class of 77 students taking an online course. The students in the control groups worked individually on assignments, while those in the treatment group worked collaboratively in small groups on the same assignments. The study found that student-student interaction had a significantly positive impact on student success and satisfaction in online learning environments. Finally, Sebastianelli, Swift and Tamimi's (2015) study of factors affecting students' perceptions of learning, satisfaction, and quality in online master of business administration (MBA) courses revealed that student-student interaction had a significantly positive impact on student of business administration (MBA) courses.

Student-content interaction as the most important dimension. Strachota (2006) examined the impact of student interaction on satisfaction. For this purpose, he identified four types of interaction that are important to student satisfaction in online learning environments: learner-learner, learner-instructor, learner-content, and learner-technology interactions.

Upon administering "The Student Satisfaction Survey", he found the most influential interaction dimensions to be learner-content interaction (58%), followed by learner-instructor interaction (4.8%) and learner-technology interaction (.9%). However, learner-learner interaction had little to no impact on student satisfaction, although Strachota noted that students

who engaged in online discussion activities as part of their online coursework were more satisfied than those who did not.

Similarly, Sebastianelli, Swift and Tamimi (2015) examined how six factors related to content and interaction impact students' perceptions of learning, satisfaction, and quality in online master of business administration (MBA) courses. The findings revealed that course content (student-content interaction) was the strongest predictor of all three outcomes (perceived learning, satisfaction, and quality); and was the only significant factor affecting perceived learning.

Alston (2014) built on Moore (1993) and Strachota's (2006) work to investigate the association between graduate students' perceptions of their level of interaction as measured by interaction between learner-instructor, learner-learner, learner-content, and learner-technology, and their satisfaction with an online course. The findings from this study revealed that learner-content and learner-technology interactions had the most significant relationships with student satisfaction for a graduate-level online course; whereas learner-instructor and learner-learner interactions were not found to be significantly related to student satisfaction for graduate-level online learners. Learner-content interaction was the most important dimension, although the difference with the influence of learner-technology interaction was relatively small.

Anderson (2003) suggested that although student-student and student-instructor interactions are noticeable contributors to students' success in online learning environments, none is necessary, as long as high student-content interaction is present and supported by a robust technological system.

Student-technology interaction as the most important dimension. As mentioned previously, Alston's (2014) study of graduate students' perceptions of their level of interaction as

measured by interaction between learner-instructor, learner-learner, learner-content, and learnertechnology, and their satisfaction with an online course revealed learner-technology and learnercontent interaction as the most significant relationships with student satisfaction. Moreover, the two dimensions were almost equally impactful to student satisfaction in an online graduate level course.

All interaction dimensions as equally important. Some scholars took a more conservative stance by viewing all interaction aspects as being equally important to student success outcomes in online learning environments.

For instance, Anderson (2003) states that "Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student-teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience. High levels of more than one of these three modes will likely provide a more satisfying educational experience, though these experiences may not be as cost or time effective as less interactive learning sequences" (p. 4). Similarly, Frederickson, Pelz, Pickett, Shea, and Swan (2001) surveyed of 3,800 students enrolled in 264 courses at the State University of New York Learning Network, and found that "the greater the percentage of the course grade that was based on discussion the more satisfied the students were" (p.12). In other terms, the study showed a positive relationship between student-student and student-instructor interactions, and student satisfaction and perceived learning (Frederickson et al., 2001). Furthermore, An, Shin and Lim's (2009) comparative study of the impacts of three approaches to interaction facilitation indicated that although students seldomly engaged voluntarily with one another, required communications among students (discussion posting and response to a classmate's post) resulted in negative instructor feedback.

Conversely, upon limiting the instructor's interventions, one could see an improvement of students' levels of opinion expression. Finally, Swan's (2002) investigation of the development of learning communities in online discussions aligned with previous findings regarding the importance of interaction in the online learning environment. The study uncovered three factors impacting student satisfaction and learning in online courses: student-peers interaction, student-instructor interaction and student-content interaction.

Overall, there is an agreement among scholars on the importance of interaction in the online learning environment. More specifically, most previous studies proved interpersonal interaction (student-student and student-instructor interactions) to positively impact student success as measured by satisfaction (Ali, 2018; Alston, 2014), or as measured by both satisfaction and perceived learning (Arbaugh, 2000; Askov and Simpson, 2001; Fredericksen et al., 2000; Hiltz, 1994; Johnson et al., 2000; Miller Lewis, 2011; Richardson, 2003; Sher, 2000; Young, 2006). A handful of studies added a nonpersonal dimension of interaction, student-content interaction, as one of the predictors of students' perceived learning and satisfaction (Bartlett, 2017; Jaggars and Xu, 2016; Moore, 1993; Moore, 2013; Swan, 2002). Others added student-technology interaction as a predictor of student satisfaction (Ali, 2018; Alston, 2014; Strachota, 2006), while some included course quality as an outcome positively impacted by students' interpersonal interaction (Sebastianelli, Swift & Tamimi, 2015).

Upon consideration of the most impactful dimension of interaction in online learning, one clearly realizes the divide that exists within the scholarship on the importance of interaction in online learning. In fact, some work appears to show that student-instructor interaction carries more value in online learning settings (Ali, 2018, Fredericksen et al., Hiltz, 1994; 2000; Jaggars and Xu, 2016; Johnson et al., 2000; Miller Lewis, 2011; Richardson, 2003; Sher, 2000; Young,

2006), whereas other inquiries found that a model of online instruction emphasizing mandatory collaborations among students resulted in better success outcomes (Bernard et al., 2009). A third strand of work advocates for strong student-content interaction supported by robust technology as being the most important interaction dimension that positively affects student outcomes in online learning environments (Alston, 2014; Anderson, 2003; Sebastianelli, Swift & Tamimi, 2015; Strachota, 2006). In this sense, neither student-student interaction, nor student-instructor interaction is necessary, as long as the conditions for strong student-content interaction with a solid technological foundation are maintained (Anderson, 2003).

Four Dimensions of Interaction

Previous research revealed a framework of four types of interactions that are essential to learning in online environments: (a) student-to-student interaction; (b) student-to-instructor interaction; (c) student-to-content interaction (Bartlett, 2018; Johnson, 2000; Miller Lewis, 2011; Moore, 1993); and (d) student-to-technology interaction (Ali, 2018; Alston, 2014; Strachota, 2006). However, given the vocational orientation of CTE, and in order to attend to its practical aspect, the researcher incorporated student-to-work-based learning interaction as the fourth type of interaction that was explored in the present study. Each dimension is developed in the following sections.

Student-to-instructor interaction. Student-to-instructor interaction, also referred to as learner-instructor interaction (Alston, 2014; Moore, 1993; Sher, 2009; Strachota, 2006) or student-faculty interaction (Ali, 2018), is defined as the interaction between the student and the instructor.

It can consist in the instructor delivering of information, providing feedback, answering questions or simply communicating about course activities (Moore, 1993).

In general, whether among students, with instructors, or as part of a group, individuals like to interact with each other in an effort to comfort their sense of belonging (Baumeister & Leary, 1995). Several researchers have emphasized the fundamental role played by studentinstructor interaction in ensuring positive student outcomes in terms of cognitive advancement and development of students in institutions of higher education (Astin, 1993a; Hollis, 2016; Pascarella & Terenzini, 2005). Along the same lines, Boyer (2013) advocates for the necessity to establish human interaction in online learning environments through regular, constant interactivity among students and between students and instructors.

Interaction between students and instructors may take on several forms depending on the its level of formality, together with the setting and matter of the interaction. For instance, formal interactions between students and instructors translate the professional relationship that exists between them, and naturally falls within some form of classroom setting with educational matters being the center of interaction (Endo & Harpel, 1982; Tinto, 1993). Examples of educational matters include: lessons, assignments and feedback provision from the instructor to the student (Pascarella & Terenzini, 1979). Informal interactions between students and instructors may take place online through various forms—for instance, communication through e-mail, online forums or even synchronous videoconferencing.

In a study of factors affecting students' perceptions of learning, satisfaction and quality in online master of business administration (MBA) courses, Sebastianelli, Swift and Tamimi (2015) found that student-instructor interaction had a significantly positive impact on students' satisfaction, but not on students' perception of course quality. Additionally, Zhang (2005) contends that by engaging with instructors in inquiry-based collective interaction, students take control of their quest for knowledge, as instructors act as co-students or facilitators. Student-

instructor interaction has been shown to positively impact student retention (Lau, 2003) and success (Terenzini & Pascarella ,1980). Similarly, Lundberg and Schreiner (2004) revealed that higher student-instructor interaction rates were linked to higher knowledge acquisition rates by students, as well as increases in the extra time students spend working on assignments, due to timely instructor feedback and other informal interactions.

Upon reviewing the literature, the consortium around the importance of student-instructor interaction is pretty apparent. However, it seems worthy to emphasize that interaction is not a one-way endeavor, as it requires participation from both the student and the instructor. On that note, Muirhead (2000) highlighted the communication risks between faculty-learner interactions and learner-learner interactions by stating: "When teachers face heavy workloads from large online classes requiring large amounts of personal e-mails, phone calls and discussion forum comments, the quality of online interactivity with students suffers" (p. 3). So doing, Muirhead presented interaction as the shared responsibility of the instructor and the student, and contended that both the instructor and student should constantly engage in the online course. The literature revealed a second factor that positively relates to student success outcomes in online learning environments: student-student interaction.

Student-to-student interaction. Student-to-student interaction or learner-learner interaction (Alston, 2014; Moore, 1993; Sher, 2009; Strachota, 2006) or student-student interaction (Ali, 2018) refers to students' opportunities to engage with one another.

This type of interaction can occur inside or outside of the learning environment, and can incorporate activities such as course discussions, activities, and group projects (Strachota, 2006). Sher (2009) asserts that this type of interaction can generate learning through collaboration and knowledge sharing among students.

A study by Tinto (1997) explored community college students' participation in a Coordinated Studies Program and found that students' general view of the community college experience was positively influenced by their interaction with their peers and faculty members. Additionally, Tinto (1999) recommended interactive learning with peers and classroom involvement as some of the conditions favorable to an increase in student success outcomes. Comparably, according to Astin (1993a, 1993b), among higher education students of various backgrounds, regular interactions were linked with increases in social understanding and a commitment to understanding. Moreover, these results were independent from any individual or institutional characteristics. Additionally, increased levels of student educational development (analytical, writing skills, critical thinking, and general and specific knowledge) and satisfaction with an institution of higher education were positively associated with increased interactions among students of diverse backgrounds.

Prior research has highlighted many benefits resulting from enhanced interaction among students in online learning environments. Such benefits include students' acquisition of knowledge by participating in collective inquiry-based activities. Kolloff (2011) stressed the centrality of sense of community building through the fostering of conditions favorable to students' interaction among themselves in online asynchronous courses, in an effort to help them develop cognitive skills.

A study by Richardson and Swan (2003) on the position of social presence in online courses of ninety-seven undergraduate students at Empire State College in 2000 found that the students who interacted more learned more from the course than the students who were less involved in the course. Students learned more in the courses where they were liked by the faculty member. Furthermore, Richardson and Swan (2003) investigated social presence in online courses by using an adapted version of a Social Presence Scale developed by Gunawardena and Zittle (1997). The survey targeted undergraduate students at Empire State College in 2000, and found a positive relationship between increased levels of student interaction and levels of learning. Thus, students who interacted more with their peers reported learning more from the course compared to those who did not (Richardson & Swan, 2003). The study also found a direct relationship between high levels of social presence and the extent to which students liked their faculty member (Richardson & Swan, 2003).

Student-to-student interaction has been shown to significantly impact student success outcomes; however, student-to-content interaction is another factor that drives student success in online learning environments.

Student-to-content interaction. Student-to-content interaction, also called learnercontent interaction (Alston, 2014; Moore, 1993; Sher, 2009; Strachota, 2006) or student-content interaction (Ali, 2018) refers to the students' opportunities to engage with the content of the course. This type of interaction includes the students' access and use of learning materials, such as assignments, projects, reading material, tests, and quizzes (Strachota, 2006).

According to Moore and Kearsley (2005), "Content" refers to the subject material that is to be studied. The interaction of students with the content is the main reason that warrants the existence of formal education (Ali, 2018). Moreover, Vrasida (2000) contends that *studentcontent* interaction is the most important method of interaction upon which all learning is established. Similarly, Tuovinen (2000) considers *student-content* interaction as being the highest level of interaction of all interactions since it is the basis for all learning.

Content can be either external to the student such as a formalized academic subject or internal to the student such as beliefs and capabilities of self. Ali (2018) states that "Interaction

with instructional material is content-centered and leans to overlay with student-to-content interaction" (p. 35). As such, it is the fundamental mode of interaction and it happens when the student reads online resources and receives feedback that is relevant to the learning material at hand from the faculty member or from other students (Jung, et al., 2002). In online learning environments, content and course design both take center stage among the most impactful factors to student satisfaction.

Student-to-work-based learning interaction. The emphasis on connecting curriculum to the workplace is one of the hallmarks of career and technical education (Gibney, 2015). Moreover, Gibney (2015) asserts that "CTE practitioners pride themselves on their ability to make content come alive by demonstrating how the knowledge and skills students learn in the classroom transfer to the activities they will one day conduct on the job. When it comes to high-quality CTE programs, perhaps no better example can be offered than the ultimate classroom-to-workplace application: work-based learning" (p.1). Furthermore, Xanthis (2015) views WBL as the fundamental piece needed to connect students to work. It encompasses a framework for integrating career preparation into curriculum and an approach to learning that connects the classroom and the workplace (Gibney, 2015). Thus, it is important for CTE students to get exposed to work-based-learning opportunities that will enhance their readiness to enter the workforce in their respective field upon graduation.

These opportunities are designed to give the student some practical and contextual experience pertaining to applying the skills acquired throughout their training curriculum/ program. Such activities include: internships, capstone projects, field trips, interactions with professionals from the field, job shadowing, and other forms of work-based learning. According to the ACTE, work-based learning involves "sustained, meaningful interactions with industry or

community professionals that foster in-depth, firsthand engagement with the tasks required in a given career field. Experiences may be delivered in workplaces, in the community, at educational institutions and/or virtually, as appropriate, and include a range of activities such as workplace tours, job shadowing, school-based enterprises, internships and apprenticeships" (ACTE, 2019, p.1).

Hence, the researcher defines student-work-based learning interaction as the level of students' exposure to practical experiences that enhance their ability to perform their duties in their respective disciplines at a satisfactory level, upon graduation. This fourth independent variable will allow the researcher to expand the current literature on the interaction factors that positively impact student success outcomes, within the specific context of online CTE courses taken at a community college.

Kirkpatrick's Four-Level Model of Training Evaluation

Current technical education programs focus of preparing individuals to enter the workforce in vocational occupations and fields. Ensuring the quality of these programs relies on the implementation of robust evaluation processes and procedures. Kirkpatrick and Kirkpatrick (2006) developed a model of program evaluation that focuses on four dimensions: reaction, learning, behavior and results. Each successive level represents a more precise measure of the effectiveness of a training program. The first level, *reaction*, measures how satisfied participants are with the training, by investigating how valuable they perceive the training to be, as demonstrated by their engagement and participation levels. Thus, level 1 assesses the degree to which participants find the training favorable, engaging and relevant. Level 2 is that of *learning*, and focuses on measuring what learners have and have not learned. It gauges the degree to which participants gained the purposive skills, attitudes, knowledges, confidence and

commitment from participating in the training. Level 3, that of *behavior*, measures how well the learners apply their newly acquired knowledge once back on the job, long enough after the training has ended. Level 4 is that of *results*, and involves analyzing the results of the training. It consists in assessing how well intended learning outcomes were met (Kirkpatrick & Kirkpatrick, 2006). Figure 1.2 represents the Kirkpatrick's Four-level Model of Training Evaluation.

The researcher used Kirkpatrick's Four-Level Model of Training Evaluation as a lens to guide the investigation of the impact of four dimensions of interaction on students' success outcomes in online postsecondary CTE courses as measured by: student satisfaction, student perceived learning, student academic success, and student perceived transfer of learning.

Student satisfaction. Prior research has emphasized the key role student satisfaction plays in ensuring positive retention outcomes (Ali, 2018, Alston, 2014; Astin, 1993; Bean, 1980; Chang & Smith, 2008; Sher, 2009; Strachota, 2006).

Sher (2009) investigated the relationship between student-student interaction, studentinstructor interaction, and perceived learning and satisfaction. Findings from the study revealed that students' interactions with their instructors and peers positively affect their learning and satisfaction. He observed that "Due to the physical separation of learners, from instructors and other learners, technology plays a vital role in providing a learning experience compatible with a face to face class" (Sher, 2009, p. 114). Astin (1980) contends that student satisfaction is one of the most important outcomes that should be targeted by institutions of higher education, and recommends administrators renew their focus on students' perceptions regarding the quality of their learning experiences. Priority has been given to student satisfaction as means for evaluation and feedback (Astin, 1993; Bean, 1980; Bean & Bradley, 1986). Therefore, several researchers have focused on student satisfaction outcomes as a measure of the impact of different interaction dimensions on student success in online CTE courses (Ali, 2018; Alston, 2014; Arbaugh, 2000; Sher, 2009; Strachota, 2006).

In their investigation of the relationship between personal interaction and student satisfaction, Chang and Smith (2008) examined student-to-student, student-instructor, and learner-content interactions. They found that by encouraging diverse forms of interactions within the course, instructors could significantly improve student satisfaction outcomes. Such interactive activities included: first-week face-to-face orientations, chat sessions, prompt feedback, and others. Students identified prompt feedback and constructive comments from the instructor as factors that increased their enjoyment levels and influenced their course satisfaction (Chang & Smith, 2008).

Student learning. Student learning could be assessed through student course grades. However, institutional privacy policies may prevent researchers from gaining access to such grades (Miller Lewis, 2011). Thus, several researchers have relied on perceived learning as a measurable outcome in investigative studies regarding the effect of interaction on students' performance in online learning environments (Arbaugh, 2000a; Hiltz, 1994; Sher, 2009).

For instance, McCroskey, Fayer, Richmond, Sallinen and Barraclough (1996) contend that it is acceptable to use perceived learning in this type of research, because "clearly students generally have a good sense of what they have learned" (p. 202). Richardson (2003) studied the effect of social presence on students' perceptions of learning in online learning environments. Sher (2009) used both student course grade and perceived learning as proxies for students' mastery of skills. Hiltz (1994) asserts that the quality of a course should be measured by the extent to which students learn, retain, and later use the material or skills the course has exposed them to. Student perceived learning is used to capture the learning level in Kirkpatrick's Fourlevel Model of Training Evaluation.

Student academic success. Student course grades and overall grade-point average are the most commonly used measures of academic success. However, due to institutional privacy policies restricting access to these types of student information, researchers have had to rely on different measures of student learning and success, such as their self-reported perceived learning (Arbaugh, 2000; Hiltz, 1994; Miller Lewis, 2011; Sher, 2009).

The researcher uses students' self-reported previous course grade, self-reported gradepoint average, and self-reported retention in the program as measures of academic success. Student academic success is used to attend to the learning level in Kirkpatrick's Four-level Model of Training Evaluation.

Student perceived transfer of learning. Student perceived transfer of learning is used to attend to the *behavior* level in Kirkpatrick's Four-level Model of Training Evaluation. Holton et al. (1997) define *Transfer of learning as* the degree to which trainees apply knowledge, skills, and attitudes they gain in training to their jobs. Accordingly, student perceived transfer of learning can be defined as the perception of the extent to which the student applies the knowledge, skills, and attitudes gained in training to their jobs or other classes.

Student perceived transfer of learning also incorporates the student's perception of the extent to which the newly acquired knowledge, skills, and attitudes will help her gain employment. A third dimension included in this variable attends to students' perception of their ability to teach the newly acquired knowledge, skills, and attitudes to others.

Summary

In summary this literature review provided an overview of the community college, the community college as a human capital developer, the history of CTE, the role of the community college in CTE, online learning in the community college in general, and in CTE in particular. The evolution of research on interactions in the online environment was explored as well, with an overview of the literature's treatment of four interaction dimensions (student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interactions) as well as four student success outcomes (Satisfaction, perceived learning, academic success, and perceived transfer of learning).

The literature demonstrates the framework for this study. Additionally, the review shows the connection to course interactions and student success. Existing research presents decreased isolation, increased collaborative learning and the development of learning communities as some of the outcomes from student learning facilitated through interaction in the online learning environment (Moore, 1993; Barab & Thomas, 2001; Curtis & Lawson, 2001; Richardson, 2003; Gunawardena & Zittle, 1997).

The connection between interaction and student success outcomes warrants the exploration of interaction in an effort to evaluate student success in online learning environments within the CTE context.

CHAPTER 3: RESEARCH DESIGN AND METHODS

Introduction

Research states that when students are satisfied with the institutions at which they study, the probability to remain enrolled at the institution goes higher (Gleason, 2004; Nitsch, 2003). Student satisfaction is believed to be what keeps students in college. The purpose of this quantitative correlational study was to examine the relationship between a range of four types of student's interaction dimensions (student-faculty, student-student, student-content, and studentwork-based learning) and student satisfaction, perceived learning, academic success and perceived transfer of learning in online postsecondary CTE courses. The framework of this study was based on a strong thematic organization relying on the social aspects of online learning using Vygotsky's (1978) socio-cultural theory, Walther's (2008) social information processing theory and Taylor et al.'s (1999) social constructivism theory on four types of interactions including (a) student-instructor, (b) student-student, (c) student-content, and (d) student-work-based learning as these lead to student satisfaction and, thus, success in online postsecondary CTE courses. Current research has yet to find a strong relationship between social interactions and satisfaction, perceived learning, academic success and perceived transfer of learning in online postsecondary CTE courses. This study focused on two research questions:

Q1: What is the level of interaction of students in online postsecondary CTE courses with other students, faculty, content, and work-based learning?

Q2: Does the level of interaction between students and other students, faculty, content, and work-based learning explain student satisfaction with the course, students perceived learning, student perceived transfer of learning and academic success as measured by GPA, grade in last course and students' intent to complete?

Research Design

The study used a survey research method. This allowed to provide "a quantitative description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell, 2003, p. 153). Moreover, a non-experimental correlational design (Johnson, 2001) was used, as such a design aims to establish whether and to what degree a relationship exists between two or more quantifiable variables (Gay & Dehil, 1992; Cherry, 2012). The study used multiple regression analysis (MRA) because it is "a statistical technique that can be used to investigate relationships between a single outcome variable and two or more predictor variables" (Thompson, 2006, p. 216). According to Kerlinger and Lee (2000), multiple regression analysis is "a method for studying the effects and the magnitudes of the effects of more than one independent variable on one dependent variable, using principles of correlation and regression" (p. 755).

This study is not a comparison between online and face-to-face courses, but rather seeks to determine whether a significant relationship exists between students, instructors, content, and work-based learning interactions and success outcomes. Specifically, the study examined:

- whether a significant relationship exists between student-to-instructor interaction, student-to-student interaction, student-to-content interaction, student-to-work-based learning interaction and satisfaction;
- (2) whether a significant relationship exists between student-to-instructor interaction, student-to-student interaction, student-to-content interaction, student-to-work-based learning interaction and perceived learning;

- (3) whether a significant relationship exists between student-to-instructor interaction, student-to-student interaction, student-to-content interaction, student-to-work-based learning interaction and academic success;
- (4) whether a significant relationship exists between student-to-instructor interaction, student-to-student interaction, student-to-content interaction, student-to-work-based learning interaction and perceived transfer of learning in an online postsecondary CTE course.

The research method section will describe the participants, instrumentation, data collection, and data analysis.

Participants

The specific population for this study is Community College students enrolled in CTE programs and taking online courses as part of their program. A total of 357 students started the survey and a total of 183 completed the survey yielding a 51.3% completion rate. The desired sample for this study was made up of community college students enrolled in an Associate in Applied Science (AAS) degree program for at least one semester, and having completed an online course in their technical area of expertise as of the Spring of 2020 at a large eastern urban community college. This study used a purposeful sample of students. A survey and directions were emailed to qualifying students to share with them the purpose of the study, and the importance of their contribution to the study.

Instrumentation / Variables

A survey was used to collect data on several variables, including independent, dependent, and covariate variables.

Independent variables. Student-to-instructor interaction, student-to-student interaction, student-to-content interaction and student-to-work-based learning interaction were the independent variables in this study. These survey items were adapted from Sher (2009), whose survey items were derived from Johnson et al. (2000).

Student-to-instructor interaction was measured using six items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measured student-to-instructor interaction is: "The instructor encouraged me to become actively involved in the course discussions".

Student- to-student interaction was measured using five items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measured student-to-student interaction is: "I was able to communicate with other students in this course".

Student-to-content interaction was measured using six items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measured student-to-content interaction is: "The course documents, lessons, or lecture notes used in this class facilitated my learning".

Student-to-work-based learning interaction was measured using four items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measured student-to-instructor interaction is: "I interacted with an individual from the community to meet a course/activity objective".

Dependent variables. Student perceived learning, student satisfaction, student academic success, and student perceived transfer of learning were the dependent variables in this study.

Student perceived learning and student satisfaction were each measured using six items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measures student perceived learning is: "I gained a good understanding of the basic concepts of the material". One that measured student satisfaction is: "I was very satisfied with this course". The survey items used to measure student perceived learning and satisfaction were adapted by Sher (2009) from Hiltz (1994).

Student academic success and student perceived transfer of learning were each measured using four items on a 5-point likert-type scale, with 5 representing strongly agree and 1 representing strongly disagree. A sample item that measured student academic success is: "I plan to complete the program I am currently enrolled in". One that measures student perceived transfer of learning is: "In my future work or classes there are tasks in which I will be able to use the knowledge, skills, and abilities I gained from this course". The survey items used to measure academic success and perceived transfer of learning were created by the researcher.

Covariate variables. The control variables used in the study included student gender, age, ethnicity, Pell eligibility, full or part-time status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program.

These variables emerged from the review of the literature on online courses, and have previously been used by several researchers focusing on online learning (Arbaugh, 2001; Hiltz, 1994; Ridley & Sammour, 1994; Johnson et al., 2000; Sher, 2009; Miller Lewis, 2011).

Data Collection

Dillman's (1978) Total Design Method (TDM) was modified for this study. Social incentives, including personal attention and social courtesies, have been shown to be more effective than monetary incentives and small gifts, and thus serve as the foundation of the methodology (Dillman 1978). The data were collected via a self-administered online survey made available to students enrolled in an AAS program at a mideastern large size urban community college which offers online CTE courses.

One week prior to the study a notification email was sent to potential participants with a description of the purpose of the study. Dillman's (1978) approach includes strategies that focus upon social etiquette and personal attention. These were achieved by careful wording of questions and communications, using 'please' and 'thank you', and responding promptly and personally to all queries. The researcher conveyed his regard for the importance and value of the respondent's time and effort through precise emailing and follow up procedures. Follow-up proceeded according to a set pattern. On day 0 the initial survey was emailed to participants; on day 7 the first reminder email was sent; on day 14, the second reminder email was sent to non-respondents, including a replacement questionnaire; on day 21 a third and final reminder email was sent to non-respondents (Dillman 2000). In order to control for non-response bias, the researcher compared early and late respondents on the major variables of the study and demographics (Miller and Smith, 1983).

Data Analysis

The analysis of the collected data was done in three phases: prior to conducting any analysis, a pre-data analysis was carried out in order to make sure the data met all the requirements for multivariate analysis. Then, two factor analyses were conducted on the appropriate summated scales that explored the interaction constructs and the dependent variables that used summated scales. Finally, the resulting summated scales capturing the different constructs represented in the independent and dependent variables were used in five multiple regression analyses designed to answer the research questions.

Pre-data analysis. In order to attain an understanding of the data and relationships, support the specification and refinement of the multivariate models together with a reasoning for the interpretation of results, and ensuring the data met all requirements for multivariate analysis, an examination of the data was conducted prior to running any analysis.

First, a graphical examination of the data was carried out, in an effort to gain an understanding of the basic characteristics of individual variables, as well as the relationships between variables. For this purpose, histograms were used to establish the univariate profile of each variable; while scatterplots were produced to create bivariate profiles examining the relationship between two variables; and boxplots were produced to examine group differences (Hair, Black, Babin, & Anderson, 2014).

Secondly, missing data were analyzed in an attempt to identify the patterns and relationships underlying the missing data so that once remedies were applied, the original distributions of values were maintained as close as possible. Additionally, through this process, the researcher developed an understanding of any underlying missing data processes and their impact (Hair et al., 2014). Following Hair et al.'s (2014) Four-step Process for Identifying Missing Data and Applying Remedies, the researcher:

- Determined the type of missing data in terms of whether or not they were ignorable;
- Determined the extent of missing data with regards to whether or not their amount was low enough to not affect the results. Missing data under 10 percent for an individual case

or observation may be ignored, unless the missing data occurs in specific nonrandom fashion (Meyers, 1979; Morrison, 2002). Here, individual cases or variables with as little as 15 % missing data were deleted, but higher levels of missing data were remedied (Kirk, 1994);

- Diagnosed the degree of randomness present in the missing data, between Missing At Random (MAR) and Missing Completely At Random (MCAR) (McCullagh, & Nelder, 1989). Here the *Missing Value Analysis* functionality in SPSS was employed.
- Selected an imputation method. Depending on the type of missing value (MAR or MCAR), the researcher selected an approach to accommodate the missing data in the analysis through imputation. Imputation is the process of estimating the missing value based on valid values of other variables and/ or cases in the sample. The goal here is to use known relationships identified in valid values of the sample to assist in estimating the missing value (Hair et al., 2014).

Thirdly, outliers were detected and handled according to their nature. In detecting outliers, the researcher used a combination of univariate, bivariate and multivariate perspectives, looking for a consistent pattern across perspectives to identify outliers. In the *univariate detection* approach, each variable's distribution was analyzed and outliers selected as those falling outside the range (high or low) of the distribution. For this purpose, the data were converted to standard scores, which have a mean of 0 and a standard deviation of 1, and outliers identified as observations with standard scores of 4 or more (Hair et al., 2014). The *bivariate detection* perspective involved an assessment of pairs of variables jointly through a scatter plot. So doing, cases falling outside the range of the other observations were seen as isolated points in the scatter plot. That range was delimited by an ellipse representing a bivariate normal
distribution's confidence interval set at the 95% confidence level (Hair et al., 2014). The *multivariate detection* employed the Mahalanobis distance as a means to measure the multidimensional position of each observation relative to the mean center of all observations (Hair et al., 2014). The Mahalanobis distance is the distance of a case from the centroid of the remaining cases, where the centroid is the point created by the means of all the variables (Tabachnick & Fidell, 2007). It is a multivariate assessment of each observation across a set of variables. Multivariate outliers were identified by the creation of a variable capturing each observation's Mahalanobis distance. That variable was then tested using chi-square criteria, and outliers indicated by chi-square values that were significant at p < .001, with the number of variables being identified for outliers used as the number of degrees of freedom (Mertler & Vannatta Reinhart, 2017).

Lastly, the four fundamental assumptions encompassing the requirements for the underlying statistical base for multivariate analysis were tested. The test was conducted on two levels: first for the each separate variable, and second for the multivariate model variate, as it represents the variables in the model collectively, and thus must meet the same assumptions as individual variables. These assumptions included: normality, homoscedasticity, linearity, and the absence of correlated errors (Hair et al., 2014).

Normality was assessed at the univariate level using a normal probability plot as a graphical approach and the Kolmogrov-Smirnov test as an empirical approach. Univariate departures from normality were corrected using square root, logarithms, squared, cubed or even inverse transformations, depending on the type of nonnormality at hand. At the multivariate level, normality was tested through the examination of residuals scatterplots and normality plots with tests (Mertler & Vannatta Reinhart, 2017).

Homoscedasticity was tested graphically using scatterplots and boxplots (bivariate homoscedasticity for metric variables), and empirically using the Levene test (bivariate homoscedasticity assessed through a test of equality of variances within groups formed by nonmetric variables) or the Box's M test (when testing more than one metric variable). Furthermore, departures from homoscedasticity were addressed using similar transformations to those used in addressing nonnormality (Hair et al., 2014).

As for tests of linearity, nonlinear relationships were identified by means of scatterplots of the variables, and departures were corrected by transforming the variables using methods previously mentioned.

The absence of correlated errors assumption was verified by identifying possible causes for correlated errors. For this purpose, values for the suspected variable were grouped or ordered on that variable and examined for any patterns. Correlated errors were remedied by including any omitted causal factors into the multivariate analysis (Hair et al., 2014).

Factor analysis. Prior to data analysis, two factor analyses were conducted on the appropriate summated scales that explored the interaction constructs and the dependent variables that used summated scales. The first set of variables included were survey items assessing student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interactions. The second set of variables included in the second factor analysis was made up of survey items assessing student satisfaction, student perceived learning, student academic success, and student perceived transfer of learning.

These factor analyses were conducted following Hair et al.'s (2014) six-stage model building paradigm. In the first stage, it was determined that factor analysis was appropriate to summarize the data and reduce the items into scales. This process used an exploratory factor analysis using R-type factor analysis.

In the second stage, the correlation matrix of all survey items was generated. The sample size was determined in an effort to satisfy the rule of thumb to have at minimum at least five times as many observations as the number of variables to be analyzed. Thus, the researcher tried to obtain the highest cases-per-variable ratio to minimize the chances of data overfit (Hair et al., 2014). So doing, the goal was to obtain the most parsimonious set of variables/ items, guided by conceptual and practical reasons.

In the third stage, critical conceptual and statistical assumptions underlying factor analysis were tested. Here the researchers ensured that the observed patterns were conceptually valid and appropriate, making sure to avoid including both "dependent and independent variables in a single factor analysis and then using the derived factors to support a dependence relationship" (Hair et al., 2014, p. 101). From a statistical perspective, normality, homoscedasticity, and linearity were tested; however, the researcher kept in mind that any departure from these assumptions would only be important if it reduced the observed correlations either from the overall or individual variable level.

The fourth stage involved deriving the factors and assessing their overall fit. Principal component analysis was chosen as factor extraction method. A total of four factors were extracted, based on a combination of criteria including: eigenvalues criterion (only retaining factors with eigenvalues greater than 1), a priori criterion (a predetermined number of factors based on prior research), percentage of variance criterion (enough factors to meet 60% or more variance explained), and scree test criterion (factors before the inflection point on the scree plot) (Hair et al., 2014).

The fifth stage consisted in interpreting the derived factors. First, a factor matrix was generated containing the factor loadings for each variable/ item on each factor. Then, in order to get a factor matrix that provided the most adequate interpretation of the variables involved, VARIMAX rotation was used in an effort to reduce some of the ambiguities that could be present in interpretations of the unrotated factor matrix. Finally, the researcher evaluated the rotated factor matrix.

In the sixth stage, the factor analysis was validated by assessing the stability of the factor model results. The researcher made every effort to obtain the largest sample size possible and create the most parsimonious model in order to increase the cases-to-variable ratio, resulting in an increased generalizability of the results. Moreover, the degree of generalizability of the results to the population was assessed by randomly splitting the sample into two subsets before estimating the factor models for each subset. A comparison of the two resulting factor matrices confirmed the robustness of the factor solution across samples (Hair et al., 2014).

Once the factor analyses were completed, the derived factors were used to create summated scales representing the concepts captured in each independent and dependent variable. Considerations regarding dimensionality were addressed by ensuring that the items were unidimensional and each summated scale consisted of items loading highly on a single factor (Anderson, Gerbing & Hunter, 1987; Hattie, 1985; McDonald, 1981). Furthermore, the reliability of the summated scales was assessed using Cronbach's alpha (Cronbach, 1951; Nunnally, 1979; Peter, 1979). An acceptable Cronbach's alpha is .70 or above, although it may decrease to .60 in exploratory research (Robinson, Shaver & Wrightsman, 1991). **Descriptive analysis.** The descriptive analysis involved producing a description of the different variables included in the study. Quantitative variables were described by providing their mean and standard deviation. Qualitative variables were described by providing a frequency count of the different categories making up the variables.

Multiple regression analysis. The newly created summated scales capturing the concepts represented in the independent variables (student-student interaction, student-instructor interaction, student-content interaction, and student-work-based-learning interaction) and dependent variables (student satisfaction, student perceived learning, student academic success, and student perceived transfer of learning) were incorporated into five multiple regression analyses designed to answer both research questions.

The multiple regression analyses were conducted following Hair et al.'s (2014) six-stage model building framework. In the first stage, the objectives of the analyses were established. Research question 1 had an explanatory objective, as the goal was to assess the degree and character of the relationship between each dependent variable (student satisfaction, student perceived learning, student academic success, or student perceived transfer of learning) and independent variables (student-to-student interaction, student-to-instructor interaction, student-to-content interaction, and student-to-work-based learning interaction) by examining the magnitude, sign, and statistical significance of the regression coefficient for each independent variable. Conversely, research question 2's objective was predictive in nature, due to the fact that it investigated the extent to which the set of independent variables could predict each one of the dependent variables. Furthermore, the use of summated scales ensured the remediation of possible measurement errors that might be detrimental to the achievement of an acceptable level of predictive accuracy (Hair et al., 2014).

The second stage involved addressing the design of the multiple regression analyses with respect to their statistical and practical significance. For this purpose, considerations of sample size were addressed in relation to maintaining the necessary levels of statistical power and practical significance. In order to ensure adequate statistical significance, the researcher maintained a power of .80 at a significance level of .05. As for ensuring the generalizability of results, a ratio of 47 observations for each independent variable was maintained, as the researcher elected to employ a stepwise procedure. Furthermore, the number of degrees of freedom (the difference between the sample size and the number of estimated parameters) was maintained as large as possible in order to increase the generalizability of the results. (Hair et al., 2014).

In the third stage, the multiple regression analyses' assumptions were examined, including linearity, constant variance of the error terms (homoscedasticity), independence of the error terms, and normality of the error term distribution for all independent and dependent variables. Linearity was assessed by creating *residual plots*. In order to identify the individual independent variables that deviated from linearity, *partial regression plots* were employed. In instances of violations of linearity, corrective actions encompassed the transformation of one or more independent variables to achieve linearity (Mosteller & Tukey, 1977). The independence of the error terms was tested through a visual inspection of residual plots, with violations displaying a consistent pattern in the residuals; and data transformations addressed violations' occurrences (Hair, et al., 2014). As for assessing homoscedasticity, the Levene test for homogeneity of variance was used to measure the equality of variances for each pair of variables. In case of heteroscedasticity, appropriate variance-stabilizing transformations were employed so that the transformed variables exhibited homoscedasticity. Finally, *normal probability plots*

were employed to assess the normality of independent and dependent variables, with transformations serving to correct instances of nonnormality (Daniel & Wood, 1999). It is important to note that the aforementioned tests of assumptions were conducted not only for independent and dependent variables, but for the corresponding variates as well. However, the test of assumptions for the variates only occurred once the models were estimated on stage four (Hair, et al., 2014).

In stage four, the regression models were produced and their overall fit assessed. A stepwise estimation method was employed to produce the regression models, with the independent variable with the greatest contribution being added first. Then, independent variables were selected for inclusion based on their incremental contribution over the variable(s) already in the equation. Furthermore, *F* tests were conducted in order to assess the statistical significance of the overall models (testing whether their R^2 value was significantly greater than zero), whereas significance tests for the models' regression coefficients were conducted in the SPSS statistical package.

In stage five, the regression variates were interpreted for each model. Here, the regression coefficients from multiple regression models corresponding to research question 1 provided indications of the relative impact and importance of the independent variables in their relationships with the dependent variables. Thus, answers to question 1 were formulated. Similarly, the significance of multiple regression models pertaining to research question 2 provided insights into the level of predictability of each dependent variable from the set of independent variables (Hair, et al., 2014).

In the sixth and last stage, the results from the multiple regression analyses were validated in order to ensure their generalizability and transferability. This process consisted in dividing the original sample into two subsamples: an estimation subsample for creating the regression model and the holdout or validation subsample used to test the equation. Therefore, the researcher determined the validity of the original models by comparing them to regression models estimated with the validation subsample (Hair, et al., 2014).

Hypotheses

The hypotheses that were analyzed are:

Hypothesis 1. Student-to-instructor interaction, student-to-student interaction, student-to-content interaction and student-to-work-based learning interaction are significantly positively associated with student satisfaction in an online postsecondary CTE course, when controlling for the effects of gender, age, ethnicity, Pell eligibility, full or parttime status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program.

Hypothesis 2. Student-to-instructor interaction, student-to-student interaction, student-to-content interaction and student-to-work-based learning interaction are significantly positively associated with student perceived learning in an online postsecondary CTE course, when controlling for the effects of gender, age, ethnicity, Pell eligibility, full or part-time status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program.

Hypothesis 3. Student-to-instructor interaction, student-to-student interaction, studentto-content interaction and student-to-work-based learning interaction are significantly positively associated with student academic success in an online postsecondary CTE course, when controlling for the effects of gender, age, ethnicity, Pell eligibility, full or part-time status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program.

Hypothesis 4. Student-to-instructor interaction, student-to-student interaction, studentto-content interaction and student-to-work-based learning interaction are significantly positively associated with student perceived transfer of learning in an online postsecondary CTE course, when controlling for the effects of gender, age, ethnicity, Pell eligibility, full or part-time status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program.

Validity and Reliability

Reliability was ensured by measuring the variables' internal consistency, which refers to the consistency among the variables in a summated scale (Hair et al., 2014). The internal consistency of each summated scale was assessed and reported using Cronbach's alpha (Cronbach, 1951; Nunnally, 1979; Peter, 1979). An acceptable Cronbach's alpha is .70 or above, although it may decrease to .60 in exploratory research (Robinson, Shaver & Wrightsman, 1991).

To ensure validity, the following types of validity that are important to survey research were considered: construct validity, convergent validity, content validity, representation validity, face validity, criterion validity, concurrent validity, predictive validity, statistical conclusion validity, internal validity, external validity, and ecological validity. The National Business Research Institute (NBRI) defines each type of validity as follows:

- *Construct validity* refers to the extent to which a survey measures what it says it measures.
- *Convergent validity* is the degree to which a measure is correlated with other measures that it is theoretically predicted to correlate with.
- *Content validity* refers to the degree to which the content of the survey matches a content domain associated with the construct. For instance, a survey of the ability to add two numbers should include a range of combinations of digits. A survey with only one-digit numbers, or only even numbers, would not have good coverage of the content domain. Content related evidence typically involves subject matter experts evaluating survey items against the survey specifications.
- *Representation validity*, also known as *translation validity*, is about the extent to which an abstract theoretical construct can be turned into a specific practical survey.
- *Face validity* is an estimate of whether a survey appears to measure a certain criterion; it does not guarantee that the survey actually measures phenomena in that domain. It is closely related to content validity. Measures may have high validity, but when the survey does not appear to be measuring what it is, it has low face validity. Indeed, when a survey is subject to faking (malingering), low face validity might make the survey more valid. Considering one may get more honest answers with lower face validity, it is sometimes important to make it appear as though there is low face validity whilst administering the measures.
- *Criterion validity* involves the correlation between the survey and a criterion variable (or variables) taken as representative of the construct. In other words, it compares the survey with other measures or outcomes (the criteria) already held to be valid. For example,

employee selection surveys are often validated against measures of job performance (the criterion), and IQ surveys are often validated against measures of academic performance (the criterion).

- *Concurrent validity* refers to the degree to which the operationalization correlates with other measures of the same construct that are measured at the same time. When the measure is compared to another measure of the same type, they will be related (or correlated). For example, surveys are administered to current employees and then correlated with their scores on performance reviews.
- *Predictive validity* refers to the degree to which the operationalization can predict (or correlate with) other measures of the same construct that are measured at some time in the future. Again, with the selection survey example, this would mean that the surveys are administered to applicants, all applicants are hired, their performance is reviewed at a later time, and then their scores on the two measures are correlated. Without a valid design, valid conclusions cannot be drawn.
- *Statistical conclusion validity* is the degree to which conclusions about the relationship among variables based on the data are correct or 'reasonable'. Statistical conclusion validity involves ensuring the use of adequate sampling procedures, appropriate statistical surveys, and reliable measurement procedures. As this type of validity is concerned solely with the relationship that is found among variables, the relationship may be solely a correlation.
- *Internal validity* is an inductive estimate of the degree to which conclusions about causal relationships can be made (e.g. cause and effect), based on the measures used, the research setting, and the whole research design. Good experimental techniques, in which

the effect of an independent variable on a dependent variable is studied under highly controlled conditions, usually allow for higher degrees of internal validity than, for example, single-case designs.

- *External validity* concerns the extent to which the (internally valid) results of a study can be held to be true for other cases, for example to different people, places or times. In other words, it is about whether findings can be validly generalized. If the same research study was conducted in those other cases, would it get the same results? External validity will be considered under conditions of nonresponse bias.
- *Ecological validity* is the extent to which research results can be applied to real life situations outside of research settings. This issue is closely related to external validity but covers the question of to what degree experimental findings mirror what can be observed in the real world (NBRI, 2019).

Furthermore, the researcher had subject matter experts review the instrumentation by evaluating survey items against the survey specifications. This process constituted the field testing of the survey instrument.

Summary

This chapter provided a description of the research methods that were used to conduct the current study. This research project examined the relationship between the student's quality of interactions and student success outcomes in online CTE courses at a large eastern urban community college. The researcher employed convenience sampling and quantitative survey following Dillman's (1978) TDM method to measure the relationship between *student-to-instructor, student-to-student, student-to-content,* and *student-to-work-based learning* interactions and *student satisfaction, student perceived learning, student academic success, and*

student perceived transfer of learning in online postsecondary CTE courses. The instrument that was used in this study includes additional questions that revealed demographic information about the participants.

Descriptive statistics were employed to present the demographic data that were collected, and inferential statistics were used to make generalizations about the findings of the study. Factorial and Multiple regression analyses following Hair et al.'s (2014) model were used in the data analysis processes.

CHAPTER 4: RESULTS

Introduction

The purpose of the current study was to identify the interactions in online CTE courses and then explore the relationships among interactions and student success outcomes in the context of an online postsecondary CTE environment. More specifically, the study explored the relationship between student-to-student, student-to-instructor, student-to-content, student-towork-based learning interactions and student perceived learning; the relationship between student-to-instructor, student-to-content, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-toinstructor, student-to-content, student-to-work-based learning interactions and student academic success as reflected by self-reported GPAs; and the relationship between student-to-student, student-to-instructor, student-to-content, student-to-work-based learning interactions and student perceived transfer of learning.

This study focused on two research questions:

Q1: What is the level of interaction of students in online postsecondary CTE courses with other students, faculty, content, and work-based learning?

Q2: Does the level of interaction between students and other students, faculty, content, and work-based learning explain student satisfaction with the course, students perceived learning, student perceived transfer of learning and academic success as measured by GPA, grade in last course and students' intent to complete?

This chapter presents the findings on student satisfaction, perceived learning, academic success, and perceived transfer of learning as they relate to four components of interaction as reported by students enrolled in an Associate in Applied Science (AAS) degree program for at

least one semester, and having completed an online course in their technical area of expertise as of the Spring of 2020 at a large eastern urban community college.

Pre-data Screening

The pre-data screening explored for the dependent variables, independent variables and covariates. A comparison of early and late respondents on students' demographics revealed no significant difference between them.

Table 1 provides the correlations between the online student interaction scales and Table 2 provides correlations between the student outcomes. The student interactions all had moderate or substantial associations. The outcome variables of satisfaction, perceived learning, and perceived transfer had substantial associations. Intent to complete and achievement had low associations with the other outcomes and low association with each other.

Table 1.

Correlations Between CTE Online Student Interactions with Content, Instructor, Students, and Work-based Learning

	Student to Content	Student to Instructor	Student to Student	Student to WBL
Student to Content	1.00			
Student to Instructor	.352	1.00		
Student to Student	.523	.665	1.00	
Student to WBL	.351	.407	.533	1.00

Note. Davis (1971) Descriptors to Interpret Correlations: .70 or higher = Very strong association, .50 to .69 Substantial association, .30 to .49 = Moderate association, .10 to .29 = Low association, .01 to .09 = Negligible association

Table 2.

	Satisfaction	Perceived Learning	Perceived Transfer	Intent to Complete	Achievement
Satisfaction	1.00				
Perceived Learning	.685	1.00			
Perceived Transfer	.613	.713	1.00		
Intent to Complete	.164	.184	.170	1.00	
Achievement	.155	.181	.184	015	1.00

Correlations Between CTE Online Students Outcomes of Satisfaction, Perceived Learning, Perceived Transfer of Learning, Intent to Complete, and Achievement

Note. Davis (1971) Descriptors to Interpret Correlations: .70 or higher = Very strong association, .50 to .69 Substantial association, .30 to .49 = Moderate association, .10 to .29 = Low association, .01 to .09 = Negligible association

Descriptive Statistics

In this study, descriptive statistics were used to describe the population. A total of 183 students completed the survey. The survey included questions on participants' gender, age, ethnicity, Pell eligibility, employment status, full or part-time status, number of online courses completed in the Associate of Applied Science degree, and number of courses completed in the Associate of Applied Science program. An analysis of reported gender revealed that 74.3 % (n= 136) were female and 25.7% (n= 47) were male. The mean age for the participants was 33.62 (SD=10.73). Table 3, Table 4, Table 5, Table 6 and Table 7 present the respondents by age, ethnicity, Pell eligibility, employment status, and full or part-time status respectively.

Table 3

	Frequency	Percent of Respondents in Category
18 to 19	9	4.9
20 to 29	67	36.6
30 to 39	48	26.2
40 to 49	38	20.8
50 to 59	16	8.7
No age reported	5	2.7
Total	183	100

Age of Survey Respondents

	Frequency	Percent of Respondents in Category
White	98	53.6
Hispanic or Latino	23	12.6
Black or African American	43	23.5
Native American or American Indian	1	.5
Asian or Pacific Islander	4	2.2
Other	14	7.7
Total	183	100

Ethnicity of Survey Respondents

The number of online courses completed in the Associate of Applied Science degree was summarized with a mean score of 6.70 and a standard deviation of 5.71. Similarly, the number of courses completed in the Associate of Applied Science program was determined and had a mean score of 10.62 and a standard deviation of 6.70.

Table 5

Pell Eligibility of Survey Respondents

	Frequency	Percent of Respondents in Category
Eligible	68	37.2
Not Eligible	115	62.8
Total	183	100

Table 6

Employment Status of Survey Respondents

	Frequency	Percent of Respondents in Category
Unemployed	70	38.3
Working Part Time	46	25.1
Working Full Time	67	36.6
Total	183	100

Program Area by Full or Part-Time Status of Survey Respondents

Program Area	Part-time	Full-time	Percent
Accounting and Finance	9	5	7.8
Advertising and Graphic Design	8	4	6.7
Associate in Nursing	10	16	14.4
Automotive Systems Technology	0	2	1.1
Baking and Pastry Arts	0	2	1.1
Biopharmaceutical Technology	2	1	1.7
Business Administration	7	9	8.9
Business Analytics	1	1	1.1
Civil Engineering Technology	4	1	2.8
Computer Engineering	0	2	1.1
Computer Programming & Development	3	3	3.3
Construction Management Technology	0	2	1.1
Criminal Justice Technology	2	1	1.7
Culinary Arts	0	2	1.1
Cybersecurity	3	2	2.8
Data Science and Programming Support Services	0	1	.6
Dental Hygiene	3	2	2.8
Early Childhood Education	1	4	2.8
Electronics Engineering Technology	0	1	.6
Emergency Medical Science	0	1	.6
Geomatics Technology (Surveying)	1	1	1.1
Health and Fitness Science	1	1	1.1
Healthcare Business Informatics	0	1	.6
Hospitality Management	0	2	1.1
Human Services Technology	5	4	5.0
Interior Design	0	1	.6
Mechanical Engineering Technology	2	0	1.1
Medical Assisting	2	4	3.3
Medical Laboratory Technology	0	2	1.1
Medical Office Administration	2	11	7.2
Network Management	1	2	1.7
Office Administration	3	0	1.7

Note. Three respondents did not report their program area and full or part-time status.

Program Area	Part-time	Full-time	Percent
Pharmacy Technology	0	1	.6
Radiography	3	2	2.8
Storage and Virtualization	1	0	.6
Supply Chain Management	2	0	1.1
Technical Support	2	0	1.1
Web Designer	2	1	1.7
Web Developer	1	4	2.8
Total	81	99	100

Program Area by Full or Part-Time Status of Survey Respondents (Continued)

Note. Three respondents did not report their program area and full or part-time status.

Factor Analysis

Two factor analyses were conducted on the survey items that explored the interaction constructs and the dependent variables that used summated scales. The first set of variables included were survey items assessing student-to-student interaction (Q_{10_1} , Q_{10_2} , Q_{10_3} , Q_{10_4} , and Q_{10_5}), student-to-instructor interaction (Q_{9_1} , Q_{9_2} , Q_{9_3} , Q_{9_4} , Q_{9_5} and Q_{9_6}), student-to-content interaction (Q_{6_1} , Q_{6_2} , Q_{6_3} , Q_{6_4} , Q_{6_5} , Q_{6_6} and Q_{6_7}), and student-to-work-based learning interaction (Q_{11_1} , Q_{11_2} , Q_{11_3} and Q_{11_4}).

Principal components analysis was conducted utilizing a varimax rotation to produce a four-components solution. The components' loadings are represented in Table 8. Because survey item Q_{9_1} loaded strongly on the student-to-student factor, the researcher included it to the corresponding summated scale. However, Q_{6_6} and Q_{6_1} loaded almost equally on the student-to-student and the student-to-content factors. Therefore, they were both included in the summated scale capturing the student-to-content construct. As a result, the sum of survey questions Q_{10_1} , Q_{10_2} , Q_{10_3} , Q_{10_4} , Q_{10_5} and Q_{9_1} created the composite variable *Student-to-student Interaction*; whereas the sum of survey questions Q_{9_2} , Q_{9_3} , Q_{9_4} , Q_{9_5} and Q_{9_6} created the composite

variable Student-to-instructor Interaction. Moreover, the sum of survey questions Q_{11_1}, Q_{11_2},

Q11_3 and Q11_4 created the composite variable Student-to-work-based learning Interaction; and

the sum of survey questions Q_{6_1} , Q_{6_2} , Q_{6_3} , Q_{6_4} , Q_{6_5} , Q_{6_6} and Q_{6_7} created the composite

variable Student-to-content Interaction. A reliability test for each summated scale using

Cronbach's alpha as criterion revealed that the scales were moderately to highly reliable. Table

9 presents the reliability of each summated scale and their corresponding survey items.

Table 8

Component Loadings for Student Interactions factor analysis

	Factor	Factor	Factor	Factor
	1	2	3	4
Q10_2 (My learning in my last online CTE class was facilitated	.786	.309	.172	.065
by communicating with other students in the course.)				
Q10_1 (My learning in my last online CTE class was facilitated	.734	.262	.286	.094
by sharing learning experiences with others.)				
Q10_5 (My learning in my last online CTE class was facilitated	.680	.327	.368	011
by encouragements/ opportunities to work in small groups/				
teams.)				
Q10_4 (My learning in my last online CTE class was facilitated	.664	.388	.416	.041
by a sense of community with fellow students taking the course.)				
Q10_3 (My learning in my last online CTE class was facilitated	.657	.436	.354	044
by increased contact with fellow students that helped me get				
more out of the course.)				
Q9_1 (My learning in my last online CTE class was facilitated by	.645	.313	.015	.286
the instructor encouraging me to become actively involved				
online discussions.)				
Q6_6 (My learning in my last online CTE class was facilitated by	.512	133	.197	.317
assignments that required writing.)				
Q6_1 (My learning in my last online CTE class was facilitated by	.473	.162	146	.322
the course documents, lessons, or lecture notes.)				
Q9_6 (My learning in my last online CTE class was facilitated by	.150	.838	.148	.106
the instructor caring about my success.)				
Q9_5 (My learning in my last online CTE class was facilitated by	.275	.825	.133	.050
the instructor caring about me personally.)				
Q9_2 (My learning in my last online CTE class was facilitated by	.125	.725	.059	.145
the instructor providing timely feedback.)				
Q9_4 (My learning in my last online CTE class was facilitated by	.215	.702	.238	.046
the instructor informing me about my progress periodically.)				
Q9_3 (My learning in my last online CTE class was facilitated by	.380	.632	.146	.095
the instructor interacting with me in online discussions.)				

Factor 1 = Student-to-student Interaction; Factor 2 = Student-to-student Interaction; Factor 3 = Student-to-work-based Learning Interaction; Factor 4 = Student-to-content Interaction.

Component Loadings for Student Interactions factor analysis (Continued)

Q11_2 (My learning in my last online CTE class was facilitated by interacting with a business to meet a course/activity objective (job shadow, interview, internship, work-based learning).)	.120	.151	.842	.197
Q11_3 (My learning in my last online CTE class was facilitated by interacting with a professional in the field to meet a course/activity objective.)	.102	.172	.841	.205
Q11_4 (My learning in my last online CTE class was facilitated by participating in service learning.)	.189	.164	.825	.035
Q11_1 (My learning in my last online CTE class was facilitated by interacting with an individual from the community to meet a course/activity objective.)	.310	.114	.747	.155
Q6_5 (My learning in my last online CTE class was facilitated by assignments that addressed real-word problems.)	.087	.081	.145	.682
Q6_7 (My learning in my last online CTE class was facilitated by assignments that required critical thinking.)	.046	.063	.195	.616
Q6_4 (My learning in my last online CTE class was facilitated by assignments.)	.350	212	189	.550
Q6_3 (My learning in my last online CTE class was facilitated by preparation for quizzes.)	.311	.331	.023	.519
Q6_2 (My learning in my last online CTE class was facilitated by online resources.)	015	.119	.163	.453

Factor 1 = Student-to-student Interaction; Factor 2= Student-to-student Interaction; Factor 3= Student-to-workbased Learning Interaction; Factor 4 = Student-to-content Interaction.

Table 9

Reliability of Survey Scales and Items for Student Interactions Factor Analysis

Interaction Scales	Survey Items	
		Alpha
Student-to-student	$Q_{10_{-1}}, Q_{10_{-2}}, Q_{10_{-3}}, Q_{10_{-4}}, Q_{10_{-5}}, Q_{9_{-1}}$.91
Student-to-instructor	Q9_2, Q9_3, Q9_4, Q9_5, Q9_6	.86
Student-to-work-based learning	Q11_1, Q11_2, Q11_3, Q11_4	.90
Student-to-content	$Q_{6_1}, Q_{6_2}, Q_{6_3}, Q_{6_4}, Q_{6_5}, Q_{6_6}, Q_{6_7}$.65

The set of variables included in the second factor analysis was made up of survey items assessing student satisfaction (Q_{12_1} , Q_{12_2} , Q_{12_3} , Q_{12_4} , Q_{12_5} and Q_{12_6}), student perceived learning (Q_{13_1} , Q_{13_2} , Q_{13_3} , Q_{13_4} , Q_{13_5} and Q_{13_6}), student academic success (Q_{15_1} , Q_{15_2} , Q_{18} , Q_{19}), and student perceived transfer of learning (Q_{14_1} , Q_{14_2} , Q_{14_3} and Q_{14_4}).

Principal components analysis was conducted utilizing a varimax rotation to produce a four-components solution. However, survey items from both the perceived learning and the perceived transfer of learning constructs loaded strongly on the same component, while survey items Q_{15} and Q_{15} loaded strongly on a different component than survey items Q_{18} and Q_{19} . For those reasons, the researcher elected to produce a five-components solution. The resulting components' loadings are presented in Table 10. Consequently, the sum of survey questions Q_{13_1}, Q_{13_2}, Q_{13_3}, Q_{13_4}, Q_{13_5} and Q_{13_6} created the composite variable *Student Perceived Learning*; whereas the sum of survey questions Q_{12_1}, Q_{12_2}, Q_{12_3}, Q_{12_4}, Q_{12_5} and Q_{12_6} created the composite variable *Student Satisfaction*. Moreover, the sum of survey questions Q₁₄, Q₁₄, Q₁₄, Q_{14_3} and Q_{14_4} created the composite variable *Student Perceived Transfer of Learning*; the sum of survey questions Q_{15_1} and Q_{15_2} created the composite variable Intent to Remain Enrolled and *Complete*; and the sum of survey questions Q_{18} and Q_{19} (using their standardized scores) created the composite variable Student Achievement. A reliability test for each summated scale using Cronbach's alpha as criterion revealed that the scales were moderately to highly reliable. Table 11 presents the reliability of each summated scale and their corresponding survey items.

Component Loadings for Student Outcomes Factor Analysis

	Factor	Factor	Factor	Factor	Factor
	1	2	3	4	5
Q13_3 (I learned to identify the central issues of the	.785	.245	.285	.026	.093
course.)					
Q13_5 (I improved my ability to integrate facts and	.776	.221	.329	.130	.031
develop generalizations from the course material.)					
Q13_2 (I gained a good understanding of the basic	.772	.214	.195	.022	.085
concepts of the material.)					
Q13_1 (I learned to interrelate the important issues in	.750	.354	.181	.019	028
the course material.)					
Q13_6 (I learned concepts and principles in the course.)	.714	.287	.343	.108	.113
Q13_4 (I developed the ability to communicate clearly	.638	.368	.246	.076	.060
about the subject.)					
Q12_3 (If I had another opportunity to take another	.076	.819	.074	.038	.066
course via this mode I would gladly do)					
Q12_1 (The quality of the course compared favorably	.345	.776	.171	.019	045
to my other courses.)				0.47	0.0.4
Q12_6 (I would recommend the course to another	.396	.773	.213	.065	.034
student.)	212	=20	225	006	107
Q12_4 (I gained more interest in the subject matter of	.313	.738	.335	.086	.107
the course.)	202	=26	200	007	074
Q12_2 (I was very satisfied with the course.)	.382	.736	.308	.005	.074
Q12_5 (I feel that the course served my needs well.)	.447	.680	.333	.124	.039
Q14_3 (I will be able to use the knowledge, skills, and	.365	.304	.743	.048	.096
abilities I gained from the course In)					
Q14_4 (The knowledge, skills, and abilities from the	.253	.280	.714	.228	048
course will help me obtain employment.)	2.52	1.54	(0.4	070	100
Q14_2 (I could teach others the content of the course.)	.252	.164	.694	070	.192
Q14_1 (I have used the knowledge, skills, or abilities	.378	.208	.690	.021	.003
from the course in my work or other classes.)	005	10-		0.0.6	
Q15_1 (I plan to remain enrolled in my current	.085	.107	.007	.906	007
program.)	0.62	015	004	000	01.6
$Q15_2$ (1 plan to complete the program I am currently	.062	.015	.094	.898	016
enrolled in.)	0.40	004	026	104	007
Q18 (My current GPA 1s)	.040	.004	.036	124	.905
Q19 (My letter grade in the last course I took was a:)	.109	.107	.111	.102	.872

Factor 1 = Student Perceived Learning; Factor 2= Student Satisfaction; Factor 3= Student Perceived Transfer of Learning; Factor 4 = Intent to Remain Enrolled and Complete; Factor 5 = Student Achievement.

Outcome Scales	Survey Items	Cronbach's
		Alpha
Perceived Learning	$Q_{13_1}, Q_{13_2}, Q_{13_3}, Q_{13_4}, Q_{13_5}, Q_{13_6}$.91
Satisfaction	$Q_{12_1}, Q_{12_2}, Q_{12_3}, Q_{12_4}, Q_{12_5}, Q_{12_6}$.93
Perceived Transfer of Learning	$Q_{14_1}, Q_{14_2}, Q_{14_3}, Q_{14_4}$.83
Intent to remain enrolled and complete	Q15_1, Q15_2	.80
Achievement	Q18, Q19	.77

Reliability of Survey Scales and Items for Student Outcomes Factor Analysis

Multiple Regression Analysis

The newly created summated scales capturing the concepts represented in the independent variables (student-student interaction, student-instructor interaction, student-content interaction, and student-work-based-learning interaction) and dependent variables (student satisfaction, student perceived learning, student academic success, and student perceived transfer of learning) were incorporated into five multiple regression analyses designed to answer both research questions.

The first research question explored the levels of interaction between the students and content, instructor, student, and work-based learning. The highest rated level of interaction was student to content (M = 4.36, SD = .483) and the lowest was student to work-based learning (M = 2.70, SD = 1.26). The students agreed with the interactions with content and instructor, were neutral in relation to student to student interactions, and somewhat disagreed with the student to work-based learning interactions. Table 12 shows the summary statistics (means and standard deviations) for the levels of student interactions with content, instructor, students, and work-based learning in online CTE.

Table 12.

Mean and Standard Deviation of CTE Online Student Interactions with Content, Instructor,

	М	SD
Student to Content	4.36	.483
Student to Instructor	3.81	.988
Student to Student	3.41	1.10
Student to WBL	2.70	1.26

Students, and Work-based Learning (WBL)

Note. 5 = Strongly agree, 4 = Agree, 3 = Neither Agree or Disagree, 2 = Disagree, 1 = Strongly Disagree

The second research question explored the types of interaction that explain student success outcomes. For this purpose, five independent multiple regression analyses were conducted on the independent variables (student-student interaction, student-instructor interaction, student-content interaction, and student-work-based-learning interaction) and each one of the dependent variables (student satisfaction, student perceived learning, student academic success, and student perceived transfer of learning), while controlling for age, gender, ethnicity, Pell status, and online course experience. Interaction effects were tested with the variables gender, age, and ethnicity for each dependent variable and not present in any of the cases.

During stepwise regression, the variables enter into the regression equation one block at a time. In the current study, the control variables *gender* (Converted into a binary variable *Gender*, with 1 representing male and 0 female.), *age*, *ethnicity* (Broken down into binary variables *Black*, *Hispanic* and *White* which represented the main categories.), *Pell eligibility*, *full or part-time status*, *number of online courses completed in the Associate of Applied Science degree*, *and number of courses completed in the Associate of Applied Science program* entered into the equation in the first step or block, while the second block included the independent

variables student-to-instructor interaction, student-to-student interaction, student-to-content interaction and student-to-work-based learning interaction. Furthermore, the variable ONLINE_RATIO was created by dividing the number of online courses completed in the Associate of Applied Science degree by the number of courses completed in the Associate of Applied Science program.

Hypothesis 1. In order to test hypothesis 1, student-to-instructor interaction, student-tostudent interaction, student-to-content interaction and student-to-work-based learning interaction were regressed on student satisfaction using stepwise multiple regression and controlling for gender (Male=1, Female=0), age as measured continuously, ethnicity (Black, Hispanic and White), Pell eligibility (Yes or No), full or part-time status, and the ratio of the number of online courses completed in the Associate of Applied Science degree over the number of courses completed in the Associate of Applied Science program (online courses/course). The results of the analysis are shown in Table 13. Although the control variables entered in the first block of the regression produced a statistically significant increase in explained variance [$R^2 =$.086, $R_{adj}^2 =$.080, F(1, 165) = 15.853, p < .001], ONLINE_RATIO was the only control variable to enter the model; and only explained about 8.8% of variance in student satisfaction.

In the second block of the stepwise regression, the four independent variables were entered as a block. The variables *student-to-instructor interaction* and *student-to-content interaction* explained a statistically significant increase in explained variance $[R^2 =$.464, $R_{adj}^2 =$.454, F(3, 163) = 48.139, p < .001]. The final model explained 46.4% of variance in student satisfaction. Coefficients revealed that *student-to-instructor interaction* ($\beta =$.505, t(163) = 8.304, p < .001) and *student-to-content interaction* ($\beta =$.226, t(163) =3.741, p < .001) both have a significantly positive relationship to student satisfaction. These findings suggest that increased levels of interaction between student and instructors, as well as

between students and course content result in increased student satisfaction in online CTE

courses.

Table 13

Regression Analysis to Explain Student Satisfaction with Four Types of Interaction in Online

Model	Sum of Squares	df	Mean Square	F	р
Regression	2605.940	3	868.647	46.484	<.001
Residual	3045.988	163	18.687		
Total	5651.928	166			
	Unstand	lardized	Standardized		
	Coeff	icients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	503	3.062		164	.870
Ratio of Online Cou	ırse 2.974	.878	.197	3.386	.001
Student-to-instructo	r .602	.073	.505	8.196	<.001
Student-to-content	.386	.105	.224	3.662	<.001

CTE Courses

Note. R^2 =46.1%; *Variables Excluded from Model: Gender, Age, Ethnicity (Black, Hispanic and White), Pell Status, Full/Part-time status, Student-to-student, Student-to-work-based learning.*

Hypothesis 2. In order to test hypothesis 2, student-to-instructor interaction, student-tostudent interaction, student-to-content interaction and student-to-work-based learning interaction were regressed on student perceived learning using stepwise multiple regression and controlling for gender (Male=1, Female=0), age as measured continuously, ethnicity (Black, Hispanic and White), Pell eligibility (Yes or No), full or part-time status, and the ratio of the number of online courses completed in the Associate of Applied Science degree over the number of courses completed in the Associate of Applied Science program (online courses/course).

The results of the analysis are shown in Table 14. The control variables were included in the first block of the regression analysis, but none of them entered the final model.

In the second block of the stepwise regression, the four independent variables were entered as a block. The variables *student-to-student, student-to-content, and student-toinstructor interaction* explained a statistically significant increase in explained variance $[R^2 =$.380, $R_{adj}^2 =$.369, F(3, 163) = 33.362, p < .001]. The final model explained 38.1% of variance in student perceived learning. Coefficients revealed that *student-to-student interaction* $(\beta = .161, t(163) = 1.825, p < .001)$, *student-to-content interaction* $(\beta = .330, t(163) =$ 4.589, p < .001) and *student-to-instructor interaction* $(\beta = .271, t(163) = 3.359, p <$.001) all had a significantly positive relationship to student perceived learning. These findings suggest that increased levels of interaction between students and their peers, between students and course content, and between student and instructors favor increased student perceived learning in online CTE courses.

Hypothesis 3. In order to test hypothesis 3, student-to-instructor interaction, student-tostudent interaction, student-to-content interaction and student-to-work-based learning interaction were regressed on student perceived transfer of learning using stepwise multiple regression and controlling for gender (Male=1, Female=0), age as measured continuously, ethnicity (Black, Hispanic and White), Pell eligibility (Yes or No), full or part-time status, and the ratio of the number of online courses completed in the Associate of Applied Science degree over the number of courses completed in the Associate of Applied Science program (online courses/course). The results of the analysis are shown in Tables 15. The control variables were included in the first block of the regression analysis, but none of them entered the final model.

Regression Analysis to Explain Student_Perceived Learning with Four Types of Interaction in

Model	Sum of Squares	df	Mean Square	F	р
Regression	1153.344	3	384.448	33.362	<.001
Residual	1878.357	163	11.524		
Total	3031.701	166			
	Unstar	ndardized	Standardized		
	Coef	ficients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	7.031	2.503		2.809	.006
Student-to-student	.106	.058	.161	1.825	<.001
Student-to-content	.415	.091	.330	4.589	<.001
Student-to-instructo	or .237	.070	.271	3.359	<.001

Online CTE Courses

Note. $R^2=38.1\%$; Variables Excluded from Model: Gender, Age, Ethnicity (Black, Hispanic and White), Pell Status, Full/Part-time status, Online-ratio, Student-to-work-based learning.

In the second block of the stepwise regression, the four independent variables were entered as a block. The variables *student-to-instructor interaction*, *student-to-content interaction* and *student-to-work-based learning interaction* explained a statistically significant increase in explained variance $[R^2 = .275, R_{adj}^2 = .261, F(3, 163) = 20.591, p < .001]$. The final model explained 27.5% of variance in student perceived transfer of learning. Coefficients revealed that *student-to-instructor interaction* ($\beta = .274, t(163) = 8.645, p < .001$), *studentto-content interaction* ($\beta = .228, t(163) = 3.102, p < .05$) and *student-to-work-based learning interaction* ($\beta = .183, t(163) = 2.406, p < .05$) have a significantly positive relationship to student perceived transfer of learning. These findings suggest that increased levels of interaction between students and instructors, between students and course content, and between students and work-based learning favor increased student perceived learning in online CTE courses.

Regression Analysis to Explain Student_Perceived Transfer of Learning with Four Types of

Model	Sum of Squares	df	Mean Square	F	р
Regression	498.691	3	166.230	20.591	<.001
Residual	1315.860	163	8.073		
Total	1814.551	166			
	Unstand	dardized	Standardized		
	Coeff	icients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	5.250	2.037		2.577	.011
Student-to-instructo	or .185	.051	.274	3.645	<.001
Student-to-content	.222	.072	.228	3.102	.002
Student-to-wbl	.121	.050	.183	2.406	.017

Interaction in Online CTE Courses

Note. $R^2=27.5\%$; Variables Excluded from Model: Gender, Age, Ethnicity (Black, Hispanic and White), Pell Status, Full/Part-time status, Online-ratio, Student-to-student.

Hypothesis 4. In order to test hypothesis 4, student-to-instructor interaction, student-tostudent interaction, student-to-content interaction and student-to-work-based learning interaction were regressed on Student Intent to remain enrolled and complete and Student Achievement using stepwise multiple regression and controlling for gender (Male=1, Female=0), age as measured continuously, ethnicity (Black, Hispanic and White), Pell eligibility (Yes or No), full or part-time status, and the ratio of the number of online courses completed in the Associate of Applied Science degree over the number of courses completed in the Associate of Applied Science program (online courses/course). The results of the analysis are shown in Tables 16 and 17.

With *Student Intent to remain enrolled and complete* as the dependent variable, although the control variables entered in the first block of the regression produced a statistically significant increase in explained variance $[R^2 = .029, R_{adj}^2 = .023, F(3, 163) = 4.940, p <$.05], *full or part-time status* was the only control variable to enter the model; and only explained about 2.9% of variance in student Intent to remain enrolled and complete.

In the second block of the stepwise regression, the four independent variables were entered as a block. The only variable to enter the model was *student-to-work-based learning interaction, which* explained a statistically significant increase in explained variance $[R^2 =$.090, $R_{adj}^2 = .079, F(2, 164) = 8.156, p < .05]$. The final model explained 9% of variance in Student intent to remain enrolled and complete. Coefficients revealed that *full or part-time status* ($\beta = .182, t(164) = 2.443, p < .05$) had a significantly positive relationship to student students' intent to remain enrolled and complete their degree program. These findings suggest that increased levels of interaction between student and work-based learning result in increased intent to remain enrolled and complete in online CTE courses.

With *Student Achievement* as the dependent variable, interestingly enough, some of the control variables included in the first block explained a statistically significant amount of variance, whereas none of the interaction variables entered the final model. The final model explained 12.6% of variance in Student Academic Achievement [$R^2 = .126$, $R_{adj}^2 = .110$, F(3, 163) = 7.835, p < .001]. Coefficients revealed that *White* ($\beta = .288$, t(163) = 3.871, p < .001) and Age ($\beta = .162$, t(163) = 2.206, p < .05) had a significantly positive relationship to student students' academic achievement, while *Gender* ($\beta = -.155$, t(163) = -2.072, p < .05) had a significantly negative relationship to student students' academic achievement. These findings suggest that older students tend to be more successful in online CTE courses compared to younger students. Furthermore, they also reveal that female students tend to perform better than their male counterparts, and white students tend to be more successful than students from other ethnicities.

Regression Analysis to Explain Student Intent to Remain Enrolled and Complete with Four Types of

Model	Sum of Squares	df	Mean Square	F	р
Regression	11.853	2	5.927	8.156	<.001
Residual	119.177	164	.727		
Total	131.030	166			
	Unstand	dardized	Standardized		
	Coeff	icients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	9.048	.176		51.432	<.001
Full-time/Part-time	.324	.133	.182	2.443	.016
Student-to-wbl	.044	.013	.248	3.327	.001

Interaction in Online CTE Courses

Note. $R^2 = 9\%$, Variables Excluded from Model: Gender, Age, Ethnicity (Black, Hispanic and White), Pell Status, Onlineratio, Student-to-content, Student-to-instructor, Student-to-student.

These results motivated the researcher to further investigate the impact of demographic variables on students' academic achievement. For this purpose, the four components of student interaction were regressed on *GPA* and *Grade* separately by controlling for the same demographic variables. Tables 18 and 19 present the results of the analyses.

With *GPA* as the dependent variable, two control variables (*Black* and *Age*) were the only variables to enter the final model that explained 11.1% of variance in Student GPA [$R^2 = .111, R_{adj}^2 = .100, F(2, 164) = 10.271, p < .001$]. Furthermore, coefficients revealed that *Black* ($\beta = -.279, t(164) = -3.770, p < .001$) had a significantly negative relationship to student students' GPA and *Age* ($\beta = .212, t(164) = 2.870, p < .05$) had a significantly positive relationship to student students' GPA. These findings revealed the fact that ethnicity impacts students' GPA, with Black students having the lowest GPAs. Furthermore, older students have better GPAs than their younger counterparts.

Regression Analysis to Explain Student Academic Achievement with Four Types of Interaction in

Model	Sum of Squares	df	Mean Square	F	р
Regression	69.655	3	23.218	7.835	<.001
Residual	483.011	163	2.963		
Total	552.666	166			
	Unstand	lardized	Standardized		
	Coeff	icients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	-1.342	.469		-2.859	.005
White	1.052	.272	.288	3.871	<.001
Age	.027	.012	.162	2.206	.029
Gender	649	.313	155	-2.072	.040

Online CTE Courses

Note. $R^2 = 12.6\%$; Variables Excluded from Model: Black, Hispanic, Pell Status, Full/Part-time status, Onlineratio, Student-to-content, Student-to-instructor, Student-to-student, Student-to-work-based learning.

With *Grade* as the dependent variable, two variables (*White* and *student-to-content interaction*) entered the final model that explained 10.8% of variance in Student Grade $[R^2 = .108, R_{adj}^2 = .097, F(2, 164) = 9.942, p < .001]$. Furthermore, coefficients revealed that *White* ($\beta = .268, t(164) = 3.615, p < .001$) and *student-to-content interaction* ($\beta = .221, t(164) = 2.980, p < .05$) had a significantly positive relationship to student students' Grade in their last course. These findings revealed the fact that ethnicity impacts students grade in their last course, with White students having the highest grades. They also revealed that increased level of student-to-content interaction result in increased course grades.

Regression Analysis to Explain Student GPA with Four Types of Interaction in Online CTE

Model	Sum of Squares	df	Mean Square	F	р
Regression	18.995	2	9.497	10.271	<.001
Residual	151.649	164	.925		
Total	170.644	166			
	Unstand	lardized	Standardized		
	Coeffi	cients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	520	.246		-2.110	.036
Black	672	.178	279	-3.770	<.001
Age	.020	.007	.212	2.870	.005

Note. $R^2 = 11.1\%$; Variables Excluded from Model: Gender, White, Hispanic, Pell Status, Full/Part-time status, Online-ratio, Student-to-content, Student-to-instructor, Student-to-student, Student-to-work-based learning.

Table 19

Regression Analysis to Explain Student Grade in Last Course with Four Types of Interaction in

Online CTE (Courses
--------------	---------

Model	Sum of Squares	df	Mean Square	F	р
Regression	18.208	2	9.104	9.942	<.001
Residual	150.173	164	.916		
Total	168.381	166			
	Unstand	dardized	Standardized		
	Coeff	icients	Coefficients		
Model	В	Std. Error	Beta	t	р
(Constant)	-2.301	.689		-3.337	.001
White	.541	.150	.268	3.615	<.001
Student-to-content	.066	.022	.221	2.980	.003

Note. $R^2 = 10.8\%$; Variables Excluded from Model: Gender, Age, Black, Hispanic, Pell Status, Full/Part-time status, Online-ratio, Student-to-instructor, Student-to-student, Student-to-work-based learning.

Courses

Summary

This chapter summarized the statistical results of this study. The study examined the relationship among students' satisfaction, perceived learning, academic success, and perceived transfer of learning as they relate to four components of interaction as reported by students enrolled in an Associate in Applied Science (AAS) degree program for at least one semester, and having completed an online course in their technical area of expertise as of the Spring of 2020 at a large eastern urban community college.

These findings revealed that increased levels of interaction between students and instructors, as well as between students and course content result in increased student satisfaction in online postsecondary CTE courses. Similarly, increased levels of interaction between students and their peers, between students and course content, and between student and instructors favor increased student perceived learning in online postsecondary CTE courses. Moreover, increased levels of interaction between students and instructors, between students and course content, and between students and course content, and between students and course content, and between students and work-based learning favor increased student perceived transfer of learning in online postsecondary CTE courses. Likewise, increased levels of student-to-content interaction result in increased course grades.

Demographic characteristics were found to impact academic success as well, with older students being more successful (higher GPAs) compared to younger students, and female students performing better than their male counterparts in online postsecondary CTE courses. Furthermore, ethnicity was found to affect students' success in that Black students have the lowest GPAs, while their White counterparts earn the highest grades.

Chapter V will discuss the implications of the results of the study before providing recommendations for policy, practice and future research.

CHAPTER 5: DISCUSSION

The purpose of the current study was to identify the interactions in online CTE courses and then explore the relationships among interactions and student success outcomes in the context of an online postsecondary CTE environment. More specifically, the study explored the relationship between student-to-student, student-to-instructor, student-to-content, student-towork-based learning interactions and student perceived learning; the relationship between student-to-instructor, student-to-content, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-toinstructor, student-to-content, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-toinstructor, student-to-content, student-to-work-based learning interactions and student academic success as measured by GPA, grade in last course and students' intent to complete, and the relationship between student-to-student, student-to-instructor, student-to-content, student-to-work-based learning interactions and student-to-work-based learning interactions.

This study focused on two research questions:

Q1: What is the level of interaction of students in online postsecondary CTE courses with other students, faculty, content, and work-based learning?

Q2: Does the level of interaction between students and other students, faculty, content, and work-based learning explain student satisfaction with the course, students perceived learning, student perceived transfer of learning and academic success as measured by GPA, grade in last course and students' intent to complete?

The specific population for this study is Community College students enrolled in CTE programs and taking online courses as part of their program. A total of 357 students started the survey and a total of 183 completed the survey yielding a 51.3% completion rate. The desired sample for this study was made up of Community College students enrolled in an Associate in
Applied Science (AAS) degree program for at least one semester, and having completed an online course in their technical area of expertise as of the Spring of 2020 at a large eastern urban community college. This study used a purposeful sample of students. A survey and directions were emailed to qualifying students to share with them the purpose of the study, and the importance of their contribution to the study.

Conclusions

This study provides a foundation to understand interactions in online postsecondary CTE courses. The findings from this study extend the knowledge to examine the student interactions with content and work-based learning, as well as student outcomes related to their perceived transfer of learning, retention and achievement. There are five major conclusions from this research study.

First, the students' experience with work-based learning in the online postsecondary CTE environment was rated the lowest among the four types of interactions. This result is important in relation to the emphasis placed on connecting curriculum to the workplace in postsecondary CTE programs. In fact, according to Gibney (2015), the emphasis on connecting curriculum to the workplace is one of the hallmarks of career and technical education. Moreover, Gibney (2015) asserts that "CTE practitioners pride themselves on their ability to make content come alive by demonstrating how the knowledge and skills students learn in the classroom transfer to the activities they will one day conduct on the job. When it comes to high-quality CTE programs, perhaps no better example can be offered than the ultimate classroom-to-workplace application: work-based learning" (p.1). Furthermore, Xanthis (2015) views work-based learning as the fundamental piece needed to connect students to work. Therefore, the fact that students do not feel enough exposure to opportunities to learn by doing in an online

postsecondary CTE program can become a serious impediment to their overall learning experience and readiness to enter the workforce in their respective fields of study upon graduation.

Second, student satisfaction, perceived learning, and perceived transfer of learning to the job highly correlate, however, they are not as strongly related to the students' intent to continue their studies or their achievement. This result highlights the need to incorporate students' retention and achievement dimensions as part of outcomes' metrics in studies investigating interaction in online postsecondary CTE courses. In that sense, the present study extends the body of knowledge on interactions in online postsecondary CTE courses.

Third, the student interactions did explain satisfaction, perceived learning, and perceived transfer of learning. However, they were each slightly different. The student-to-content, student-to-student, student-to-instructor, and student-to-work-based learning interactions all were shown to be related to those three outcomes. This aligns with previous investigations of interaction in online postsecondary courses. For instance, Sebastianelli, Swift and Tamimi's (2015) study of factors affecting students' perceptions of learning, satisfaction, and quality in online master of business administration (MBA) courses revealed that student-content interaction predicts perceived learning and satisfaction, whereas student-student interaction predicts perceived learning. Similarly, Ali (2018) and Alston's (2014) investigations of the association between students' perceptions of their level of interaction (student-to-instructor, student-to-student, and student-to-content) and their satisfaction with the course revealed that all three types of interactions had significant relationships with student satisfaction. The current study also showed that students' satisfaction positively related to the interactions with the instructor and the content. This aligns with findings of Sher (2009) that student-to-instructor and student-to-

student interactions are significantly related to satisfaction. Moreover, the current study also revealed that the students' perceived learning positively related to their interactions with students, content, and the instructor, in accordance with several previous studies (Arbaugh, 2000; Askov and Simpson, 2001; Fredericksen et al., 2000; Hiltz, 1994; Johnson et al., 2000; Miller Lewis, 2011; Richardson, 2003; Sher, 2000; Young, 2006). This is also similar to the findings of Bartlett (2017), Jaggars and Xu (2016), and Moore (2013) that student-to-content interaction is significantly related to perceived learning. Furthermore, it also came out of the current study that the students perceived ability to transfer their learning to their future career positively related to the interactions with the instructor, content, and work-based learning. This finding was particularly important, because no previous studies had included student-work-based learning interaction and transfer of learning as part of the measures of interaction levels and outcomes. In that sense, the current study extends the body of knowledge on interaction in online postsecondary CTE courses. Additionally, the ratio of online courses completed by the student related positively with satisfaction. This result is inconsistent with most previous studies' that controlled for students' previous online experience, as they found no significant association between students' previous experience with online courses and their outcomes (Ali, 2018; Alston, 2014; Sher, 2009).

Fourth, only one type of interaction related to students' intent to remain enrolled and complete the program. In actuality, students' intent to continue positively related to their interactions with work-based learning and whether they were enrolled full or part time, with their enrollment status being the strongest predictor of retention and persistence. The fact that workbased learning interaction was the only one that explained students' intent to continue their education highlights the imperative for faculty, administrators and policymakers to focus on improving postsecondary students' exposure to a variety of work-based learning opportunities throughout their program.

The final conclusion is that interactions did not relate to the students' achievement as measured by GPA and last online course grade, whereas students' ethnicity, age, and gender related to their achievement score. This result exposed an aspect of our educational system that requires more attention, that of the impact of students' demographic characteristics on their academic success. So doing, it calls for an in-depth investigation of the reason why students' demographic characteristics have such an important impact on their chances to successfully complete their academic program.

Limitations

One of the limitations of this study was the lack of balance in regards to participants' gender. In fact, an analysis of reported gender revealed that 74.3 % (n= 136) were female and 25.7% (n= 47) were male. Such a disproportionate amount of female participants could impact the generalizability of the results of this study. Furthermore, Hiltz and Shea (2005) reviewed a number of studies investigating the impact of gender in online learning environments. Among other findings, female students were reported to exhibit higher levels of class participation, satisfaction, and communication with their peers and faculty. Therefore, the smaller male representation among participants limits the researcher's ability to fully investigate the possible occurrence of similar findings in the present study. Additional research is needed to understand the impact of gender on student outcomes in online postsecondary CTE courses.

This study was also limited by the uniqueness of the academic institution used for data collection purposes. In fact, the institution is a large community college located in a large, urban area, thus limiting the generalizability of this research.

Furthermore, in an attempt to ensure that the assumptions for the different statistical analyses were not violated, the variable *Ethnicity* was further separated into binomial variables representing the most important ethnic categories among survey respondents. As a result, ethnic categories not having enough respondents were not included in the different analyses. This limits the study in its lack of representation of all ethnic categories. However, this decision was solely driven by considerations pertaining to safeguarding the study against any violations of the different statistical analyses' assumptions.

Discussion

This study has implications for policy, practice and future research related to interaction in online postsecondary CTE environments. Based on the findings specific recommendations will be presented.

Implications for policy. The findings imply that there is a need for postsecondary CTE policymakers to create guidelines that will make mandatory an emphasis on students' constant exposure to a variety of opportunities to interact with peers, faculty, content and work-based learning throughout their curriculum. This is particularly important given the recent emphasis placed on online education in response to the COVID-19 pandemic.

The data also highlighted the need for standard metrics used to assess students' workbased learning interaction and a protocol for corrective measures established to facilitate the identification and remediation of the lack of work-based learning exposure.

The impact of student demographic characteristics on retention and achievement metrics in online postsecondary CTE calls for new policies that make mandatory the disaggregation of student success data by administrators and faculty. Disaggregating data has the potential to help in the identification and support of students that are the most at risk of failing for reasons other than a lack of exposure to different types of interactions.

Recommendations for policy. Online postsecondary CTE policy setters could require program administrators to foster and monitor faculty's efforts to create classroom environments that make it easier for students to interact with peers, faculty, content and work-based learning. For instance, faculty could be required to have students post to discussion boards, submit content-related homework assignments and attend live sessions with the class or an individual from the industry on a weekly basis, in an effort to strengthen the level of interaction in their online classrooms.

Policy makers could also create opportunities to offer curriculum design support to community colleges offering online CTE courses. Such assistance would ensure that institutions offering online postsecondary CTE courses and programs are equipped with the tools needed to produce curricula that enhance students' exposure to the different types of interactions. At a time when educational institutions are forced to switch to online learning due to the COVID-19 pandemic, having that support would improve the quality of the CTE courses community colleges offer online.

Furthermore, policies could be established that require community colleges to incorporate course evaluation systems that assess the level of interaction in a given course, and provide faculty with the timely feedback they need to quickly address any shortcomings. This would support and sustain continuous improvement efforts.

Implications for practice. The implications for practice in online instruction for CTE students will include suggestions for work-based learning, interactions overall, student achievement, and the need for practitioners to disaggregate data.

Work-based learning is a critical component of many CTE programs. It is viewed as the connector between students and work (Xanthis, 2015). Since work-based learning was the only variable that related to retention and it was the lowest rated interaction, faculty need to explore more methods to create students' interactions with work-based learning in online environments. Such methods could incorporate a framework for integrating career preparation into curriculum and an approach to learning that connects the classroom and the workplace (Gibney, 2015). Suggestions include the creation of online experiences that allow students to interact with employers. One specific example could be to include a project including opportunities for students to create a product for an employer in the community. For example, in a business technology course, students could create web content for an employer.

Interactions in online courses are important in relation to students' success in online postsecondary CTE environments. Therefore, faculty teaching online CTE courses should enhance students' opportunities to interact with peers, faculty, content, and their future career or field of study. Faculty should work to intentionally design courses that include these types of interactions. Postsecondary administrators, when thinking about online CTE courses, could facilitate faculty access to professional development that is directed toward enhancing the different types of interactions. These interactions in the online environment will help in a number of manners and can create positive success outcomes in online postsecondary CTE courses, especially given the current educational context marked by the transaction to online learning in response to the COVID-19 pandemic.

Faculty need to be aware of what variables are explaining achievement in an online CTE course. These findings provide indication it is critical for faculty to disaggregate student success data by gender, age, and ethnicity. Additionally, faculty need to be aware of the possible equity issues in these courses. Since students' levels of achievement relate to demographic characteristics, faculty should be intentional in disaggregating students' success data. This would allow for more efficient preventive measures and timely interventions targeting the students who might need more help and those at-risk of not succeeding.

Recommendations for practice. Several recommendations for practice have been formed based on the findings of this research study.

First, institutions offering online postsecondary CTE should establish frameworks that will allow their faculty to create and maintain environments that favor student interactions with peers, faculty, content and work-based learning. One avenue would involve requiring a maximum of these types of interactions in their online courses. For instance, regular participation in activities encouraging these interactions could be made mandatory for students taking postsecondary CTE courses online. Second, those institutions could assess their offerings of online work-based learning activities and opportunities for their students in an effort to improve their retention and completion rates. Third, administrators in charge of planning online postsecondary CTE program offerings and faculty teaching courses as part of these programs should do so with an equity lens in mind. This includes disaggregating student success data by gender, ethnicity, and age in order to offer online postsecondary CTE programs that respond to the needs of the most at-risk students.

Implications for research. The suggestions for future research will include exploring in more detail the interactions and specifically work-based learning, connecting future research to labor market outcomes of students, the exploration of student achievement, and looking more indepth at the student characteristics in relation to the issues of equity in student outcomes.

Since WBL was the lowest rated interaction in online CTE courses, it is important to understand why it is low and how that interaction can be increased. One possible suggestion is to explore what techniques are being used to connect WBL to the students in online CTE courses at the community college. Because work-based learning was the lowest rated interaction component, more research is needed to understand WBL in the online CTE environment. One possible study could identify students that rated the interactions high and explore best practices they experienced. This type of research shares the practices and creates environments resulting in higher levels of students' interaction with, and involvement in work-based learning activities.

Future research is needed to provide a better understanding of the reasons for such a pronounced relationship between student demographic characteristics and their achievement levels in online CTE environments. For instance, a future study could investigate the relationship between interactions and success outcomes in online CTE disaggregated by gender, ethnicity, and age. Exploring these considerations in online CTE courses with an equity lens is needed for an in-depth appreciation of online CTE student success outcomes.

Recommendations for research. There is a need to further investigate the types of interactions that favor student success in postsecondary CTE courses.

Based on the literature and findings of the present study, the following recommendations are proposed for future research.

First, qualitative research must be added to the current quantitative studies in order to provide a more comprehensive understanding of the role of interaction on student success in online postsecondary CTE courses. These would allow to identify the specific behaviors that favor student success outcomes in online CTE courses. For instances, focus groups, interviews and studies investigating best practices could inform practitioners and researchers' understanding of the types of interactions that lead to improved student outcomes in online postsecondary CTE courses.

Second, due to the possible effects of the larger female respondents' body on the study's results, additional research is needed in a more gender-equal environment/ population. For instance, replicative studies conducted on a more gender-equal population have the potential to not only improve the generalizability of the results, but also highlight the effect of students' gender on their outcomes in online CTE courses.

Third, previous research studies on student interaction in online courses conducted in different academic fields or programs of study highlighted the importance of different types of interactions for student success outcomes. Because the current study included a wide variety of CTE program areas, replicative studies can be conducted with a focus on specific fields of study or career paths in order to get a better understanding of the impact of students' demographic characteristics on their outcomes in online postsecondary CTE courses.

Fourth, future studies on the impact of interaction on student outcomes in online postsecondary CTE could use a larger sample to be able to study subpopulations in more depth. Such studies have the potential to provide a more inclusive and less limited depiction of the interactions and student outcomes in online postsecondary CTE by taking into account our country's diversity.

Summary

This chapter described the discussion, conclusions, implications and recommendations based on the findings of the present study. This study is the first of its kind in that it incorporated a dimension of student interaction (Web-based-learning interaction) and student course outcome (Perceived transfer of learning) that had not been used before in analyzing student interaction and outcomes in online postsecondary CTE courses. This study examined the relationship between student-to-student, student-to-instructor, student-to-content, student-towork-based learning interactions and student perceived learning; the relationship between student-to-student, student-to-content, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-toinstructor, student-to-content, student-to-work-based learning interactions and student satisfaction; the relationship between student-to-student, student-tosuccess as reflected by self-reported GPAs; and the relationship between student-to-student, student-to-instructor, student-to-content, student-to-student, student-to-instructor, student-to-content, student-to-work-based learning interactions and student perceived transfer of learning.

Data for this study were gathered through the completion of a survey made available to Community College students enrolled in an Associate in an Applied Science (AAS) degree program for at least one semester, and having completed an online course in their technical area of expertise as of the Spring of 2020 at a large eastern urban community college. A survey and directions were emailed to qualifying students to share with them the purpose of the study, and the importance of their contribution to the study.

The study revealed that student-to-student, student-to-instructor, student-to-content, and student-to-work-based learning interactions were all positively correlated with student satisfaction, perceived learning and perceived transfer of learning. However, student-to-work-

based learning interaction was the only interaction to explain student retention into and completion of the program, and none of the interactions explained student achievement as measured by GPA and grade in the last online course.

Although prior research has been conducted on the impact of interaction on student success outcomes in online postsecondary CTE courses, more research is still needed in this area. This study could be reproduced in a more gender-equal environment, or with a focus on a particular field of study. There is also an opportunity to replicate this study using a qualitative method of inquiry in order to learn more about interaction in online postsecondary CTE courses. Implications and recommendations for community college policy makers, administrators and faculty including disaggregating student success data and emphasizing all four types of interactions, and in particular work-based learning interaction were presented in this chapter.

105

REFERENCES

- Advance CTE & Higher Learning Advocates. (2019). *101: Career and Technical Education*. Retrieved from https://cte.careertech.org/sites/default/files/documents/fact-sheets/CTE_101_June2019.pdf
- Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly*, *18*(2), 159-174.
- Alfonso, M., Bailey, T. R., & Scott, M. (2005). The educational outcomes of occupational subbaccalaureate students: Evidence from the 1990s. *Economics of Education Review*, 24, 197-212. doi:10.1016/j.econedurev.2004.02.003
- Ali, M. N. (2018). A correlational study of types of interactions and student satisfaction in online community college mathematics, english, or information technology courses (Order No. 10813317). Available from ProQuest Dissertations & Theses Global. (2198599323).
 Retrieved from https://proxying.lib.ncsu.edu/index.php/login?url=https://search-proquest-com.prox.lib.ncsu.edu/docview/2198599323?accountid=12725
- Allen, I. E., & Seaman, J. (2015). Grade level: Tracking online education in the United States. Wellesley, MA: Babson Survey Group and Quahog Research Group, LLC. Retrieved from https://www.onlinelearningsurvey.com/reports/gradelevel.pdf

Alston, B. (2014). An examination of the association between learner interactions and student satisfaction among graduate students in an online learning environment (Order No. 3626226). Available from ProQuest Central; ProQuest Dissertations & Theses Global; Social Science Premium Collection. (1557703838). Retrieved from https://proxying.lib.ncsu.edu/index.php/login?url=https://search-proquest-com.prox.lib.ncsu.edu/docview/1557703838?accountid=12725

- American Association of Community Colleges. (2015). *Fast facts from our fact sheet*. Retrieved from: http://aacc.nche.edu/AboutCC/Pages/fast factsfactsheet.aspx
- American Association of Community Colleges. (2018). *Fast facts from our fact sheet*. Retrieved from:https://www.aacc.nche.edu/wp-content/uploads/2018/04/2018-Fast-Facts.pdf
- An, H., Kim, S. & Kim, B. (2008). Teacher perspectives on online collaborative learning:
 Factors perceived as facilitating and impeding successful online group work.
 Contemporary Issues in Technology and Teacher Education, 8(1), 65-83.
- Anderson, T. (2003). Getting the mix right again: an updated and theoretical rationale for interaction. *International Review of Research in Open and Distance Learning*, 4(2), 9-14.
- Anderson, J. C., Gerbing, D. W. & Hunter, J. E. (1987). On the assessment of unidimensional measurement: Internal and external consistency and overall consistency criteria. *Journal* of Marketing Research, 24 (November): 432–37.
- Arbaugh, J. (2000a). How classroom environment and student engagement affect learning in internet-based MBA courses. *Business Communication Quarterly*, *63*(4), 9-26.
- Arbaugh, J. (2000b). Virtual classroom characteristics and student satisfaction with internetbased MBA courses. *Journal of Management Education*, 24(1), 32-54. doi: 10.1177/105256290002400104
- Arbaugh, J. B. (2001). How instructor immediacy behaviors affect student satisfaction and learning in web-based courses. *Business Communication Quarterly*, 64(4), 42-54. doi: 10.1177/108056990106400405
- Ashby, J., Sadera, W. A., & McNary, S. W. (2011). Comparing student success between developmental math courses offered online, blended, and face-to-face. *Journal of Interactive Online Learning*, 10(3), 128-140.

Askov, E. & Simpson, M. (2001, March). Researching distance education: Penn State's online adult education Med program on the world campus. Paper presented at the Australian Vocational Education and Training Association Conference. Adelaide. Abstract retrieved from http://www.avetra.org.au/abstracts_and_papers_2001/Askov-Simpson_full.pdf

Association for Career and Technical Education. (2017). CTE in community colleges: Barriers and opportunities. *CTE Policy Watch*. Retrieved from https://ctepolicywatch.acteonline.org/2017/11/cte-in-community-colleges-barriers-andopportunities.html

- Association for Career and Technical Education. (2018). *CTE Today*. Retrieved from https://www.acteonline.org/cte-today/
- Association for Career and Technical Education. (2019). *About CTE*. Retrieved from https://www.acteonline.org/about-cte/#postsecondary
- Association for Career and Technical Education. (2019). *Work-Based Learning*. Retrieved from https://www.acteonline.org/professional-development/high-quality-cte-tools/work-based-learning/
- Astin, A.W. (1993a). What matters in college? Four critical years revisited. San Francisco: Jossey-Bass.
- Astin, A.W. (1993b). Diversity and multiculturalism on campus: How are students affected? *Change*, 25, 44-49.
- Bailey, T. R., Alfonso, M., Scott, M., & Leinbach, D. T. (2004, August). Educational outcomes of occupational postsecondary students (CCRC Brief No. 22). New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http:// ccrc.tc.columbia.edu/Publication.asp?UID=252

- Bailey, T. R., Jaggars, S. S., & Jenkins, D. (2015). *Redesigning America's Community Colleges:* A clearer path to student success. Cambridge, MA: Harvard University Press.
- Barab, S. & Thomas, M. (2001). Online learning: from information dissemination to fostering collaboration. *Journal of Interactive Learning and Research*, 12, 105-143.
- Bartlett, M. E. (2017). *Integration of e-service learning: The trials and triumphs*. Presented at the Lilly National Conference on Designing Effective Teaching, International Teaching Learning Cooperative, Asheville, NC.
- Bartlett, M. E. (2018). Using Flipgrid to increase students' connectedness in an online class. *Elearn Magazine*, 2018(12), 55-61. Retrieved from https://dl.acm.org/citation.cfm?id=3302261
- Bean, J. (1980). Dropouts and turnover. The synthesis and test of a causal model of student attrition. *Research in Higher Education*, *12*(2), 155-187.
- Becker, G. (1993). *Human capital: A theoretical and empirical analysis* (3rd ed.). Chicago, IL: The University of Chicago Press.
- Benson, A. D., Johnson, S. D., Duncan, J., Shinkareva, O. N., Taylor, G. D., & Treat, T.
 (2008). Community college participation in distance learning for career and technical education. *Community College Journal of Research and Practice*, *32*(9), 665-687. doi: 10.1080/10668920600859848
- Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., et al. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research*, 79, 1243-1289.
- British Columbia Ministry of Advanced Education. (2003). Understanding student satisfaction.BC College & Institute Student Outcomes (Issue Paper), 3(1). British Columbia, Canada:

Author. Retrieved from

http://outcomes.bcstats.gov.bc.ca/Libraries/DACSO_Papers/issue_satisfa ction_pdf.pdf

- Bumphus, W. (2017). America's college promise. American Association of Community Colleges. Retrieved from http://www.aacc.nche.edu/2017/11/01/americas-collegepromise/.
- Camp, W. G., & Crunkilton, J. R. (1985). History of Agricultural Education in America: The Great Individuals and Events. *Journal of the American Association of Teacher Educators in Agriculture*, 26(1), 57-63.
- Carnevale, A. P., Smith, N. & Strohl, J. (2013). Recovery: Job growth and education requirements through 2020. Washington, DC: Georgetown University's Center on Education and the Workforce.
- Cherry, K. (2012, June 28). Correlational studies: Psychology correlational studies. *About.com Guide*. Retrieved from

http://www.psychology.about.com/od/researchmethods/a/correlational.htm

- Cohen, A. M., & Brawer, F. B. (2008). *The American community college* (5th ed.). San Francisco, CA: Jossey-Bass.
- Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Belknap Press.
- Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- Cronbach, L. J. (1951). Coefficient Alpha and the internal structure of tests. *Psychometrika*, *31*, 93–96.

- Curtis, D. & Lawson, M. (2001). Exploring collaborative online learning. *Journal of Asynchronous Learning Networks*, 5(1), 21-34.
- Daniel, C. & Wood, F. S. (1999). *Fitting Equations to Data*, (2nd ed.). New York, NY: Wiley-Interscience.
- Dassance, C. R. (2011). The next community college movement. *New Directions for Community Colleges, 2011*(145), 31–39. Retrieved from http://dx.doi.org/10.1002/cc.464

Davis, J. A. (1971). Elementary survey analysis. Englewood Cliffs, NJ: Prentice-Hall.

- Davis, J. L. (2005). *History of Industrial/Technical Education*. October 25, 2005 URL: http://www.tamu-commerce.edu/cct/history.htm
- Dede, C. (2004). Enabling distributed-learning communities via emerging technologies. *Society for Information Technology in Teacher Education*, *32*(2), 12-22.
- D'Amico, M. M., Sublett, C. M., & Bartlett, J. (2019). Preparing the workforce in today's community colleges, *Issues and Implications for Higher Education Leaders, American Council on Education (ACE)*.
- D'Amico, M. M., Morgan, G. B., Katsinas, S. G., & Friedel, J. N. (2014). State director views on community college workforce development. *Career and Technical Education Research*, 39(3), 191-211.
- Dillman D. A. (1978). *Mail and telephone surveys: The total design method*. New York, NY:John Wiley & Sons.
- Dillman D. A. (2000). *Mail and internet surveys: The tailored design method*. New York, NY: John Wiley & Sons.

- Dougherty, K. J. & Townsend, B. K. (2006). Community college missions: A theoretical and historical perspective. *New Directions for Community Colleges*, 136, 5–13. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/cc.254/full.
- Dychtwald, K., Erickson, T. & Morison, R. (2006). *Workforce crisis*. Boston, MA: Harvard Business School Press.
- Fike, D., & Fike, R. (2008). Predictors of first-year student retention in the community college. Community College Review, 36(2), 68-88.
- Fredericksen, E., Pickett, A., Shea, P., Pelz, W., & Swan, K. (2000). Student satisfaction and perceived learning with online courses: principles and examples from the SUNY learning network. *Journal of Asynchronous Learning Networks*, 4(2).

Ganss, H. (1910). Martin Luther. The Catholic Encyclopedia, 9.

- Garza Mitchell, R. L. (2017). Online career and technical education in the community college.
 Community College Journal of research and Practice, *41*(6), 336-340. doi:
 10.1080/10668926.2016.1270242
- Gatta, M. (2005). Not just getting by. Lanham, MD: Lexington Books.
- Gay, L.R. & Dehil, P. L. (1992). *Research methods for business and organization*. New York, NY: Macmillan.
- Gibney, T. (2015, May). Work-based learning for the new economy: From "K to J" in Tennessee. *Techniques Magazine*. Retrieved from https://www.acteonline.org/wpcontent/uploads/2018/05/Techniques-May2015-WBLForNewEconomy.pdf
- Githens, R. P., Crawford, F. L., & Sauer, T. M. (2010). Online occupational education in community colleges: Prevalence and contextual factors. Louisville, KY: National Research Center for Career and Technical Education. Retrieved from

http://www.nrccte.org/resources/publications/online-occupational-education-community-colleges

- Gleason, B. (2004). Retention issues in online programs: A review of the literature. Proceedings from the Second AIMS International Conference on Management, Calcutta, India. Retrieved from http://thinairlabs.com/papers/216.pdf
- Glenn, L., Jones, C., & Hoyt, J. (2003). The effect of interaction levels on student performance:
 A comparative analysis of web-mediated versus traditional delivery. *Journal of Interactive Learning and Research, 14*, 285-299.
- Gordon, E. (2000). *Skill Wars: Winning the battle for productivity and profit* (1st ed.). Amsterdam: Butterworth-Heinemann.
- Gordon, H. R. (2014). *The history and growth of career and technical education in America* (4th ed.). Long Grove, IL: Waveland Press, Inc.
- Gray, K., & Herr, E. (1998). *Workforce education: The basics*. Needham Heights, MA: Allyn and Bacon.
- Grubb, W. (1997). Not there yet: prospects and problems for "education through occupations". Journal of Vocational Education Research, 22(2), 77-94.
- Gunawardena, C. & Zittle, F. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education*, 11(3), 8-26.
- Gray, K., & Herr, E. (1998). *Workforce education: The basics*. Needham Heights, MA: Allyn and Bacon.
- Hair, J. F., Black, W. C., Babin, B. J. & Anderson, R. E. (2014). *Multivariate Data Analysis* (7nd ed.). Essex, England: Pearson.

- Hattie, J. (1985). Methodology review: Assessing unidimensionality of tests and items. *Applied Psychological Measurement*, *9*, 139–64.
- Hiltz, S. R. (1994). *The virtual classroom: Learning without limits via computer networks* (2nd ed.). Norwood, NJ: Ablex.
- Holton, E. F. III, Bates, R., Seyler, D., & Carvalho, M. (1997). Toward construct validation of a transfer climate instrument. *Human Resources Development Quarterly*, 8, 95–113

Huck, S. W. (2004). Reading statistics and research (4th ed.). Boston, MA: Pearson.

Ismail, O. (2006). Universiti Teknologi. Retrieved from:

http://www.othmanismail.com/classes/BEL600/5_Significance_Limitations. htm#sig

- Jaggars, S. S. & Xu, D. (2016). How do online course design features influence student performance? *Computers and Education*, *95*, 270-284.
- Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher*, *30*(2), 3–13. https://doi.org/10.3102/0013189X030002003
- Johnson, S. (2003). *Distance learning in postsecondary career and technical education*. St. Paul, MN: National Research Center for Career and Technical Education.
- Johnson, S. & Benson, A. (2003). *Distance learning in postsecondary career and technical education.* St. Paul, MN: National Research Center for Career and Technical Education.
- Johnson, S., Aragon, S., Shaik, N. & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning and Research*, 11(1), 29-49.

- Johnson, S. D., Benson, A. D., Duncan, J., Shinkareva, O. N., Taylor, G. D., Treat, T.(2004). Internet-based learning in postsecondary career and technical education. *Journal of Vocational Education Research*, 29(2), 101–119.
- Jung, I., Lim, C., Choi, S, Hand, Leem, J. (2002). Effects of different types of interactions on learning achievements, satisfaction, participation on Web- based instruction. *Innovation in Education and Teaching International*, 39(2) 153-162.
- Kane, T. & Rouse, C. (1999). The community college: Educating students at the margin between college and work. *Journal of Economic Perspectives*, *13*(1), 63-84.
- Kerlinger, F. N. & Lee, H. B. (2000). *Foundations of behavioral research* (4th ed.). New York, NY: Holt, Rinehart and Winston.
- Kirk, R. E. (1994). *Experimental design: Procedures for the behavioral sciences* (3rd ed.).Belmont, CA: Wadsworth Publishing.
- Kirkpatrick, D. L. & Kirkpatrick, J. D. (2006). *Evaluating training programs: The four levels*. San Francisco, CA: Berrett-Koehler Publishers.
- Kolloff, M. (2011). Strategies for effective student/student interaction in online courses. 17th annual conference on distance teaching and learning.
- Krusi, H., (2005). Pestalozzi: His Life, Work and Influence.
- Kurucay, M. & Inan, F. A. (2017). Examining the effects of learner-learner interactions on satisfaction and learning in an online undergraduate course. *Computers & Education* ,115, 20-37. Retrieved from

https://www.sciencedirect.com/science/article/pii/S036013151730146X

Lannan, F. H. (2009). Documenting and assessing the role of community colleges in developing human capital. *Community College Journal of Research and Practice*, *30* (10), 855-869.

- Lave, J. & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. New York: Cambridge University Press.
- Lokken, F. (2016, April). 2015 distance education survey results, trends in learning: Tracking the impact of elearning at community colleges. Washington, DC: Instructional Technology council.
- Lokken, F. & Mullins, C. (2015, April). Trends in eLearning: Tracking the impact of eLearning at community colleges, 2014 distance education survey results. Washington, DC: Instructional technology Council.
- Lux, D., & Ray, W. (1971). *Industrial arts curriculum project* (The Ohio State University Research Foundation). Bloomington, IL: McKnight & McKnight Publishing.
- Maley, D. (1978). *The industrial arts technical handbook: Techniques, principles, and methods*.Boston: Allyn & Bacon.
- Maxfield, C. (2001). Bebop to the boolean boogie. Boston, MA. LLH Technology.
- McCroskey, J., Fayer, J., Richmond, V., Sallinen, A. & Barraclough, R. (1996). A multicultural examination of the relationship between nonverbal immediacy and affective learning. *Communication Quarterly*, 44, 297-307.
- McCullagh, P. & Nelder, J. A. (1989). *Generalized Linear Models* (2nd ed.). New York: Chapman and Hall.
- McDermott, R. P. (1993). The acquisition of a child by a learning disability. In C. Chaiklin & J.
 Lave (Eds.), *Understanding practice: Perspectives on activity and context* (pp. 269-305).
 New York: Cambridge University Press.
- McDonald, R. P. (1981). The dimensionality of tests and items. *British Journal of Mathematical and Social Psychology, 34*, 100–117.

Mertler, C. A. & Vannatta Reinhart, R. (2017). *Advanced and multivariate statistical methods: Practical application and interpretation* (6th ed.). New York, NY: Taylor & Francis.

Meyers, J. L. (1979). Fundamentals of Experimental Design. Boston: Allyn & Bacon.

- Miller, L. E. & Smith, K. L. (1983). Handling nonresponse issues. *Journal of Extension*, 21, 45-50.
- Miller Lewis, J. L. (2011). The computer ate my classroom: Assessing student interactions, perceived learning, and satisfaction in online community college career technical education courses (Order No. 3455445). Available from ProQuest Central; ProQuest Dissertations & Theses Global; Social Science Premium Collection. (868529348).
 Retrieved from https://proxying.lib.ncsu.edu/index.php/login?url=https://search-proquestcom.prox.lib.ncsu.edu/docview/868529348?accountid=12725
- Moore, M. G. (1991). Distance education theory. *The American Journal of Distance Education* 5(3). Retrieved from http://www.ajde.com/Contents/vol5_3.htm#editorial
- Moore, M. G. (1993). Three types of interaction. In D. Harry, K., Hohn, M., & Keegan (Eds.), *Distance education: New perspectives* (pp. 12-24). London: Routledge.
- Moore, M. G. (2013). The theory of transactional distance. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed.). New York, NY: Routledge.
- Moore, M., & Kearsley, G. (2005). *Distance education: A systems view* (2nd ed.). Belmont, CA: Thomson Wadsworth.
- Mosteller, F. & Tukey, J. W (1977). *Data Analysis and Regression*. Reading, MA: Addison-Wesley.
- Morrison, D. F. (2002). Multivariate Statistical Methods (4th ed.). Belmont, CA: Duxbury Press.

- MyFutureNC (2019). A Call to Action for the State of North Carolina. Retrieved from https://www.myfuturenc.org/wp-content/uploads/2019/04/A-Call-to-Action-Final-Report_040319.pdf
- NBRI. (2019). What Are the Different Types of Validity that must be Considered when Conducting a Survey? Retrieved from https://www.nbrii.com/faqs/dataanalysis/different-types-validity-must-considered-conducting-survey/
- Nitsch, W. (2003). *Examination of factors leading to student retention in online graduate education*. (Doctoral dissertation). Retrieved from http://www.decadeconsulting.com/decade/papers/StudentRetention.pdf
- NDSU. (2005). *Shrine to Justin Smith Morrill*. Retrieved from http://www.ndsu.nodak.edu/instruct/isern/morrill.htm
- Nunnally, J. L. (1979). Psychometric Theory. New York: McGraw-Hill.
- Oliveira, J., & Rumble, G. (1982). Vocational education at a distance. In G. Rumble and J.Oliveira (Eds.), *Vocational education at a distance: International perspectives* (pp. 3-9).London: Kogen.
- O'Malley, J. & McCraw, H. (1999). Students perceptions of distance learning, online learning and the traditional classroom. *Online Journal of Distance Learning Administration*, 2(4), 107-115.
- Parsad, B., and Lewis, L. (2008). Distance education at degree-granting postsecondary institutions: 2006-07 (NCES 2009-044). Washington, DC: National Center for Education Statistics.
- Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. Journal of Marketing Research 16 (February): 6–17.

Pethokoukis, J. (2002). E-learn and earn. U.S. News and World Report, 32(22), 36.

- Radford, A. W., & Weko, T. (2011, October). Learning at a distance: Undergraduate enrollment in distance education courses and degree programs (NCES 2012-154). Washington, DC: U.S. Department of Education, national Center for Education Statistics, Institute of Education Sciences.
- Rephann, T. J. (2007). Community college growth opportunities: Untapped potential in America's heartland. *Growth and Change*, *38*(3), 443-459.
- Richardson, J. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks*, 7(1), 68-88.
- Ridley, D. & Sammour, H. (1994). Viable alternative means of instructional delivery: On-line courses as an alternative teaching method. *College Student Journal*, *30*, 337- 339.
- Robbins, J. (2005). Contexts, Collaboration. and Cultural Tools: A sociocultural perspective on researching children's thinking. *Contemporary Issues in Early Childhood*, 6, (2), 140-149.
- Robinson, J. P., Shaver, P. R. & Wrightsman, L. S. (1991). Criteria for Scale Selection and Evaluation. In *Measures of Personality and Social Psychological Attitudes*, Robinson, J.
 P. Shaver, P. R. & Wrightsman, L. S. (eds.). San Diego, CA: Academic Press.
- Robinson, J. P., Shaver, P. R. & Wrightsman, L. S. (1991). Measures of Personality and Social Psychological Attitudes. San Diego, CA: Academic Press.
- Rothwell,W. J. & Gerity, P. E. (2017). *Community college leaders on workforce development: Opinions, observations, and future directions*. Lanham, MD: Rowman & Littlefield.

- Seaman, J. E., Allen, I. E., , & Seaman, J. (2018). Grade Increase: Tracking online education in the United States. Wellesley, MA: Babson Survey Group and Quahog Research Group, LLC. retrieved from https://onlinelearningsurvey.com/reports/gradeincrease.pdf
- Sebastianelli, R., Swift, C. & Tamimi, N. (2015). Factors affecting perceived learning, satisfaction, and quality in the online MBA: A structural equation modeling approach. *Journal of Education for Business*, *90* (6), 296-305, DOI: 10.1080/08832323.2015.1038979
- Sher, Ali. (2009). Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in web-based online learning environment. *Learning*, 8(2), 102-120.
- Simonson, M., Smaldino, S., Albright, M. & Zvacek, S. (2000). *Teaching and learning at a distance: Foundations of distance education*. Upper Saddle Rive, NJ: Merrill-Prentice Hall.
- Smith, M. K. (1998). *Aristotle and Informational Education*. The informal education homepage, October 13, 1998, URL//http:www.infed.org/thinkers/et-arist.htm
- Smith, P. (2003). Workplace learning and flexible delivery. *Review of Educational Research*, 73(1), 53-88.
- Strachota, E. M. (2003). Student satisfaction in online courses: An analysis of the impact of learner-content, learner-instructor, learner-learner, and learner- technology interaction.(Doctoral dissertation). Available from Dissertations and Theses database. (UMI No. 3100902)
- Strachota, E. M. (2006). The use of survey research to measure student satisfaction in online courses. *Proceedings from The Midwest Research-to-Practice Conference in Adult,*

Continuing, and Community Education St. Louis, M.O: University of Missouri- St. Louis, 2, pp 1-6.

- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon.
- Tallent-Runnels, M., Thomas, J., Lan, W., Cooper, S., Ahern, T., & Shaw, S. (2006). Teaching courses online: A review of the research. *Review of Educational Research*, 76(1), 93-135. doi: 10.3102/00346543076001093

Tapscott, D. (2009). Grown up digital. New York, NY: McGraw-Hill.

- Taylor, N., Lucas, K., & Watters, J. (1999). Collaborative science activities and the social construction of understanding of physical science concepts by pre-service teacher in Fiji. *Research in Science Education*, 29(4), 479-500.
- Thompson, B. (2006). *Foundations of behavioral statistics: An insight-based approach*. New York, NY: The Guilford Press.
- Thornburg, D. D. (1992). *Edutrends 2010: Restructuring, technology and the future of education* (1st ed.). Mountain View, AR: Starsong.
- Thurmond, V., Wambach, K., Connors, H., & Frey, B. (2002). Evaluation of student satisfaction:
 Determining the impact of a web-based environment by controlling for student
 characteristics. *The American Journal of Distance Education*, *16*(3), 169-189.
- Tuovinen, J. E. (2000). Multimedia distance education interactions. *Education Media International*, *37*(1), 16-24.
- Urtel, M. G. (2008). Assessing academic performance between traditional and distance education course formats. *Technology and Society*, 7(1), 322-330.

Vrasidas, C. (2000). Constructivism versus objectivism: Implications for interaction, course design, and evaluation in distance

education. International Journal of Educational Telecommunications, 6, 339-362.

Vygotsky, L. (1978). *Interaction between learning and development. Mind in Society*. Cambridge, MA: Harvard University Press.

Wagner, W. (1947). Policies in industrial arts education. Englewood Cliffs, NJ: Prentice-Hall.

- Walther, J. (2008). Social information processing theory: Impressions and relationship development online. In D. Baxter & L. Braithwaite (Eds.), *Engaging theories in interpersonal communication: Multiple perspectives* (pp. 391-404). Thousand Oaks, CA: Sage.
- Walther, J. & Burgoon, J. (1992). Relational communication in computer-mediated interaction. *Human Communication Research*, 19, 50-88.
- Warwick, P. And Kershner, R. (2008). Primary teachers' understanding of the interactive whiteboard as a tool for children's collaborative learning and knowledge building. *Learning, Media and Technology, 33*(4), 269-287.
- Webster, (1993). *Merriam-Webster's collegiate dictionary* (10th ed.). Springfield, MA: Merriam Webster.
- Williamson, J. C. (2017, March 1). Memorandum addressed to NC business leaders. *Community Colleges*. Retrieved from http://businessnc.com/wp-content/uploads/2017/02/community-colleges_march17.pdf
- Xanthis, B. (2015, January). Work-based learning: The key to connecting students to work. *Techniques Magazine*. Retrieved from https://www.acteonline.org/wp-

content/uploads/2018/05/Techniques-January2015-

WBLKeyConnectingStudentsToWork.pdf

- Xu, D., & Jaggars, S. S. (2011). The effectiveness of distance education across Virginia's community colleges: Evidence from introductory college-level math and English courses. *Educational Evaluation and Policy Analysis*, 33, 360-377.
- Young, J. (1997). Community economic development through community colleges. *New Directions for Higher Education*, 97, 74-84.
- Zemsky, R. & Massy, W. F. (2004). *Thwarted innovation: What happened to e-learning and why*. Philadelphia, PA: The Learning Alliance at the University of Pennsylvania.
- Zirkle, C. (2003). Distance education and career and technical education: A review of the research literature. *Journal of Vocational Education Research*, 28(2), 161-181. doi: 10.1227/01.neu.0000375285.45144.d8

APPENDICES

APPENDIX A: INSTRUMENT

Predicting Student Success in Online Postsecondary Career and Technical Education:

Engaging with Peers, Faculty, Content and Work-Based Learning

Please answer the following questions.

 Have you completed an online course in your technical area of expertise (Criminal Justice, Business, Data Analytics, list all) in the past?

> IF NOT, this survey was about online classes. Thank you for your time. IF YES, please answer the following questions.

- 2. What AAS degree are you in? (Drop down)
- 3. What was the last technical course you completed online? (Drop down)
- 4. Think about the last course in your technical area of expertise you completed online and answer the following questions.

Please place a check mark under each feeling associated with the question item.

Construct	Item	Question	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Student- content Interaction (7 items)	1	The course documents, lessons, or lecture notes used in this class facilitated my learning.	8				
	2	The websites that were linked to this course facilitated my learning.				an	
	3	The assignments and/or projects in this course facilitated my learning.					
	4	Preparation for quizzes/exams in this course facilitated my learning.				1888	87
	5	The learning activities in this course required application of problem solving skills which facilitated my learning.					
	6	I feel this online class experience has helped improve my written communication skills.	901				
	7	The learning activities in this course required critical thinking which facilitated my learning.					a
Student-to- instructor Interaction (5 items)	8	The instructor encouraged me to become actively involved in the course discussions.					
	9	The instructor provided me timely feedback (within 24-48 hours) on my work through comments.				10	
	10	I was able to interact with the instructor during the course discussions.					
	11	The instructor treated me as an individual.					
	12	The instructor informed me about my progress periodically.					

Student-to- student Interaction (5 items)	13	I was able to share learning experiences with others.					
	14	I was able to communicate with other students in this course.		61	1886		
	15	Increased contact with fellow students helped me get more out of this course.			an		8
	16	A sense of community existed with fellow students taking this course.					
	17	This course encouraged me to work in small groups/ teams.		-	NEE		
Student-to- work-based learning Interaction (4 items)	18	I interacted with an individual from the community to meet a course/activity objective.					-
	.19	I interacted with a business to meet a course/activity objective					
	20	I interacted with a professional in the field to meet a course/activity objective.					
	21	I participated in service learning activities as part of the course.					
Satisfaction (6 items)	22	The quality of the course compared favorably to my other courses.	28	8	1886	10	
	23	I was very satisfied with this course.	81				
	24	If I had another opportunity to take another course via this mode I would gladly do so.	4	a.	986	-	
	25	I gained more interest in the subject matter of this course.	18	a	182	и.	
	26	I feel that this course served my needs well.					
	27	I would recommend this course to another student.					

Perceived learning (6 items)	28	I learned to interrelate the important issues in the course material.	10	18			
	29	I gained a good understanding of the basic concepts of the material.	ш		8	=	
	30	I learned to identify the central issues of the course.	81			100	
	31	I developed the ability to communicate clearly about the subject.			-NU		
	32	I improved my ability to integrate facts and develop generalizations from the course material.					
	33	I learned concepts and principles in the course.					
Perceived transfer of learning (4 items)	34	I have used the knowledge, skills, or abilities from this course in my work or other classes.					
	35	I could teach others the content of the course.					
	36	In my future work or classes there are tasks in which I will be able to use the knowledge, skills, and abilities I gained from this course.					
	37	The knowledge, skills, and abilities from this course will help me obtain employment.					
Academic success (4 items)	38	I plan to remain enrolled in my current program.					
	39	I plan to complete the program I am currently enrolled in.					

Construct	Item	Question	Less than 2.50	Between 2.50 and 2.99	Between 3.00 and 3.49	Between 3.50 and 3.99	.4.0 or better
Academic success	40	What is your current GPA?	-			a	
Construct	Item	Statement	F	D	С	В	A
Academic success	41	My grade in the last course I took was a:	-			a	

- 5. Are you a full-time or part-time student? (Drop down)
- 6. How many classes have you completed in your AAS program. (Drop down)
- How many of the classes have you completed in the AAS degree were online. (drop down)
- 8. What is your current employment status? (Drop down)
- 9. Are you a Pell grant recipient?
- 10. What is your age group? (Drop down)
- 11. What is your gender? (Drop down)
- 12. What is your ethnicity? (Drop down)
- 13. Please describe the most engaging part of the last course.
APPENDIX B: MEAN AND STANDARD DEVIATION OF CTE ONLINE STUDENT

OUTCOMES

	М	SD
Satisfaction	4.09	.987
Perceived Learning	4.38	.704
Perceived Transfer of Learning	4.22	.806
Intent to Remain and Complete	4.86	.432
Achievement	3.00	.765

Mean and Standard Deviation of CTE Online Student Outcomes

Note. 5 = Strongly agree, 4 = Agree, 3 = Neither Agree or Disagree, 2 = Disagree, 1 = Strongly Disagree Except

for variable Achievement.