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The Impact of an Interprofessional Education Curriculum on the Clinical Practice of Physical Therapy Doctoral Students

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THE IMPACT OF AN INTERPROFESSIONAL EDUCATION CURRICULUM ON THE CLINICAL PRACTICE OF PHYSICAL THERAPY DOCTORAL STUDENTS

by

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ABSTRACT

As the healthcare system has continued to change in the 21st century, the creation of a more collaborative practice-ready workforce is necessary. Interprofessional education (IPE) is an accepted mechanism to cultivate interprofessional collaborative practice in health care providers to improve quality of care and address workforce needs. Development of interprofessional collaborative practice requires synergies of the health care and education systems to develop and deliver an effective IPE curriculum. This study examined the impact of an IPE curriculum on the clinical practice of physical therapy doctoral students through a mixed-methods approach. The IPE curriculum was rooted in the established Interprofessional Learning Continuum and linked to core competencies from the Interprofessional Education Collaborative. Quantitative procedures examined student clinical performance in the immediate internship following completion of the curriculum, and these criteria were compared to historical norms. Qualitative procedures sought to determine if areas of clinical performance were influenced by the curriculum and examine how students translated learning into the clinical environment.

The results of this study identified numerous areas of significant impact of interprofessional learning on patient care in the clinical environment, although none of the quantitative measures identified significant differences. Several salient themes were identified which recognize the multidimensional nature of patient care in the complex clinical environment, involving an interplay of communication, experience, role understanding, and interprofessional interactions all being strongly developed within the IPE curriculum. These findings contribute to the literature calling for mixed methods analyses of influences of IPE of health care students on clinical practice in order to better understand and further develop interprofessional practice.

ACKNOWLEDGEMENTS

To my father, who has always taught me the value of hard work.

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LIST OF ABBREVIATIONS

CPI	Clinical Performance Instrument
DPT	Doctor of Physical Therapy
IOM	Institute of Medicine
IPE	Interprofessional Education
IPEC	Interprofessional Education Collaborative
IPLC	Interprofessional Learning Continuum
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

Introduction

Improvement in the healthcare delivery system has been the focus of much attention in the last twenty years. Shortages of worldwide workforce, quality, access, safety, and cost concerns have created reforms and calls to action in healthcare delivery and education (Institute of Medicine [IOM], 2001; Kohn, Corrigan, & Donaldson, 2000; World Health Organization [WHO], 2000). As the healthcare system has continued to change in the 21st century, the creation of a more collaborative practice-ready workforce has been identified as a mechanism to address these concerns (IOM, 2001; WHO 2010). The desire to have a more collaborative practice-ready workforce has thus created a renewed interest in the training of such practitioners through interprofessional education (IPE). IPE is an interactive learning intervention in which practitioners or students from two or more professions learn about, from, and with each other in order to enable effective collaboration and improve health outcomes (WHO, 2010).

The concept of IPE has evolved historically from the notion of interdisciplinary education, which was first defined and outlined for health sciences education in the United States by the IOM nearly a half-century ago where a team-based approach to healthcare was first identified (IOM, 1972). Shortly after this time, utilization of an interprofessional healthcare care team was recognized as a possible mechanism to promote comprehensive care and collaborative practice of primary health care providers, a.k.a. medical doctors (WHO, 1978; 1988). However, due to continued inadequacies of the health care system with rising costs, decreased access, and workforce shortages, interest in teamwork and collaboration involving other health care professionals continued to rise (Baldwin, 1996; IOM, 2001; WHO, 2000).

As the attention to team-based care has developed over the later 20th century, significant concerns remain regarding health care quality, access, safety, and workforce readiness. Numerous national and international organizations have led the initiative to address these shortcomings. Just after the turn of the century, the IOM published several prominent reports. In 2001, the IOM published a report, *Crossing the quality chasm: A new health system for the 21st century*, which calls for fundamental changes to the health care system due to fragmentation within the system and lack of progress in addressing quality and cost concerns (IOM, 2001). The proposed changes were a result of the IOM's earlier report by its Committee on Healthcare Quality in America (Kohn, et al., 2000). This report identified patient safety as a critical component of quality, and that many medical errors could have been mitigated through improved reporting, teamwork, and communication. Further, it claimed that "the decentralized and fragmented nature of the health care delivery system…contributes to unsafe conditions for patients, and serves as an impediment to efforts to improve safety" (p. 3). To address these identified issues in the health care system and better serve the needs of patients, the IOM called for education institutions to prepare the future health care workforce in a manner that would foster greater collaboration and communication (IOM, 2001). Reinforcing this concept two years later, the IOM held a summit which served as a level of guidance for educational institutions by developing core competencies of professional health care education including: patient-centered care, quality improvement, evidence-based practice, health informatics, and interdisciplinary teamwork (IOM, 2003).

In a parallel path to the IOM's efforts, the WHO has examined the worldwide health care workforce. Alarmingly, in 2006, the WHO identified a shortage of 4.3 million providers, which

included doctors, nurses, and other health workers (WHO, 2006). In recognition of this shortage, the WHO adopted a resolution during the 59th World Health Assembly that proposed a rapid scaling up of the health care workforce using innovative strategies of practice and education (WHO, 2006b). In recognition of the urgent nature of these workforce issues, the WHO created an international panel of policy, education, and practice experts that was tasked with identifying, evaluating, and synthesizing evidence that could serve as action-items to promote and develop interprofessional education and collaborative practice. This panel became known as the WHO Study Group on Interprofessional Education and Collaborative Practice (Yan, Gilbert, Rodger, & Hoffman, 2007). The WHO Study Group's work culminated in a document that was adopted by the WHO and disseminated worldwide. In this document, *Framework for Action on Interprofessional Education & Collaborative Practice*, the WHO not only held the position that IPE and collaborative practice can play a significant role in mitigating many of the issues facing the health care systems worldwide, but also provided a framework interlinking health and educational systems throughout the process (WHO, 2010). The aim of the resulting framework was to incorporate actions by leaders and policy makers to synchronize the education and healthcare systems, thus reducing the fragmentation, creating synergies, instilling a collaborative practice-ready workforce, and improving outcomes.

The framework for action adopted by the WHO and early work of the IOM initiated steps in creating actions to enhance the collaboration necessary to advance health care practice. Both proposed that the advancement of practice was predicated on the active involvement of the professional educational system. In 2010, *The Lancet*, one of the world's oldest and most reputable international medical journals, created a Commission on Education for Health

Professions to examine and develop instructional and institutional strategies to advance professional education in the 21st century (Bhutta et al., 2010). The Commission concluded that professional health care education has been outpaced by the demands of the health care system, and that the professional education of health care providers needs a re-examination and redesign. Among their recommendations, the Commission called for transformative and interdependent professional education that fosters collaborative practice that would break down professional silos and enhance both technical skills and non-technical skills such as clinical reasoning and communication. Consistent with recommendations from the WHO, the Commission recommended using external collaborations to expand from traditional academic systems into a more dynamic professional education system (Frenk et al., 2010).

During nearly the same time that these organizations were making their recommendations, professional education organizations were also facilitating changes in educational practices to enhance collaboration. In 2009, the Interprofessional Education Collaborative (IPEC) was formed by six national educational associations. This collaborative organization was formed to "advance substantive interprofessional learning experiences to help prepare future health care professionals for enhanced team-based care of patients and improved population health outcomes" (Interprofessional Education Collaborative [IPEC], 2018, para. 1). IPEC has since grown from its founding six professional organizations to 20, which now includes medicine, nursing, social work, pharmacy, physical therapy, speech-language pathology, and audiology, to name a few. IPEC acknowledged that high-quality, accessible, and patient-centered care can be achieved through interprofessional practice but requires meeting interprofessional competencies as part of the educational process of health care providers (IPEC,

2011). In order to develop these competencies, IPEC linked initial recommendations provided by the IOM (2003), and the integrated the framework for synergies between the education and health systems adopted by the WHO (2010). IPEC also utilized work by D'Amour and Oandasan (2005), which proposed an interdependency of professional education competency development for interprofessional practice and the needs of the professional practice system. Using these frameworks, IPEC developed competencies for interprofessional collaborative practice in an attempt to facilitate the development and delivery of IPE within professional education communities. These competencies were grouped under four domains which included values and ethics, roles and responsibilities, interprofessional communication, and teams and teamwork (IPEC, 2011). More recently IPEC provided an update to reaffirm the original competencies, position the domains as core competencies under one singular domain, Interprofessional Collaboration, and expand the sub-competencies to capture changes in the health system environment such as population health, costs, and patient value in the healthcare experience. IPEC postulated that this competency update would allow for professional educators to develop interprofessional learning activities appropriate for the current healthcare environment (IPEC, 2016).

Statement of the Problem

The problem being investigated in this study is that research demonstrating the linkage of IPE in educational settings to clinical practice performance is limited. While many national, international, and educational organizations have assisted in the development and support of IPE as a means for developing collaborative practice in health care practice, many challenges exist in

both execution and research. Implementation of meaningful IPE learning experiences in alignment with proposed frameworks has been difficult. Common challenges include coordination of divided curricula and faculty involvement from different professions, instruction and assessment of professional behaviors and skills, and integration of learning activities between academic institutions and health care systems (Cerra & Brandt, 2011; Frenk et al, 2010). Due to the multifaceted nature of the varied academic fields and clinical practice settings there has been little consistency in the delivery of IPE, which have resulted in varying levels of success and relevancy of outcomes to clinical practice (Cerra & Brandt, 2011; Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013).

In response to continued variability in IPE research and questions regarding impacts of IPE on practice, the IOM recently examined evidence linking IPE and collaborative practice on patient and health system outcomes in order to provide recommendations and guidance to future educators, policy makers, and researchers (IOM, 2015). Contrary to previous recommendations, the IOM found that much research on IPE has continued to focus on student learning, knowledge, and attitudes within the classroom, with many fewer studies investigating links between IPE and performance in practice. The lack of ability to demonstrate a change in performance in practice demonstrates a breakdown in transfer of learning (Perkins & Salomon, 1992).

Further, the IOM identified numerous gaps in the literature that must be addressed to better evaluate the impact of IPE on collaborative practice (2015). These gaps included building a close alignment of the education and health care systems, developing and utilizing a conceptual framework to guide interprofessional models of learning, creating a stronger the evidence base

through more purposeful and well-designed studies, and linking IPE to changes in collaborative behavior. Last, the IOM called for the improvement of research methodologies through the adoption of a mixed-methods approach to investigate IPE interventions due to the belief that a single research design alone may not be adequate to fully convey the detail and context necessary to be informative (IOM, 2015). Further, the IOM stated that "IPE research would benefit from adoption of a mixed-methods approach that combines quantitative and qualitative data to yield insight into both the 'what' and 'how' of an IPE intervention and its outcomes" (IOM, 2015, p.58). This view is consistent with Creswell and Plano Clark (2011) who posed that mixed methods research will add breadth and depth of understanding of the problem and explanation of the results.

In consideration of the recent IOM report and other authors, several areas of concern exist for the development of future IPE research involving health care providers. First, research examining the direct cause and effect relationship between IPE and clinical practice enhancement is lacking (Brashers, et al., 2001; Brashers, Phillips, Malpass, & Owens, 2015; IOM, 2015; Lutfiyya, Brandt, & Cerra, 2016; Reeves, et al., 2013). In addition, the setting in which learning occurs is becoming recognized as essential to the transfer of learning to clinical practice (Bridges, Davidson, Odegard, Maki, & Tomkowiak, 2011; Oandasan & Reeves, 2005). Thus, IPE should be delivered in a continuum of educational experiences that span traditional education to clinical practice and use a conceptual framework that emphasizes on adult learning concepts (Brandt, 2018; IOM, 2015). Last, due to the complexities and contextual influences in both the academic and clinical practice environments, a single methodology is not sufficient. Thus mixed-methods research designs should be utilized to investigate research questions related

to the influence of IPE on interprofessional practice. The combination of methodological approaches will provide a better understanding of the impact of IPE on clinical practice than either approach alone (IOM, 2015; Lutfiyya, et al., 2016). However, even with these recommendations, a recent systematic review found that research within the last ten years on the measurable impact of IPE and collaborative practice on patient care continues to be limited (Lutfiyya, Chang, McGrath, Dana, & Lipsky, 2019).

It is with these issues in mind that the present study is proposed. The body of research involving IPE has fallen short of meeting previous recommendations of national and international agencies, which includes linking the education and clinical environments, examining impact of education on practice improvements, and using robust research designs to fully examine and understand changes in interprofessional practice.

Purpose of the Study

The purpose of this study is to examine the impact of a formal IPE curriculum on the collaborative practice of Doctor of Physical Therapy students. The study will focus on the clinical practice of students conducting actual patient care in clinically immersive environments upon their completion of a formal IPE curriculum that was developed in congruence with recent recommendations by the IOM (2015) and IPEC (2016). Specifically, the researcher will examine student clinical performance in domains of their clinical performance instruments that are in alignment with established IPEC competencies (IPEC, 2016), and explore how students are able to apply their interprofessional learning to enhance their clinical practice through these core competencies. Thus, this study aims to examine both the "what" and "how" of IPE impact on

collaborative practice as students transition from traditional academic to health care environments. In nearly all health care fields of study, literature is lacking in these areas.

Research Questions

The following research questions will be investigated in this study:

1. Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum?
    a. Does the average of professional practice scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    b. Does the average of patient management scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    c. Does a greater proportion of DPT students who completed an IPE curriculum achieve "entry-level" designation in professional practice scores compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    d. Does a greater proportion of DPT students who complete an IPE curriculum achieve "entry-level" designation in patient management scores compared to

historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

e. Does the clinical practice scores of the practice domains within the performance instrument that closely align with IPEC core competencies differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    i. Safety
    ii. Communication
    iii. Screening
    iv. Plan of Care
f. Does a greater proportion of DPT students who complete an IPE curriculum achieve "entry-level" designation in the practice domains within the performance instrument that closely align with IPEC core competencies compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    i. Safety
    ii. Communication
    iii. Screening
    iv. Plan of Care

2. What has been the impact of an IPE curriculum on patient care in the clinical practice environment?
    a. Have areas of professional practice, patient management, and subdomains of safety, communication, screening, and plan of care been improved? If so, how? If not, why not?
3. How have DPT students who have completed an IPE curriculum been able to translate interprofessional learning into the clinical practice environment?

Conceptual Framework

The conceptual framework guiding this study is the Interprofessional Learning Continuum (IPLC) as proposed by the IOM (2015). The IPLC was developed as a recommendation in order to strengthen the evidence base for evaluating the impact of IPE on collaborative practice and patient outcomes. It was designed with consideration of a continuum that was proposed by Owen and Schmitt (2013) that linked IPE to pre-licensure education, graduate education, and formal and informal workplace activities. The IOM added to this model by including linkage to learning outcomes, and health and system outcomes, along with the influence of enabling or interfering factors (IOM, 2015).

The IPLC accounts for the ongoing nature of IPE that incudes learning as health care students' progress through their didactic education to clinical education when students are immersed in practice environments. Formal learning takes place within planned didactic educational programming, while informal learning involves more natural or authentic learning within the workplace environment (IOM, 2015; Nisbet, Lincoln, & Dunn, 2013). The IPLC

includes stages of learning from foundational education, to graduate education and finally continuing professional development. Foundational education is defined as the entry-level education in the degree program. Graduate education is the stage of learning that involves progressive integration into complex learning environments and specialty training in clinical settings. Last, continuing professional development is post-licensure and a time in which the health care provider implements continuous improvement strategies in the workplace (IOM, 2015).

To follow the IPLC, IPE is introduced in the foundational education (or pre-licensure) stage of professional education. As students enter clinical internships or residencies, they progress to the graduate education stage of the IPLC. Within this stage, interprofessional learning activities are connected to the practice environment in order to allow for transfer of learning to patient care settings (IOM, 2015; WHO, 2010). In the clinical health care environment, learning becomes more complex and relationship based (Brandt, 2018; IOM, 2015). Thus, the inclusion of learning experiences in the clinical healthcare environment will provide a rich environment to influence future learning or allow the application to other similar environments or situations. This concept is the essence of transfer of learning (Haskell, 2000). Therefore, it is within this learning continuum that the current study will examine the ability of students to translate their learning into their future clinical practice.

Upon review of the proposed conceptual framework and related literature that declared the need for the development of interprofessional learning experiences that focus on the transfer of learning from the academic environment to the complex clinical practice environment, the interrelationship of social and adult learning is evident in this study. Thus, the conceptual

framework chosen to guide this study, the Interprofessional Learning Continuum (IPLC), is rooted in social constructivism and andragogy. In accordance with the IPLC, the researcher holds that IPE should create learning experiences that form social exchange and interaction, with the focus on the learning process, environment, social exchange, and experiences, and not the information itself. IPE experiences should cultivate this collaborative process through facilitation of varied active learning experiences in constructivist learning environments, which then promotes transfer of learning to similar environments (Adams, 2006; Cooper, Braye, & Geyer, 2004; Palincsar, 1998). Further integration of the conceptual framework will be further described in Chapter 3.

Significance of Study

Research has demonstrated that interprofessional education (IPE) can improve collaborative knowledge, skill, and perceptions (Reeves et al., 2011; Thistlewaite, 2012; Zwarenstein et al., 2009). However, IPE literature collectively has possessed inconsistent study designs, methodological challenges that did not thoroughly evaluate application of learning and lacked a conceptual framework that underscored the learning continuum as a basis for interprofessional learning (IOM, 2015). Thus, establishing a direct causal relationship between IPE and collaborative practice outcomes on actual patient care has been limited (Brashers, et al., 2001; Reeves, et al., 2013).

To address the shortcomings of prior IPE research, this study will incorporate many of the recommendations that were proposed by the IOM to evaluate the impact of IPE on collaborative practice. The study will involve students who have completed an IPE curriculum

that is in alignment with the IOM's conceptual framework (IOM, 2015) and the core competencies developed by IPEC (2016). In addition, it will utilize a mixed-methods approach to capture quantitative and qualitative data that will allow a more thorough examination of the transfer of learning from the IPE curriculum to the clinical environment. Results of this study could assist in the future examination of IPE interventions or curricular changes to identify optimal dosing and construct of the IPE learning activities that will translate to clinical practice environments. Thus, the significance of this study is that it will examine the impact of IPE on clinical practice through use of a framework and methodology that will appropriately examine the application of learning to the complex clinical health care environment.

Delimitations

Delimitations in this study predominantly include the population being studied due to its purposive sampling. All participants in the study will be doctoral students in physical therapy from one institution, and from one cohort. While the IPE curriculum involves a large number of students from other various disciplines (medicine, nursing, social work, and pharmacy), research sampling from these populations would not allow for inclusion of the quantitative data to be collected in clinical practice due to disciplinary focus of the instrument being utilized. Efforts will be made to establish and/or control for statistical normality of quantitative data, especially in consideration of the historical control group that will be utilized. Due to the cohort nature of the sample population included in the study, the researcher is assuming that extraneous variables during the learning continuum outside of the IPE curriculum will be similar and will not variably impact either the collected quantitative or qualitative data.

Limitations

Limitations in this study involve factors that could impact the quantitative or qualitative data being collected as well as generalizability. First, due to the limitation of the scale being utilized for the quantitative portion of the study, a ceiling effect may exist. To mitigate this, the investigator will code data on the instrument in a manner that will allow utilization of a nonparametric assessment (chi-square statistics to examine proportion) in addition to a parametric assessment (mean comparisons) on the data. A limitation involving the qualitative data collection involves the potential for outside confounding issue to be influential in student responses. Efforts will be made during the qualitative data collection to extract responses that are aligned with the IPE curriculum being investigated rather than any of the students' other professional or non-professional experiences that may have had an influence on their clinical practice.

Another limitation that exists is the generalizability of the results. This study involves a single cohort of students from one discipline in an isolated year. However, the methodology is designed in a manner that could be reproduced with the other disciplines using the appropriate clinical performance instrument for that field of practice along with similar qualitative assessment. In addition, the intervention in the study, the IPE curriculum, is aligned with the appropriate framework as proposed by national and international agencies.

Definition of Terms

Education: Any formal or informal process that promotes any improvement in behavior, information, knowledge, understanding, attitude, values or skills (United Nations Educational, Scientific and Cultural Organization, 1997).

Health: "A state of complete physical, mental and social well-being and not merely the absence of disease" (WHO, 2010, p.13).

Health systems: All the organizations, policies, and people whose actions and aims are promote, restore, maintain, or advance the health and well-being of society (WHO, 2010)

Education systems: All the organizations, policies, people whose actions and aims are to facilitate learning (WHO, 2010)

Interprofessional collaborative practice: When health care workers from different professional backgrounds provide patient-centered services through working with individual patients, their families, communities, and other providers to deliver the highest quality of care across settings (WHO, 2010).

Interprofessional competencies: Knowledge, skills, behaviors, and values that define collaborative patient care across disciplines to improve health outcomes (IPEC, 2016).

Interprofessional education: **"**When two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes" (WHO, 2010, p. 13).

Interprofessional learning: Learning arising from interaction between students or members of two or more professions. It may be the product of formal IPE or occur spontaneously in the educational or workplace setting (Freeth, Hammick, Reeves, Koppel, &
Barr, 2005)

Interprofessional team-based care: Care to patients that is created and delivered by health care providers who collectively share responsibility for a patient or patient's health (IPEC, 2016).

Transfer of learning: The application or translation of learning from one context to a similar or novel context (Perkins & Salomon, 1992).

Summary

The body of research involving interprofessional education has been varied in its approaches and not consistently met recommended standards from the Institute of Medicine (2015) or World Health Organization (2010). This study will align with those established standards by utilizing an established conceptual framework and examining the impact of a formal interprofessional education curriculum on the clinical practice of Doctor of Physical Therapy students through a mixed-methods approach. Thus, this study aims to examine both "what" and "how" learning is translated to the practice environment and to impact patient care.

The research report will be presented in five chapters and include appendices and references. Chapter 2 reviews the literature regarding the development of IPE, its theoretical framework, and studies of its efficacy in linking to learning and practice outcomes. Chapter 3 discusses the research methods which will include design, sampling, data collection, and data analysis.

CHAPTER 2: REVIEW OF LITERATURE

Introduction

This chapter contains a review of literature focused on the background of IPE, its relation to professional education in health professions, as well as the theoretical foundations of IPE and IPE research. Included in this chapter are also professional organization position statements and standards that serve as a guide for IPE research. The chapter concludes with a discussion of the conceptual framework that will guide this study.

Historical Development of Interprofessional Education

According to the World Health Organization (WHO), IPE "occurs when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes" (WHO, 2010, p. 13). While this is the most recently recognized definition of IPE, the concept developed over the past century, with several peaks and valleys before being accepted today in the contemporary education of professional health care and medical providers (Brandt, 2018).

Interprofessional collaborative practice (IPCP) and IPE have evolved over the past forty to fifty years in the United States (Brandt & Schmitt, 2011). However, Baldwin (1996) and Royer (1978) note that concepts of IPCP and IPE developed well over a century ago in various countries. First, the initial practice of team-based health care was employed prior to the beginning of the twentieth century when hospital outreach programs in India sent medical doctors, nurses, and ancillary support providers to remote areas of the country. In addition, the team approach to health care was advocated for in Great Britain in the 1920's. This proposed

model included the establishment of centers similar to the triage system employed in military models of primary health care (Baldwin, 1996; Royer, 1978). This use of interdisciplinary primary health care teams in community health settings was later utilized in South Africa and Israel by the 1950's (Baldwin, 1996). Similar efforts were beginning with the United States in the first half of the twentieth century with the advocacy for use of teamwork among health providers. This resulted in health provider teams at hospital systems in Boston and New York City. The greatest test and success, however, was the that of the multidisciplinary teams established for surgery, burns, rehabilitation and other areas implemented during World War II (Baldwin, 1996).

Credit for initiating the development of practicing interdisciplinary teams in the United States has been given to the work of two different medical doctors for their work shortly after World War II (Baldwin, 1996). First, Martin Cherkasky developed hospital outreach services that included physicians, social workers, and nurses in local communities in 1948 (Cherkasky, 1949). Second was Georea Silver, who first proposed expansion of primary care medical providers' network to include others within the health care team (Silver, 1958), and then moved to develop teams of physicians, nurses, and social workers for primary care (Silver, 1974). Unique to Silver's work, however, was the additional focus on preventative health care and a family focus. During the same time, the University of Washington developed an interdisciplinary educational approach to family health care, which included students and faculty from medicine, nursing, social work, nutrition, dentistry, physiatry, and others (Deisher, 1953).

The next significant factor that instigated the concept of teamwork in health care occurred as a result of the involvement of the federal government. In the 1960's President

Johnson's vision for the "Great Society" and "War on Poverty" continued the focus on community health but added the notion of access to health care for all populations (Baldwin, 1996). The result of this initiative was the creation of the Office of Economic Opportunity (OEO), which provided funding for community health centers throughout the country. Although the OEO sought to stimulate and assist "innovative and experimental efforts to involve poor persons more effectively in the provision of ambulatory care services" (Office of Economic Opportunity [OEO], 1970, p.2), it also stated that "new ways should be sought to develop, train, and utilize a health team that is innovative in both structure and function" (OEO, 1970, p.2).

With the increased focus on accessibility and availability of health care services as well as the new funding initiatives for community health centers, it became apparent that there was a large workforce shortage of providers. The result was a proliferation of medical schools, nursing, and allied health programs. With this growth of programs and subsequent specialization of many disciplines, many concepts of interdisciplinary teamwork were lacking due to lack of collaborative learning experiences to promote team relationships or lack of contact with each other during their educational process (Baldwin, 1996; Brandt, 2018).

During the 1970s there were several activities that instigated the further development of interdisciplinary focus of curricula in the education of health professional. First, in 1972, the IOM convened a conference and prepared a report entitled "Education for the Health Team" (IOM, 1972). This report provided a definition for interdisciplinary education, and some guidance for educators to develop educational programming. Interdisciplinary education can include students from more than one profession being instructed by faculty from one profession, students from one profession being instructed by faculty from more than one profession, or

students from more than one profession being instructed by faculty from more than one profession (IOM, 1972).

While there were several courses and un-integrated curricula and a few universities in the 1970s such as Miami, Indiana, Kentucky, it was not until there was further involvement and funding by the federal government that this interdisciplinary education effort grew. In the early part of this decade, funding from the Robert Wood Johnson Foundation allowed for the creation of the Institute for Health Team Development and a subsequent Office of Interdisciplinary Programs (OIP). The OIP was able to provide some limited funding to schools of health professions, but it was not until the establishment of the Comprehensive Health Manpower Training Act of 1971 that more meaningful funding could be provided (Baldwin, 1996). While this act was established to provide assistance to schools for facilities for health professions education and assist with student loans for their students, it also established funding "to establish cooperative interdisciplinary training among schools …including projects for training in the use of the team approach to the provision of health services" (H.R. 8629, 1971, Section 770 (g) (1) (B)). In the mid-to-latter part of the 1970s, this added funding allowed for creation of awards to numerous other interdisciplinary health training programs at universities throughout the country. However, there was a great deal of inconsistency in the goals and objectives of these universities. Some crated academically focused projects while others held only activities with a clinical emphasis. Some universities emphasized community-based activities alone that were extracurricular in nature, and some administrated only a single course or clinical activity (Baldwin, 1996).

Due to a decrease in federal funding, there was an eventual reduction of efforts in the 1980s, especially in universities where interdisciplinary training programs were not well institutionalized. In addition, due to professional pressures for disciplinary identity and autonomy of many health professions, many interdisciplinary efforts subsided during this time period (Baldwin, 1996). While there were still some federal programs and private philanthropic foundations that were providing initiatives and opportunities during this period, one of the major supporters of training of interdisciplinary teams has consistently been through the Veteran's Administration. The Veteran's Administration has sustained commitment to geriatric care and development of large interdisciplinary teams of medical and health professionals (Baldwin, 1996; Brandt & Schmitt, 2011). These efforts, along with those of foundations such as the Robert Wood Johnson Foundation that focused on primary care dominated the focus of interprofessional team training in the 1980s (Baldwin, 1996).

The ensuing phase of in the development of interdisciplinary team training focused on continuous quality improvement for teams in education and clinical practice. This has been supported through vastly expanding interest and guidance by numerous national and international organizations such as the IOM and the WHO.

The IOM, which was re-named in 2016 as the "Health and Medicine Division" of the National Academies of Sciences, Engineering, and Medicine, aims "to help those in government and the private sector make informed health decisions by providing evidence upon which they can rely" (Health and Medicine Division [HMD], 2019, para. 2). As a part of the National Academies, it conducts "activities to solve complex problems and inform public policy decisions related to science, technology, and medicine" (HMD, 2019, para. 1).

At the turn of the century, the IOM published several guiding reports. In 2000, the IOM's Committee on Healthcare Quality in America cited concerns of patient safety due to medical errors that could be mitigated through improved reporting, team-based behaviors, and communication of health care providers (Kohn, et al., 2000). In 2001, the IOM published *Crossing the quality chasm: A new health system for the 21st century*, which identified needed changes to the health care delivery system due to these safety concerns, fragmented care, low quality, and high cost. The proposed changes included a call for action of educational institutions to improve the communication and collaboration in future health care providers (IOM, 2001). Two years later, the IOM held an educational summit to develop core competencies for educational institutions that deliver health professions education. These included patient-centered care, quality improvement, evidence-based practice, health informatics, and interdisciplinary teamwork (IOM, 2003).

In nearly a parallel fashion, the WHO has become involved in supporting these initiatives in a similar manner. The goal of the WHO is to "ensure that a billion more people have universal health coverage, to protect a billion more people from health emergencies, and provide a further billion people with better health and well-being" (WHO, 2019, para.2). In its 2006 world health report, the WHO estimated a workforce shortage of approximately 4.3 million health care providers (WHO, 2006). During its 59th World Health Assembly, it called for a rapid scaling up of the health care workforce using new strategies of practice and education (WHO, 2006b). Further, it created a panel that was tasked with identifying, evaluating, and synthesizing evidence that could serve as action-items to promote and develop collaborative practice. This international panel composed of policy, education, and practice experts became known as the WHO Study

Group on Interprofessional Education and Collaborative Practice (Yan, Gilbert, Rodger, & Hoffman, 2007). The work of this group resulted in a document, *Framework for Action on Interprofessional Education & Collaborative Practice*, that was adopted by the WHO and disseminated worldwide (WHO, 2010). This document provided the definition of IPE which is when "two or more professions learn with, about, and from each other to enable effective collaboration and improve health outcomes." (WHO, 2010, p.10). The framework provided by the WHO proposed new model of educating health care providers through the synchronization of the health care systems with educational systems (IOM, 2015, p. 18; WHO, 2010, p.39). The WHO believed that such a model would help create a collaborative practice workforce and allow health care providers to optimize each other's skillsets. It would thus improve access to care, alleviate workforce shortages, and improve healthcare outcomes (WHO, 2010).

Professional Education Development of IPE

At the same time the WHO published its framework for action and shortly after the IOM developed core competencies for health professions education that focus on IPE, the focus for inclusion of IPE within professional education was facilitated further through the Commission on Education for Health Professions (Bhutta et al., 2010). This commission, formed by *The Lancet*, one of medicine's top international journals developed institutional and instructional strategies to advance professional education. This commission called for the enhancement of both technical and non-technical skillsets of health care providers such as clinical reasoning and communication to enhance team function. It also recommended using educational models that break down

professional silos, and the use of external collaborations to deliver professional education outside the traditional academic setting due to the dynamic healthcare environment (Frenk et al., 2010).

One of the most impactful organizations for the development of IPE to enhance collaborative practice has been the Interprofessional Education Collaborative (IPEC). IPEC was formed in 2009 by six national educational associations. This collaborative organization was formed to "advance substantive interprofessional learning experiences to help prepare future health care professionals for enhanced team-based care of patients and improved population health outcomes" (Interprofessional Education Collaborative [IPEC], 2018, para. 1). Over the past 10 years, IPEC has grown 20 professional organizations, which now includes but is not limited to medicine, nursing, social work, pharmacy, physical therapy, and speech language pathology. IPEC stated that high-quality, accessible, and patient-centered care can be achieved through interprofessional practice, but such training requires interprofessional competencies as part of the educational process (IPEC, 2011).

To develop these competencies, IPEC identified a link between the recommendations provided by the IOM (2003), and the framework for created by the WHO that identified potential synergies between the education and health systems (WHO, 2010). IPEC also cited work by D'Amour and Oandasan (2005), which proposed an alignment of professional education competencies to facilitate interprofessional practice with the needs of the professional practice system. To facilitate widespread and consistent delivery of IPE within the professional education and health care communities, IPEC developed competencies within four domains in 2011. These domains included values and ethics, roles and responsibilities, interprofessional communication, and teams and teamwork (IPEC, 2011). More recently IPEC provided an update to its original

competencies with some realignment into one domain, Interprofessional Collaboration. IPEC expanded sub-competencies to allow professional educators to align IPE activities that are more appropriate with the current healthcare environment (IPEC, 2016).

Synchronization of Organizational Positions

There is much consistency and synergy between the various organizational positions that have built the construct of IPE today. The WHO is an active proponent for action in the implementation of interprofessional education to impact healthcare. The WHO holds that clinicians trained in interprofessional care more effectively optimize the skillsets of all team members, which ultimately improves patient care (WHO, 2010). Thus, purposeful integration of professional education with collaborative practice in the healthcare setting is necessary in order to achieve optimal health outcomes. Next, IPEC has advocated for the continuous development of health care professionals through the implementation of IPE experiences in congruence with core competencies to promote interactive learning and crossover to team-based care when entering the workforce. IPEC identified desired principles for an IPE program which include patient-centered care, outcome-driven assessment, applicability across practice settings, and activities and assessments that are appropriate for the learner (IPEC, 2011).

These positions have been further corroborated by IOM. Recently, the IOM developed a report to examine evidence connecting IPE of both students and healthcare professionals to clinical outcomes of patients and health systems. This report, *Measuring the impact of interprofessional education on collaborative practice and patient outcomes* (IOM, 2015), synthesized IPE literature and developed several key recommendations to improve the body of

knowledge moving forward that will best influence health care practice. These recommendations included the following: alignment of the education and health care systems, utilization of a conceptual framework to guide interprofessional models of learning, creation of stronger evidence base through more purposeful and well-designed studies, link of IPE to changes in behaviors that can influence practice and improvement of research methodologies through the adoption of a mixed-methods approach to investigate IPE interventions (IOM, 2015).

Interprofessional Learning Continuum

The Interprofessional Learning Continuum (IPLC) is a conceptual framework that was developed by the IOM (2015). The IOM recommended this model to strengthen the evidence base of IPE and develop consistency of research designs in order to better examine the impact of IPE on clinical practice and outcomes. It was developed based on a continuum of education originally proposed by Owen and Schmitt (2013). This model linked IPE to pre-licensure education, post-licensure or graduate education, and both formal and informal interprofessional activities within the workplace. The IOM built to this model by linking learning outcomes, health and health system outcomes, and enabling or interfering factors. Learning outcomes include a range from attitudes and perceptions of the learner to skills, collaborative behavior, and performance in practice. Health and system outcomes include individual and population health, as well as organizational change, system efficiencies, and cost-effectiveness. Last, enabling factors include professional and workforce culture as well as policies. (IOM, 2015).

Conceptual Framework

The IPLC accounts for the comprehensive nature of professional education in which IPE is proposed to take place. This includes learning activities as students progress from didactic education within traditional academic settings to clinical education environments such as internships, where students are immersed in clinical practice settings. These clinical workplace settings allow for the integration of both formal and informal learning (Nisbet, Lincoln, & Dunn, 2013). The IPLC accounts for these clinical activities within the "graduate education" stage, which allows for integration of knowledge and skills into more complex learning environments, with transition into the workplace (IOM, 2015). In the clinical health care environment, learning becomes more complex, socially interactive, and relationship based (Brandt, 2018; IOM, 2015; Nisbet, Lincoln, & Dunn, 2013). Therefore, the inclusion of learning experiences in the clinical healthcare environment will provide a rich environment to influence future learning or allow the application to other similar environments or situations (Haskell, 2000).

The IPLC is thus synergistic with other learning models that incorporate authentic environments for learning activities and appropriate translation into other areas of practice. These include the interprofessional learning model that identifies formal and informal activities that are available within clinical health care environments (Nisbet, Lincoln, & Dunn, 2013), and the importance of social and environmental construct of learning in order to be able to better translate learning to alternate environments, known as transfer of learning (Haskell, 2000). The IPLC therefore is a conceptual framework that is rooted in the interrelationship between social and adult learning. This conceptual framework is a link between two theories, social constructivism and andragogy.

Integration of social constructivism and andragogy.

The process of learning involves creation of knowledge and understanding from a collaborative approach (Oandasan & Reeves, 2005). Thus, an appropriate theory upon which to base interprofessional education is social constructivist theory (Cooper, Braye, & Geyer, 2004; Hean, Craddock, Hammick, & Hammick, 2012). Social constructivist theory has foundations with John Dewey (1938), who proposed the construction of knowledge is predicated on the sociocultural and sociohistorical contexts in which learning is created. Applying this theory to IPE is important to educate and train students to navigate complex situations involving interpersonal dynamics, professional scopes of practice, and frameworks and disciplinary boundaries of professions which are all created through varied healthcare environments (Oandasan & Reeves, 2005).

At the core of social constructivist theory, however, is the need for comprehension of the knowledge being created, which necessitates high order thinking and learning. Dewey (1938) identified these needs, but his theoretic foundation was progressed by others who further developed this notion. Successful navigation of the discourse and dialogue between entities can further understanding, leading to new meaning (Kaufman & Mann, 2010). This concept was originally developed by Vygotsky, who proposed that higher order processes of understanding require this interaction and give and take (1978). He also held that social interaction with capable peers who have advanced or complementary skillsets will advance those skills beyond what an individual can achieve on his or her own. Later, Piaget (1985) supported this concept of social learning through identification of the need for alteration of the equilibrium of a social and learning system in order to advance the knowledge and understanding. Thus, both theorists pose

that a collective group may achieve more and create a higher level of understanding than the individual units.

While social exchange and interaction contributes to the construct of knowledge to advance understanding, another learning theory is evident in this study. Reflection and use of an inner dialogue have demonstrated the ability to advance understanding further. According to Schon (1992), personal reflection and inner dialogue is a component of Dewey's original framework. Possessing this inner, personal reflection advances learning and enables critical thinking and reasoning (Shulman & Carey, 1984). Integrating this level of critical reflection with social exchange and discourse within social constructivist theory links to another theory present in higher education today, andragogy.

Andragogy, also known as adult learning, originated with Knowles (1973) and involves all these components of learning, now applied to higher education. The principles of adult learning initially included the notion that adults best learn in environments where they have involvement in planning and evaluation of instructional activities, examination of topics that have immediate relevance to their job or personal life, reflection on life experiences in the learning process, and encounter problem-based learning (Knowles, 1984). Adult learners consider their lived experiences when they are learning. They are more independently driven and take greater initiative in guiding their actions. Adult learners offer more insight and discourse in the learning process, which in return advances the level of knowledge transfer and understanding (Knowles, 1984).

The synchronization of social constructivism and andragogy can be visualized in a recent study by Jackson (2016), which examined skill transfer of graduates as they transition from

higher education into the workplace. This study sought to model transfer of learning through examination of the learner characteristics, program characteristics, and workplace characteristics. The study sample included 674 graduates over a three-year period and employed a survey to examine factors that influenced their skill transfer to the workplace. Through confirmatory factor analysis and structured equation modeling, the study found a significant influence of several factors. Some factors included that align with theoretical underpinnings of social constructivism and andragogy were the association of related work experience, association of learning context with application context (work environment), collaborative learning environment, relevancy of skills learned, and similarities between the work place and learning contexts (Jackson, 2016).

The alignment of social constructivism and adult learning integrate within the IPLC, which has been a stated gap in IPE research (IOM, 2015; Oandasan & Reeves, 2005). Through this integration, IPE learning experiences could form social exchange and interaction in the learning process, with the focus on the learning process, and not the information itself. IPE experiences could cultivate this collaborative process through application in various learning activities through facilitation in constructivist learning environments (Adams, 2006; Palincsar, 1998). Adams (2006) provided a guidance from which to create such learning experiences. This included focus of the learning process and not the teaching, use of authentic activities, co-operative creation of new knowledge, using educators who guide the learning process and not teach or dictate it and creating a shared understanding of knowledge.

This type of learning environment and social construct has been likened to a community of practice (Duffy & Cunningham, 1996; Thistlewaite, 2012). A community of practice was first defined by Wenger (1998) and it is understandable why this has been noted due to the construct

and function of these IPE groups as a team interacting to solve common problems in a social learning environment. However, IPE groups need to interact, function, and learn in a higher order due to the complexity of healthcare. Thus, this group may be better termed a "community of inquiry." Lipman (2003) and Golding (2011) identify the critical thinking that needs to transpire in order to address complex questions of practice.

Golding further identifies the need for a "community of critical thinkers" and thus cultivation of critical thinking is essential to creating high functioning teams of practice, those that can engage in dialogue, discourse, and progression of knowledge (2011). These communities of inquiry progress and create effective changes in like manner to high functioning teams. Cultivating these groups appropriately can elevate the functions of the team in order to address contemporary and complex issues in healthcare (Salas & Rosen, 2013). One important note in addition to this discussion, however, is that of consistency of the team construct. Many of these highlights may originate from stable teams, a luxury our student population does not have due to their eventual graduation and progression into professional fields. However, Thompson (2016) identifies redundancy as being a favorable component to navigating complex IPE scenarios. Thus, if students are presented with needs to form critical-thinking teams, it should be more natural for them to re-create this in the future.

In conclusion, social constructivist theory and andragogy accurately guide the process of high order learning and integrate into the IOM's IPLC (2015). This framework design may prepare future learners in health care disciplines construct meaning and translate this learning to their clinical environments. Through facilitation of varied active learning experiences in

constructivist learning environments, transfer of learning to similar environments may be promoted (Adams, 2006; Cooper, Braye, & Geyer, 2004; Palincsar, 1998).

Relevant Research on IPE in Health Care

Learning within a specific setting has been stated as an essential component of interprofessional education (Bridges et al., 2011; Oandasan & Reeves, 2005; Salas & Rosen, 2013). This concept supports the aforementioned notion that education and healthcare systems need coordination of efforts to enact effective interprofessional education (WHO, 2010). These notions, rooted in social constructivist learning theory, hold that the environment, and the context in which the learning is taking place assist the individual in developing meaning through the reciprocal influence of other individuals, (Shulman & Carey, 1984).

This theory and further elucidation of the potential for interprofessional education is substantiated in a recent meta-analysis by Salas et al. (2008). In this study, Salas et al. (2008) examined the effectiveness of team training and found moderately positive effects on the domains of cognitive outcomes, affective outcomes, team functioning, and performance. The analysis included 12-25 effect sizes for each of the domains and resulted in true score correlations ranging from .35 to .44, respectively. The meta- analysis concluded that between 12-19% of the variance in outcome can be attributed to team training.

Although this meta-analysis was not isolated to healthcare systems, ensuing studies have been able to translate the effectiveness specifically into healthcare settings. A study by Deering et al. (2011) used an interprofessional education program targeted at improving team efficiency and communication and applied it to an acute trauma setting. The study assessed patient safety

reports before and after over 3000 healthcare personnel were trained and standardized the medical error rates based on census. Although the investigators found that there was a non-significant reduction in patient safety reports post education intervention, it did find statistically significant reduction in medical errors associated with occurrences related to communication, mutual support, and situation monitoring. Communication errors were reduced by approximately 65% in the immediate six months post training, reducing from 5.2 to 1.8 medical error incidents per 1000 inpatient days.

The findings of the aforementioned studies have been corroborated though several additional studies on providers in other clinical settings. Spiva et al. analyzed falls in inpatient populations of two different hospitals over an 11-month period and found a 62% reduction in falls. In addition, the study also noted s significant change in communication and coordination of care related to fall prevention (2014). In similar fashion, communication, knowledge of roles and responsibilities, and team behaviors were improved through team training in other specialized areas of clinical practice such as the emergency department setting (Lisbon et al., 2016) and pediatric intensive care unit (Mayer et al., 2011). However, although both found significant effects of the training to multidisciplinary group of providers, it is important to note that these studies involved training interventions lasting between 6-12 hours and possessed limited follow up.

A team training model that has been developed by the Agency for Healthcare Research and Quality and US Department of Defense and has been studied for medical team training in the US (King et al., 2008). This program has recently been found to be effective in collaborative practice involving communication, patient safety, knowledge of roles, and team behaviors in

patient care in numerous healthcare disciplines and settings. These include nursing in the emergency setting (Harvey, Echols, Clark, & Lee, 2014), academic emergency department settings (Lisbon et al., 2016), neonatal units (Sawyer, Laubach, Hudak, Yamamura, & Pocrnich, 2013), and long-term care facilities (Liaw et al., 2014). A study involving physicians, nurses, and respiratory therapists in the neonatal care setting found significant improvements in communication, patient monitoring, and mutual support, with reported effect sizes for teamwork skill improvements reached a large influence at reported values of d=1.49 and r=0.6 (Sawyer, Laubach, Hudak, Yamamura, & Pocrnich, 2013). The effects of the training program were further corroborated through a meta-analysis that found moderate to large effects of the training program at d=.44 (Salas, Diaz Granados, Weaver, & King, 2008).

In association with these findings, a recent study also demonstrated positive patient outcomes and system-level outcomes for the improvement of practice due to an interdisciplinary approach to patient care in a family medicine residency (Guck et al., 2019). This investigation consisted of examination of patient outcomes during a year before and after the implementation of an interprofessional collaborative practice model to patient care. This included clinician and staff training on conflict management and engagement, daily sessions to foster interprofessional communication, and formation of interprofessional planning groups for patient care. Results demonstrated a significant impact, with a reduction of hospitalization by nearly 18%, reduction of emergency department visits by 17%, and reduction of total patient charges by 48% (Guck et al., 2019). Through considerations provided by these studies, team training may be impactful to other healthcare disciplines and translate utility of IPE in professional education programs to better prepare future healthcare providers.

IPE Research and Student Populations

All the aforementioned studies have been conducted on post-graduate, licensed providers, and thus not included student populations as the framework from the IOM has proposed (2015). Several studies have been conducted to examine the efficacy of interprofessional education of professional healthcare students in conjunction with their formal training (Brock et al., 2013; Fernandes, Palombella, & Wainman, 2015; Liaw et al., 2014; Sytsma et al., 2015). The study by Brock et al. incorporated a pretest-posttest design to examine changes in communication and in association with a four-hour IPE intervention. It included a sample of 364 medical, nursing, and pharmacy students and achieved good results, with good effect sizes for all dependent variables reaching as high as 1.01 for interprofessional communication (2013).

Other studies, however, possessed flaws that have been previously outlined by numerous sources (Brashers, et al., 2001; IOM, 2015; Reeves, et al., 2013). Sytsma et al. (2015) evaluated perceptions of IPE in a cohort of 53 medical and physical therapy students after seven weeks of combined anatomy coursework. Although this study's design provided a one-year follow-up on the effects of the intervention, the study only evaluated the perception of IPE and did not inform the reader on the nuances of interactions nor patient-care centricity. In like manner, a recent study by Bartlett and Dimitroff (2018) examined the self-reported confidence levels of nursing and physical therapy students. While this study did find increase levels of confidence after an interprofessional experience, there were no measures examining the direct influence on clinical practice and the IPE intervention was limited to only a single session and without rooting in a theoretical or conceptual framework. A study by Fernandes, Palombella, and Wainman (2015) provided a much longer platform of interprofessional exposure and included several health care

disciplines, which included medicine, midwifery, nursing, physician's assistant, physiotherapy, and occupational therapy. This study included 10 weeks of interprofessional activities as well as anatomical dissection. While the students experienced significant increases in role clarity and attitudes towards the other disciplines, the study also failed to incorporate the domains of interprofessional collaboration or utility of patient-centered care.

While these studies have demonstrated an increase in knowledge and attitudes of professional healthcare students, limitations remain. The training sessions involved in these studies were limited in duration, associated domains of interprofessional competencies, or involved limited occurrences of interactions. Although the study by Brock et al (2013) involves standardized patients, none of the aforementioned studies include the care of real patients in the clinical setting and not in proper alignment with the recommendations by the IOM, IPEC, or WHO. In addition, none of the studies involved strong qualitative components to explain the observed changes in their outcome measures.

Other recent literature has called attention to the limitations in the current body of IPE research. A systematic review by Zwarenstein, Reeves, and Perrier (2005), identified a clear lack of well-deigned and effective pre-licensure IPE with assessment of impact post-licensure. Although it was noted that much research is demonstrating effective outcomes in post-licensure IPE interventions, there are very little studies identifying meaningful changes with IPE delivered in the pre-licensure, or student, population. Also, there is a definitive lack of connection between interventions and outcomes in the transition from pre-licensure to post-licensure. Research gaps could be addressed by not only bridging this gap, but also examination of the experiences of graduates when they have made the transition from classroom to clinic.

Although individual studies possess weaknesses as cited above, there is a growing body of evidence that interprofessional education is effective in cultivating improvements in clinical performance and patient outcomes due to the enhancement in communication skills as identified in the above studies (Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013). However, there has been inherent challenges of IPE interventions in academic programs and difficulty in generalizability of findings (IOM, 2015). Therefore, recent literature has been calling for an increased focus on explanation of the empirical findings cited in many of the quantitative studies being published on IPE. Several review articles have called for greater research involving qualitative and mixed-methods research designs to further explain how IPE is being experienced and create a better understanding of the manner in which interprofessional education is making an impact (IOM, 2015; Reeves, Boet, Zierler, & Kitto, 2015; Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013; Thistlethwaite, 2012). While there is some evidence of qualitative studies being conducted in post-licensure providers to increase their performance, there is a paucity of research in the experiences of students learning through IPE. A stronger understanding of student experiences will allow for the future development of effective IPE in both academic settings and health systems.

Building an inter-relationship of learning goals, activities, and assessment is integral to establishing behavior changes in adult learners (Fink, 2013). IPEC competencies model the learning goals, while IOM and WHO frameworks propose learning activities for IPE. While assessment processes can and have been built for identified interprofessional learning activities, none connect the processes of implementation as indicated by the IOM to assessment. For example, there are numerous IPE assessment scales in existence that examine immediate effects

of a learning activity (IOM, 2015; Oates & Davidson, 2015). Others are based off isolated learning activities from one singular event, in contrast to IOM recommendations for implementation (IOM, 2015). In addition, many others focus solely on student perceptions rather than observed behaviors by other raters (Fike et al., 2013; Terreri et al., 2017). In a recent review of 90 studies involving IPE with healthcare student populations, only four involved assessments by observation or interview (Thistlethwaite, Moran, Kumar, Saunders, & Carr, 2015). Consideration of the shortcomings of studies such as these were apparent in a recent consensus document that affirmed the need for improved assessment of IPE learning through validated instruments. This statement asserts that learning competencies such as those provided by IPEC should be put into practice and assessed for pre-licensure students in health professions (Rogers et al., 2017).

Conclusion

There is much research demonstrating the effectiveness of team training with performance and the impact that interdisciplinary approaches to problems are effective. However, research demonstrating a link from educational preparation to performance in practice continues to be limited. Much research is needed to continue to connect the student experiences in higher education to their environments of practice in health care settings.

CHAPTER 3: METHODOLOGY

Introduction

The purpose of this study is to examine the impact of a formal IPE curriculum on the collaborative practice of Doctor of Physical Therapy students. The study will examine the clinical practice of students conducting actual patient care in clinically immersive environments upon their completion of a formal IPE curriculum that was developed in congruence with recent recommendations by the IOM (2015) and IPEC (2016). Student clinical performance will be assessed via examination of domains within their clinical performance instrument that are in alignment with established IPEC competencies (IPEC, 2016). Further it will explore how students are able to apply their interprofessional learning to enhance their clinical practice through learning that occurred within the IPE curriculum. Thus, the aim of this study is not only to examine the impact of the IPE curriculum both through assessment of the specific performance indicators, but also through examination of how they were able to translate learned experiences into the clinical environment to influence patient care.

It is well-established that IPE can improve collaborative knowledge, skill, and perceptions (Reeves et al., 2011; Thistlewaite, 2012; Zwarenstein et al., 2009). However, research on IPE has been limited by many factors, which include inconsistency of study designs, lack of thorough evaluation of application of learning due to methodological shortcomings, and lack of use of a conceptual framework that underscored the learning continuum as a basis for interprofessional learning (IOM, 2015). Therefore, establishing a direct causal relationship between IPE and collaborative practice outcomes on actual patient care has been limited (Brashers, et al., 2001; Reeves, et al., 2013).

To address the shortcomings of prior IPE research, this study will incorporate many of the recommendations that were proposed by the IOM to evaluate the impact of IPE on collaborative practice. The study will involve students who have completed an IPE curriculum that is aligned with the IOM's conceptual framework (IOM, 2015), and the core competencies developed by IPEC (2016). In addition, it will utilize a mixed-methods approach to capture quantitative and qualitative data that will allow a more thorough examination of the transfer of learning from the IPE curriculum to the clinical practice environment. Thus, the significance of this study is that it will examine the impact of IPE on clinical practice through use of a framework and methodology that will appropriately examine the application of learning to the complex clinical health care environment.

Research Questions

The following research questions were investigated in this study:

1. Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum?
    a. Does the average of professional practice scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?
    b. Does the average of patient management scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students

who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

c. Does a greater proportion of DPT students who completed an IPE curriculum achieve "entry-level" designation in professional practice scores compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

d. Does a greater proportion of DPT students who complete an IPE curriculum achieve "entry-level" designation in patient management scores compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

e. Does the clinical practice scores of the practice domains within the performance instrument that closely align with IPEC core competencies differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

    i. Safety

    ii. Communication

    iii. Screening

    iv. Plan of Care

f. Does a greater proportion of DPT students who complete an IPE curriculum achieve "entry-level" designation in the practice domains within the performance instrument that closely align with IPEC core competencies

compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States?

   i. Safety
   ii. Communication
   iii. Screening
   iv. Plan of Care

2. What has been the impact of an IPE curriculum on patient care in the clinical practice environment?
   a. Have areas of professional practice, patient management, and subdomains of communication, safety, screening, and plan of care been improved? If so, how? If not, why not?
3. How have DPT students who have completed an IPE curriculum been able to translate interprofessional learning into the clinical practice environment?

Research Design

This is a mixed-method, quasi-experimental study. The quantitative assessment was conducted through a two group, comparative nonequivalent control-group design (Gall, Gall, & Borg, 2007), while the qualitative assessment was conducted through a phenomenology approach (Creswell, 2013). The data was then integrated via convergent parallel mixed methods approach (Creswell & Plano Clark, 2011).

Population & Sampling

This study utilized purposive sample of convenience. The intervention group included the students Doctor of Physical Therapy Program graduating cohort of 2020. A historical sample was used as a control group. This control group consisted of the graduating Doctor of Physical Therapy cohort of students from 2014-2016. In a preliminary analysis by the primary investigator, independent samples t-tests found no statistical significance ($p>0.05$) in the clinical performance ratings of clinical instructors in the four areas being assessed in this study, nor collated professional practice or practice management ratings.

Data Collection Procedures

The research protocol for this study was approved by the University of Central Florida's Institutional Review Board (IRB). The investigator withheld the study aims from both the participants and the clinical instructors whose rating of student performance was utilized. Awareness of the study's aims could significantly impact the internal validity of this study.

Intervention.

The intervention utilized in this study was the Interprofessional Education co-curriculum in which the UCF Doctor of Physical Therapy students participated along with the UCF College of Medicine, UCF School of Social Work, UCF College of Nursing, and UF College of Pharmacy. The IPE co-curriculum constituted four formal IPE events that are progressive in nature and in alignment with the underlying conceptual framework IPLC. A description of the

IPE curriculum and its alignment with IPEC competencies and the underlying theories of social constructivism and andragogy is included in Appendix A.

Instrumentation.

The American Physical Therapy Association's (APTA) Clinical Performance Instrument (CPI) was utilized to assess quantitative clinical performance of the students (APTA, 2006). The CPI is an eighteen-item instrument involving a twenty-one-point interval scale including anchor definitions as well as sample behaviors and performance indicators for each item. In order to access the instrument all clinical instructors who evaluate student performance using it are required to complete a two-hour training program on the instrument. The CPI has been shown to possess strong internal consistency (Cronbach's alpha = .99) and good inter-rater reliability (r=.98) (Roach et al., 2012). The CPI items that are in alignment with the core competencies as stated by IPEC (2011) were used as primary outcome measures for clinical performance. The IPEC core competencies and sub-competencies are listed in Appendix B, with the CPI items that are aligned with these competencies are listed in Appendix C as a reference. A content mapping of these performance criteria to the IPEC core competencies is then outlined in Appendix D.

Data Collection.

The quantitative data collected is from the CPI. The CPI was used in the evaluation of student clinical performance in the clinical setting by the clinical instructor at the midpoint and final weeks of all student internships. The clinical instructor is a licensed physical therapist who has been working in the field for greater than one year and is working with the student on a one-on-one basis in the clinical setting. All clinical instructors must complete a standardized training

program for appropriate use of the CPI in order to access the instrument. Such processes are standard practice in physical therapy clinical education. These processes ensure reliable use of the instrument.

The final ratings from the clinical instructor were utilized for those CPI criteria that are aligned with the core competencies of IPE as cited by IPEC (2011), which includes Communication, Safety, Screening, and Plan of Care. In addition, overall Patient Management and Professional Practice scores was used to examine overall patient care impact.

After the end of the clinical internship, and once the CPI was completed, the qualitative data collection ensued. Qualitative data was collected directly from students through phenomenology to ascertain the lived experiences of transitioning from their IPE experiences into collaborative clinical practice. Semi-structured interviews with an initial sample of 10 students were conducted. These interviews allowed students to describe their experiences transitioning into the clinical environment and discuss the essence of their integration of collaborative practice. The researcher used an interview protocol to collect the data relative to the research questions, and interviews were recorded and compiled with field notes to use in data analysis. An interview protocol with mapping of the interview questions to research questions and theoretical foundations are included in Appendix E.

Data Analysis

Research Question 1: Quantitative Analysis.

All data was downloaded into IBM SPSS, Version 22. Descriptive and inferential statistics were calculated. Descriptive statistics included group means, standard deviations, and

ranges of clinical performance scores and distributions of practice settings (hospital settings, outpatient practice, specialty clinics). Between group differences for the mean score on each CPI item was assessed using an analysis of variance (ANOVA). To examine proportions, chi-square statistics examined the relationship of IPE training with the achievement of "entry level" designation for students in the cohort and students in the historical control were calculated for each CPI item. *A priori* alpha was set at .05.

Research Question 2 and 3: Qualitative Analysis.

Semi-structured interviews were conducted to gather qualitative data using a phenomenological approach (Creswell, 2012). The method for data analysis followed thematic analysis for transcendental phenomenology (Moustakis, 1994), which includes bracketing, data reduction, textural description, structural description, and thematic or essence description. The researcher's role was to collect data relative to the experiences of the health care pstudent ractitioner describing his or her transition into clinical practice with regard to the ability to improve practice in the areas of safety, communication, screening, and plan of care (research question 2) and overall practice in a collaborative manner and practice the skills learned during the interprofessional education curriculum (research question 3).

Trustworthiness.

The analysis of the data provided in the methodology was guided by Colaizzi's phenomenological method of data analysis (1978) and validation strategies exemplified by Creswell (2013). The first step ws achieved through multiple reviews of each recording so that the feelings and sense of feelings in which the participant was conveying can be captured. This

data also will be shared with the participants with the instruction to add any other relevant information, context, or correct any misinterpretations. This form of member-checking added to the validity of the data. As data analysis ensued as described above, meanings, clustered themes and emergent themes were verified by an external expert. The exhaustive description was reduced to a fundamental, or essential structure of the phenomenon. Assessing the flow of logic in making these connections done through consultation with an expert in the field served as an establishment of validity and trustworthiness of the data, especially as exhaustive description took place and were integrated into the development of a structure of the phenomenon.

The aforementioned data analysis plan supported trustworthiness in the data. This is evident in the methodology's use of member checking, routine peer review as described during the organization of themes or during the exhaustive description stages, and thick, rich description that was provided. In addition, positionality of the researcher was noted and addressed as best as possible due to proximity of the researcher with the participants or their supervisors. It was also likely evident to these individuals that the researcher has been involved in the IPE curriculum, resulting in potential bias due to a vested interest in the programming. However, trustworthiness in the data collection was be evident due to the ample time for data collection, adherence to the interview protocol, and focus on data saturation as a study end point. An audit trail for the data collected was generated through the use of complete audio recordings of the interview, field notes collected during the interview, reflective journaling, and descriptive transcription. The use of this procedure allowed for accurate generation of data to be examined in the data analysis. Therefore, trustworthiness was well established with these considerations.

Last, trustworthiness and validity of the data and analysis in this study is supported through the sampling and focus on data saturation as a means to sample size determination. If there was disagreement in the data or development without true development of fundamental structure in the phenomena, more individuals may be invited to participate. Thus, the sampling and data-focused nature of the study addressed concerns.

CHAPTER 4: RESULTS

Introduction

This study intended to examine the impact of a formal IPE curriculum on the clinical practice of Doctor of Physical Therapy students through a mixed methods approach. The study sought to examine this impact through the evaluation of clinical performance of students via the clinical performance instrument scores provided by clinical instructors, and the analysis of semi-structured interviews with a sample of students. Thus, it pursued not only identifying if performance was impacted by the IPE curriculum, but also how it may have been impacted. The purpose of this study was achieved by examining scores of the cohort of students in clinical internships immediately after completion of the formal IPE curriculum, followed by semi-structured interviews exploring the possible impact further as well as identifying how the students were able to translate learned experiences into the clinical environment to influence patient care.

This chapter presents the results of the data analyses related to the stated research questions. For analysis of the first research question and all related sub-components, descriptive statistics are reported, along with internal consistency statistics of the clinical performance instrument. Next mean score comparisons of the experimental student cohort to a historical control group are presented, followed by an examination of proportions of students from the experimental and control groups who met high standards, known as “entry-level” performance. The second and third research questions were assessed through thematic analysis of the semi-structured interviews that were guided by an interview template that included specific questions and prompts.

Consistent with convergent parallel design, collection and analysis of quantitative data from the clinical performance instrument occurred independently from the data collection and analysis from the semi-structured interviews. These analyses transpired prior to triangulation and synthesis of the results (Creswell & Plano Clark, 2011).

Testing Research Question 1

Quantitative Analysis: Independent and Dependent Variables.

The dependent variable in this study was clinical performance as measured by the clinical performance instrument data in several domains of the 18-item instrument. These domains included individual items from the instrument as follows: safety, communication, screening, and plan of care. It also included compiled score averages for professional practice, which consisted of the mean of six professional practice items that are specifically denoted on the performance instrument, and patient management, which consisted of the mean of twelve patient care items, which are also denoted on the performance instrument. The independent variable was IPE group, which was based on the year of graduation of the student.

Quantitative Analysis: Descriptive Statistics.

The experimental group in this study consisted of a cohort of 35 doctoral students, who represented the graduating class of 2020. The historical control group consisted of 112 students, which consisted of students from the classes of 2014, 2015, and 2016. In order to accept the compiled historical control group, a-priori assessment of the cohort scores in the dependent variables from the class of 2014, 2015, and 2016 was conducted through both and analysis of

variance and Kruskal–Wallis test. Both tests resulted in no mean score or mean rank differences at $p<.05$.

In order to utilize a complied score average of professional practice and patient management domains as dependent variables, an internal consistency reliability analysis was conducted. This analysis found excellent internal consistency reliability via a Cronbach alpha of .950 for the overall sample in professional practice and .977 for the overall sample in patient management. In addition, the scores for each group of students based on IPE training within each domain of practice were over .90 for internal consistency reliability (Table 1). The mean scores for the compiled domains of professional practice and patient management were thus included in this study as measures of clinical performance, along with other individual performance items. The mean scores and standard deviations for these variables can be viewed in Table 2.

Table 1.
Internal Reliability

Clinical Performance Criteria	IPE Group	Cronbach's Alpha
Professional Practice	IPE training	.933
	No IPE training	.953
	Overall	.950
Patient Management	IPE training	.987
	No IPE training	.975
	Overall	.977

Table 2.
Descriptive Data for Clinical Performance Instrument Scores

Clinical Performance Criteria	IPE Group	Mean (SD)	Skewness (SE)	Kurtosis (SE)
Professional Practice	IPE Training	17.27 (1.29)	.920 (.398)	1.810 (.778)
	No IPE Training	17.43 (1.64)	-.436 (.228)	1.757 (.453)
Patient Management	IPE Training	16.34 (1.58)	-.251 (.398)	0.100 (.778)
	No IPE Training	16.79 (1.67)	-.760 (.228)	3.500(.453)
Safety	IPE Training	17.20 (1.47)	.985 (.398)	1.305 (.778)
	No IPE Training	17.20 (1.63)	-.183 (.228)	1.804 (.453)
Communication	IPE Training	16.80 (1.62)	-.138 (.398)	1.659 (.778)
	No IPE Training	17.23 (1.80)	-.318 (.228)	1.550 (.453)
Screening	IPE Training	16.23 (1.72)	-.266 (.398)	0.023 (.778)
	No IPE Training	16.51 (2.24)	-2.749 (.228)	15.852 (.453)
Plan of Care	IPE Training	16.26 (1.77)	-.213 (.398)	-0.085 (.778)
	No IPE Training	16.85 (1.68)	-.091 (.228)	1.175 (.453)

Prior to examination of inferential statistics, examination of normality of data was conducted through assessment of visual inspection of histograms and examination of skewness, kurtosis, and Shapiro-Wilk test of normality (Cain, Zhang, & Yuan, 2017; DeCarlo, 1997). Skewness was significantly non-normal for the screening item in the control group with a value of -2.749 (SE =.228), while all other items were within normal skewness. Kurtosis however was significantly non-normal for every dependent variable in the control group (No IPE training), while the scores for the IPE training group were kurtotic for communication and professional practice variables (Table 2).These findings were substantiated through the Shapiro-Wilk test for normality which found statistically significant deviation from normality in every dependent variable in the control group and all but one variable for the experimental group (Table 3).

Therefore, to conduct mean differences between the experimental (IPE training) group and control (No IPE training) group, nonparametric inferential statistics were utilized to address the first research question (Cain, Zhang, & Yuan, 2017).

Table 3.
Tests for Normality of Dependent Variables

Clinical Performance Criteria	IPE Group	Shapiro-Wilk statistic	Degrees of freedom	Significance level
Professional Practice	IPE Training	.907	35	.006
	No IPE Training	.923	112	.000
Patient Management	IPE Training	.960	35	.224
	No IPE Training	.921	112	.000
Safety	IPE Training	.839	35	.000
	No IPE Training	.872	112	.000
Communication	IPE Training	.860	35	.000
	No IPE Training	.915	112	.000
Screening	IPE Training	.921	35	.015
	No IPE Training	.763	112	.000
Plan of Care	IPE Training	.933	35	.035
	No IPE Training	.912	112	.000

Quantitative Analysis: Inferential Statistics.

In this study, descriptive and inferential statistics were used to examine the first research question and all of its components (a-f). Level of significance was set *a-priori* at $p<.05$ to determine statistical significance for all analyses, which is consistent with commonly used statistical practices (Gall, Gall, & Borg, 2007). Due to non-normality of data, the non-parametric

equivalent of the analysis of variance, the Mann-Whitney U test was conducted to examine mean group differences for research question 1 (a), (b), and (e). Research question 1 (c), (d), and (f) investigated the proportion of students in both groups who meet the "entry level" designation to determine an association between these high performers and IPE training. To identify students who met "entry level" performance level, the interval data provided by the clinical performance instrument was transformed to nominal level data by designating each student who achieve a score of 17 on the 21-point scale as "entry level" while those who were less than 17 were designated as "below entry level." A 2x2 contingency table was developed using this data for each variable and a chi-square statistic was utilized to examine this association with Cramer V to measure size effect if significance was found.

Research Question 1(a).

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? (a) Does the average of professional practice scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? The professional practice average score was calculated for both the experimental and control group. A Mann-Whitney U test found no statistically significant difference in the mean scores of the groups ($U=1712$; $p=.257$). Thus, students who received IPE training (Mean rank = 66.91) did not achieve higher professional practice average scores compared to the historical control group who did not receive IPE training (Mean rank = 76.21).

Research Question 1(b).

Does the clinical practice of doctor of physical therapy (DPT) students improve after completion of an IPE curriculum?(b) Does the average of patient management scores differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? The patient management average score was calculated for both the experimental and control group. A Mann-Whitney U test found no statistically significant difference in the mean scores of the groups (U=1608; p=.108). Thus, students who received IPE training (Mean rank = 63.94) did not achieve higher patient management average scores compared to the historical control group who did not receive IPE training (Mean rank = 77.14).

Research Question 1(e).

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? (e) Does the clinical practice scores of the practice domains within the performance instrument that closely align with IPEC core competencies differ between DPT students who have completed an IPE curriculum and historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? These domains included safety, communication, screening, and plan of care. Mann-Whitney U tests conducted on each of the mean rank scores for these four variables failed to reject the null hypothesis ($p>.05$). Although higher mean rank scores were found in the control group for each variable, no statistically significant difference in the mean scores of the groups were found (Table 4). Thus, students who received IPE training did not

achieve higher scores in safety, communication, screening, or plan of care compared to the historical control group who did not receive IPE training.

Table 4.
IPE Group Comparisons

Clinical Performance Criteria	IPE Group	Mean rank	Mann-Whitney U statistic	Significance
Professional Practice	IPE Training	66.91	1712.0	.257
	No IPE Training	76.21		
Patient Management	IPE Training	63.94	1608.0	.108
	No IPE Training	77.14		
Safety	IPE Training	70.59	1840.5	.556
	No IPE Training	75.07		
Communication	IPE Training	66.80	1708.0	.229
	No IPE Training	76.25		
Screening	IPE Training	66.71	1705.0	.224
	No IPE Training	76.28		
Plan of Care	IPE Training	62.84	1569.5	.064
	No IPE Training	77.49		

Research Question 1(c).

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? (c) Does a greater proportion of DPT students who completed an IPE curriculum achieve "entry-level" designation in professional practice scores compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? Approximately 85.7% of the IPE training group (N=30) and 84.8% of the no IPE training group (N=95) achieved entry level status in the professional practice average score. The chi-square analysis found no statistically

significant relationship in IPE training with achievement of entry level status (X^2=.017; p=.897). The data for professional practice achievement as well as the ensuing other proportions and chi-square analyses can be visualized in Table 5.

Table 5.
Comparisons of Proportions

Clinical Performance Criteria	IPE Group (N)	Entry Level: Group Percent (N)	Chi-square Statistic	Significance
Professional Practice	IPE Training (35)	85.7 (30)	.017	.897
	No IPE Training (112)	84.8 (95)		
Patient Management	IPE Training (35)	54.3 (19)	2.80	.094
	No IPE Training (112)	69.6 (78)		
Safety	IPE Training (35)	77.1 (27)	.284	.594
	No IPE Training (112)	81.3 (91)		
Communication	IPE Training (35)	74.3 (26)	.016	.900
	No IPE Training (112)	73.2 (82)		
Screening	IPE Training (35)	54.3 (19)	1.13	.288
	No IPE Training (112)	64.3 (72)		
Plan of Care	IPE Training (35)	48.6 (17)	4.71	.030[a]
	No IPE Training (112)	68.8 (77)		

[a] Cramer's V statistic = .179

Research Question 1(d).

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? (d) Does a greater proportion of DPT students who complete

an IPE curriculum achieve "entry-level" designation in patient management scores compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? Approximately 54.3% of the IPE training group (N=19) and 69.6% of the no IPE training group (N=78) achieved entry level status in the patient management average score. The chi-square analysis found no statistically significant relationship in IPE training with achievement of entry level status (X^2=2.80; p=.094).

Research Question 1(f).

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? (f) Does a greater proportion of DPT students who complete an IPE curriculum achieve "entry-level" designation in the practice domains within the performance instrument that closely align with IPEC core competencies compared to historical norms of DPT students who have not completed an IPE curriculum (2014-2016) at a large public university in the southeastern United States? These domains included safety, communication, screening, and plan of care. For safety, the proportion of students with IPE training that met entry level designation (77.1%) was slightly less than the proportion of students from the group who did not have IPE training (81.3%). The chi-square analysis found no statistically significant relationship in IPE training with achievement of entry level status (X^2=.284; p=.594). For communication, the proportion of students with IPE training that met entry level designation (74.3%) was slightly greater than the proportion of students from the group who did not have IPE training (73.2%). The chi-square analysis also found no statistically significant relationship in IPE training with achievement of entry level status for communication (X^2=.016; p=.900).

In the domains of screening and plan of care, there was a much greater difference in proportions of students from the groups who met the entry level designations. In screening, approximately 54.3% (N=19) of the students in the IPE training group achieved entry level status, while 64.3% (N=72) of the students in the no IPE training group met entry level (Table 5). However, the chi square analysis did not find a statistically significant relationship between IPE training and achievement of entry level status in screening (X^2=1.13; p=.288). For plan of care, there was also a greater difference in proportion of students who met entry level designation in each group. Approximately 48.6% (N=17) of the students in the IPE training group achieved entry level status, while 68.8% (N=77) of the students in the no IPE training group met entry level. In this case, the chi square analysis did find a statistically significant relationship between IPE training and achievement of entry level status in screening (X^2=4.71; p=.030). The Cramer's V statistic (.179) for effect size was small in this case (Cohen, 1988). Thus, students without IPE training had a significant relationship with meeting entry level designation, with a small effect.

Testing Research Question 2 and Research Question 3

Qualitative Analysis: Research Question 2 and Research Question 3.

Research questions 2 and 3 were assessed through thematic analysis of the semi-structured interviews that were guided by an interview template that included specific questions and prompts. Ten consecutive respondents to an electronic solicitation from the class of 2020 were consented and enrolled into the study the semester immediately following their clinical internship. During the semi-structured interviews, the same interview protocol involving questions and prompts was utilized and all interviews were recorded. During each recording,

member checking was conducted at the end of the interview to ensure trustworthiness of data. The audio recordings were reviewed multiple times and cross referenced with field notes, which allowed the development and organization of textural and structural descriptions, and formation of themes that addressed the research questions. Saturation was achieved with the data from the collective sample of students as the final interviews did not offer new descriptive information that differed from the initial interviews (Creswell, 2013).

The analysis of the research question 2 identifies the "what" of patient care which has been impacted due to IPE in this student cohort. The first part of question 2 is followed by a more directed inquiry (question 2(a)) which specifies certain areas of practice. Thematic analysis consisted of multiple reviews of audio recordings, field notes, and reflective journaling to create a textural description. Textural description contributed to the creation of structural descriptions where themes for each participant emerged. To determine a salient theme for this research question, examination of the structural descriptions took place to ascertain agreement among participants. If a theme was included in the structural descriptions from five participants, this was considered a salient theme relative to the research question.

While research question 2 was an examination as to "what" the impact of patient care was due to IPE curriculum, research question 3 is a deeper examination of "how" students were able to translate interprofessional learning into the clinical practice environment. In regard to this research question thematic analysis transpired in a similar mechanism, with creation of major themes that best describe how the patient care of students was impacted and translated into the clinical practice environment. Emergence of themes relative to research question 3 was determined if consistency of themes existed between at least five of the participants in the study.

Further, the emphasis or weighting of the prominent themes for research question 3 was provided through composite scoring system in which the frequency of the theme being included within the structural description for all the participants, and also a count of number of times a core term associated with the theme was stated throughout the textural description for all the participants.

Research Question 2.

What has been the impact of an IPE curriculum on patient care in the clinical practice environment? This research question was addressed through examination of data from responses associated with interview template questions 4,5, and 10 (Appendix E). Several prominent themes emerged from the data, which suggested a significant impact on patient care due to the IPE curriculum. These themes are as follows.

Students felt that the IPE curriculum increased their ability to care for their patient through enhanced communication skills and heightened awareness of roles of other health care providers. Specifically, communication was explicitly stated as an impact of the IPE curriculum on clinical patient care by six of the participants. In addition, mention of the impact of knowledge of roles of other providers was stated by nine of the ten participants.

Participant 1 noted that "more open communication about patient care developed" with other healthcare providers due to the increased comfort with communication from IPE experiences. In similar nature, participant 4 reported her "ability to treat patients was improved based on understanding of roles" and a greater ability to communicate patient care needs to other providers. Other students remarked on increased efficiency of communication and fluidity of care that was enhanced. Last, participant 9 summarized by stating that a better understanding of

patients' needs allowed an improved ability to manage their care, and that after the IPE curriculum, he was "looking for things that I was not previously looking for."

Students were more able to hold a deeper understanding of their patient needs and engage in critical inquiry. Linked to the heightened awareness of roles and improved communication skill was the progression of depth of understanding of patient needs and improved ability to manage patient needs. Students believed that they had improved their critical thinking, clinical decision-making and problem solving. Much of this was noted in participants who reported increased evaluation skills and development and implementation of a patient plan of care. Specifically, six of the ten participants discussed the improved ability to evaluate, coordinate, and manage their patient care more effectively. Participant 10 noted the improvement with critical thinking and ability to identify patient problems and their needs. He also noted he could now more "quickly and seamlessly streamline patient care." This notion was reinforced by both participant 2 and 8, who noted improved ability to comprehensively manage patient care for complex patients with multidimensional needs. Linking these themes together, Participant 4 noted that understanding the roles of other disciplines and gaining experience with communication through IPE improved her comfort. She noted with this established comfort, she was able to identify patient needs more readily in clinic due to engagement in higher level conversation and problem solving.

Research Question 2 (a).

Have areas of professional practice, patient management, and subdomains of safety, communication, screening, and plan of care been improved? This subset research question was

addressed through examination of data from responses associated with interview template question 6, which queried these areas specifically by name (Appendix E). This question followed question 5, which examined clinical practice skills without the leading of the participant to these specific areas to allow some of the topics to be conveyed organically from the participants' responses.

Professional practice was recognized by the students as a compilation of existing areas of the performance instrument. Although many could not recall all of them by name, the group established a consistent theme related to practice in this overall domain. Without prompting to the inclusivity of the list of these areas, six students identified a significant role in communication, which is one of the six subsets that forms professional practice in the performance instrument. However, many students also noted that other areas of professional practice were not as relative to learned experiences in the IPE curriculum. Four of the ten participants noted that many professional behaviors are either inherent from one's personal upbringing, instilled in them as they mature into adulthood, or a product of their professional degree program socialization into the profession.

Patient management was a category recognized as a compilation of numerous areas in the performance instrument by the participants. The data produced strong themes from this line of questioning as all participants recognized areas of patient management that were impacted due to IPE. Students were more able to comprehensively manage their patient care through understanding roles, communication, interaction, and coordination of care. Within this specific line of inquiry in the interview, half of the respondents directly reported the knowledge of roles of other providers allowed for improved patient management, while half of the participants also

noted that elevated communication and interaction with other providers had a direct impact on their patient care.

Safety was an area of practice that students suggested a weaker effect from IPE. While four students noted communication skill development from IPE enhanced their ability to identify "red flags" in patients they treated, three of the students noted that such identification of patient problems was more so attributed to the preparation within the academic degree program. Another weaker theme emerged in the reporting that role understanding was able to influence the ability to seek and identify areas of concern that may not have been thought of previously. This was identified in participant 7 and participant 8 who felt that interaction with behavioral health students heightened their awareness of psychosocial factors in patients they later treated.

Communication was a practice area that developed very strong agreement with the participants. All participants reported improved communication in practice due to IPE. Students all felt their patient care was positively impacted due to enhanced communication. Notably, participant 5 reported that IPE enhanced his clinical communication, and that such skills are an "instrumental part of patient care." In addition, participants 2, 9, and 10 added to the support of developing communication skills within the IPE curriculum. All participants noted that while communication was initially developed in the IPE environment, it was further developed and enhanced once gaining more experience, especially in the clinical environment.

Screening is an area of practice that developed strong agreement among the participants. All ten participants identified improvement in the ability to manage patient care through improvement in the screening domain because of IPE. This improvement was achieved through enhanced understanding of roles and communications with other providers. Participant 1

emphasized the added "dimensions" of patient care that were recognized due to understanding of roles of other providers. This contribution of roles to the improvement of screening was echoed in seven other participants. Participants 4, 7, and 10 notes that the improved coordination of care was especially evident in the management of complex patients who had cases that necessitated higher level of problem solving and discussion with other providers.

Plan of care is an area of practice that in which participants had strong agreement of emergent themes. Seven of the ten participants noted improved coordination of care and communication skills developed in IPE contributed to developing and implementing a plan of care in the clinical setting. In similar fashion as other practice areas, it was also noted that knowledge of roles of providers also contributed to the plan of care for patients in the clinical setting.

Research Question 3.

How have DPT students who have completed an IPE curriculum been able to translate interprofessional learning into the clinical practice environment? Research question 3 was addressed through examination of data from responses associated with interview template questions 8 and 9 (Appendix E). Research question 3 is a deeper examination of "how" students were able to translate interprofessional learning into the clinical practice environment. At this stage of the analysis, thematic analysis transpired resulting in the creation of major themes to best describe "how" the patient care of students was impacted and translated into the clinical practice environment. A breakdown of emergent themes and sub-themes developed by participants through structural description is presented in Table 6, while the compilation into

prominent themes and their sources from the data are reported in Table 7. From this analysis several themes emerged.

Table 6.
Thematic Development: Structural Descriptions

	Emergent Themes	Sub-themes or comments
Participant 1	Communication	Efficiency of care; patient-centered needs
	Real world experiences	Authentic learning
	Knowledge	Roles; resources; focus of other providers
	Interactions	Teamwork; experiences with group; building comfort
Participant 2	Communication	Increases with group experiences; improve comfort
	Roles	Awareness; confidence; understanding
	Experiences	Real life; navigate positive and negative interactions
	Interactions	Efficiency of care; improve trust; patient management
Participant 3	Communication	Built comfort; enhance patient management
	Experience	Managing interactions; differing opinions; practicing communication
	Clinical experience	Real world; social interactions; different perspectives
Participant 4	Knowledge	Understanding roles; management of patient care contribution
	Communication	Increase efficiency; role understanding
	Experience	Increase knowledge and contribution to care; real patient interaction
	Interaction	Group; exchange ideas; authentic interactions
Participant 5	Experiences	Real life; real patient care; group interactions
	Knowledge	Roles of providers; comprehensive care; enhance patient specific needs
	Interaction	Different perspectives; group dynamics; practice strategies for communication
	Communication	Patient interaction; group interaction
Participant 6	Interactions	Other provider involvement improved care; social in settings different; teams

	Emergent Themes	Sub-themes or comments
	Roles	Understanding enhances communication; patient management enhanced
	Experiences	Interactions with other providers; improves comfort; environment facilitates
	Communication	Strong coordination of care; comfort cultivated and enhanced for practice with other professionals
Participant 7	Environment / Setting	Real world settings; patient interactions more meaningful; setting cultivated or hindered
	Communication	Active listening; patient to provider; and provider to provider
	Interaction	Social interaction with others developed understanding; cultivated communication
	Experience	Enhanced knowledge; awareness of roles; real world and problem based; more awareness of patient needs
Participant 8	Experience	Increases comfort; clinical experience gives perspective
	Interactions	Patient interactions; provider interactions; active listening establishes trust; positive experiences have greater interaction
	Communication	Respectful communication develops mutual trust; active listening contributes to positive interactions
	Roles	Knowledge enhances patient management and evaluation skills
Participant 9	Roles	Understanding enhanced with more experience; more clearly identifiable with patient interactions; self-awareness; referral
	Communication	Experience enhances; comfort increased with interactions; patient specific needs; settings varied applicability
	Experience	Experience in environment; clinical value
Participant 10	Collaboration	Interactions; team mindset; role understanding enhances; group interactions
	Experience	Contributions in clinic and class improved congruently;
	Roles	Understanding enhanced management and collaborative behaviors; enhanced self-awareness

Experience contributes to clinical learning and performance. The importance of experience was substantiated very strongly in the data. A theme emerged relative to experience in all ten participants. Additionally, all ten participants noted that experience positively contributed to learning in the IPE program and allowed transfer of learning into the clinical environment. Participant 8 noted that experiences working with groups and teams contributed to clinical practice performance, while participant 6 directly stated that clinical performance was due to "experiences interacting with other professionals." This notion was affirmed by participant 1 who stated "experience communicating with other providers" contributed to improved performance in safety domains of practice. In similar manner, participant 2 added that experience negotiating negative interactions contributed to her ability to perform well in professional practice areas.

Participants noted a significant contribution of real life experience in the learning process in many ways. First, participants noted the importance of the live patient experiences in the IPE curricula. All ten participants reported that the standardized patient or the live patient interaction were most memorable IPE moments. Three participants felt that these specific events were notable in that they elevated the attentiveness and engagement of all group members. Participant 5 noted "pen and paper with limited real life experiences…limits transferability of what we learn to the real world." However, he further added another dynamic by stating "IPE events are more important than classroom work, but not as valuable as learning in clinical experiences, which is a more authentic learning environment." Such positions were shared by participant 7 who reported clinical experience was instrumental in developing communication skills initially developed in IPE, while participant 9 added that "internship experience substantiates what is learned in IPE."

Finally, this authentic learning relative to experience was promoted succinctly by participant 8 who stated, “to get better at something you got to literally do it.” Participants in this study recognized the value of experience and drew upon their experiences in IPE to be successful in the clinic.

Communication skills translate to improved patient care. The next major theme that was well substantiated in the data was communication. Nine of the ten participants developed significant themes in communication, while the tenth developed a very closely related theme, collaboration. Students recognized the enhancement of communication that evolved from IPE was able to be practiced and translated to the clinical practice environment. Students felt that with more knowledge, experience, and practice, communication skills improved. Participants lined the importance of communication skills to patient management, coordination of care, and efficiency of care (Table 6). Participant 1 reported that her “open communication about patient care developed with other providers” as they became more aware of each other’s abilities. Participant 2 added that “confidence in communication in clinicals as a result of IPE…lent itself to more experience…. the more you are exposed to it the easier it gets.”

Notably, other participants related communication concepts directly to the clinical environment. Balancing communication and exchange of ideas was improved with IPE experiences. Participant 3 reported that the “ability to practice interacting and communicating with individuals who have different focus and styles of communications assisted in ability to work with other providers in clinic...communication is most relatable to clinical environment.” She further reported that practicing communication to others has allowed improvement and ability to perform successfully in the clinical environment. Last, participant 9 stated that

communications and interactions from IPE allowed better translation to clinical practice environment for patient-centered rounds in hospital.

Application of role understanding improves efficiency and quality of care. Understanding roles of other providers from different disciplines was a significant theme or sub-theme in nearly all participants. The emergence of role understanding in the data was nearly always attributed to being better able to manage the patient care. Students acknowledged learning roles of other students throughout the IPE curriculum and recognized the importance of understanding the applicability in the clinical environment. Participant 2 noted that the knowledge of roles improved comfort in referring patients to other providers to better utilize all members of the health care team more appropriately. Participant 8 affirmed this by reporting "IPE gave knowledge of other roles and abilities of other disciplines…. heightened awareness of areas of practice that impact patient care." Thus, he was able to conduct a more comprehensive evaluation of the patient needs.

As understanding of roles was established, participants noted they were able to elevate their care. Per participant 10, "once I was more aware of others' roles, responsibilities, strengths, and perspectives, I was more comfortable with approaching other professions and deferring to others" in the clinical setting. Participant 4 added "my ability to treat patients was improved based on my understanding of roles" which allowed him to "have a higher level conversation with other providers about a specific patient need…to problem solve patient needs. This concept was also reinforced by participant 5 who reported that his problem solving capacity was enhanced and participant 9 who noted that the interaction with other providers improved efficiency of care. Finally, participant 10 added that knowledge of roles and responsibilities

"improved critical thinking" and allowed him "to come to a conclusion with patient problems and better identify their needs."

Interactions build collaborative care. The last major theme that emerged from the data was the concept of interactions. The concept of interactions or collaboration were identified in the significant themes or sub-themes of every participant. Each of these areas refers to either group, team, provider, or patient interactions. All participants noted significant value to social interaction via interpersonal or team dynamics in their responses.

First, interactions built into the IPE curriculum enhanced communication skills. Participants 2, 8, and 9 all reported that the interactions instilled confidence in their future communications in the clinical setting. Participant 8 added a different perspective, however, by adding the experiences he had with interactions involving both verbal and non-verbal communications of team members. Participant 2 added a dynamic to this concept as well by noting that navigating negative interactions with a team member specifically aided her comfort with managing similar scenarios in the clinical setting. Participant 3 affirmed this type of interaction, but also conveyed that such interactions have allowed him to manage discourse in the more complex clinical environment. He reported that he has been able to be more tolerant of altered viewpoints from other providers and noted the volume of social dynamics that exist in health facilities and hospitals.

While these interactions are more interpersonal in nature, others reported on interactions that cultivated a more direct influence on patient care. Many participants drew on their problem solving interactions that seemed to translate into the clinic. Participants 2 and 4 noted the team interactions in IPE contributed to the team based problem solving that is necessary in the clinical

environment. Patient management, referral to other providers and identification of complex patient needs all require multiple interactions with other providers.

As recognized by participant 7, clinical settings possess more genuine interaction of multiple providers with patients. In supporting fashion, learning experiences that align with clinical interaction involving groups or teams in a problem based learning structure allowed translation of learning from classroom to clinic. These concepts were supported by participants 4, 5, 8, and 10. Of particular note, participant 10 reported that experience working with teams and interactions creating collaborative approach to patient care were valuable and associated with clinical practice. Navigating interpersonal dynamics involving patients and other health care providers allowed for an improved ability to problem solve patient needs. Participant 8 adds that more experiences with group interactions allowed for improved future interactions and enhancement of positive dynamics for future events, activities, and patient care.

Table 7.
Thematic Development: Salient Themes

Compiled Theme Titles	Origin Participant Themes	Source
Experience contributes to clinical learning and performance	Experience, Real World Experience	Participants 1-10
Communication skills translate to improved patient care	Communication	Participants 1-9
Application of role understanding improves efficiency and quality of care	Roles; Knowledge of roles	Participants 1-2; 4-6; 8-10
Interactions build collaborative care	Interactions, Collaboration	Participants 1-5; 7-8; 10

The emphasis or weighting of the emergent themes for research question 3 was provided through composite scoring system. The frequency counts include the number of participants

whose data reflected the given theme within his or her associated structural description. In addition, the overall count of the core term associated with the theme within the textural descriptions for all participants was conducted. Data reflecting these counts associated with the emergent themes is provided in Table 8.

Table 8.
Salient Themes: Emphasis / Weighting

Theme	Frequency Count of Theme	
	Structural Description: #Participants	Textural Descriptions: # References
Experience contributes to clinical learning and performance	10	90
Communication skills translate to improved patient care	9	127
Application of role understanding improves efficiency and quality of care	8	82
Interactions build collaborative care	8	124

Conclusion

In this chapter an introduction was provided to review the purpose of the study and identify the mechanisms by which the stated research questions were to be answered. This was followed by a brief discussion of the independent and dependent variables as well as the descriptive and inferential statistics used to answer the first research question and all of its components.

While the instrument measuring the dependent variable demonstrated very strong internal consistency for the groups of students (α=.933 - .987), non-normality of the of the data identified with Shapiro-Wilk tests resulted in the use of non-parametric analyses for group comparisons.

Thus, all subcomponents of research question 1 that examined group comparisons used a Mann-Whitney U test, while those subcomponents of research question 1 that examined proportions of the student cohorts meeting "entry level" designation was conducted via a chi-square. The group comparison analyses resulted in failure to reject the null hypothesis for all components in the research question examining mean scores of the control versus intervention group. Therefore, there was no statistically significant difference in clinical performance between the groups using this scale. In addition, all proportions of students meeting "entry level" designation were not significantly different in all domains except plan of care. In this domain, however, the control group had a significantly greater proportion of students who met entry level designation, but with only a weak effect identified via Cramer's V effect size.

The second and third research questions were addressed through a qualitative approach via semi-structured interviews. In response to research question two, analyses identified strong support of influence of the IPE curriculum on communication, screening, plan of care, and patient management, whereas professional practice and safety were weakly supported. Thematic analysis for research question 3 resulted in four themes that were congruent with findings of question 2. These themes were as follows: (1) experience contributes to clinical learning and performance, (2) communication skills translate to improved patient care, (3) application of role understanding improves efficiency and quality of care, (4) interactions build collaborative care.

The next chapter will present a summary, discussion, and conclusion of the findings. The focus will be on convergence of the data, with relation to practice, and insight into future directions of study.

CHAPTER 5: SUMMARY, DISCUSSION, AND CONCLUSION

Introduction

In the previous chapter, the presentation and analysis of quantitative and qualitative data have been reported. This chapter consists of a summary of the study and followed by discussion of the findings. The discussion of the findings is organized by each research question but also includes convergence of the data, and support of the conceptual framework for the study. This chapter also includes implications for practice, recommendations for further research, and conclusions. The purpose of these latter sections is to contextualize the findings in order to provide a better understanding of this research as it relates to IPE and translation of interprofessional learning into the clinical practice environment. Last, synthesizing statements are offered to reflect the essence and extent of what has been attempted in this research.

Summary of the Study

The purpose of this study was to examine the impact of a formal IPE curriculum on the collaborative practice of Doctor of Physical Therapy students. The study focused on the ability of the IPE curriculum to influence the actual patient care provided by students in clinically immersive environments upon their completion of their formal IPE curriculum. The IPE curriculum was developed in congruence with guidelines provided by the IOM (2015) and IPEC (2016).

To meet its stated purpose the study employed a mixed-methods approach in a convergent -parallel design to triangulate the quantitative data from the clinical performance instrument with qualitative data from semi-structured interviews. Quantitatively, student clinical

performance was examined through use of a previously validated instrument (Roach et al., 2012). For purposes of this study the data from the instrument only included domains of the instrument that were aligned with established core competencies for interprofessional education (IPEC, 2016), which is demonstrated in Appendix D. The scores were provided by trained clinical preceptors who supervised the students in their internship within the semester immediately after completion of the IPE curriculum. The study further sought to explore how students are able to apply their interprofessional learning to enhance their clinical practice through these core competencies. Thus, this study aimed to examine both the "what" and "how" of IPE impact on clinical practice as students transition from traditional academic to health care environments.

Several research questions were designed to meet the study's state purpose. Research question 1 examined the impact on patient care strictly through a quantitative lens. Sub-components of research question 1 were developed to examine various constructs of patient care in six areas, which included professional practice, patient management, safety, communication, screening, and plan of care. Due to potential for the presence of a ceiling effect with use of this 21-point scale, and the potential for bias from external raters who were using the instrument in an educational capacity, additional sub-components to research question 1 were formed. This involved examination of proportions of students who met a level or performance beyond the current educational expectation, known as "entry-level" designation on the instrument. This was denoted with those students who received a score of 17 or more on the 21 point scale.

Research questions 2 and 3 were examined using a qualitative approach to through phenomenology. First, research question 2 sought to examine the impact of the IPE curriculum

on clinical practice first without guidance to domains of practice (research question 2), and then again in regard to the previous six areas of practice (research question 2a). Last, research question 3 examined "how" the IPE curriculum had an impact on the clinical practice of students as they transitioned to practice.

Discussion of the Findings

Research Question 1.

Does the clinical practice of Doctor of Physical Therapy (DPT) students improve after completion of an IPE curriculum? Research question 1 was examined through quantitative analyses using two different approaches. The first approach, aligned with research question 1(a), 1(b), and 1(e) examined mean scores of the cohort who attended an IPE curriculum compared to the historical control who did not have an IPE curriculum. The cohort of students who underwent the IPE curriculum did not possess significantly greater scores in the six areas of clinical practice examined in this study. These six domains were professional practice, patient management, safety, communication, screening, and plan of care. In fact, the mean scores of the IPE group were slightly lower in each of the six categories, although none of those differences met statistical significance. Such issue could have been related to the unequal sample sizes, with the IPE (experimental) group being nearly one-third the size of the non-IPE (control) group. Thus, changes in just a few student performance scores in the IPE group could have had a greater impact on the sample mean.

Data related to research question 1 had some violations of normality as observed in Table 2 and Table 3. This was observed both through examination of skewness and kurtosis as well as

the Shapiro-Wilk test. To determine impact of skewness and kurtosis values, raw scores and standardized scores were considered. While normal expectation for raw scores is that the score falls between -1 and +1, influence was only determined if the standardized value, calculated by score divided by error, it greater than 3 (Cain, Zhang, & Yuan, 2017; DeCarlo, 19997; Ho & Yu, 2015). Examining the variables from this perspective, one group possessed significant skewness in screening, while in the control group, all six of the variable domains were significantly kurtotic. Further, although not all values in skewness were at the level of concern, all of them were negative, which indicates a potential ceiling effect (Ho & Yu, 2015). In regard to the Shapiro-Wilk test for normality, it was found that at least one group within each of the six domains assessed violated normality assumptions (Table 3).

For these reasons of violation of normality, non-parametric inferential statistics were utilized for group comparisons, which treated the data as ordinal in nature. Mann-Whitney U tests conducted on group rank scores did not find group significantly different in clinical performance scores at the $p<.05$ level. Thus, the IPE curriculum did not appear to have an effect on the scores of students as rated by their clinical preceptors when examining mean scores.

The second approach to research question 1 examined proportions of students who received scores placing them into an "entry-level" designation. This analysis was associated with research question 1(c), 1(d), and 1(f). An "entry-level" designation was indicated by a score of 17 or more on the 21-point scale. This procedure was utilized due to the suspicion by the investigator that a ceiling effect may exist due to the construct of the performance instrument being confined to a 21-point scale, and to attempt to mitigate any potential bias from the raters. Since the activity being examined in association with this study is a component of the

educational process for DPT students, the internship is associated with a university course. In accordance with expected procedures for the course, both the students and the clinical preceptors are provided expectations of performance, which includes established score level of 14 (advanced intermediate) on the 21-point scale as a score the student should receive in order to successfully receive a passing grade in the course. Therefore, the potential of bias was a concern, and the investigator utilized a mark of 17 on the 21-point scale, which was the next highest level described on the scale.

When students' data was transformed into entry level versus non-entry level, 2x2 contingency tables were constructed for each of the six clinical performance domains, and the proportions of students from the IPE group were plotted with those of the non-IPE group. Chi-square analyses did not find any relationship in IPE training with entry level designation in all areas of clinical practice except plan of care. Similar to the mean score comparisons, the proportions for meeting entry level were greater in many areas for the non-IPE group, although two domains, professional practice, and communication, were greater for the IPE group under this analysis. However, contrary to hypothesis, the non-IPE training (control) group was significantly associated with higher proportion of achievement in entry-level designation as opposed to the IPE training group. The strength of this association, however, was considered weak due to a Cramer's V statistic of effect size being .179 (Cohen, 1998). Again, unequal sample sizes may have confounded these findings due to the nature of the IPE group being roughly a third of the size of the control group making changes more impactful to this group.

There are several considerations that can be drawn from the evaluation of findings from all analyses associated with research question 1.It is possible that the instrumentation used in this

study may need further validation for research purposes due to the observed ceiling effect and widespread findings of non-normality in all domains of the instrument, especially in the control group which represents three years of data. This may be due to the nature of the instrument and expectations of student performance being transparently communicated to the preceptor. Use of this instrument for research purposes that typically requires strict control, rather than its educational purpose may have uncovered this confounding factor.

Concerns of instrumentation have been shared by numerous other investigators (Reeves et al., 2015; Thistlethwaite et al., 2015). Thistlethwaite et al. supports the evaluation of performance in the clinical environment in which students will be learning and practicing but also questions the utility of instruments designed for educational purposes (2015). Further, this group also questions the duration upon which performance is evaluated in proximity to the intervention. Her team supports a longer term follow up to ensure evidence of genuine change. Further, in the proposition of evaluation principles for IPE learning activities, Reeves et al. (2015) acknowledges the presence of an evaluator effect that can influence behaviors as well as behavior, thus substantiating some of the concerns of this study's evaluation process involving the performance instrument that is dependent on an individual preceptors ratings rather than a more objective process.

Research Question 2.

What has been the impact of an IPE curriculum on patient care in the clinical practice environment? Research question 2 was examined through a qualitative approach via semi-structured interviews. It is important to note that the themes that emerged relative to this question

were built off participants' responses to three questions. Two of these questions were conducted prior to inquiring about more pointed and specified areas of practice that were examined relative to research question 2(a). Thus, the investigator believes that these themes possessed a high level of authenticity and validity. The prominent themes that emerged relative to this research question were that students felt the IPE curriculum (1) increased their ability to care for their patients through enhanced communication skills and awareness of roles of other health care providers, and (2)were more able to hold a deeper understanding of their patient needs and engage in critical inquiry.

These themes are indicative of multifactorial composition benefit on patient care, which is congruent with previous literature. Understanding roles and responsibilities, and enhanced ability to communicate with other health care providers has been linked to improved patient management in the emergency department setting (Lisbon et al., 2016), pediatric intensive care unit (Mayer et al., 2011), inpatient hospital setting for fall prevention (Spiva et al., 2014), and acute trauma setting (Deering et al., 2011).

Further, as identified in the second theme, once clinicians possess these skillsets, they are more able to manage the patient care through a higher level of critical thinking, coordination of efforts, and clinical decision-making. These findings are consistent with literature that demonstrates high efficiency teams developed through interprofessional collaborative practice. Salas et al. (2008) demonstrated this high functioning performance in teams that demonstrate mutual support and synergies. Such efficiencies have been created through interprofessional collaborative practice especially needed in complex patient care environments. Deering et al. (2011) demonstrated this in acute trauma settings in the battlefields, while Sawyer et al. (2013)

identified improved efficiencies and outcomes in the neonatal units, and Harvey et al. (2014). in the emergency setting. When clinicians move beyond the basic knowledge of roles and foundational communication skills, they may be able to work on enhancing interprofessional engagement and shared decision-making and more effectively achieve higher level outcomes for patients. This notion was evident in in Guck et al. (2019) whose collaborative practice model resulted in reduced emergency room visits, hospitalization, and patient charges.

Research Question 2(a).

Have areas of professional practice, patient management, and subdomains of safety, communication, screening, and plan of care been improved? Research question 2(a) was also examined through a qualitative approach via semi-structured interviews. This question specifically examined domains in the clinical performance instrument that were associated with IPEC core competencies (2016). Two of the areas investigated, professional practice and safety, did not emerge from the analysis, while the other four areas, patient management, communication, screening, and plan of care did appear as being significantly improved through involvement in the IPE curriculum. It should be noted that there is some challenge to interpretation of these areas due to some overlap. Professional practice, which is a composite of six sub-domains, includes both safety and communication, which were analyzed separately as well. In addition, patient management includes twelve sub-domains, which also includes screening and plan of care, which again were analyzed individually as well in this study.

The findings relative to this research question present some interesting conflicts. First, professional practice did not emerge as a salient theme. This was surprising due to the fact that

this construct is directly linked to IPEC Core Competency 1: Values/Ethics for Interprofessional Practice (IPEC, 2016), which was directly linked to one of the IPE curricular events as its sole focus. However, as indicated by three participants, students considered these areas as either being inherent, developed personally due to family or upbringing, or cultivated within the socialization with the professional degree program. The next area of interest was the lack of emergence of safety as a theme. This is somewhat surprising due to the volume of literature that denotes improved safety associated with interprofessional practice and higher team functioning (Brock et al., 2013). In addition, safety was in fact one of the precipitating factors for the call for IPE (IOM, 2001; Kohn et al., 2000; WHO 2010).

The themes that were salient in relation to this research question were communication, patient management, screening, and plan of care. These constructs seemed to interact with each other as participants often referred back and forth between these areas. To the participants, managing patients appropriately was predicated on knowledge and communication. An improved ability to screen patients and direct his or her plan of care was predicated on possessing a high level of communication. These findings reinforced the similar findings in research question 2 theme (1) indicating the multifactorial nature of patient care.

Research Question 3.

How have DPT students who have completed an IPE curriculum been able to translate interprofessional learning into the clinical practice environment? Research question 3 was the final research question examined through the qualitative approach via the semi-structured interviews. Due to the nature of the question in its examination of "how" students were able to

translate skills, this research question was most aligned with a phenomenological approach. Thematic analysis resulted in four themes which are as follows: (1) experience contributes to clinical learning and performance, (2) communication skills translate to improved patient care, (3) application of role understanding improves efficiency and quality of care, and (4) interactions build collaborative care.

Identification of the salient themes transpired through the compilation of structural descriptions of each research participant (Table 6, Table 7) and were affirmed through assessment of weighting of themes (Table 8). The first prominent theme established for research question 3 holds a central focus on the importance of experience. This concept was echoed in all ten research participants. Students held that experience in IPE, clinical patient care, communication with other providers, working in teams, the academic degree program, or just life in general, was meaningful and impactful and allowed for improved performance in the clinical environment. Thus, experience appeared to underscore every other established theme.

Interestingly, themes (2) and (3) were in much agreement with those areas identified in research question 2 that participants believed were domains that were positively impacted. Moreover, it should be noted that these areas, communication and roles and responsibilities, are the topics of two IPEC Core Competencies "Roles and Responsibilities" and "Interprofessional Communication" (IPEC, 2016). According to the mapping of the IPE curriculum in Appendix A, these two core competencies were each identified as IPEC competencies rooted in two different IPE curricular events. In addition, theme (4) interactions build collaborative care, appears to be in alignment with IPEC Core Competency "Teams and Teamwork." Realizing that these

established core competencies aligned with themes that emerged in this research study gives confidence to the efficacy of the IPE curriculum.

The interaction between communication and roles and responsibilities, themes (2) and (3), respectively, is well established in the IPE literature for improving team efficiency for patient care. Communication, knowledge of roles and responsibilities, and team behaviors were improved through team training in complex areas of clinical practice such as the emergency department setting (Harvey, Echols, Clark, & Lee, 2014; Lisbon et al., 2016), pediatric intensive care unit (Mayer et al., 2011; Sawyer, Laubach, Hudak, Yamamura, & Pocrnich, 2013), and long-term care facilities (Liaw et al., 2014). In a study systematic review by Reeves et al. (2013),

Convergence of Findings.

The examination of research questions transpired with different methodological approaches. Research question 1 was examined through quantitative methods, while research question 2 and 3 were examined through a qualitative approach. There is some disagreement in the quantitative and qualitative findings of this study. Interestingly, the qualitative approach may have uncovered some reasoning for the lack of findings in the quantitative data.

During semi-structured interviews, it was noted by four participants that the translation of interprofessional skills to the clinic environment was often dependent upon the specific environment or clinical setting in which the student was entering. Notably, students felt that clinical practice in hospital settings were much richer in their interprofessional interactions and collaborative care compared to outpatient or ambulatory care settings. Students noted this concept when discussing the ability to translate learning and would often discuss similarities and

differences among their four clinical internships throughout their degree program. Thus, the ability of the clinical performance instrument to detect the intended constructs may have been impacted due to the specific clinical setting variability of the students. However, during the interview process, many of these same participants would note that although they were not afforded the ability to enact certain interprofessional practices, they felt a heightened comfort and ability to do so in the future.

An area of practice that held agreement between the quantitative and qualitative analyses were the lack of strength in the impact of professional practice and safety domains of practice. Quantitative analyses did not detect any differences in the students to perform in these areas, which was met with agreement in the interviews. As stated previously, students considered professional practice being more so personally inherent, developed due to family upbringing, or cultivated within the professional degree program. Students also held only minor support for safety. Several students felt that safety was more likely associated with degree program preparation and experiences in the clinical setting.

With the emergence of salient themes in the qualitative analyses, it is somewhat surprising that numerous constructs were not met with statistical significance in the qualitative analyses. Topics related to interprofessional communication emerged in analyses relate to both research question 2 and research question 3, but it was not found to be statistically different than control groups in research question 1. In addition, several themes from research question 2 and research question 3 focused on the enhanced ability to manage patient care through coordinated efforts. This is evident in theme 2 under research question 2 and theme 3 and 4 under research

question 3. Again, quantitative findings did not agree with the salient themes from the qualitative analyses.

Lack of agreement in quantitative and qualitative findings underscore difficulties in research related to IPE and collaborative practice. In order to effectively examine interprofessional learning and impact on health outcomes, investigators must ascertain that learning has transpired and health outcomes have been impacted. While there are many validated learning outcomes scales, evaluating quantitative change in practice is more difficult due to the differences in roles of health care providers engaged in practice (Reeves et al, 2011; Reeves et al., 2015; Thistlethwaite, 2012).

This study utilized a clinical performance instrument that is standard in DPT education, with intentions of mitigating thee challenges by mapping selected performance criteria to IPEC competencies (Appendix D). Although this process aligns well with the recently published *International consensus statement on the assessment of interprofessional learning outcomes* by Rogers et al. (2017), some challenges cited by this consensus statement may have influenced the quantitative findings with this study. Namely, Rogers et al. noted that it is nearly impossible to provide all learners with the same learning experiences during their programs, which agrees with participant statements herein regarding variability of internship practices. Further, the consensus statement reported challenges with instruments that rely on observation in practice by supervisors as this study included.

Support of Study's Conceptual Framework.

The prominent themes established upon analysis associated with research question 3 align with the conceptual framework for this study. As identified in Chapter 1 and discussed further in Chapter 2, the Interprofessional Learning Continuum (IPLC) served as the conceptual framework for this study (IOM, 2015). The IPLC demonstrates growth in activities from foundational activities through graduate education and continuing professional development. This natural progression denotes the progressive nature of IPE as someone gains more experience, while also emphasizing learning outcomes such as collaborative behavior and performance in practice (IOM, 2015, p.29).

The theoretical underpinnings of the IPLC identified in relation to this study were social constructivism and andragogy. These theories strongly link to two of the prominent themes developed in relation to research question 3: (1) experience contributes to clinical learning and performance, and (4) interactions build collaborative care. However, upon review of the analyses of the emergent themes that contributed to the establishment of these prominent themes, there was likely even greater relevancy of these two theories with research question 3. Constructs of social constructivism and andragogy are mapped to emergent themes from each of the participants in Table 9, which displays this widespread association.

This study's demonstration of the association of social constructivism and andragogy to IPE research is also supported in existing IPE literature. Oandasan and Reeves (2005) noted that interpersonal dynamics, professional scopes of practice, and frameworks for roles and limitations of professions are all created through experiences in clinical healthcare environments. Participants in this study conveyed experiences that contributed to their interprofessional

learning that strongly link to social constructivism. These included navigation of discourse and dialogue that led to higher order understanding (Kaufman & Mann, 2010), the requisite interaction and exchange of ideas to establish elevated thinking and understanding (Piaget, 1985; Vygotsky, 1978), learning in an authentic environment (Adams, 2006), and the importance of reflection and self-awareness to enable critical thinking and reasoning (Schon, 1992; Shulman & Carey, 1984).

Principles of andragogy were also strongly present in this study. When considering Knowles' principles and assumptions of andragogy (1984), clear linkage of this theory to the emergent themes from participants in this study is demonstrated (Table 9). Also, it is important to note that an emergent theme relative to experience was noted in all ten participants in this study (Table 8), which validates the influence that experience held on the ability to successfully engage in clinical practice.

Interprofessional education and collaborative practice are multidimensional, and thus the conceptual framework for this study is as well. As demonstrated in the emergent themes from the participants and resultant salient themes, participants interlinked many of the theoretical foundations (Table 9). The findings of this study in this regard are similar in nature with those from Jackson (2016), who found similar interaction between social constructivism and andragogy as students transferred from the academic to workplace environments. More relative to IPE literature in relation to clinical practice, agreement is found with Oandasan and Reeves (2005), and Brashers et al. (2011) who found significance with both the professional interactions and experience within the healthcare environment due to its relationship-based nature (Brandt, 2018).

Table 9.
Thematic Development: Structural Descriptions with Theoretical Foundations

	Emergent Themes	Sub-themes or comments	Theoretical Foundation
Participant 1	Communication	Efficiency of care; patient-centered needs	Andragogy
	Real world experiences	Authentic learning	Andragogy
	Knowledge	Roles; resources; focus of other providers	-
	Interactions	Teamwork; experiences with group; building comfort	Social Constructivism
Participant 2	Communication	Increases with group experiences; improve comfort	Andragogy
	Roles	Awareness; confidence; understanding	-
	Experiences	Real life; navigate positive and negative interactions	Andragogy; Social Constructivism
	Interactions	Efficiency of care; improve trust; patient management	Social Constructivism
Participant 3	Communication	Built comfort; enhance patient management	-
	Experience	Managing interactions; differing opinions; practicing communication	Social Constructivism
	Clinical experience	Real world; social interactions; different perspectives	Andragogy; Social Constructivism
Participant 4	Knowledge	Understanding roles; management of patient care contribution	-
	Communication	Increase efficiency; role understanding	-
	Experience	Increase knowledge and contribution to care; real patient interaction	Andragogy
	Interaction	Group; exchange ideas; authentic interactions	Social Constructivism
Participant 5	Experiences	Real life; real patient care; group interactions	Andragogy; Social Constructivism
	Knowledge	Roles of providers; comprehensive care; enhance patient specific needs	Andragogy

	Emergent Themes	Sub-themes or comments	Theoretical Foundation
	Interaction	Different perspectives; group dynamics; practice strategies for communication	Social Constructivism
	Communication	Patient interaction; group interaction	Social Constructivism
Participant 6	Interactions	Other provider involvement improved care; social in settings different; teams	Social Constructivism
	Roles	Understanding enhances communication; patient management enhanced	
	Experiences	Interactions with other providers; improves comfort; environment facilitates	Social Constructivism; Andragogy
	Communication	Strong coordination of care; comfort cultivated and enhanced for practice with other professionals	Social Constructivism
Participant 7	Environment / Setting	Real world settings; patient interactions more meaningful; setting cultivated or hindered	Andragogy
	Communication	Active listening; patient to provider; and provider to provider	Social Constructivism
	Interaction	Social interaction with others developed understanding; cultivated communication	Social Constructivism
	Experience	Enhanced knowledge; awareness of roles; real world and problem based; more awareness of patient needs	Andragogy
Participant 8	Experience	Increases comfort; clinical experience gives perspective	Andragogy
	Interactions	Patient interactions; provider interactions; active listening establishes trust; positive experiences have greater interaction	Social Constructivism
	Communication	Respectful communication develops mutual trust; active listening contributes to positive interactions	Social Constructivism
	Roles	Knowledge enhances patient management and evaluation skills	-

	Emergent Themes	Sub-themes or comments	Theoretical Foundation
Participant 9	Roles	Understanding enhanced with more experience; more clearly identifiable with patient interactions; self-awareness; referral	Andragogy
	Communication	Experience enhances; comfort increased with interactions; patient specific needs; settings varied applicability	Social Constructivism
	Experience	Experience in environment; clinical value	Andragogy
Participant 10	Collaboration	Interactions; team mindset; role understanding enhances; group interactions	Social Constructivism
	Experience	Contributions in clinic and class improved congruently;	-
	Roles	Understanding enhanced management and collaborative behaviors; enhanced self-awareness	Andragogy

Implications for Practice

The findings of this study have implications for educational researchers and educators who wish to design, develop, and evaluate IPE for students in applied health fields. This study identified strong links of IPE for prelicensure physical therapy students to clinical practice. Some of these links may have been due to the design of the IPE curriculum with rooting in IPEC core competencies (2016), as this study found salient themes associated with IPEC competencies that were focal points in two events.

Experience was also highlighted as an essential component for IPE, and the ability of students to translate learning into a clinical practice environment. Experience was denoted as being relative to experience with communication, experience being involved in interactions with other health care professionals, clinical experience, and real life experience. Several of these

concepts were reinforced through the design of the IPE events within the curriculum. The duration of the IPE curriculum involved in this study consisted of four events that spanned over an entire calendar year. This time period allowed for the accumulation of real life experience and clinical experience of students in parallel as they progressed through their programs. This concept was reinforced by several participants. Two participants noted that increased clinical experiences that occurred during the academic training was significantly impactful to learning in IPE as they progressed through the program. In addition, another student felt that areas of practice may have been more translatable to practice if the dosing of the IPE curriculum was even greater.

The dynamic interaction among emergent and salient themes presented within this study underscore the multidimensional nature of patient care. This is visualized in two ways within this study. First, in alignment with the IPLC (IOM, 2015), progression of learning from enabled through the gradual progression of interaction with other disciplines during the academic preparation. All participants noted the importance of authentic learning environments in IPE, reporting the most impactful IPE experiences were those that involved actual patient interaction. This concept was also reinforced with the emphasis of experience in clinical environments as previously noted. Authenticity of environment is well supported by theory (Adams, 2006; Brandt, 2018; Nisbet, Lincoln, & Dunn, 2013) and IPE research recommendations (Bridges et al., 2011; Jackson, 2016; Oandasan & Reeves, 2005; Thistlethwaite, 2012).

Besides experience and progression to authentic learning environments, communication and interaction with other health care providers were concepts that were embedded into many of the themes developed in this study. Communication skills impacted the ability to interact with

other providers and patients, develop relationships, and allowed student clinicians to have a higher level understanding of others and the patient problems to better manage the patient care more effectively. This is similar in nature to the difference between being able to examine a patient and evaluate a patient. Students noted the ability to move beyond treatment for a patient toward being able to manage the patient care more comprehensively. This type of interaction and coordination of care creates more of a social constructivist learning environment and allows learning to be more effectively translated into other environments (Adams, 2006; Cooper, Braye, & Geyer, 2004; Palincsar, 1998).

Last, this study identifies an implication associated with the practice of IPE curricular and student evaluation. As identified within limitations of the quantitative data analyses as well as previously in this chapter, the performance instrument examining IPE and performance of practice related to IPE are challenging. In addition, the timing of such examination also presents a challenge. Enough time should transpire to allow the student to actually implement the learned practices from IPE into clinical care environments. As stated previously, no experiences of two students will be exactly the same, and thus examination of student performance will be equally challenged.

Taking these considerations into account, the researcher recommends building IPE curricula that is rooted in IPEC core competencies, with a progression in active learning activities that culminate in interprofessional performance in clinical settings with real patients. Further, the curriculum should span a time period that allows the learner to accumulate more advanced knowledge of his or her own field of study, and develop intellectually and personally through more lived experiences. This curriculum should focus on instilling communication and

interactions with other health care providers to develop problem-based learning approaches to patient care. Last, any evaluation of the curriculum should assess learning as well as performance in practice. Performance in practice should include instruments that are validated for the intended constructs and conducted over a length of time that allows for successful integration of the learned activities into the clinical environment. These instruments should be examined with consideration of potential limitations and integrated with qualitative findings to determine efficacy.

Study Limitations

Several limitations in this study exist relative to each of the research questions and findings. In relation to the first research question, there was much dependence on the clinical performance instrument to secure valid quantitative data associated with constructs of IPE. This current study attempted to establish construct validity through mapping the performance instrument descriptors to the IPEC core competencies. However, in consideration of the recent consensus statement on interprofessional learning outcomes (Rogers, et al., 2017), the mechanism by way which students are evaluated by an external observer may have confounded the results.

Another limitation related to the first research question is that the study involved comparison of groups that were pre-developed, or cohort-driven. These cohorts were separated by years in time with the experimental group occurring 3-6 years after the control group. This separation was created to account for the convergent parallel design in which quantitative and qualitative data were to be collected in as close proximity to each other as possible. Thus, the

design would have prevented use of class of 2019 due to that cohort already being in clinical practice as a licensee at the time of this study. Cohort 2018 did not experience the full IPE curriculum due to implementation timeframe and thus was not a candidate for consideration for either group. To diminish the effects of other confounding variables associated with cohorts and timing, future studies could be implemented within the same cohort, and by randomizing involvement in the IPE curriculum in an attempt to mitigate confounding variables associated with the cohort experience and team dynamics.

Limitations associated with research question 2 and 3 may exist due to the nature of the design of the qualitative approach. While phenomenology provides examination into the experiences of the phenomenon, the use and development of the interview template may have caused participants to focus only on certain areas of practice. Research approaches using other qualitative procedures, including observational studies, case study, or even grounded theory could assimilate this study's findings or expand into other constructs entirely. Another limitation involving the qualitative approach may be the positionality of the researcher, who was a faculty member involved in the IPE curriculum in which the student engaged, and also faculty within the academic program of the students. Attempts to mitigate this were conducted in the study procedures establishing validity and trustworthiness of the data. However, future or follow-up studies could be conducted with this same group of participants, but from another investigator.

Overall limitations for this study involve generalizability of findings. The study sample for this study involved a single cohort of students from one university. While qualitative procedures aim to mitigate this issue, this matter certainly applied to the qualitative approaches aligned with the first research question. Further, the study population involved a single

discipline, and thus generalizing any of the results to others should proceed with caution. Future studies could aim to triangulate the data established herein with other professional health care disciplines. Another overall limitation exists related to the timing of data collection. While the qualitative approach captured clinical performance as evaluated at one specific moment within a time period, the qualitative data captured may have spanned a wider timeframe. Students were interviewed in a timing that was convenient, which on most occasions, was three months after the internship that captured the quantitative data. During those interviews, students often spoke of experiences that were involved in that internship, but also many times included dialogue that spanned outside the time frame. Thus, although convergence of the data was described and discussed within this chapter, the investigator holds stronger value in the qualitative results.

Recommendations for Further Research

The objective of this study was to examine the impact of a formal IPE curriculum on the clinical practice of Doctor of Physical Therapy students through a mixed methods approach. It sought to not only identify areas of practice that were impacted from both a quantitative and qualitative tactics, but also examine how students were able to translate their learning from IPE to the clinical practice environment. To meet this objective, data was collected to examine three main research questions. While this study was developed in alignment with recommendations from the IOM (2015) and with a curriculum that is rooted in IPEC core competencies (2016), there are several areas to recommend further research in association with this study's findings.

In regard to research question 1, and the quantitative approach to examining student performance, limitations found were consistent with other investigators (Reeves et al., 2015;

Thistlethwaite et al., 2015). The lack of significant findings in the quantitative approach could have been due to the lack of timing of follow up, control of the clinical setting, or control in relationship to the clinical instructor who was scoring the student. Although this current study met the recommendation for evaluation of performance in the clinical environment from Thistlethwaite et al. (2015), it did not, however, meet these same authors' additional recommendation for a longer-term follow up to evaluate the behaviors. This recommendation was substantiated in this current study's qualitative findings and reports from students that the clinical settings varied on the amount interprofessional practice due to their construct (i.e. hospital vs. private clinic).

In addition, the concern of the effect from the evaluator that this study reported is echoed by others (Reeves et al., 2015; Rogers et al., 2017). Due to the findings denoting a possible ceiling effect and lack of normality in the data, a strong source of error exists in the evaluators as indicated. Thus, future studies should consider a training for the clinical instructors on IPE so that they can better identify skill competencies, but also understand their positionality to attempt to mitigate the potential observer bias.

Interestingly, there was a finding relative to research question 2 that identifies areas of future study. Contrary to other investigators, safety specifically was not impacted by IPE in this study. Safety did not arise in research question 2 and it was not supported by participants in the study when specified by the investigator in association with research question 2a. It also was not supported in the quantitative assessments relative to research question 1. The lack of finding of support for the impact on safety is in direct contrast with Deering et al. (2011) who found significant improvements with safety with interdisciplinary training in reduction of medical

errors. However, the focus of Deering et al. was on reduction of errors in existing teams within hospital settings. Thus, future research that is focused on improvement of safety, should therefore aim to focus more on existing teams of providers clinical training or those groups of students in large interdisciplinary clinical environments such as hospitals.

Research question 3 identified how students were able to translate learning into the clinical practice environment. The findings relative to this research question fills numerous gaps in literature that did not examine influence of student IPE on patient care (Bartlett & Dimitroff, 2018; Fernandes, Palombella, & Wainman, 2015; Sytsma, et al., 2015). With added guidance from this study, future studies should focus on the cross over of behaviors from pre-licensure IPE curricula on post-licensure practice as other authors recommend (Zwarenstein, Reeves, and Perrier, 2005). The findings from the current study identified the contribution of experience, importance of communication, influence of role understanding, and interactions that build collaborative care. Future studies can examine if these themes carry over into post-licensure and determine how they may differ based on settings and team construct.

Conclusions

The findings of this mixed-methods study indicate that a structured IPE curriculum for professional students in health care that is aligned with established interprofessional competencies and rooted in a learning continuum may be impactful to future care. Although quantitative analyses in this study did not support a significant difference compared to historical controls, qualitative analyses demonstrated salient themes that convey a significant impact to patient care in the clinical environment. Through thematic analysis, students identified that the

IPE curriculum increased their ability to care for their patients through enhanced communication skills and heightened awareness of roles of other health care providers, and were more able to hold a deeper understanding of their patient needs and engage in critical inquiry. Students conveyed that they were able to successfully translate their interprofessional learning into the clinical practice environment due to four salient themes: (1) experience contributes to clinical learning and performance, (2) communication skills translate to improved patient care, (3) application of role understanding improves efficiency and quality of care, and (4) interactions build collaborative care.

These findings align with previous literature that identify learning in the clinical healthcare environment as complex and relationship-based (Brandt, 2018; IOM, 2015). This notion coincides with the multidimensional nature of the salient themes in this study where experiences, communication, knowledge, and interactions all contribute dynamically to the coordination of patient care.

APPENDIX A: IPE CURRICULUM & MAPPING

Description of IPE Activities

Activity Name	Session Description	Specific Session Activities
IPE Module 1 *"Values and Ethics for Interprofessional Practice"*	Students work in teams to plan a public health response outreach to a suburban town	Interdisciplinary groups create solutions to public health issue, with focus on providing solutions that align with cultural, ethical, legal, and moral considerations of the population and practice. Ideas and solutions presented to peers for feedback and discussion among groups.
IPE Module 2 *"Providing Care to Ms. Robinson: AN IPE Focused on Roles, Responsibilities and Teamwork"*	Students learn more about the roles and responsibilities of physicians, nurses, pharmacist, physical therapist and behavioral health professional and how interdisciplinary collaboration can improve patient outcomes	Interdisciplinary groups learn of roles and responsibilities of each other's' disciplines, then work on solutions to complex case studies involving comprehensive care and transition of patient management ideas based on knowledge and understanding of each other's fields.

IPE Module 3 *"Collaborative Inter-Professional Communication: Learning the Patient's Story"*	Teams elicit a patient's story and learn about working together with other professionals to achieve a full understanding of a patient's needs	Interdisciplinary groups design and develop a strategy to conduct a patient assessment for a complex patient within a healthcare simulation facility. Students then conduct the assessment on standardized patients as a group, outline strategies to address patient problems, and then discuss / debate their prioritized lists with other students and faculty. Students receive feedback from both the faculty and standardized patient after the encounter.
IPE Module 4 *"Geriatric Wellness and Health Assessment Event"*	Students work in interdisciplinary teams to conduct a comprehensive health & wellness assessment for a local older adult	Interdisciplinary groups of students design and develop a strategy to conduct a comprehensive health and wellness assessment for an older adult. The assessment is conducted with the patient/client, the team develops recommendations that are approved by faculty, and then delivered back to the patient / client.

Mapping of IPE Curriculum with IPE Core Competencies and Theory

IPE Curriculum Activity	IPEC Core Competency	Theory
IPE 1	Values & Ethics	Andragogy: problem-centered Social Constructivism: reciprocal influence (other students)
IPE 2	Roles & Responsibilities	Andragogy: problem-centered Social Constructivism: reciprocal influence (other students)
IPE 3	Roles & Responsibilities, Interprofessional Communication, Teams & Teamwork,	Andragogy: problem-centered; planning and evaluation Social Constructivism: context of learning (clinical environment)
IPE 4	Interprofessional Communication, Teams & Teamwork	Andragogy: immediate relevance; planning and evaluation Social Constructivism: context of learning, reciprocal influence (faculty and client/patient)

APPENDIX B: IPEC CORE COMPETENCIES

IPEC Core Competencies and Sub-Competencies:

Adopted from: Interprofessional Education Collaborative Expert Panel. (2016). *Core competencies for interprofessional collaborative practice: 2016 update*. Washington, DC: Interprofessional Education Collaborative.

Competency 1. Values and Ethics (VE) for Interprofessional Practice

Description: Work with individuals of other professions to maintain a climate of mutual respect and shared values.

Sub-competencies:

VE1. Place interests of patients and populations at center of interprofessional health care delivery and population health programs and policies, with the goal of promoting health and health equity across the life span.

VE2. Respect the dignity and privacy of patients while maintaining confidentiality in the delivery of team-based care.

VE3. Embrace the cultural diversity and individual differences that characterize patients, populations, and the health team.

VE4. Respect the unique cultures, values, roles/responsibilities, and expertise of other health professions and the impact these factors can have on health outcomes.

VE5. Work in cooperation with those who receive care, those who provide care, and others who contribute to or support the delivery of prevention and health services and programs.

VE6. Develop a trusting relationship with patients, families, and other team members.

VE7. Demonstrate high standards of ethical conduct and quality of care in contributions to team-based care.

VE8. Manage ethical dilemmas specific to interprofessional patient/ population centered care situations.

VE9. Act with honesty and integrity in relationships with patients, families, communities, and other team members.

VE10. Maintain competence in one's own profession appropriate to scope of practice.

Competency 2. Roles and Responsibilities (RR)

Description: Use the knowledge of one's own role and those of other professions to appropriately assess and address the health care needs of patients and to promote and advance the health of populations.

Sub-competencies:

RR1. Communicate one's roles and responsibilities clearly to patients, families, community members, and other professionals.

RR2. Recognize one's limitations in skills, knowledge, and abilities.

RR3. Engage diverse professionals who complement one's own professional expertise, as well as associated resources, to develop strategies to meet specific health and healthcare needs of patients and populations.

RR4. Explain the roles and responsibilities of other providers and how the team works together to provide care, promote health, and prevent disease.

RR5. Use the full scope of knowledge, skills, and abilities of professionals from health and other fields to provide care that is safe, timely, efficient, effective, and equitable.

RR6. Communicate with team members to clarify each member's responsibility in executing components of a treatment plan or public health intervention.

RR7. Forge interdependent relationships with other professions within and outside of the health system to improve care and advance learning.

RR8. Engage in continuous professional and interprofessional development to enhance team performance and collaboration.

RR9. Use unique and complementary abilities of all members of the team to optimize health and patient care.

RR10. Describe how professionals in health and other fields can collaborate and integrate clinical care and public health interventions to optimize population health.

Competency 3. Interprofessional Communication (CC)

Description: Communicate with patients, families, communities, and professionals in health and other fields in a responsive and responsible manner that supports a team approach to the promotion and maintenance of health and the prevention and treatment of disease.

Sub-competencies:

CC1. Choose effective communication tools and techniques, including information systems and communication technologies, to facilitate discussions and interactions that enhance team function.

CC2. Communicate information with patients, families, community members, and health team members in a form that is understandable, avoiding discipline-specific terminology when possible.

CC3. Express one's knowledge and opinions to team members involved in patient care and population health improvement with confidence, clarity, and respect, working to ensure common understanding of information, treatment, care decisions, and population health programs and policies.

CC4. Listen actively and encourage ideas and opinions of other team members.

CC5. Give timely, sensitive, instructive feedback to others about their performance on the team, responding respectfully as a team member to feedback from others.

CC6. Use respectful language appropriate for a given difficult situation, crucial conversation, or conflict.

CC7. Recognize how one's uniqueness (experience level, expertise, culture, power, and hierarchy within the health team) contributes to effective communication, conflict resolution, and positive interprofessional working relationships (University of Toronto, 2008).

CC8. Communicate the importance of teamwork in patient-centered care and population health programs and policies.

Competency 4. Teams and Teamwork (TT)

Description: Apply relationship-building values and the principles of team dynamics to perform effectively in different team roles to plan, deliver, and evaluate patient/population-centered care and population health programs and policies that are safe, timely, efficient, effective, and equitable.

Sub-competencies:

TT1. Describe the process of team development and the roles and practices of effective teams.

TT2. Develop consensus on the ethical principles to guide all aspects of teamwork.

TT3. Engage health and other professionals in shared patient-centered and population-focused problem-solving.

TT4. Integrate the knowledge and experience of health and other professions to inform health and care decisions, while respecting patient and community values and priorities/preferences for care.

TT5. Apply leadership practices that support collaborative practice and team effectiveness.

TT6. Engage self and others to constructively manage disagreements about values, roles, goals, and actions that arise among health and other professionals and with patients, families, and community members.

TT7. Share accountability with other professions, patients, and communities for outcomes relevant to prevention and health care.

TT8. Reflect on individual and team performance for individual, as well as team, performance improvement.

TT9. Use process improvement to increase effectiveness of interprofessional teamwork and team-based services, programs, and policies.
TT10. Use available evidence to inform effective teamwork and team-based practices.
TT11. Perform effectively on teams and in different team roles in a variety of settings.

APPENDIX C: CLINICAL PERFORMANCE CRITERIA

Details of Clinical Performance Instrument criteria that are linked to Interprofessional Education. CPI detail below adopted from: American Physical Therapy Association. (2006). Physical therapist clinical performance instrument for students. Alexandria, VA: American Physical Therapy Association.

Safety

Practices in a safe manner that minimizes the risk to patient, self, and others.

Sample Behaviors

1. Establishes and maintains safe working environment.
2. Recognizes physiological and psychological changes in patients and adjusts patient interventions accordingly.
3. Demonstrates awareness of contraindications and precautions of patient intervention.
4. Ensures the safety of self, patient, and others throughout the clinical interaction (e.g., universal precautions, responding and reporting emergency situations, etc.).
5. Requests assistance when necessary.
6. Uses acceptable techniques for safe handling of patients (e.g., body mechanics, guarding, level of assistance, etc.).
7. Demonstrates knowledge of facility safety policies and procedures.

Communication

Communicates in ways that are congruent with situational needs.

Sample Behaviors

1. Communicates, verbally and nonverbally, in a professional and timely manner.
2. Initiates communication in difficult situations.
3. Selects the most appropriate person(s) with whom to communicate.
4. Communicates respect for the roles and contributions of all participants in patient care.
5. Listens actively and attentively to understand what is being communicated by others.
6. Demonstrates professionally and technically correct written and verbal communication without jargon.
7. Communicates using nonverbal messages that are consistent with intended message.
8. Engages in ongoing dialogue with professional peers or team members.
9. Interprets and responds to the nonverbal communication of others.
10. Evaluates effectiveness of his/her communication and modifies communication accordingly.
11. Seeks and responds to feedback from multiple sources in providing patient care.
12. Adjust style of communication based on target audience.
13. Communicates with the patient using language the patient can understand (e.g., translator, sign language, level of education, cognitive impairment, etc.).

Screening

Determines with each patient encounter the patient's need for further examination or consultation by a physical therapist or referral to another health care professional.

Sample Behaviors

1. Utilizes test and measures sensitive to indications for physical therapy intervention.
2. Advises practitioner about indications for intervention.
3. Reviews medical history from patients and other sources (e.g., medical records, family, other health care staff).
4. Performs a system review and recognizes clusters (historical information, signs and symptoms) that would preclude interventions due to contraindications or medical emergencies.
5. Selects the appropriate screening tests and measurements.
6. Conducts tests and measurements appropriately.
7. Interprets tests and measurements accurately.
8. Analyzes and interprets the results and determines whether there is a need for further examination or referral to other services.
9. Chooses the appropriate service and refers the patient in a timely fashion, once referral or consultation is deemed necessary
10. Conducts musculoskeletal, neuromuscular, cardiopulmonary, and integumentary systems screening at community sites.

Plan of Care

Establishes a physical therapy plan of care that is safe, effective, patient-centered, and evidence-based.

Sample Behaviors

1. Establishes goals and desired functional outcomes that specify expected time durations.
2. Establishes a physical therapy plan of care in collaboration with the patient, family, caregiver, and others involved in the delivery of health care services.
3. Establishes a plan of care consistent with the examination and evaluation.
4. Selects interventions based on the best available evidence and patient preferences.
5. Follows established guidelines (e.g., best practice, clinical pathways, and protocol) when designing the plan of care.
6. Progresses and modifies plan of care and discharge planning based on patient responses.
7. Identifies the resources needed to achieve the goals included in the patient care.
8. Implements, monitors, adjusts, and periodically re-evaluate a plan of care and discharge planning.
9. Discusses the risks and benefits of the use of alternative interventions with the patient.
10. Identifies patients who would benefit from further follow-up.
11. Advocates for the patients' access to services.

APPENDIX D: MAPPING IPEC COMPETENCIES TO CPI CRITERIA

Alignment of CPI Criteria and IPEC Competencies

Clinical Performance Instrument: Performance Criteria	IPEC Core Competency	IPEC Sub-competency
Safety	VE	VE4 / VE10
	RR	RR1 / RR2 / RR5 / RR6 / RR9
	CC	CC1 / CC2
	TT	TT1 / TT3 / TT7 / TT8
Communication	VE	VE2 / VE5 / VE6
	RR	RR1 / RR3 / RR4 / RR6 / RR10
	CC	CC1-CC8
	TT	TT3 / TT4 / TT6 / TT8 / TT9
Screening	VE	VE1 / VE4 / VE5 / VE9 / VE10
	RR	RR2 / RR3 / RR6 / RR7 / RR8 / RR9
	CC	CC3 / CC7 / CC8
	TT	TT3 / TT4 / TT7 /TT10 / TT11
Plan of Care	VE	VE1-VE6 / VE10
	RR	RR1-RR7 / RR10
	CC	CC2 / CC3 / CC7
	TT	TT3 / TT4 / TT7 / TT10 / TT11

APPENDX E: INTERVIEW TEMPLATE AND MAPPING

Research Questions Associated with Qualitative Methodology

2. What has been the impact of an IPE curriculum on patient care in the clinical practice environment?
    a. Have areas of professional practice, patient management, and subdomains of communication, safety, screening, and plan of care been improved?
3. How have DPT students who have completed an IPE curriculum been able to translate interprofessional learning into the clinical practice environment?

Mapping of Data, Questions, and Theory

Data	Main Interview Questions	Prompts / Elicitations / Follow-up	Research Question	Theory
Ice breaker & open dialogue	1. Tell me about your internship	- Did you find it was beneficial platform to put your skills to practice? How? - How did you grow as you progressed from early to late internships?		
IPE Curriculum & Clinical Practice	2. Tell me about your IPE program & training	- Describe your most memorably IPE event / activity - Share something you learned from your IPE curriculum. - Share something you learned that you used in the clinic. - How did you value your IPE curriculum when in your didactic program and did		

		this change when in final internships?		
	3. What kind of skills do you believe you developed through your IPE training program?		2	
	4. What has been the impact of the skills you learned in IPE curriculum on your patient care in the internship?	- How much do you attribute to the academic program vs. IPE curriculum?	2	
	5. What specific *clinical performance* skills do you believe were impacted through your involvement in the IPE curriculum?	- Why do you think they were or were not impacted? - Was there contribution of social dynamics or interactions? - How did they translate to the internship environment during internship?	2,3	Social Constructivism
	6. Tell me about the influence of the IPE curriculum on your clinical practice as it relates to: professional practice; patient management; safety; communication; screening; plan of care.	- How did they translate to the internship environment during internship?	2a	
	7. What factors in the IPE curriculum most influenced your ability to learn and/perform in	- Learning from other providers? - Learning in the environment?	2	Social Constructivism

	the clinical environment during internship?			
	8. How did the following contribute to your learning in IPE program? -problem based learning -relevance of scenarios/cases -experiences with the group -involvement in learning process (feedback, planning)	- How did these components translate to the clinical environment during internship?	3	Andragogy
	9. How did learning in the team environment influence your ability to integrate learned skills in the clinical practice environment?	- Which skills easiest to carry-forward? - Which skills most difficult?	3	Social Constructivism Andragogy
	10. How was your patient care impacted due to what you learned in the IPE curriculum?	- Positive examples? - Negative examples?	2	
Additional info	11. Any additional information to add?			
Member checking	Summary; IPE curriculum, IPE skills learned and translated, experiences translating skillsets to clinic, role of IPE in practice			

APPENDIX F: IRB APPROVAL

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

EXEMPTION DETERMINATION

April 8, 2020

Dear Patrick Pabian:

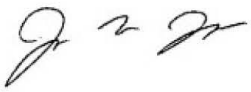
On 4/8/2020, the IRB determined the following submission to be human subjects research that is exempt from regulation:

Type of Review:	Initial Study, Category 2
Title:	The impact of an interprofessional education curriculum on the clinical practice of physical therapy doctoral students
Investigator:	Patrick Pabian
IRB ID:	STUDY00001646
Funding:	None
Grant ID:	None
Documents Reviewed:	• irb_HRP-251-FORM-FacultyAdvisorReview_v-2-12-19.pdf, Category: Faculty Research Approval; • Clinical Performance Instrument (CPI): Secondary data instrument, Category: Other; • Email Invitation_2.docx, Category: Recruitment Materials; • HRP-254-FORM-Explanation_of_Research_IPE_Pabian_2.pdf, Category: Consent Form; • Interview Mapping and Questions.docx, Category: Interview / Focus Questions; • Protocol, Category: IRB Protocol;

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made, and there are questions about whether these changes affect the exempt status of the human research, please submit a modification request to the IRB. Guidance on submitting Modifications and Administrative Check-in are detailed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,



Racine Jacques, Ph.D.
Designated Reviewer

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