# THE QUALITY OF TRANSDISCIPLINARY TEAM ASSESSMENT PRACTICES FOR MOBILE TECHNOLOGY AS AUGMENTATIVE AND ALTERNATIVE COMMUNICATION

by

Laura Jeanne Mansfield

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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## ABSTRACT

While research acknowledges the impact the rapid growth in mobile technology is having on the field of augmentative and alternative communication (AAC), little has been done to investigate the impact this development has had on assessment practices for matching an individual with the appropriate technology. The purpose of this descriptive and causal-comparative research study was to gather demographic and descriptive data on mobile technology as AAC and to investigate the quality of transdisciplinary teamwork assessment practices as evaluated by speech-language pathologists (SLPs) for the provision of mobile technologies as AAC devices across SLP practice settings. A random sample of 60 SLPs in each of the three practice settings of education, health care, and private practice completed a survey containing demographic questions and the Team Decision Making Questionnaire (TDMQ). Proposed data analysis consisted of descriptive statistics and an ANOVA. Due to a violation of homogeneity, a Welch's ANOVA was conducted with post hoc testing. A statistically significant difference between SLP ratings of the quality of transdisciplinary assessment practices for mobile technology as AAC was discovered between education and health care settings as well as between education and private practice settings. This difference was significant across all subscales of the TDMQ as well. There was no statistically significant difference found in quality ratings between health care and private practice settings. Descriptive analysis revealed additional areas of differences across practice settings in the provision of mobile technology as AAC. Limitations of this study were identified and further research recommendations were made.


*Keywords*: speech-language pathologist, augmentative and alternative communication, transdisciplinary teamwork, AAC assessment, mobile technology, complex communication needs, consumer-oriented model, platform-first model

## Dedication

For Aunt Judy,

Listening to your colleagues talk about the kind of mentor and leader you were to them inspires me to want to be a better leader to those God places in my care. I pray that I can love others as well as you did, and that in doing so I will honor the legacy of love you began. I will carry you with me always. You will be forever missed and never forgotten.

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To my Lord and Savior, Jesus Christ, thank you for saving me. Thank you for your relentless love, endless pursuit, and your beautiful promises. Thank you for all you have done in me throughout this process and in the waiting. May this work, and whatever comes from it, honor and glorify You and You alone.

## Table of Contents

ABSTRACT ..... 3

Dedication ..... 4

Acknowledgments ..... 5

List of Tables ..... 10

List of Figures ..... 11

List of Abbreviations ..... 12

CHAPTER ONE: INTRODUCTION ..... 13

- Overview ..... 13
- Introduction ..... 13
- Background ..... 14
- Problem Statement ..... 20
- Purpose Statement ..... 21
- Significance of the Study ..... 23
- Research Questions ..... 24
- Definitions ..... 24

CHAPTER TWO: LITERATURE REVIEW ..... 28

- Overview ..... 28
- Conceptual Framework ..... 28
  - International Classification of Functioning, Disability and Health ..... 28
  - Frameworks of AAC Assessment ..... 30
  - Transdisciplinary Assessment for AAC ..... 32
  - Quality of Transdisciplinary Teams ..... 34

Related Literature ..... 36

Complex Communication Needs ..... 36

AAC as Evidence-Based Practices for CCN ..... 41

AAC Assessment and the SLP ..... 46

Mobile Technology and AAC Practices ..... 49

Summary ..... 55

CHAPTER THREE: METHODOLOGY ..... 56

Overview ..... 56

Design ..... 56

Research Question ..... 58

Hypotheses ..... 58

Participants and Setting ..... 59

Instrumentation ..... 61

Procedures ..... 63

Data Analysis ..... 64

Assumption Tests for the Null Hypothesis ..... 65

Analysis of RQ2 ..... 65

CHAPTER FOUR: FINDINGS ..... 67

Overview ..... 67

Research Questions ..... 67

Hypotheses ..... 67

Descriptive Statistics ..... 68

Results ..... 69

Data Screening ..... 69
Assumption Tests ..... 70
Null Hypothesis One ..... 73
Null Hypothesis Two ..... 74
Analysis of RQ2 ..... 78
Additional Analysis ..... 79
CHAPTER FIVE: CONCLUSIONS ..... 82
Overview ..... 82
Discussion ..... 82
Null Hypothesis One ..... 83
Null Hypothesis Two ..... 85
Research Question Two ..... 88
Implications ..... 89
Discussion of Additional Analysis ..... 91
Limitations ..... 92
Recommendations for Future Research ..... 93
REFERENCES ..... 95
APPENDIX A: Permission to Use and Reproduce the Survey Instrument ..... 122
APPENDIX B: Institutional Review Board Exemption ..... 123
APPENDIX C: Consent Form ..... 124
APPENDIX D: Descriptive Tables ..... 126

## List of Tables

Table 1. Mean and Standard Deviation TDMQ Scores across Practice Settings. ..... 68

Table 2. Descriptive Statistics of Demographic Data across Practice Settings of Education, Health Care, and Private Practice ..... 70

Table 3. Skewness and Kurtosis Calculations per Practice Setting ..... 72

Table 4. Games-Howell Multiple Comparisons of TDMQ across Practice Settings ..... 74

Table 5. Descriptive Data for Mean Subscale and TDMQ Scores across Practice Settings ..... 75

Table 6. Welch's Robust Test of Equality of Means ..... 75

Table 7. Games-Howell Multiple Comparisons of TDMQ Subscales across Practice Settings ... 76

Table D1. Descriptive Data for Decision Making Subscale of the TDMQ across Practice Settings ..... 126

Table D2. Descriptive Data for Team Support Subscale of the TDMQ across Practice Settings ..... 127

Table D3. Descriptive Data for Learning Subscale of the TDMQ across Practice Setting ..... 128

Table D4. Descriptive Data for Developing Quality Services Subscale of the TDMQ across Practice Settings ..... 129

## List of Figures

Figure 1. Boxplots ..... 72

Figure 2. Clustered Bar Graph of Mean Subscale Scores of the TDMQ across Practice Settings 78

Figure 3. Percentage of Individuals Using Mobile Technology as AAC without Prior Assessment per Practice Setting ..... 79

Figure 4. Percentage of AAC Evaluations Resulting in Traditional vs. Mobile Devices by Practice Setting ..... 80

Figure 5. Percentage of Mobile Device Evaluations Done as Part of a Transdisciplinary Team per Practice Setting ..... 81

## List of Abbreviations

Augmentative and Alternative Communication (AAC)

American Speech-Language-Hearing Association (ASHA)

Analysis of Variance (ANOVA)

Autism Spectrum Disorder (ASD)

Center for Disease Control and Prevention (CDC)

Certificate of Clinical Competence (CCC)

Complex Communication Needs (CCN)

Every Student Succeeds Act (ESSA)

Evidence-Based Practices (EBP)

Individualized Education Program (IEP)

Individuals with Disabilities Education Improvement Act of 2004 (IDEA)

International Classification of Functioning, Disability and Health (ICF)

International Classification of Functioning, Disability and Health, Children and Youth (ICF-CY)

Interprofessional Collaborative Practices (IPCP)

Speech-Language Pathologist (SLP)

Speech-Generating Device (SGD)

Team Decision Making Questionnaire (TDMQ)

Voice Output Communication Aids (VOCA)

World Health Organization (WHO)

# CHAPTER ONE: INTRODUCTION

## Overview

This chapter provides an introduction and background related to the multifaceted requirements of individuals with complex communication needs (CCN). The complexities of providing thorough and accurate assessment for augmentative and alternative communication (AAC) devices will be discussed. The conceptual framework will be presented to provide context for the assertion of the problem statement as it relates to how today's technology-driven marketplace is impacting AAC assessment and the resulting purpose and significance of this study. The research questions will be outlined in addition to the provision of important definitions pertinent to this critical research.

## Introduction

Individuals with CCN possess a combination of cognitive, motor, sensory, language, reading, and writing skill deficits that impact independent access and participation in academic, social, and community contexts (Erickson & Geist, 2016). These individuals often require access to symbolic supports that allow them to independently communicate their ideas, wants, and needs, resulting in the development of communicative competence (Light & McNaughton, 2014). With increasing frequency, parents and guardians of individuals with CCN are bypassing what has traditionally been an in-depth transdisciplinary, time-consuming, and intensive assessment process (Meder & Wegner, 2015). With ever-increasing frequency, they are electing to select and purchase technology exclusive of the best practice of transdisciplinary assessment, known as a consumer-oriented model or platform-first approach (Costello, Shane, & Caron, 2013). This shift has largely been driven by the rising access consumers have to dynamic display devices through a range of cost-effective mobile technologies that mimic communication

device technology. These devices include smartphones with iOs®, Apple®, or Android™ platforms, as well as tablet devices, including the iPad®, also referred to as an "iDevice" in some research literature (AAC-RERC, 2011; Meder & Wegner, 2015). While research referencing the effects of a consumer-oriented delivery model on intervention strategies for AAC supports is growing, there has been limited research to date on the impact this trend is having on the assessment practices of speech-language pathologists (SLPs) across the United States (Light & McNaughton, 2013; McNaughton & Light, 2013). SLPs often drive the integrated teams that determine the individual needs of those with CCN to successfully match technology that will maximize communication success for their clients; however, this technologically rich environment has resulted in a platform-first model for many individuals with CCN (Allen & Shane, 2014; Caron, 2015; Costello et al., 2013; Meder & Wegner, 2015). The need for this study will be established in this chapter, the problem statement and purpose of the study presented, and the significance of the study, the research question, and definition of terms outlined.

## Background

Enhancing the quality of life for those with CCN necessitates a thorough assessment of how well they are able to effectively share their ideas, wants, and needs in their communities (Brady et al., 2016; Krüger & Berberian, 2015). Meder and Wegner (2015) found that more than half of participating parents bypassed the established best practice of team assessment practices for AAC provision to purchase a mobile technology for their child who required an AAC device to communicate. This platform-first model results in the provision of technology that may not meet the complex needs of individuals requiring AAC as an alternative to verbal language (Erickson & Geist, 2016). In fact, Andzik, Schaefer, Nichols, and Chung (2018) found that the

majority of students requiring and using AAC were not implementing the support sufficiently to be perceived by their teachers as proficient or competent communicators. Given the high availability of a range of advanced technology, the chasm between availability of technology and its proficient implementation must be investigated to determine how assessment practices for this vulnerable population of individuals is affecting individual outcomes given the significant impact AAC intervention can have for individuals with CCN (Beukelman, Hux, Dietz, McKelvey, & Weissling, 2015; Roche, Sigafoos, Lanciono, O'Reilly, & Green, 2015; Romski, Sevcik, Barton-Hulsey, & Whitmore, 2015).

Complex communication needs is a widely used term to describe individuals of various ages, abilities, and challenges who may be impacted by a range of motor, sensory perceptual, cognitive, and language disorders that effect their access to opportunities for interactions, verbal communication, and/or language and literacy development (Ganz et al., 2017). A diverse span of disabilities or diagnoses are included in the overarching category resulting in a CCN, including but not limited to, autism spectrum disorder (ASD), Down syndrome, apraxia of speech, cerebral palsy (CP), and/or an acquired disability resulting from a stroke or traumatic brain injury (Andzik et al., 2018; Beukelman & Mirenda, 2013; Drager, Light & McNaughton, 2010; Erickson & Geist, 2016). The number of individuals impacted by CCN is growing rapidly. The most recent statistics provided by the Center for Disease Control and Prevention (CDC, 2014) indicate that the number of children with autism alone has grown from approximately 1 in 150 children in the year 2000 to approximately 1 in 59 children in 2014. Of those with an ASD diagnosis, 33-50% do not acquire the skills necessary to communicate functionally and are classified as having CCN (CDC, 2014; Light & McNaughton, 2012a). Individuals presenting with CCN require systems of supports that allow for the development of critical receptive,

expressive, and social language skills. One highly effective mode for providing the necessary link for these individuals to harness the power of communication is access to an AAC device (Light & McNaughton, 2014).

The research demonstrating the significant benefits of AAC for individuals with CCN is substantial and growing (Beukelman et al., 2015; Ganz, 2015; Light & McNaughton, 2012b; Roche et al., 2015; Romski et al., 2015). In fact, there is strong empirical evidence that supports positive outcomes in functional communication skills as a result of targeted AAC provision and intervention (Beukelman et al., 2015; Fried-Oken, Beukelman, & Hux, 2012; Kent-Walsh, Murza, Malani, & Binger, 2015; Light & McNaughton, 2015; Roche et al., 2015; Romski et al., 2015; Scholsser & Koul, 2015; Smith, 2015). The increased federal and state regulations mandating implementation of technology when appropriate, along with improved public and professional awareness of the benefits associated with AAC implementation, have propelled these strategies into mainstream awareness as effective intervention options for individuals with CCN (Light & McNaughton, 2012b).

Pairing an individual with CCN with the appropriate technology requires a thorough team assessment (Chung & Stoner, 2016). The AAC assessment process requires the input of a team of licensed professionals, often spearheaded by a speech-language pathologist (SLP), and may also include an assistive technology specialist, occupational therapist, physical therapist, teacher of the visually impaired, orientation and mobility specialist, social worker, regular and special education teachers, behavioral clinicians, the person with CCN requiring AAC, and his or her family and friends (Beukelman & Mirenda, 2013). SLPs are most often the professionals on the forefront of the assessment and intervention process for individuals with CCN since they are advantageously positioned to anticipate communicative challenges and assess, diagnose, and

treat communication disorders across the life span (American Speech-Language-Hearing Association [ASHA], 2016a). SLPs are most often the leaders of transdisciplinary teams that assess individuals with severe expressive and/or language comprehension disorders, including those classified as having CCN, resulting in the provision of AAC devices (ASHA, 2016b). Best practices dictate that a transdisciplinary team of professionals assess the individual with CCN for the matching of AAC technology based on the communicative profile which includes detailing areas of strength and deficit (Batorowicz & Shepherd, 2011; Downing, Hanreddy, & Peckham-Hardin, 2015; Ogletree et al., 2017; Pennington, Courtade, Ault, & Delano, 2016).

Increasingly, AAC supports are selected based on popular media stories, Internet testimonials, or recommendations from fellow parents, friends or family as access to mobile technologies has improved (Meder & Wegner, 2015). The introduction of the iPad on April 3, 2010, began a revolution that created a new and growing market for touchscreen tablet style technology. Advancement of a range of devices during the 2000s increased access to technology, which led to improved access to information and allowed for social connections through phones, tablets, and notebook computers (Boster & McCarthy, 2017). These technological progressions have created a powerful assortment of options that expand to those with CCN (Light & McNaughton, 2013). In fact, the same technology innovations that make access easier for society at large have begun to impact the AAC field in a variety of ways, including the development of smaller, more portable, and more easily accessible speech-generating devices (SGDs) and other mobile technologies with AAC apps (Alzrayer, Banda, & Koul, 2014; Bradshaw, 2013; Lorah et al., 2013, McNaughton & Light, 2013; Shane, Blackstone, Vanderheiden, Williams, & DeRuyter, 2012).

This increase of available mobile technology has a significant impact on the lives of many individuals with CCN (Fager, Bardach, Russell, & Higginbotham, 2012; Flores et al., 2012; McNaughton & Light, 2013). This burgeoning technology market has resulted in the consumer now making independent decisions about AAC solutions, potentially segregating him or her from the transdisciplinary assessment process (McNaughton & Light, 2013). The consumer-oriented purchase of AAC solutions creates a shift away from the best practice of transdisciplinary assessment (Beukelman, 2012; Fager et al., 2012; Flores et al., 2012; Gosnell, Costello, & Shane, 2011; Hershberger, 2011; Light & McNaughton, 2012b; McNaughton & Light, 2013; Shane, Laubscher, et al., 2011). Meder and Wegner (2015) found that 64% of the participants they surveyed who owned an iDevice had not had an assessment of their communication needs prior to the purchase being made. This lack of appropriate assessment shifts focus to the technology instead of the individual, often resulting in a decrease in the effectiveness of the intervention, limited growth in communicative competence, and a lack of development of functional communication skills (Light & McNaughton, 2013; Meder & Wegner, 2015). Inappropriate matching of the technology to the individual also increases the likelihood of device abandonment (Ryan et al., 2015).

The World Health Organization (WHO) provided an integrative model of human functioning and disability in 2001. This new model for understanding disabilities offered a conceptual framework for integrative rehabilitation sciences that has been applied to AAC assessment practices (Stucki & Grimby, 2007; Stucki, Reinhardt, & Grimby, 2007). The WHO's International Classification of Functioning, Disability and Health (ICF) shifted popular understanding of disability as a limitation within a single person to the intersection of bodily impairment, restrictions with activities, and limitations in participation (WHO, 2001). This

requires the consideration of not only the individual's limitations in functioning but also the individual's experience within the context of his or her environment (Stucki, Reindardt, Grimby, & Melvin, 2007). Although this model provided a new and integrated holistic framework, there remained concerns regarding limitations of the ICF to quantify changes in functioning for children as they matured during their first two decades of development, necessitating the creation of the Children and Youth Version (ICF-CY) (Simeonsson, Björck-Åkesson, & Lollar, 2012). The ICF, and the subsequent ICF-CY, has had significant implications for the assessment of individuals with CCN requiring AAC as it shifts focus from the cause of the communicative impairment to the impact of the impairment on functioning in context (Raghavendra, Bornman, Granlund, & Björck-Åkesson, 2007; WHO, 2007).

The ICF and ICF-CY provide increased emphasis on an individual's participation within an environment; this is a critical component to the successful assessment and implementation of AAC (Beukelman & Mirenda, 2013; Raghavendra et al., 2007; Simeonsson et al., 2012). The conceptual frameworks of the ICF and ICF-CY provide clear direction on the type of assessment data required and outline the importance of a transdisciplinary team that includes teachers, rehabilitation professionals, parents, caregivers, the individual with CCN and others providing support across environments to bring critical knowledge about the individual's skills and needs (Simeonsson et al., 2012). While there is no standardized measure for assessment in AAC practice, existing research and currently available assessment tools emphasize collaborative team approaches for successful assessment based on the conceptual framework provided by the ICF and ICF-CY (Beukelman & Miranda, 2005; Rowland et al., 2012; Zabala, 2014).

Without quality transdisciplinary assessment, successful outcomes for individuals with AAC are not possible (Pennington et al., 2016). Unfortunately, a transdisciplinary team's careful

consideration of an individual's needs within the context of varied communicative environments and with different communicative partners is being dismissed due to the increasing popularity and availability of mobile technologies (Light & McNaughton, 2013; Meder & Wegner, 2015). The most current research findings emphasize that in order to maximize AAC device use, SLP led transdisciplinary teams must consider the full range of options and fit the technology to the person based on quality assessment, not fit the person to the popular or easily accessible technology (Light & McNaughton, 2013; Rackensperger, Krezman, McNaughton, Williams, & D'Silva, 2005). Determining to what extent SLPs perceive the quality of transdisciplinary assessment practices are being impacted is a vital endeavor given that effective assessment leads to more successful interventions for this vulnerable population of individuals (Light & McNaughton, 2013). Evaluating the quality of the transdisciplinary assessment practices of SLPs within this changing and shifting culture of mobile technology is a critical step to ensure the most successful treatment outcomes possible for individuals with CCN (McNaughton & Light, 2013; Meder & Wegner, 2015).

## Problem Statement

The previous clinician-led assessment model for the provision of an AAC device for an individual with CCN is shifting to a consumer-oriented, or platform-first, model (Gosnell et al., 2011; Hershberger, 2011; Meder & Wegner, 2015). This platform-first model has placed technology at the center of the provision of AAC and away from the best practices of quality transdisciplinary assessment based on the conceptual framework of the ICF and ICF-CY (Costello et al., 2013; Meder & Wegner, 2015). Best practices for SLPs require an assessment process for the provision of AAC rooted in a model based on the input of a transdisciplinary team of licensed professionals that includes caregivers, family members, communicative

partners, and the individual requiring AAC (Beukelman & Mirenda, 2013; Caron, Light, & Drager, 2016; Douglas, Light, & McNaughton, 2013). This system of assessment allows for the gathering of critical information regarding the individual's strengths and deficits across environments so that the individual remains at the center of the process and not the technology (Beukelman & Mirenda, 2013; Chung & Stoner, 2016; Meder & Wegner, 2015).

Current clinically driven frameworks for individualized assessment for appropriate AAC supports require a transdisciplinary team approach (Beukelman & Mirenda, 2013; Chung & Stoner, 2016; Helling & Minga, 2014; Mercurio-Standridge, 2014). Information collected within the transdisciplinary team assessment process, paired with the knowledge and experience of those completing the AAC assessment, allows for an appropriately matched AAC device for the individual (Beukelman & Mirenda, 2013; Helling & Minga, 2014; Light & McNaughton, 2013). A concerning shift away from this high quality transdisciplinary assessment toward a new consumer-oriented, or platform-first, model for identifying AAC solutions is ongoing (Beukelman, 2012; Costello et al., 2013; Fager et al., 2012; Flores et al., 2012; Gosnell et al., 2011; Hershberger, 2011; Light & McNaughton, 2012b; McNaughton & Light, 2013; Meder & Wegner, 2015; Shane, Laubscher, et al., 2011). The problem is that research has yet to quantify the impact that the provision of mobile technology as an AAC device is having on the quality of the transdisciplinary assessment process as evaluated by SLPs across practice settings (McNaughton & Light, 2013; Meder & Wegner, 2015).

## Purpose Statement

The purpose of this descriptive and causal-comparative research study was to determine the quality of transdisciplinary assessment practices as evaluated by SLPs for the provision of mobile technology as AAC for individuals with CCN and to collect descriptive data related to

mobile technology as AAC. The independent variable was the SLP practice setting of education, health care, or private practice. The SLP practice setting of education was defined as early intervention, preschool, and K-12 schools (ASHA, 2016c). The SLP practice setting of health care was defined as hospitals and health care facilities, including outpatient clinics and doctors' offices (ASHA, 2016c). The SLP practice setting of private practice was defined as an SLP working full- or part-time as an independent entrepreneur or with other professionals (ASHA, 2016c). The dependent variable was the SLP evaluation of the quality of transdisciplinary teamwork as measured by the mean TDMQ total score, as well as mean subscale scores, for mobile devices as AAC. Transdisciplinary teamwork was defined as the process of close collaboration of all team members as equals for careful assessment and intervention planning (Batorowicz & Shepherd, 2008; Beukelman & Mirenda, 2013; Thylefors, Persson, & Hellstrom, 2005). Mobile devices were defined as those readily available through the consumer-oriented model in the popular marketplace that mimic communication device technology, including smartphones with iOs®, Apple®, or Android™ platforms, as well as tablet devices including the iPad®, referred to as an "iDevice" in some research literature (AAC-RERC, 2011; Meder & Wegner, 2015). In addition to the evaluation of the quality of team assessment practices, demographic and descriptive information was collected, including:

- years as an SLP,
- years of AAC experience,
- the number of individuals with CCN using an AAC device currently on the SLPs caseload,
- the number of individuals with CCN with mobile devices provided through the consumer-oriented model currently on the SLPs caseload,

- the number of AAC evaluations completed in the past two years by the SLP,
- the number of evaluations resulting in the provision of a mobile device,
- the number of evaluations resulting in the provision of a traditional device, and
- the number of evaluations resulting in the provision of a mobile device completed as a part of the transdisciplinary team process.

## Significance of the Study

In today's technologically rich environment, families frequently choose mobile technologies that are readily available and easy to use without seeking a comprehensive team assessment to determine which technology best meets the needs of their family member with CCN (Light & McNaughton, 2013; Meder & Wegner 2015). Given that effective interventions rise from effective assessment and that research indicates abandonment of poorly matched technology by individuals with CCN, investigating the relationship between these variables was essential (Beukelman & Mirenda, 2013; Bradshaw, 2013; Cockerill et al., 2014; Light & McNaughton, 2013; Meder & Wegner, 2015; Shane et al., 2012). ASHA (2004) has determined that a collaborative, transdisciplinary approach that includes professionals from across disciplines as well as families or caregivers is critical to the assessment of an individual's needs prior to matching him or her with an appropriate AAC device (Chung & Stoner, 2016).

The integrity of the assessment process that provides effective AAC for functional communication development is in jeopardy (Fannin, 2016; Light & McNaughton, 2013; Ricci, Miglino, Alberti, Perilli, & Lancioni, 2017). Understanding how the quality of AAC transdisciplinary assessment best practices by SLPs across settings was impacted as the culture shifts toward platform-first, consumer-oriented provision of SGDs was critical (AAC-RERC, 2011; McNaughton & Light, 2013; Meder & Wegner 2015). This study added to the research by

providing data related to the quality of transdisciplinary assessment practices as evaluated by SLPs across practice settings under the condition of mobile technology AAC devices.

## Research Questions

The research questions for this study were as follows:

**RQ1:** Is there a difference in speech-language pathologists' evaluation of the quality of transdisciplinary team assessment practices for individuals with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice?

**RQ2:** What is the difference in the percentage of individuals with complex communication needs who use mobile technology as augmentative and alternative communication without prior assessment in the practice settings of education, health care, and private practice?

## Definitions

The following key vocabulary and definitions provide a critical common understanding for the content of this study.

1. *American-Speech-Language Hearing Association (ASHA)* - ASHA is the national accrediting association for speech-language pathologists (SLPs) and audiologists. The vision of ASHA is to make effective communication accessible and achievable for every person by empowering and supporting its members through advancing research, setting practice standards, supporting excellence in professional practice and advocating for its members (ASHA, n.d).
2. *Autism Spectrum Disorder (ASD)* - ASD is identified in the *Diagnostic and Statistical Manual of Mental Disorders 5 (DSM5)* as being identifiable by two main characteristics:

difficulties in social communication and restricted or repetitive behaviors of interests. Severity of the ASD diagnosis is indicated by specifying the level of support an individual would need. Co-occurring conditions such as intellectual impairments or attention deficit disorder can also occur (American Psychiatric Association [APA], 2013; Wong et al., 2013).

3. *Augmentative and Alternative Communication (AAC)* - AAC is the provision of low-to-high technology supports that compensate for impairments in spoken and written modes of communication for individuals with severe disorders of speech-language production or comprehension (Beukelman & Mirenda, 2013).
4. *Complex Communication Needs (CCN)* - CCN are the diverse needs of an individual with a disability in being able to formulate a message and having that message appropriately and accurately received and interpreted by a communication partner. Complexities impacting an individual's ability to communicate vary based on the nature of the disability and may include a combination of physical, intellectual, sensory, processing, social, neurological, or other types of disability. Independent functioning is restricted and can occur in any environment across communication partners (Iacono, 2014; Light & McNaughton, 2015; Pearson Education, Inc., 2006).
5. *Communication Disorder* - Communication disorder is an impairment in the ability of an individual to receive, send, process, and comprehend concepts or verbal, nonverbal and graphic symbol systems and may range in severity from mild to profound. A communication disorder may include disorders of speech (articulation, fluency, and/or voice) and/or language (spoken, written, or symbolic) involving the form, content, or function of language in any combination (ASHA, 1993).

6. *Consumer-oriented Delivery Model* - The selection and purchase of commercially available mobile technologies, e.g. iPad, Mini iPad, iPod, Windows tablet, Android device, provided to an individual with complex communication needs for the provision of AAC supports outside of the traditional assessment model for AAC by a licensed professional (Gosnell et al., 2011: McBride, 2011).
7. *Mobile Technology* - Commercially available technologies, such as iPads, iPad Minis, iPods (also referred to as iDevices), Android, and Windows tablets and phone devices (Gosnell et al., 2011).
8. *Speech-generating Device (SGD)* - A SGD, also known as a Voice Output Communication Aid (VOCA), is an electronic speech output device that allows the user to create messages using letters, words, or pictures that can be spoken aloud to augment communication for those that are unable to use natural speech to communicate (Beukelman & Mirenda, 2013).
9. *Speech-language Pathologist (SLP)* – SLPs are "the professional who engage in professional practice in the areas of communication and swallowing across the life span" (ASHA, 2016d, p. 1). SLPs are responsible for the assessment and delivery of services to address areas related to communication and swallowing within each individual practitioner's competency based on education, training, and experience and include assessment and intervention for augmentative and alternative communication supports (ASHA, 2016d).
10. *Transdisciplinary Team* – Teams of professionals in which boundaries between specialties begin to fade as all team members gain skills in other practice areas.

Assessment practices involve integrated collaboration of all members of the team as equals (Batorowicz & Shepherd, 2008; Ogletree et al., 2017).

11. *Vocal Output Communication Aid (VOCA)* - A VOCA, also known as a speech-generating device (SGD), is an electronic speech output device that allows the user to create messages using letters, words, or pictures that can be spoken aloud to augment communication for those that are unable to use natural speech to communicate (Beukelman & Mirenda, 2013).

# CHAPTER TWO: LITERATURE REVIEW

## Overview

Chapter Two will present the conceptual framework provided by the WHO's ICF and ICF-CY and is followed by a thorough review of the related research. The use of the conceptual framework in AAC research will explain the need for transdisciplinary assessment for the provision of AAC supports. The needs of individuals with CCN will be reviewed as well as evidence-based practices for supporting functional communication for this population through AAC. The impact of the advancement of mobile technologies on best practices for AAC assessments will also be explained.

## Conceptual Framework

### International Classification of Functioning, Disability and Health

The World Health Organization (WHO) developed the conceptual framework that guides this study. The International Classification of Functioning, Disability and Health (ICF) has dramatically shifted focus in rehabilitative study, including speech-language pathology, from a previous overemphasis and underscoring of an individual's impairment to the holistic factors impacting an individual's competence, autonomy, and relatedness through an integrated rehabilitative approach (Brady et al., 2016; McCooley-O'Halloran, Worrall, & Hickson, 2004; Simeonsson et al., 2012; Stucki et al., 2007; Worrall & Hickson, 2008; WHO, 2001). The ICF was developed to provide a universal framework for the description and classification of states of health, including functioning, disability, and contextual factors that minimize an individual's experience of a disability. The ICF has been expanded and applied to areas of statistics, clinical practice, social policy, education, and research (Stucki & Grimby, 2007; Stucki et al., 2007; WHO, 2001). The components of the ICF include body functions and structures, activity and

participation, environmental, and personal factors (WHO, 2001). The aim of the ICF is to maximize the ability of those with impairments to participate in the events of daily life by emphasizing contextual factors through a bio psychosocial model (Raghavendra et al., 2007). Achieving this aim required a shift away from a hyper focus on the individual's diagnosed impairment to a wider assessment of the individual's ability to apply skills that allow maximum participation in the broader societal context (Fried-Oken & Grandlund, 2012; Stucki & Grimby, 2007; Worrall & Hickson, 2008).

The ICF provides increased emphasis on an individual's participation within an environment and was adopted by the American Speech-Language Hearing Association (ASHA, 2001), the certifying agency for SLPs and audiologist in the United States, to assist in defining the scope of practice by SLPs in the United States. The ICF has been applied to ensure functional communication and successful contextual participation is considered for the assessment and implementation of AAC supports (Beukelman & Mirenda, 2013; Enderby, 2013; Light & McNaughton, 2014; Raghavendra et al., 2007; Simeonsson et al., 2012). This framework was followed by the development of the ICF-CY, which expanded the ICF to address functioning and disability considerations for individuals in infancy through adolescence (WHO, 2007). The ICF-CY added critical components related to the development of communication skills for children within activity and participatory domains (Rowland et al., 2016; Simeonsson et al., 2012). The ICF and the ICF-CY significantly impact the assessment of individuals with CCN requiring AAC as it shifts focus from the cause of the communicative impairment, such as the particular disability or level of language impairment, to the impact of the impairment on functioning in context (Light & McNaughton, 2014; Raghavendra et al., 2007; Stucki et al., 2007; WHO, 2007).

In 2012, the WHO merged the ICF and ICF-CY to create a framework to be applied across the lifespan. Comprehensive assessment of individuals with CCN is dependent on the framework used to conceptualize functioning and disability. The ICF framework has been applied to the assessment of individuals with a range of CCN, including those with Down syndrome, traumatic brain injury (TBI), ASD and language disorders (McNeilly, 2018). The common framework provided by the ICF increases the ability of multiple professionals to contribute holistically to the assessment of barriers to improved functioning and participation (Brady et al., 2016). The aim of the ICF to maximize functioning for all people across functional skills of daily living coincides with the goals of AAC implementation for individuals with CCN (Fried-Oken & Granlund, 2012).

**Frameworks of AAC Assessment**

Standardized measurement tools that are reliable and valid to assess the diverse population of individuals with CCN for AAC are limited and a needed area of research (McNaughton & Light, 2015). To ensure assessments are comprehensive in nature, ASHA (2004) endorsed Beukelman and Mirenda's (2013) Participation Model, which aligns with the ICF and ICF-CY, for identifying the most appropriate AAC system. This model emphasizes the evaluation of an individual's participation across contexts and communication partners (Andik et al., 2018). The Participation Model provides a systematic process for conducting AAC assessments and designing interventions that are based on the functional participation requirements as seen in peers without disabilities of the same chronological age as the person with CCN (Beukelman & Mirenda, 2013; Rowland et al., 2012). The Participation Model involves four phases: (a) referral for AAC assessment, (b) initial assessment and intervention for immediate needs, (c) assessment for future needs, and (d) follow-up assessment (Beukelman &

Mirenda, 2013). Intervention can be planned and implemented by identifying the gap between the two levels of functioning and the access barriers that may be contributing to this gap (ASHA, 2004; Beukelman & Mirenda, 2013). The Participation Model emphasizes the importance of communication partners as a source for communication support and program development as well as potential barriers to communication for the individual AAC user.

One portion of the Participation Model includes the initial assessment, which results in the immediate intervention plan. Feature matching is a critical component of this aspect of the assessment and is well recognized as a critical element of the AAC assessment process (Beukelman & Mirenda, 2013). Feature matching involves careful consideration of an individual's cognitive, language, literacy, and sensory skills that allow appropriate pairing with an AAC device containing the hardware, access modes, language supports, and feedback systems that best meet the needs of the user (Andzik et al., 2018; Beukelman & Mirenda, 2013). The knowledge and experience of those completing the AAC assessment, along with the information collected within the Participation Model, allow for appropriate AAC recommendations given the wide variety of device options (Beukelman & Mirenda, 2013; Helling & Minga, 2014; Light & McNaughton, 2013). Completion of this assessment requires the input of a collaborative team of professionals (Light & McNaughton, 2012).

The Student, Environment, Tasks, Tools (SETT) is another framework a team of professionals uses to determine the factors impacting an individual's communication needs (Rowland, Quinn, & Steiner, 2015; Zabala, 2014). This collaborative tool was developed for assistive technology broadly but has been applied to AAC specifically. The goal of the tool is to promote collaborative team decision making for the provision of appropriate intervention goals across an individual's development and environments (Andzik et al., 2018). SLPs hold a critical

role in the team of professionals determining appropriate assessment given their knowledge of communication disorders and the impact of specific impairments on the individual with CCN (ASHA, 2016d).

**Transdisciplinary Assessment for AAC**

Without modes of effective communication, individuals with CCN are unable to efficiently and actively participate within their communities (Andzik et al., 2018; Brady et al., 2016). Consideration of whether or not an individual with CCN is able to demonstrate communicative competence, which includes consideration of an individual's linguistic, operational, social, and strategic competence within a given context, must be included in comprehensive assessment practices conducted by collaborative teams (Light & McNaughton, 2014; Light, Roberts, Dimarco, & Greiner, 1989). Considering an individual's communicative competence is a critical piece of effective assessment practices given the relationship of competence to an individual's overall wellbeing and the importance of equipping an individual with appropriate AAC supports to secure positive outcomes (Beukelman et al., 2015; Ganz, 2015; Roche et al., 2015; Romski et al., 2015). With the advent of the ICF, and the subsequent development of the ICF-CY, researchers in the field of AAC have begun to integrate these concepts into their research because of the shared focus by AAC interventionists and the ICF and ICF-CY on accelerating the individual with a disability's competence, relatedness, and autonomy within life's varied contexts (Fried-Oken & Granlund, 2012; Simeonsson et al., 2012; WHO, 2007).

The evolving focus away from the deficit model of assessment and toward a holistic person-centered approach requires a more comprehensive, transdisciplinary assessment of the interaction between the person with CCN and his or her environment (Beukelman & Mirenda,

2013; Chung & Stoner, 2016; Mercurio-Standridge, 2014). This level of assessment necessitates the evaluation of an individual's sensory, motor, and behavioral functioning within communicative contexts (Beukelman & Mirenda, 2013; Brady et al., 2016; Schlosser & Lee, 2000). Any one evaluator cannot achieve the level of assessment required to determine the impact of disability on an individual with CCN and provide recommendations for AAC; this level of assessment requires a group of evaluators within a cohesive, transdisciplinary team to determine the individual's functioning across contexts (Andzik et al., 2018).

A team approach to assessment of an individual with CCN for effective AAC supports is prolific within the research and has been supported as best practices throughout the literature (Beukelman & Mirenda, 2013; Chung & Stoner, 2016; DeVeney, Hoffman & Cress, 2012; Helling & Minga, 2014; Kovach, Frisbie & Moore, 2016; Lund, Quach, Weissling, McKelvey, & Dietz, 2017; Mercurio-Standridge, 2014; Mirenda & Iacono, 2009). This team is most often spearheaded by an SLP and often includes other professionals such as an assistive technology specialist, occupational therapist, physical therapist, vision specialist, social worker, regular and special education teachers, and behavioral clinicians, the person with CCN requiring AAC, and his or her family and friends. This allows for the gathering of critical information regarding the individual's strengths and deficits across environments and situations for the provision of appropriate interventions (Beukelman & Mirenda, 2013).

The conceptual frameworks of the ICF and ICF-CY provide clear direction on the type of assessment data required for effective AAC evaluation and outline the importance of the participation of a transdisciplinary team that includes multiple professionals bringing critical knowledge about the individual's skills and needs (Chung & Stoner, 2016; Simeonsson et al., 2012). While there is no standardized measure for assessment in AAC practice, existing research

and assessment tools emphasize collaborative team approaches for successful assessment based on the conceptual framework provided by the ICF and ICF-CY and widely adopted Participation Model (Andzik et al., 2018; Beukelman & Miranda, 2005; Rowland et al., 2012). An SLP must work collaboratively with persons who use AAC, their families, and a team of diverse professionals to identify and evaluate AAC technologies that fit the needs, skills, and preferences of not only the individual who requires AAC, but the family as well (Light & McNaughton, 2013).

The cultural background and attitude about technology and AAC devices in conjunction with a family's willingness to learn and integrate technologies, along with personal preferences and priorities, impact the implementation and effectiveness of AAC implementation (Fannin, 2016; Smith & Connolly, 2008). Family involvement is a critical component in achieving positive outcomes for individuals using AAC supports. Parents of individuals with CCN are critical members of the transdisciplinary team and rank the targeting of communication skills, including pragmatic or social language skills, as a top priority for treatment (Allen & Shane, 2014; Boster & McCarthy, 2018; Meder, 2012; O'Neill, Mandak, & Wilkinson, 2017; Pituch et al., 2011).

**Quality of Transdisciplinary Teams**

The assessment process for AAC is complex, necessitating the concurrent assessment of communicative content, communication goals, enrichment of social participation, integration within social networks, improved self-management and self-determination, and increased understanding of AAC technology and instructional strategies (Blackstone, Williams, & Wilkins; 2007). This process requires collaborative teams to implement dynamic procedures that involve individuals with CCN, caregivers, and the necessary rehabilitative professionals that are able to

determine what supports are necessary to enhance participation in activities of daily living (Brady et al., 2016). Interprofessional collaborative practices (IPCP) are emerging as an archetype method to achieve these goals (Ogletree et. al, 2017; WHO, 2010).

The WHO (2010) defines IPCP as a team of professionals from different specialties working with clients, families, and caregivers to maximize outcomes by providing the highest quality of care possible. IPCP has been endorsed by ASHA (2013) and is viewed as the ultimate transdisciplinary team model for the SLP most often at the heart of the AAC assessment process (Sylvester, Ogletree, & Lunnen, 2017). It is within the context of IPCP that SLPs are able to fully assess the significant complexities of individuals with CCN (Cooper-Duffy & Eaker, 2017). Given that communication disorders may impact social, behavioral, emotional, and academic development, multiple professionals within the IPCP model are required for a comprehensive assessment (Liu, Zahrt, & Simms, 2018). Carefully considering the perspective of multiple professionals results in the clinical determination of an individual's needs that is able to extend beyond any single discipline's scope of practice (Liu et al., 2018). An AAC evaluation implemented within an IPCP model focuses on individual strengths while developing an understanding of impediments to physical functions, structures, activities, participation, and environments, resulting in effective recommendations (McNeilly, 2018).

Individuals using AAC need collaborative teams that efficiently blend roles across each professional's discipline to complement and share responsibilities as within the transdisciplinary team model (Batorowicz & Shepherd, 2011; Chung & Stoner, 2016; Ogletree et al., 2017). Bruce and Bashinski (2017) asserted that the application of the IPCP in the implementation of a trifocus framework, which emphasizes assessment that encompasses the learner, the communication partner, and the environment, would bring the expertise necessary for assessment

and resulting interventions. They further emphasize that collaboration of teams of professionals from varying disciplines must work closely together to meet the diverse needs of students with CCN, which is consistent with the ICF. This framework emphasizes the application of an IPCP to effectively assess the impact of the environment and the communicative partner on the individual with CCN (Bruce & Bashinski, 2017).

Given that AAC assessment requires a team approach to be most effective, researchers Batorowicz and Shepherd (2008) collaborated to develop a scale that measured the quality of transdisciplinary teamwork based on clinical practices of AAC teams in Ontario, Canada. The Team Decision Making Questionnaire (TDMQ) consists of four subscales, including Decision Making, Team Support, Learning, and Developing Quality Services. Batorowicz and Shepherd (2008) developed this survey to effectively measure the impact of transdisciplinary teamwork during collaborative practices involving team members across disciplines. The TDMQ provides a quick assessment of current practices to better understand the quality of team functioning and is a snapshot of the quality of team assessment practices by SLPs, developed within an AAC clinical model (Batorowicz & Shepherd, 2008). The TDMQ has been used in research to evaluate the quality of AAC transdisciplinary teamwork across 21 AAC centers across Ontario (Batorowicz & Shepherd, 2011).

## Related Literature

### Complex Communication Needs

Typical language development is a critical component of a child's growth and development and is a multidimensional paradigm (Lonigan & Milburn, 2017). Within the first four to five years of life, children with normally developing language skills acquire the ability to use and understand thousands of words, form a variety of sentence structures, and learn

foundational phonological awareness skills necessary for reading and writing (Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013). This development facilitates a child's ability to share ideas, express wants and needs, engage in social exchanges, form friendships, ask questions to gain information about their world, make cognitive connections, and build literacy skills, which are key components of a child's academic, social, and behavioral success (Schmitt, Logan, Tambyraja, Farquharson, & Justice, 2017). Rowe, Raudenbush, and Goldin-Meadow (2012) found that an accelerated rate of vocabulary acquisition by preschoolers showed more significant growth in their language skills during kindergarten than children with matching vocabulary skills but a slower rate of growth. With so many factors that must be integrated for language development to proceed typically, the complexity of needs for individuals that results when that development does not occur can be profound, impacting academics, reading, writing, social skills, and overall independence (Finestack, 2018).

CCN is a widely used term that signifies the existence of a complex array of deficits in communication skills for individuals of varied ages, abilities, and challenges. The present study focused on individuals with CCN who are impacted by a range of motor, sensory perceptual, cognitive, or language disorders that effect their access to opportunities for interactions, verbal communication, and/or language and literacy development. A wide range of disabilities or diagnoses can impact a child's communication needs, including ASD, Down syndrome, apraxia of speech, CP, or an acquired disability resulting from a stroke or traumatic brain injury (Beukelman & Mirenda, 2013; Drager et al., 2010; Saturno, Ramirez, Conte, Farhat, & Piucco, 2015). Each individual presenting with a communication impairment may present very differently than the next, even though each person may be identified as having CCN (Bunning, Gona, Newton & Hartley, 2014; Erickson & Geist, 2016). Often the nature of the child's

disability limits access to his or her home, school, and community, limits his or her interactions with communicative partners such as family, peers, and friends, and results in fewer opportunities to participate in interactions (Andzik, Chung, & Kranak, 2016; Andzik et al., 2018; Clarke et al., 2011; Light & Drager, 2007). It is imperative to explore these differences to fully understand the need for proper assessment that drives the provision of communication supports, instruction, service delivery, and intervention design.

Individuals with CCN may exhibit varying levels of strengths and deficits in cognition, psychological functioning, sensory needs (visual impairment, hearing impairment, etc.), fine and gross motor skills, receptive communication, expressive communication, social skills as well as behavioral characteristics (Andzik et al., 2018; Black, Waller, Turner, & Reiter, 2012; Clarke et al., 2011; Erickson & Geist, 2016). In addition, personal factors related to age and gender, environmental factors, culture, and individualized participation opportunities impact the ability and need for individuals with CCN to communicate (Fannin, 2016). The specific disability of the individual with CCN will range in type, severity, and combination of characteristics (Iacono, 2014).

Previous research has focused on the impact of CCN on a child's ability to participate in everyday activities given deficits in communication skills with a particular concentration on children with cerebral palsy (Clarke et al., 2011; Clarke et al., 2012; Light & Drager, 2007; Raghavendra et al., 2012; Saturno et al., 2015). This population demonstrates varying degrees of deficits due to motor impairments, language disorders, cognitive impacts, and/or sensory perceptual impairments. Another prevalent and rising disability resulting in CCN is ASD, which is defined in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) as including previously separate diagnoses of pervasive developmental disorder – Not Otherwise

Specified (PDD-NOS), Asperger syndrome, and other childhood disintegrative disorders. The prevalence of ASD has increased from approximately 1 in 150 children in the year 2000 to approximately 1 in 59 children in 2014 (APA, 2013; CDC, 2014; Institute of Medicine [IOM], 2007). Research on intellectual functioning found that 31% of children with ASD have IQ scores in the range of intellectual disability (IQ ≤ 70) and 23% were found to be in the borderline range on measures of intelligence (IQ = 71-85) (CDC, 2014). Key diagnostic features of ASD are well documented and include impairments in social skills, language, and related cognitive skills (restricted problem-solving abilities), restricted interests, difficulties with behavioral and emotional regulation, as well as restricted, stereotyped, and repetitive behaviors (APA, 2013; ASHA, 2006).

Extensive and pervasive social communication impairment is also a key component of the ASD diagnosis. Social communication deficits often include difficulties in joint attention, social reciprocity, and social cognition (Hansen, Blakely, Dolata, Raulston, & Machalicek, 2014). Joint attention deficits are characterized by challenges sharing attention, using a range of communicative functions, considering another person's perspective, and self-monitoring emotional states (Santhanam & Hewitt, 2015). Social reciprocity deficits include difficulties initiating and responding to interactions, deficits with turn taking within conversations, and difficulties responding appropriately to conversational topics introduced by others (Sng, Carter, & Stephenson, 2017). Social cognitive deficits include difficulties with social and emotional learning, understanding another's perspective and feelings, and separating others' feelings from one's own as well as integrating information to construct meaning from social contexts (APA, 2013; ASHA, n.d.).

Difficulty developing functional language skills is a core characteristic of the ASD diagnosis and part of the overall profile of individuals with CCN (CDC, 2014; Ganz et al., 2012; National Research Council, 2001). The National Research Council (2001) and Light and McNaughton (2012b) noted that 33-50% of individuals with ASD do not acquire the skills necessary to communicate functionally. The combination of cognitive deficits, impairments of social or pragmatic aspects of language, and factors impacting development of verbal speech combine to create a profile of CCN for many individuals with ASD. Given the prevalence and complexity of ASD and the disorder's foundational communication difficulties, a significant number of individuals with ASD require either temporary or long-term AAC supports for expressive communication and/or to enhance the comprehension of language (Allen & Shane, 2014; Mirenda & Iacono, 2009).

The ability to communicate is not merely about asking for a particular need to be met; communication impacts all aspects of learning (Klang et al., 2016). Diminished functional communication skills results in lessened opportunities for children with CCN to communicate, develop language and literacy skills, and to socialize (Andzik, et al, 2018; Bailey, Angell, & Stoner, 2011; Drager et al., 2010). The range of individuality across individuals with CCN explains the necessity of in-depth assessment into all aspects of functioning to ensure proper identification of an appropriate AAC device, supports, treatment and services (Erickson & Geist, 2016). Given the deficits in communication for children with CCN, it is critical to examine the role of AAC in communication treatment and implementing best practices for providing the most appropriate AAC supports (Ryan et al., 2015).

**AAC as Evidence-Based Practices for CCN**

Congress enacted the *Education for All Handicapped Children Act* (P.L. 94-142) in 1975 to ensure the right of all children to a free and appropriate public education. This law was reauthorized in 1991 as the *Individuals with Disabilities Education Act* (IDEA) and subsequently amendment in 1997. It was reauthorized and signed into law by President George W. Bush on December 3, 2004 (U.S. Department of Education, 2016) and was amended through Public Law 114-95, the Every Student Succeeds Act (ESSA) as signed by President Barrack Obama on in December 10, 2015 (U.S. Department of Education, 2018). Section 601(c)(5) of the IDEA reviews key components to enhance the education of students with disabilities, and section H indicates the importance of "supporting the development and use of technology, including assistive technology devices and assistive technology services, to maximize accessibility for children with disabilities."

Sec. 300.324(a)(2)(v) and Sec. 614(d)(3)(B)(v) require that educational teams consider whether a child requires assistive technology devices and services when developing an Individualized Education Program (IEP) for that student. An IEP is a legal contract that outlines how a disability impacts the child's access to the curriculum, participation in their educational program, and how those areas of need will be addressed in the areas of suspected disability (Klang et al., 2016). The school district, in collaboration with the parent and the student's educational team, determines the supports needed and skills to be taught to improve a child's access to a free and appropriate public education based on careful and appropriate consideration of thorough evaluation results. This includes the consideration of assistive technology and AAC. Sec. 602(1)(A) defines an `assistive technology device' as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is

used to increase, maintain, or improve functional capabilities of a child with a disability" (U.S. Department of Education, 2016). Given that communication is a functional capability of a child that can be substantially impacted by CCN, federal and state laws mandate consideration of AAC for children with CCN (U.S. Department of Education, 2018).

While the No Child Left Behind Act of 2001 (NCLB) and the IDEA required educators to apply educational practices that have been proven effective through scientifically based research, the ESSA has updated that language to specify the implementation of evidence-based practices (EBP) (ESSA, 2015). This new language of the ESSA (2015) requires that the interventions put in place for students with CCN are evidence-based interventions that increase the likelihood of improving student outcomes. EBP must guide the decision making process for assessment and intervention practices to ensure the most current, proven research practices are implemented, not only as dictated through federal and state laws, but also as dictated by practice guidelines of the SLP certification board, ASHA (ASHA, 2016d; Ryan et al., 2015).

Given the complexity and severity of CCN, and the resulting impact on critical aspects of communication, applying EBP to maximize effectiveness of treatment protocols is vital (Reichow, Volkmar, & Cicchetti, 2008; Ryan et al., 2015; Simpson, 2005, 2008). Schlosser and Raghavendra (2004) proposed a definition of EBP for the field of AAC, which requires the integration of the currently best available evidence-based practices along with professional judgment that considers the values and preferences of the individual with CCN and his/her family. EBP supports functional outcomes for individuals with CCN that resonate with the aims of the ICF and ICF-CY that are designed to maximize functioning and participation in everyday life for all persons so that shared meaning and purpose in life is achieved (Fried-Oken & Granlund, 2012).

EBP for children and adults with CCN requires supports that allow them full access to learning and social interactions across contextual environments (Erickson & Geist, 2016). Implementing EBP enhances the long-term outcomes for those with CCN (Ryan et al., 2015). EBP requires the development of communicative competence for individuals with CCN with the ultimate goal of achieving mastery across linguistic, operational, social, and strategic domains (Light, 1989; Light & McNaughton, 2014; Pennington et al., 2016). Research indicates that providing AAC devices to those with CCN results in a positive impact on communication skills and quality of life measures and is an established EBP (Fried-Oken et al., 2012; Fteiha, 2017; Ganz, Rispoli, Mason, & Hong, 2014; Lorah, Karnes, & Speight, 2015; O'Neill, Light, & Pope, 2018; Roche et al., 2014; Walker & Snell, 2013; Wendt, 2009).

Intentional planning and thoughtful intervention are required to ensure that individuals with CCN have access to AAC systems that are paired with meaningful and frequent opportunities to interact with a variety of others throughout the day (Andzik et al., 2018; Chung & Douglas, 2014; Light & McNaughton, 2014). Multiple opportunities to interact across a variety of settings and a variety of communicative partners are essential for the acquisition of new communication skills and generalization of those skills (Andzik et al., 2018; Beukelman & Mirenda, 2013). Communicative partners, including teachers, friends, peers, coworkers, and family members, require training and support in the implementation, programming, and use of AAC (Andzik et al., 2018; Caron et al., 2016; De Bortoli, Arthur-Kelly, Mathisen, & Balandin, 2014; O'Neill et al., 2017). Careful and appropriate assessment is a critical EBP that allows for the matching of an individual with the best AAC technology; without this crucial consideration, development of communicative competence may be hindered and the device abandoned (Beukelman & Mirenda, 2013; Caron et al., 2016). AAC has been identified as a key resource to

provide social inclusion and communication development for a wide range of individuals with CCN, including those with ASD, intellectual and/or physical disabilities (Fteiha, 2017; Krüger & Berberian, 2015; Ricci et al., 2017).

A final key component of EBP for individuals with CCN includes the provision of these intensive interventions within the network of a team (Pennington et al., 2016). A transdisciplinary or interprofessional collaborative team is required to deliver adequate assessment and intervention supports for individuals with CCN (Batorowicz & Shepherd, 2011; Bruce & Bashinski, 2017; Downing et al., 2015; Ogletree, 2017; Pennington et al., 2016). Transdisciplinary practices require professionals, family members, and the individual with CCN to interact and share knowledge that optimizes outcomes for the individual with CCN (Ogletree, 2017). Team-based practices are therefore a critical EBP for this population of individuals (Bruce & Bashinski, 2017; Ogeltree, 2017; Ogletree et al., 2017).

AAC allows the communicative skills of an individual to achieve maximum effectiveness through symbolic supplementation or replacement of speech through aided or unaided means. An unaided communication system relies on the person's body without external supports such as sign language and gestures. Aided systems rely on external supports to augment communicative efforts, such as picture boards, communication books, and SGDs (ASHA, 2004). The use of aided systems that include visual supports (pictures and symbols) has become such a proven best practice that Krüger and Berberian (2015) asserted that they are now to be expected and not merely provided in special circumstances. Aided AAC includes VOCA, also referred to as SGDs, which can range from high-tech dynamic display devices to mid-tech devices with static, replaceable picture boards that can speak a range of pre-recorded message depending on the

complexity and size of the available outputs (Bradshaw, 2013; Hourcade, Tami, West, & Parette, 2004).

As noted previously, the research demonstrating the significant benefits of AAC for individuals with CCN is substantial and growing (Branson & Demchak, 2009; Fried-Oken et al., 2012; Ganz et al., 2012; Krüger & Berberian, 2015; Light & McNaughton, 2012b; O'Neill et al., 2018; Ricci et al., 2017; Roche et al., 2014; Schlosser, Sigafoos, & Koul, 2009; Walker & Snell, 2013). The frequency with which AAC is recommended for children with ASD is also increasing (Allen & Shane, 2014; Fteiha, 2017; Ganz, 2015; Ganz et al., 2017; Mirenda & Iacono, 2009; Ogletree, 2007; Olive, Lang, & Davis, 2008; Shane et al., 2012; Shane, Laubscher et al., 2011). The development of functional communication skills, considered the ability to apply the necessary language skills required to successfully communicate in a given context, is a primary goal of AAC interventions (Drager et al., 2010; McNaughton & Light, 2015).

The impact of CCN on the dynamic, transactional process of communication between people is significant and without functional communication there is a significant risk for barriers to effective access due to discriminatory practices (Blackstone et al., 2007; Dada, Horn, Samuels, & Schlosser, 2016). Light and McNaughton (2012b) found that the implementation of AAC supports resulted in gains in a multitude of language skills, including making requests and comments, taking turns in conversation, developing vocabulary skills, increasing sentence length, developing grammatical skills, and improving phonological awareness, reading, and writing skills. Strong empirical evidence exists to support that AAC intervention results in positive outcomes (Beukelman et al., 2015; Branson & Demchak, 2009; Fried-Oken et al., 2012; Ganz, 2015; Light & McNaughton, 2012b; Machalicek et al., 2010; Roche et al., 2015; Romski et al., 2015). The increased federal and state regulations supporting implementation of

technology, along with improved public and professional awareness of the benefits associated with AAC implementation, and empirical research of AAC as best practices, have propelled these strategies into mainstream awareness as effective intervention options for individuals with CCN (Light & McNaughton, 2012b; McNaughton & Light, 2015).

**AAC Assessment and the SLP**

SLPs play a crucial and pivotal role in the assessment and selection of appropriate AAC supports for individuals with CCN, often acting as an AAC specialist by taking charge of the team assessment process that results in the recommendation of a specific AAC device and intervention recommendations (Lund et al., 2017). ASHA's Scope of Practice in Speech-Language Pathology (2016d) indicates that SLPs are responsible for optimizing an individual's quality of life by providing EBP that facilitate his or her ability to communicate. Each person with CCN should have an individualized assessment that includes the expertise of a SLP to determine what communication needs exist and which, if any, AAC device can meet those needs (Bradshaw, 2013; Hershberger, 2011). Given the specialized training SLPs undergo in regard to the development and remediation of communication skills, they are most frequently at the center of the AAC team assessment process (Lund et al., 2017). This is a process requiring such careful consideration that Iacono (2014) refers to the practice of matching an individual with CCN with the appropriate AAC support as a "science." EBP indicates that effective assessment of individuals with CCN must include a holistic view of the impact of the disability on the individual in context, which requires a comprehensive and quality evaluation for the provision of AAC devices (Lund et al., 2017). SLPs must address numerous challenges to complete the assessment, including gathering voluminous amounts of information, keeping up with rapid

changes in AAC device development, and educating themselves on the vast differences within the population of those with CCN (Beukelman & Mirenda, 2013; Lund et al., 2017).

Cockerill et al. (2014) found that proper assessment was critical for effective AAC implementation and best achieved through a significant investment in selecting the appropriate AAC system for an individual. Assessment must consider the broader factors impacting communication skills for the individual, including functional goals of the communication and the developmental requirements of participation in targeted activities (Rowland et al., 2012.). Previous research has dictated that SLPs be a part of a comprehensive team to assess an individual's participation in various life activities for appropriate assessment of an AAC device, which includes completing feature matching to maximize effective recommendations (Beukelman & Mirenda, 2013). SLPs carefully consider the motor, cognitive, language, and contextual needs of each individual and match the features of the AAC device with the skills and needs of the client with CCN (Beukelman & Mirenda, 2013).

The influx of mobile technologies is having an impact on SLPs' team therapeutic assessment practices and interventions given the rise in technological and concomitant app availability (Caron, 2015). Gosnell et al. (2011) reported that many SLPs are often now being confronted with "iDevices" unexpectedly being presented at an assessment center or school with the expectation of implementation once the family is given requested guidance on an appropriate app to support communication needs. It is yet to be determined the impact that recent technological advancements have had on the fundamental SLP team assessment process and whether or not this has compromised the provision of best possible AAC devices for individuals with CCN (Light & McNaughton, 2013). Given that trends in the research indicate that families are now making decisions for technology and AAC options, often without the completion of a

quality assessment, a significant challenge for SLPs striving to implement best practices and technology supports that facilitate an individual's communication goals is now apparent (Meder, 2012).

Janice Light, a leading AAC researcher and contributor to the field, stated during her 1996 lecture for the International Society for Augmentative and Alternative Communication (ISAAC) titled "Communication is the Essence of Human Life," that the industry was so rushed to "do something" by providing a quick technological answer that the professionals leading the charge neglected to take the time to "watch and listen, and truly understand" the needs of the individuals they serve (Light, 1997, p. 64). Light (1997) further asserted that communication is about people and their ability to interact with each other and should not be focused on any particular technology or system. Light (1997) made these assertions prior to the introduction of the iPad, iPod, tablets, and smart phones to the culture of the United States. Today's hyper focused technological society has begun a shift toward the quick and consumer-oriented provision of technology; this practice may be threatening the preservation of best practices by SLPs within the team assessment framework that enables those with CCN to maximize their communication potential through appropriately matched AAC supports (Light & McNaughton, 2013; Meder & Wegner, 2015). It is critical to assess the impact of the increasing consumer-oriented/platform-first model on the quality of team assessment practices by SLPs supporting individuals with CCN given that best practice asserts that comprehensive team assessment should be the greatest factor driving the AAC decision-making process (Meder & Wegner, 2015).

**Mobile Technology and AAC Practices**

The introduction of the iPad on April 3, 2010, began a revolution that has resulted in a marked increase in the use of high-tech AAC as the range of devices that improve ease of access to a variety of information and allow for social connections with phones, tablets, and notebook computers has advanced (Ganz et al., 2017; Still, Rehfeldt, Whelan, May, & Dymond, 2014). Through these technological advancements there are now a range of options for everyone, including those with CCN (Light & McNaughton, 2013). Advancements include not only Apple products (e.g., iPad, iPad Pro, iPad Mini, iPhone, iPod) but also products from Samsung, Amazon, and Google that use the Android operating system (e.g., Galaxy devices, Amazon tablets, Google phones) (Boster & McCarthy, 2017). Mobile technology devices contain a wide range of accessibility features. When paired with an AAC app such as AutisMate, Proloquo2 Go, Go Talk Now, Easy VSD, Language Acquisition through Motor Planning, Snap Scene, Tobii Dynavox Compass, Sono Flex, or Boardmaker, this technology has the potential to be as or more effective than a traditional AAC device for improving an individual with CCN's functional communication skills (Boster & McCarthy, 2017, 2018; Caron, Light, Davidoff, Drager, 2017; Therrien & Light, 2016). In fact, the same technology innovations that make access easier for everyone have begun to impact the AAC field in a variety of ways, including the development of smaller, more portable, and more easily accessible SGDs and, as previously mentioned, iPads, and other mobile technologies with AAC apps (Alzrayer et al., 2014; Bradshaw, 2013; Lorah et al., 2013, McNaughton & Light, 2013; Shane et al., 2012). This increase of available mobile technology is having a dramatic impact on the lives of many individuals with CCN (Fager et al., 2012; Flores et al., 2012; McNaughton & Light, 2013; Still et al., 2014).

Light and McNaughton (2012b) contend that the development of mobile technologies "has rocketed AAC into the mainstream. Mobile technologies are relatively inexpensive, readily available, and socially valued; as a result, they are readily adopted by individuals with CCN and their families" (p. 36). Children with CCN and their peers may be more likely to use AAC technologies that are appealing to them and socially accepted (Light & Drager, 2007; Therrien & Light, 2016). The increase in the availability and use of mobile technologies has also increased the familiarity and comfort for families seeking AAC supports for their children with CCN (Hershberger, 2011; Light & McNaughton, 2013; McNaughton & Light, 2013; Meder & Wegner, 2015; Rummell-Hudson, 2011). This flourishing technology market has propelled AAC into the mainstream, resulting in increased public awareness and greater social acceptance (McNaughton & Light, 2013; Rummell-Hudson, 2011). Allen and Shane (2014) hypothesize that the shift away from a traditional model of AAC provision may be empowering for families given what can be an overwhelming process given the expansive range of options available. Although consumers may have to forfeit previously held standards of durability, reduced expense and improved convenience and portability have made these products an alluring alternative to traditional AAC devices for families (Meder & Wegner, 2015). In addition, while a specialized device could possibly highlight a disability, now individuals with CCN can use the most up-to-date technology on the market (Bradshaw, 2013; Hershberger, 2011).

Increasingly, AAC supports are being chosen based on popular media stories, Internet testimonials, or recommendations from fellow parents, friends, or family as opposed to a systematic assessment based on the individual with CCN's strengths and need areas (Meder & Wegner, 2015). The team assessment process may be bypassed completely, resulting in the purchase of AAC apps and technologies that may not match the individual's needs and skills,

thereby negating the desired positive effects (Gosnell et al., 2011; McBride, 2011; McNaughton & Light, 2013). Hershberger (2011) agreed, finding that although bypassing the funding process reduces time and cost, it also often eliminates key clinical processes involved in selecting a device and creating a clinical intervention plan.

Consumers are now making independent decisions about AAC solutions and completely segregating themselves from the clinical assessment process, including multi-disciplinary evaluation, device prescription, and funding processes (McNaughton & Light, 2013). This may be resulting in a dramatic shift away from efficient, effective, and quality team assessment and a move toward a new consumer-oriented model for identifying AAC solutions (Beukelman & Mirenda, 2013; Costello et al., 2013; Kagohara et al., 2013; Light & McNaughton, 2012b; McNaughton & Light, 2013; Meder & Wegner, 2015). No longer is the individual with CCN or family waiting for the completion of a lengthy and time-consuming assessment for carefully matched AAC supports or insurance funding; families are doing their own research and making decisions to purchase readily available technologies and apps (Beukelman, 2012; Hershberger, 2011; Light & McNaughton, 2012a; Meder & Wegner, 2015; Shane, Laubscher et al., 2011).

McNaughton and Light (2013) emphasized that researchers have arrived at a landmark moment in the AAC industry given the technological revolution permeating the mainstream society. They assert that as this access increases, researchers anticipate the impact on assessment and intervention strategies and adjust accordingly to meet the wide range of communication needs of those with CCN. McNaughton and Light (2013) also stated that this consumer-driven model focused on technology might neglect the more important goals of improved communication competence. Simply recommending an app without a careful team assessment process that evaluates the range of an individual's strengths and needs within context may result

in a discrepancy between the goals of communication and the mobile technologies purchased, which results in frustration for all involved (McNaughton & Light, 2013). Complications mount given that while parents may make purchases without professional guidance or team assessment, they often call for professional involvement in training of AAC, its components, and implementation (Meder & Wegner, 2015).

Allen and Shane (2014) further summarize two of the challenges generated by the explosion in the accessibility and utilization of mobile device availability: (a) over-fixation on technology as opposed to communication and (b) consumer implementation without input of a knowledgeable team of professionals (resulting in deficiencies in the expansion of pioneering approaches to AAC assessment and intervention). This platform-first approach is putting the technology itself at the forefront of the decision making process, instead of the consideration of individual skills, goals, needs, or availability of supports (Costello et al., 2013). The direct availability of the technology to the families is driving this shift in access and driving purchases that bypass the SLP, AAC researcher, educator, or other AAC provider (AAC-RERC, 2011; Meder & Wegner, 2015). Light and McNaughton (2013) also found that delivering AAC intervention has increasingly become nothing more than providing an AAC device. Much of the focus of consumer-oriented models has been on intervention strategies and the complexity of implementation for the population of individuals with CCN (Allen & Shane, 2014), especially given that the implementation of the mobile technologies and apps for AAC are not based on research or EBP (Light & McNaughton, 2012b). This has resulted in increasing focus on the impact of consumer-oriented decision-making on treatment interventions; however there has been limited indication of the impact on the quality of team assessment practices for

identification of AAC interventions (Baxter, Enderby, Evans, & Judge; 2012a, 2012b; Meder & Wegner, 2015).

Meder and Wegner (2015) found that of the 64 parents or caregivers of children with communication-related disabilities surveyed, 64% of the children who owned an iDevice did not receive an assessment prior to acquiring the AAC technology and 73% of those surveyed funded the purchase as an out-of-pocket expense. More than half of those taking part in the study were categorized as falling within the platform-first model and reported making that decision based on the affordability, ease of use, and multi-functionality of the devices. While parents and caregivers independently chose and purchased the AAC device, 62% wanted SLP support for the system after it was chosen in implementing the support with their child (Meder & Wegner, 2015). Given the increase in the availability of mobile technologies that can be applied as communication supports, it is critical to evaluate whether assessment practices remain comprehensive and consistently focused or if this practice has shifted to a simple selection and implementation based on the technologies available (Light & McNaughton, 2013; O'Keefe, Kozak, & Schuller, 2007).

Families have become quick to make a purchase without thorough consideration of the needs and skills of the person with CCN and without consideration of how the technology will be implemented across home, school, and community settings to enhance communication (Light & McNaughton, 2013; Meder, 2012; Meder & Wegner, 2015). Identifying an appropriate technology based on quality and thorough team evaluation may have lost its vital importance (Costello et al., 2013; Meder & Wegner, 2015). If AAC support systems are not well designed based on assessment of individual need, there is the possibility that the person's communicative performance could be negatively affected or disrupted. Light and McNaughton (2013)

highlighted these concerns in their comprehensive text on AAC by emphasizing that with platform-first decisions, individuals with CCN will be forced to adapt to the demands of the device, as opposed to ensuring the device meets their individual needs.

Researchers are encouraging SLPs to stay current in their knowledge of mobile technologies and AAC applications for these devices while encouraging them to develop systematic evaluation strategies for their application (Meder & Wegner, 2015). However, Gosnell (2011) and Bradshaw (2013) note that SLPS could be in danger of trying to fit the person to the device and the app, rather than the app and the device to the person. Unfortunately there has been little to no research to determine the impact on SLPs within the team assessment practices given the technology boom (Meder & Wegner, 2015). The most current research findings emphasize that in order to maximize AAC device use, SLPs must consider the full range of options and fit the technology to the person based on a full assessment; not fit the person to the technology (Light & McNaughton, 2013; Rackensperger et al., 2005).

Skills-based assessments by a team of professionals that focus on an individual's strengths and skills allow the alignment of strengths with appropriate AAC supports and have been found to be critical for AAC success (ASHA, 2004; Beukelman & Mirenda, 2013; Ganz et al., 2012; Helling & Minga, 2014; Light & McNaughton, 2013). Evaluating participation and environmental barriers to communication for an individual with CCN requires the close collaboration of a team of professionals, along with family members and caregivers (Rowland et al., 2012). Determining the quality of team-based assessment practices for individuals with CCN using mobile AAC devices is a critical first step in supporting appropriate intervention planning for these individuals (Meder, 2012). This research study will seek to take an important first step

in comparing the quality of team assessments for individuals with CCN using mobile technology across SLP practice settings.

## Summary

Researchers have concluded that AAC is an EBP for developing communicative competence for individuals with CCN (Erickson & Geist, 2016; Fried-Oken et al., 2012; Fteiha, 2017; Ganz et al., 2014; Lorah et al., 2015; O'Neill et al., 2018; Roche et al., 2014; Ryan et al., 2015; Walker & Snell, 2013). An AAC device provides a critical tool that facilitates the linguistic, academic, and social development of individuals with CCN (Andzik et al., 2018; Chung & Douglas, 2014; Krüger & Berberian, 2015; Light & McNaughton, 2014; Ricci et al., 2017). SLPs are at the center of the comprehensive team assessment process for determining an appropriate AAC device for this population (Andzik et al., 2018; Beukelman & Mirenda, 2013; Chung & Stoner, 2016; Helling & Minga, 2014; Kovach et al., 2016; Ogletree et al., 2017). The increase in availability and affordability of mobile technologies, such as iPad, iPhone, Galaxy series devices, Amazon tablets, and Google phones, combined with a range of apps and accessibility features, has created a platform-first, or consumer-oriented, model of device provision (Beukelman & Mirenda, 2013; Boster & McCarthy, 2017; Costello et al., 2013; Kagohara et al., 2013; Meder & Wegner, 2015). The impact of the burgeoning technology market on the quality of team assessment practices by SLPs has been inferred by some researchers; a need exists to measure the extent of the impact to fill this gap in the research (Costello et al., 2013; Meder & Wegner, 2015).

# CHAPTER THREE: METHODOLOGY

## Overview

This chapter begins with a rationale for the chosen causal-comparative and descriptive research design. The research questions and null hypotheses are presented along with a description of the participants and setting. The instrument is introduced and explained. The chapter concludes with the procedures and data analysis sections.

## Design

The purpose of this causal-comparative quantitative study was to examined the impact of the independent variable, SLP practice setting, on the dependent variable, the quality of the transdisciplinary assessment process, as appraised by SLPs through a causal-comparative research design (Creswell, 2012). To determine this difference, the researcher used survey research and a questionnaire to collect data on the quality of transdisciplinary team assessment practices from a systematic random sample of SLPs that self-identified as providing AAC assessment and intervention services to individuals with CCN. Causal-comparative research design is most appropriate for the initial exploration of cause-and-effect relationships in educational research as was required for this study (Gall, Gall, & Borg, 2007). Causal-comparative research allowed for the observation of the identified and existing independent variable of SLP practice setting on the dependent variable, the quality of transdisciplinary assessment as evaluated by SLPs (Gall et al., 2007).

The researcher collected descriptive data to better understand SLP assessment practices for mobile technology as AAC and the extent of mobile technologies being used as AAC devices across the practice settings of education, health care, and private practice. SLPs provided data related to years licensed, years of AAC experience, number of AAC evaluations completed in the

past two years, those evaluations that resulted in the provision of a mobile device, evaluations resulting in the provision of a traditional device, number of individuals with CCN using mobile devices as AAC provided without assessment, and assessment for mobile devices as AAC completed as part of a team, which were analyzed to investigate potential relationships (Gall et al., 2007). SLPs completed the TDMQ instrument to provide data related to their assessment of the quality of assessment for mobile technology as AAC across practice settings.

Survey design is an effective means to collect data from a national sample and has been used effectively to investigate a range of issues impacting the provision of services by SLPs and individuals with CCN (Bruce, Trief, & Cascella, 2011; Deitz, Quach, Lund, & McKelvey, 2012; Fatima et al., 2013; Ratcliff, Koul, & Lloyd, 2008; Sutherland, Gillon, & Yoder, 2005; Weiss, Seligman-Wine, Lebel, Arzi, & Yalon-Chamovitz, 2005). This method of data collection was most appropriate to evaluate the quality of team transdisciplinary assessment practices since a wide geographic area was evaluated and gathering data using the questionnaire provided a standardized and highly structured design method (Creswell, 2012; Gall et al., 2007).

Responses were compared across SLP practice environments as they evaluated the quality of their transdisciplinary team assessment practices for individuals with CCN provided with mobile technologies as AAC devices. This research design allowed for the comparison of the overall quality of the transdisciplinary team assessment practices, as well as the components of this process, by SLPs to evaluate to what extent best assessment practices were being implemented in today's technology-driven marketplace. Given the instrument design, the researcher was able to analyze the experience of quality as a whole, in addition to comparing aspects of the transdisciplinary assessment process as evaluated by the four subscales of the TDMQ: decision making, team support, learning, and developing quality services. The survey

design was appropriate since this research sought to determine if recent increases in mobile technologies were impacting the quality of transdisciplinary assessment practices of SLPs nationally and to compare the impact across practice settings (Creswell, 2012).

## Research Question

In order to explore the quality of assessment practices of SLPs and compare differences in various practice settings, the following research questions were posed:

**RQ1:** Is there a difference in speech-language pathologists' evaluation of the quality of transdisciplinary team assessment practices for individuals with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice?

**RQ2:** What is the difference in the percentage of individuals with complex communication needs who use mobile technology as augmentative and alternative communication without prior assessment in the practice settings of education, health care, and private practice?

## Hypotheses

The null hypotheses for this study were:

**$H_0$1:** There is no statistically significant difference in speech-language pathologists' evaluation of the overall quality of transdisciplinary team assessment practices for individuals with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice as measured by the Team Decision Making Questionnaire.

**$H_0$2:** There is no statistically significant difference in speech-language pathologists' evaluation of the quality of transdisciplinary team assessment practices for individuals with

complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice, as measured by the four subscales, decision making, team support, learning, and developing quality services, of the Team Decision Making Questionnaire.

## Participants and Setting

The target population for this study was practicing SLPs from across the United States who were active members of ASHA and held the highest level of licensure, the Certificate of Clinical Competence (CCC). According to ASHA (2016b), there are over 155,000 practicing SLPs across the United States in a variety of educational, health care, and private settings within which they provide services, including, but not limited to, the following: educational (early intervention, preschool, K-12 schools), college and university research and teaching, health care (hospitals, skilled nursing facilities, outpatient clinics, doctors' offices, home health services), and private practice. Multiple modes were used to elicit participation in this study. A message was posted on the ASHA Community site inviting members with AAC experience to participate in this research and a link to the survey was embedded in the message. A message was posted to the Special Interest Group (SIG) 12, Augmentative and Alternative Communication. This SIG is a group of approximately 3,900 SLPs dedicated to the improvement of AAC supports and services and promotes relevant research in this area of practice. Members of SIG 12 participate in an online community that discusses topics related to AAC where the message inviting members to participate in the survey was provided (ASHA, 2018). Members of SIG 12 were sent individualized messages inviting them to participate in the survey research through the ASHA website.

ASHA's website lists members acting as State Education Advocacy Leaders (SEALs) as

well as State Association officers publicly. These leaders were emailed with information regarding the study along with a request to forward the study information and survey link to those in their membership that may be interested in participating. Members of the Council of State Speech-Language-Hearing Association Presidents (CSAP) were sent the same email requesting participation or sharing of the study invitation to licensed SLPs with AAC experience. Facebook groups to support SLPs evaluating and treating individuals with CCN through AAC technologies were identified through state association websites. An invitation to participate in the study with a link to the survey was posted on these Facebook group pages, following the Facebook group administrator's approval. Lastly, members of ASHA are registered and listed through the membership directory on the organization's website.

Additional members were sampled for this study by searching for members self-identifying as having expertise in AAC. These members were sent an online message through the ASHA website inviting them to participate in this research study with a link to the survey. SLPs were selected using systematic random sampling based on the selection criteria of SLPs having self-identified as having AAC expertise for individuals with CCN in education, health care, and private practice settings, with a target of 200 SLPs per setting. In the online member directory, SLPs with expertise in AAC were selected and paired with the work setting being targeted. Of the resulting list, names were randomly chosen until 200 participants per setting were reached. To conduct the required data analysis for this study, the researcher needed a minimum sample of 60 participants in each practice setting (Gall et al., 2007). The targeted sample was to consist of a minimum of 60 SLPs in the education setting, 60 in a health care setting, and 60 in the private practice setting.

## Instrumentation

The Team Decision Making Questionnaire (TDMQ), developed by Batorowicz and Shepherd (2008), was used to measure the quality of the transdisciplinary team assessment practices of SLPs under the condition of mobile technology across practice settings. Batorowicz and Shepherd (2008) developed this instrument to address the need for a measurement tool that could evaluate the quality of the teamwork process across professionals, as is widely recognized as best practices for AAC assessment. In addition to the total score, the TDMQ consists of four subscales measuring aspects of the transdisciplinary assessment process, including: decision making, team support, learning, and developing quality services. The developers conducted a literature review and collected quantitative and qualitative data for the development of survey items, followed by a principal component analysis (PCA) with a varimax rotation (Batorowicz & Shepherd, 2008). Reliability and validity were established through test-retest reliability and internal consistency (Batorowicz & Shepherd, 2008). This instrument was developed in the clinical area of AAC, making it especially appropriate for the current study.

Since its development in 2008, the TDMQ has been cited in 12 documents per a PlumX Metrics analysis. A Scopus review revealed that the 2008 article outlining the TDMQ has been cited in the following types of research: (a) four reviews of measures of team performance (Marlow, Bisbey, Lacerenza, & Salas, 2018; Shrader, Farland, Danielson, Sicat, & Umland, 2017); (b) in the development of a new questionnaire to evaluate interprofessional consultation meetings (Vyt, 2017); (c) research related to the importance of evaluating collaborative practices across teams in early childhood intervention (Aubin & Mortenson, 2015; Kyarkanaye, Dada, & Samuels, 2017), emergency departments (Innes et al., 2016), care-planning for the elderly (Duner, 2013), nurse-led community care (Sindhu, Pholpet, & Puttapitukpol, 2010), and AAC

(Robillard, Bélanger, Keating, Mayer-Crittenden, & Minor-Corriveau, 2013). The TDMQ instrument was only implemented in one research study since its development to examine clinical perceptions within teamwork practices for AAC in Canada (Batorowicz & Shepherd, 2011).

The TDMQ is a 19-item measure consisting of the subscales related to decision making, team support, learning, and developing quality services. The TDMQ uses a seven-point Likert scale that ranges from "to a vast extent" to "not at all." Responses are as follows: To a vast extent = 7, To a very great extent = 6, To a great extent = 5, To a moderate extent = 4, To a small extent = 3, To a very small extent = 2, Not at all = 1. Likert scales are an appropriate method for collecting data on attitudes of professionals (Barnette, 2010; Gall et al., 2007). SLPs were directed to rate their average experience of team assessment practices resulting in mobile technology for individuals with CCN across their caseload for the past two years when completing the scale. Scores will be totaled for the entire tool as well as within each domain to evaluate central tendency. The combined possible total score on the TDMQ can range from 19 to 143 points. A score of 19 is the lowest possible score and would indicate a lack of quality team functioning in the areas of decision making, team support, learning, and developing quality services. A score of 143 is the highest possible score and would reflect a vast extent of quality in team functioning in the areas of transdisciplinary assessment practices.

Internal consistencies are excellent and the Cronbach's Alphas for the four components range from 0.83 to 0.91. The internal consistency for the entire instrument is 0.96 (Batorowicz & Shepherd, 2008). Permission has been granted to use the instrument and is included in Appendix A. In addition to the TDMQ, demographic information will be collected, including the following:

- years as an SLP,
- years of AAC experience,
- the number of individuals with CCN using an AAC device currently on the SLPs caseload,
- the number of individuals with CCN with mobile devices provided through the consumer-oriented model currently on the SLPs caseload,
- the number of AAC evaluations completed in the past two years by the SLP,
- the number of evaluations resulting in the provision of a mobile device,
- the number of evaluations resulting in the provision of a traditional device, and
- the number of evaluations resulting in the provision of a mobile device completed as a part of the transdisciplinary team process.

## Procedures

An Institutional Review Board (IRB) packet was completed and submitted to Liberty University for approval. The approval is included in Appendix B. The survey instrument was converted to a digital format using Qualtrics, an online survey instrument, and demographic survey questions were added. Once approval was received, members of ASHA were solicited through the Community site, SIG 12, and a random selection of ASHA members with AAC expertise were solicited to complete the survey. Potential individual participants were provided a letter explaining the study with a link to complete the survey either through community posting, message service through ASHA, or email. Completion of the survey acted as consent to participate. Respondents that completed the survey within two weeks were entered into a drawing for a small prize (e.g., $25 Amazon gift card). A follow-up posting was created after one week and a second link to the questionnaire was messaged to all potential respondents after

one week. A final reminder was posted and a message sent after another week to potential respondents requesting completion of the questionnaire instrument. The purpose of the follow-up procedures was to ensure a response return rate of greater than 50% to ensure the minimum criteria of 60 participants per setting was met (Creswell, 2012; Gall et al., 2007).

## Data Analysis

Prior to all data analysis, data screening was completed and all data sets cleaned (Creswell, 2012). Any surveys that were not completed in full were omitted. Box-and-whisker plots for each group were used to screen for outliers. The *Statistical Package for the Social Sciences (SPSS)* was used to first analyze the sample using descriptive statistics to assess mean values for SLPs in each practice setting for the past two years, including: years as an SLP, years of AAC experience, the total number of AAC evaluations completed, those evaluations that resulted in the provision of a mobile device, those evaluations that resulted in the provision of a traditional device, the number of individuals with CCN with mobile devices provided without an assessment, and the number of assessments resulting in the recommendation of a mobile device completed as part of a transdisciplinary team. Means and standard deviation TDMQ values for each setting were calculated. Scores on the TDMQ subscale items were calculated to evaluate central tendency and variance as well as means and standard deviation.

A one-way analysis of variance (ANOVA) was proposed to evaluate the null hypotheses to determine if there was a significant difference in the mean scores of SLPs evaluation of the quality of transdisciplinary teamwork as assessed by the TDMQ for individuals on their caseloads under the condition of mobile technology-based AAC devices (Gall et al., 2007; Howell, 2008). The overall mean value for the quality of the assessment process for mobile technology as AAC was calculated and compared across practice settings.

**Assumption Tests for the Null Hypothesis**

Assumptions were met for the one-way ANOVA for the level of measurement as the dependent variable was measured on the ratio scale and the independent variable is categorical. The sampling was random and SLPs were only allowed to choose one practice setting, ensuring that observations within each variable were independent. Normality was evaluated through the Kolmogorov-Smirnov test, which was not found tenable. Review of Normal Q-Q plots and z-score analysis based on skewness and kurtosis values revealed the dependent variable was approximately normally distributed for each group of the independent variable. Due to violations of Levene's Test for homogeneity of variance, Welch's ANOVA was conducted with additional Games-Howell post hoc testing, further explained in Chapter Four (Rockinson-Szapkiw, 2013). Since five ANOVAs were conducted in this study, a Bonferroni correction was needed to guard against type I error. The alpha level was calculated to be: 0.05/5 = .01 (Warner, 2013).

**Reporting.** In addition to reporting the results of each assumption test run for null hypothesis, the results of the descriptive and inferential statistics were provided. The descriptive statistics of mean (*M*) and standard deviation (*SD*) are reported for null hypotheses one and two, as well as additional descriptive statistics of central tendency. Also reported are the results of the inferential statistic, which include: number (*N*), degrees of freedom (df), significance level (*p*), confidence intervals (CI), and effect size.

**Analysis of RQ2**

Research question 2 is descriptive and has no null hypothesis. Data from the survey were collected and reported to address RQ2 which states: What is the difference in the percentage of individuals with complex communication needs who use mobile technology as augmentative and

alternative communication without prior assessment in the practice settings of education, health care, and private practice?

# CHAPTER FOUR: FINDINGS

## Overview

This study sought to investigate the quality of transdisciplinary assessment practices by SLPs for mobile technology as AAC. The independent variable was the quality of team assessment practices as determined by results of the TDMQ. The dependent variable was the SLP practice setting of education, health care, or private practice. This chapter begins with a review of the research questions that direct this study followed by the null hypotheses. The descriptive statistics are followed by results of the data analysis, including data screening methods, assumption tests, analysis of the null hypotheses, and results of the analysis for research question two. Finally, additional analysis of AAC evaluation data across practice settings is provided.

## Research Questions

**RQ1:** Is there a difference in speech-language pathologists' evaluation of the quality of transdisciplinary team assessment practices for individuals with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice?

**RQ2:** What is the difference in the percentage of individuals with complex communication needs who use mobile technology as augmentative and alternative communication without prior assessment in the practice settings of education, health care, and private practice?

## Hypotheses

**$H_0$1:** There is no statistically significant difference in speech-language pathologists' evaluation of the overall quality of transdisciplinary team assessment practices for individuals

with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice as measured by the Team Decision Making Questionnaire.

**$H_0$2:** There is no statistically significant difference in speech-language pathologists' evaluation of the quality of transdisciplinary team assessment practices for individuals with complex communication needs using mobile technologies as augmentative and alternative devices across practice settings of education, health care, and private practice, as measured by the four subscales, *decision making*, *team support*, *learning*, and *developing quality services*, of the Team Decision Making Questionnaire.

## Descriptive Statistics

Descriptive statistics of mean and standard deviation for the total TDMQ scores by practice setting can be found in Table 1. Mean and standard deviation data obtained for demographic information gathered for SLPs for the past two years for practice settings of education, health care and private practice can be found in Table 2. Detailed analysis including mean, median, mode and standard deviation values of each question in the TDMQ for the four subscales, *decision making*, *team support*, *learning*, and *developing quality services*, across the three practice setting is provided in Appendix D.

Table 1

*Mean and Standard Deviation TDMQ Scores across Practice Settings*

| Practice Setting | | Total TDMQ |
|---|---|---|
| Education | Mean | 4.47 |
| | *SD* | 1.61 |
| Health Care | Mean | 2.98 |
| | *SD* | 2.13 |
| Private Practice | Mean | 3.31 |
| | *SD* | 1.98 |

# Results

## Data Screening

Screening was conducted to check for inconsistencies in responses, missing data, and outliers. A total of 521 responses to the survey were recorded with 278 from the education setting, 118 from the health care setting, and 125 from the private practice setting. Data sets were cleaned following the procedures outlined in Creswell (2012). Sixty-five participants answered the demographic survey questions but did not answer the TDMQ survey questions. The information for these participants was deleted and removed from the data set. Remaining responses for each practice setting were 252 for education, 101 for health care, and 103 for private practice, for a total of 456 responses in the data set. Due to the discrepancy in sample size per practice setting, a randomized sample of 60 data sets was selected per practice setting for analysis. Survey responses were numbered and participants chosen based on the results of a random number generator until 60 responses were chosen for the sample per practice setting.

Table 2

*Descriptive Statistics of Demographic Data across Practice Settings of Education, Health Care, and Private Practice*

| Variable | | N | Mean | *SD* |
|---|---|---|---|---|
| Years as a Licensed CCC-SLP | Education | 60 | 3.42 | 1.45 |
| | Health Care | 60 | 3.10 | 1.58 |
| | Private Practice | 60 | 2.93 | 1.36 |
| Years' Experience with AAC | Education | 60 | 2.78 | 1.53 |
| | Health Care | 60 | 2.43 | 1.49 |
| | Private Practice | 60 | 2.62 | 1.42 |
| Number of Individuals on Caseload Using AAC | Education | 60 | 23.15 | 24.61 |
| | Health Care | 60 | 27.05 | 38.11 |
| | Private Practice | 60 | 37.38 | 92.22 |
| Number of Mobile Devices as AAC without Assessment | Education | 60 | 5.20 | 10.39 |
| | Health Care | 60 | 3.50 | 4.92 |
| | Private Practice | 60 | 4.92 | 4.86 |
| Number of AAC Evaluations | Education | 60 | 12.90 | 16.51 |
| | Health Care | 60 | 18.73 | 26.62 |
| | Private Practice | 60 | 26.13 | 67.06 |
| Evaluations Resulting in the Provision of a Traditional Device | Education | 60 | 3.00 | 5.17 |
| | Health Care | 60 | 13.93 | 22.96 |
| | Private Practice | 60 | 16.80 | 63.74 |
| Evaluations Resulting in the Provision of a Mobile Device | Education | 60 | 7.92 | 10.88 |
| | Health Care | 60 | 3.98 | 7.31 |
| | Private Practice | 60 | 7.45 | 17.55 |
| Mobile Device Evaluations as Part of a Transdisciplinary Team | Education | 60 | 7.78 | 11.99 |
| | Health Care | 60 | 2.88 | 6.67 |
| | Private Practice | 60 | 2.47 | 3.08 |

*Note.* Respondents were asked to provide data based on the past two years of data.

**Assumption Tests**

A one-way ANOVA was planned to test the null hypotheses for the first research question. An ANOVA required that six assumptions were met: (a) a continuous dependent variable (TDMQ survey); (b) the independent variable is categorical with two or more independent groups (SLP practice settings of education, health care, and private practice); (c) independence of observations (only one practice setting specified per response); (d) no

significant outliers; (e) the dependent variable is approximately normally distributed for each group of the independent variable; and (f) there is homogeneity of variances. The first three assumptions of the ANOVA were met due to the study design. There were no significant outliers in the data, as assessed by inspection of a boxplot (see Figure 1).

Normality was examined across the independent variable of practice settings using Kolmogorov-Smirnov's normality test, which was not found tenable at the .05 alpha level for the following: Education Setting factor of competence ($p$ = .061), Health Care Setting factor of competence ($p$ = .000), and Private Practice Setting factor of competence ($p$ = .000). The researcher ran a series of Normal Q-Q plots and calculated z-scores based on skewness and kurtosis. Based on graphical inspection of the plots, and results of z-score calculations at a statistical significance level of .01 as outlined in Table 3, the researcher determined to continue with the analysis using the ANOVA.

The assumption of homogeneity of variances was violated for the mean TDMQ score, as assessed by Levene's test for equality of variances ($p$ = .003). Additionally, there was homogeneity of variances for the *decision making* subscale only (p = .059) and violated for the subscales of *team support* ($p$ = .000), learning ($p$ = .008), and *decision making* ($p$ = .001). The researcher used Welch's ANOVA with post hoc testing to evaluate both null hypotheses because the assumption of homogeneity of variance was violated. Since five ANOVAs were conducted in this study, a Bonferroni correction was needed to guard against type I error. The adjusted alpha level with the Bonferroni correction was calculated to be: 0.05/5 = .01 (Warner, 2013). Welch's ANOVA is robust against violations of normality when sample sizes are similar. In this study, sample sizes were equal (N = 60) therefore no assumption of equality of variance was needed to conduct the analysis using Welch's ANOVA. Based on the results of the robust test of

equality of means, the Games-Howell post hoc test was conducted to determine where differences existed between the scores (Lund Research Ltd., 2018).

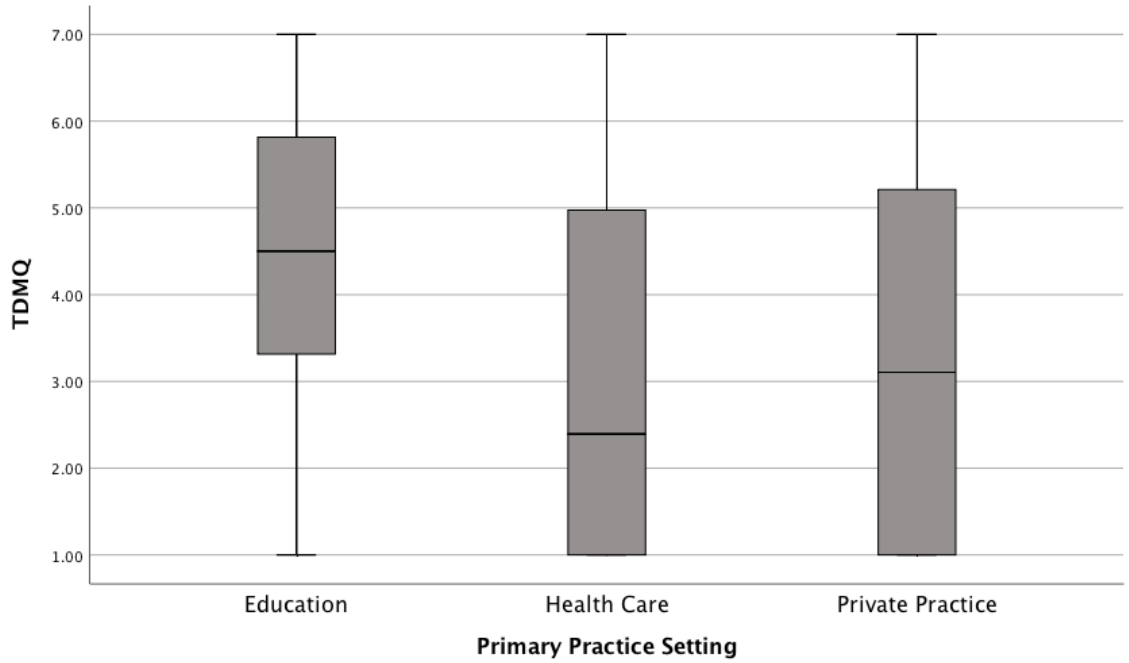


*Figure 1. Boxplots*

Table 3

*Skewness and Kurtosis Calculations per Practice Setting*

| Practice Setting | | Statistic | Standard Error | *z*-score |
|---|---|---|---|---|
| Education | Skewness | -.523 | .309 | 1.69 |
| | Kurtosis | -.698 | .608 | -1.15 |
| Health Care | Skewness | .565 | .309 | 1.83 |
| | Kurtosis | -1.215 | .608 | -1.99 |
| Private Practice | Skewness | .084 | .309 | .27 |
| | Kurtosis | -1.503 | .608 | -2.47 |

*Note*. *z*-score of ±2.58 indicates data is normally distributed

**Null Hypothesis One**

For the first research question, the researcher examined if there was a significant difference in the mean scores of SLPs evaluation of the overall quality of transdisciplinary teamwork as assessed by the TDMQ under the condition of mobile technology-based AAC devices. The quality of transdisciplinary team assessment for mobile technology as AAC (TDMQ score) was statistically different across practice settings, Welch's $F(2, 116.209) = 11.286$, $p < .001$, *est.* $\omega^2 = .26$. Based on the results of Welch's ANOVA, the Games-Howell post hoc test was conducted to compare all possible combinations of group differences given the assumption of homogeneity of variances was violated.

The quality of transdisciplinary assessment for mobile technology as AAC as rated by SLPs increased from the health care setting (N = 60, $M = 2.98$, $SD = 2.13$), to the private practice setting (N = 60, $M = 3.31$, $SD = 1.98$), to the education setting (N = 60, $M = 4.47$, $SD = 1.61$), in that order. The quality of transdisciplinary team assessment for mobile technology as AAC was rated highest by SLPs in the education setting, a mean increase of 1.49, 95% CI [.67, 2.30] over SLPs in the health care setting, which was statistically significant ($p = .001$). The quality of transdisciplinary team assessment was rated higher by SLPs in the education setting than those in the private practice setting as well, with a mean increase of 1.16, 95% CI [.38, 1.94], which was also statistically significant ($p = .002$). There was a mean increase of 0.33, 95% CI [-0.56, 1.22] in the rating of the quality of transdisciplinary team assessment by SLPs in the private practice setting above those in the health care settings, which was not statistically significant (p = .657). See Table 4 for results of the multiple comparisons conducted through the Games-Howell post hoc test.

The group means were statistically significant ($p < .01$) and, therefore, the researcher rejected null hypothesis one that there is no statistically significant difference in SLPs evaluation of the overall quality of transdisciplinary team assessment practices for individuals' with CCN using mobile technologies as AAC devices across practice settings of education, health care, and private practice.

Table 4

*Games-Howell Multiple Comparisons of TDMQ across Practice Settings*

| (I) Primary Practice Setting | (J) Primary Practice Setting | Mean Difference (I-J) | *SE* | Sig. | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|
| Education | Health Care | 1.49 | 0.34 | .000 | 0.67 | 2.30 |
| | Private Practice | 1.16 | 0.33 | .002 | 0.38 | 1.94 |
| Health Care | Education | -1.49 | 0.34 | .000 | -2.30 | -0.67 |
| | Private Practice | -0.33 | 0.38 | .657 | -1.22 | 0.56 |
| Private Practice | Education | -1.16 | 0.33 | .002 | -1.94 | -0.38 |
| | Health Care | 0.33 | 0.38 | .657 | -0.56 | 1.22 |

**Null Hypothesis Two**

For the second hypothesis, the researcher investigated if there was a difference in SLPs evaluation of the quality of transdisciplinary team assessment practices for individuals with CCN using mobile technologies as AAC devices across the practice settings of education, health care, and private practice, as measured by the four subscales, decision making, team support, learning, and developing quality services, of the TDMQ**.**

Means and standard deviation values for each setting based on the subscales and the total TDMQ scores are reported in Table 5. Additional descriptive data for individual items and subscales of the TDMQ, including mean, median, mode, and standard deviation are reported by subscale across *practice settings for decision making, team support, learning, and developing quality services* in Appendix D.

Table 5

*Descriptive Data for Mean Subscale and TDMQ Scores across Practice Settings*

| Practice Setting | | Decision Making | Team Support | Learning | Developing Quality Services | Total TDMQ |
|---|---|---|---|---|---|---|
| Education | Mean | 4.37 | 4.66 | 4.27 | 4.63 | 4.47 |
| | *SD* | 1.65 | 1.64 | 1.67 | 1.81 | 1.61 |
| Health Care | Mean | 2.86 | 3.17 | 2.88 | 3.09 | 2.98 |
| | *SD* | 2.05 | 2.31 | 2.22 | 2.20 | 2.13 |
| Private Practice | Mean | 3.02 | 3.55 | 3.23 | 3.68 | 3.31 |
| | *SD* | 1.87 | 2.15 | 2.04 | 2.30 | 1.98 |

All subscales of the TDMQ were found to be statistically different per Welch's Robust Test of Equality of Means across practice settings as displayed in Table 6, therefore the Games-Howell post hoc test was conducted to compare subscale mean scores across practice settings as displayed in Table 7. The researcher rejected the null hypothesis that there is no statistically significant difference in SLPs evaluation of the quality of transdisciplinary team assessment practices for individuals with CCN using mobile technologies as AAC devices across practice settings of education, health care, and private practice, as measured by the four subscales, *decision making*, *team support*, *learning*, and *developing quality services*, of the TDMQ.

Table 6

*Welch's Robust Test of Equality of Means*

| Subscale | Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|
| Decision Making | 12.044 | 2 | 117.083 | .000 |
| Team Support | 10.054 | 2 | 115.161 | .000 |
| Learning | 8.971 | 2 | 116.201 | .000 |
| Developing Quality Services | 9.137 | 2 | 116.630 | .000 |

*Note.* $p < .0005$ = there is a statistically significant difference in at least one group mean.

Table 7

*Games-Howell Multiple Comparisons of TDMQ Subscales Across Practice Settings*

| Dependent Variable | (I) Primary Practice Setting | (J) Primary Practice Setting | Mean Difference (I-J) | *SE* | Sig. | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|
| Decision Making | Education | Health Care | 1.51* | 0.34 | .000 | 0.70 | 2.32 |
| | | Private Practice | 1.35* | 0.32 | .000 | 0.58 | 2.11 |
| | Health Care | Private Practice | -0.16 | 0.36 | .891 | -1.02 | 0.69 |
| Team Support | Education | Health Care | 1.49* | 0.36 | .000 | 0.62 | 2.36 |
| | | Private Practice | 1.11* | 0.35 | .005 | 0.29 | 1.94 |
| | Health Care | Private Practice | -0.38 | 0.41 | .625 | -1.34 | 0.59 |
| Learning | Education | Health Care | 1.40* | 0.36 | .000 | 0.54 | 2.25 |
| | | Private Practice | 1.04* | 0.34 | .008 | 0.23 | 1.85 |
| | Health Care | Private Practice | -0.36 | 0.39 | .628 | -1.28 | 0.57 |
| Developing Quality Services | Education | Health Care | 1.54* | 0.37 | .000 | 0.66 | 2.41 |
| | | Private Practice | 0.95 | 0.38 | .035 | 0.05 | 1.85 |
| | Health Care | Private Practice | -0.59 | 0.41 | .326 | -1.56 | .039 |

*Note.* *The mean difference is significant at the Bonferroni-corrected 0.01 level.

Welch's ANOVA with post hoc analysis was conducted to explore differences in how SLPs rated the four aspects of transdisciplinary teamwork for assessment as measured by the TDMQ subscales: *decision making*, *team support*, *learning*, and *developing quality services*. The quality of *decision making* practices for mobile technology as AAC was statistically different across practice settings, Welch's $F(2, 117.083) = 12.044$, $p < .001$, *est.* $\omega^2 = .29$. The decision-making aspect of the team process increased across each of the practice settings: health

care ($M$ = 2.86, $SD$ = 2.05), private practice ($M$ = 3.02, $SD$ = 1.87), education ($M$ = 4.37, $SD$ = 1.65), in that order. The quality of *team support* within assessment practices was statistically different across practice settings, Welch's $F(2, 115.161) = 10.054$, $p < .001$, *est.* $\omega^2 = .23$. Team support also increased across each of the settings: health care ($M$ = 3.17, $SD$ = 2.31), private practice ($M$ = 3.55, $SD$ = 2.15), education ($M$ = 4.66, $SD$ = 1.64). Similarly, the quality of *learning* by teams as measured by this subscale was statistically different across practice settings, Welch's $F(2, 116.201) = 8.971$, $p < .001$, *est.* $\omega^2 = .21$. Additionally, the learning subscale followed the same trend of increasing across practice settings: health care ($M$ = 2.88, $SD$ = 2.22), private practice, ($M$ = 3.23, $SD$ = 2.04), education ($M$ = 4.27, $SD$ = 1.67). Lastly, the quality of *developing quality services* during assessment of mobile technology as AAC was statistically different across practice settings, Welch's $F(2, 116.630) = 9.137$, $p < .001$, *est.* $\omega^2 = .21$. Developing quality services showed increasing scores across each of the settings: health care ($M$ = 3.09, $SD$ = 2.20), private practice ($M$ = 3.68, $SD$ = 2.30), and education ($M$ = 4.63, $SD$ = 1.81).

Results across practice settings indicated a statistically significant higher quality of transdisciplinary team assessment practices in the education setting when compared to both the health care and private practice settings for decision making, team support, and learning. There was a statistically significant higher quality for the subscale of developing quality services between education and health care settings only. It is important to note that the difference between education and private practice settings would have been significant ($p$ = .035) had the Bonferroni correction not been employed as it lowered the alpha level to $p < .01$. The differences found between ratings of the four subscales by SLPs in the health care and private practice settings were not found to be statistically significant. The mean scores across subscales and their differences with confidence intervals are displayed in Figure 2.

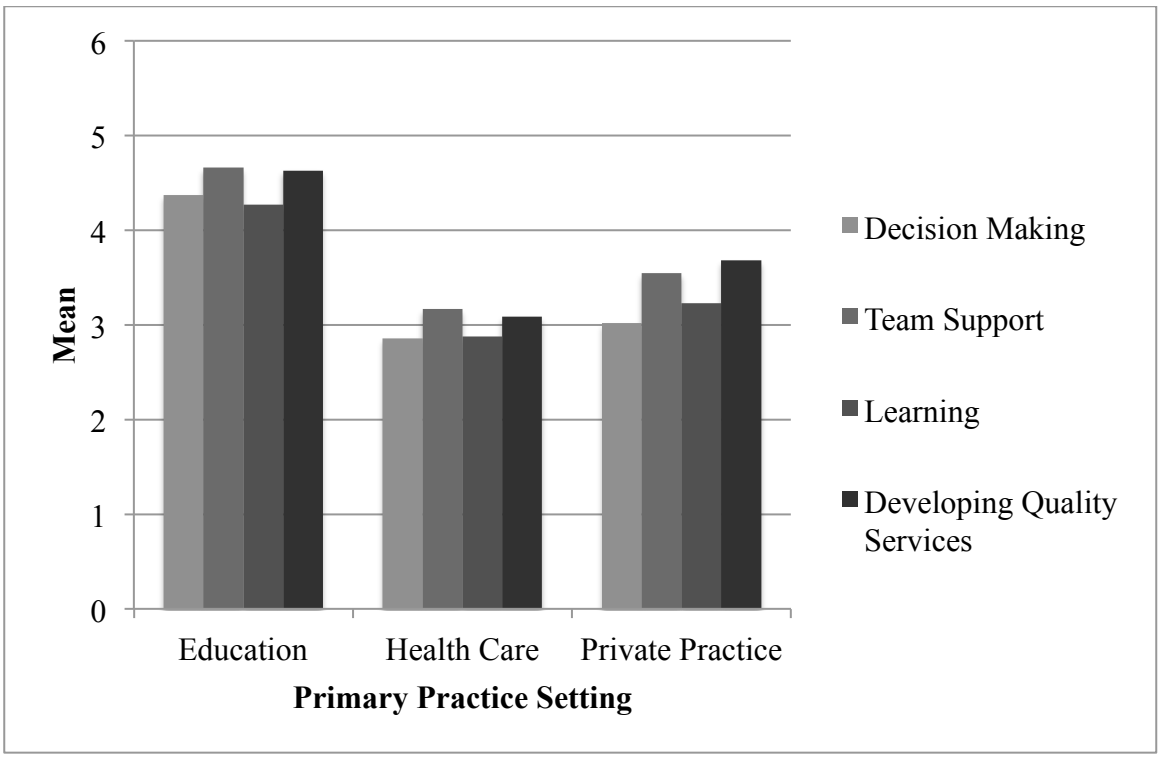


Figure 2. Clustered bar graph of mean subscale scores of the TDMQ across practice settings.

**Analysis of RQ2**

For the second research question, the researcher asked what the difference was in the percentage of individuals with CCN who use mobile technology as AAC without prior assessment in the practice settings of education, health care, and private practice. Descriptive data collected through surveys were used to calculate the average number of individuals using mobile devices as AAC without prior assessment in the past two years. This datum was divided by the average number of individuals on the SLPs caseload using AAC in the past two years and compared across SLP practice settings. The results of this analysis are outlined in Figure 3.

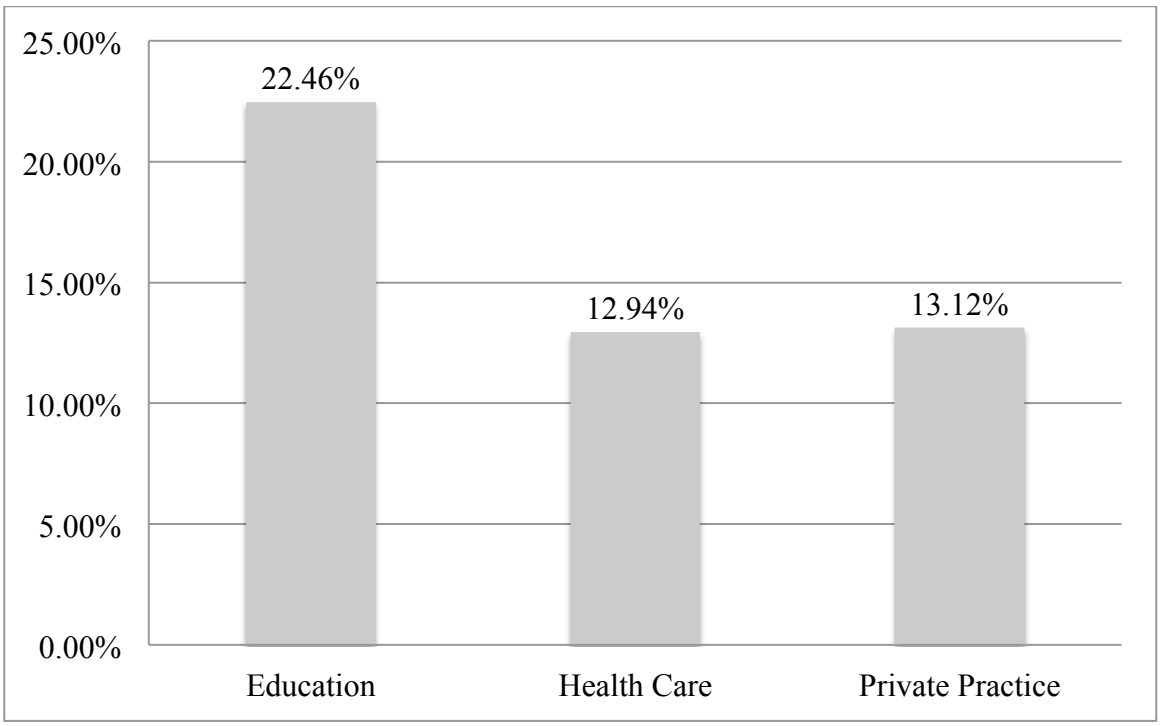


*Figure 3.* Percentage of individuals using mobile technology as AAC without prior assessment per practice setting.

**Additional Analysis**

Survey data were analyzed to determine the difference in the percentage of AAC evaluations resulting in the provision of a traditional device versus a mobile device across practice settings. For each practice setting, the average number of evaluations resulting in the provision of a traditional device was divided by the average number of total AAC evaluations completed. Similarly, for each practice setting, the average number of evaluations resulting in the provision of a mobile device was divided by the average number of total AAC evaluations completed. These data were reported across the past two years. Results of this analysis are displayed in Figure 4.

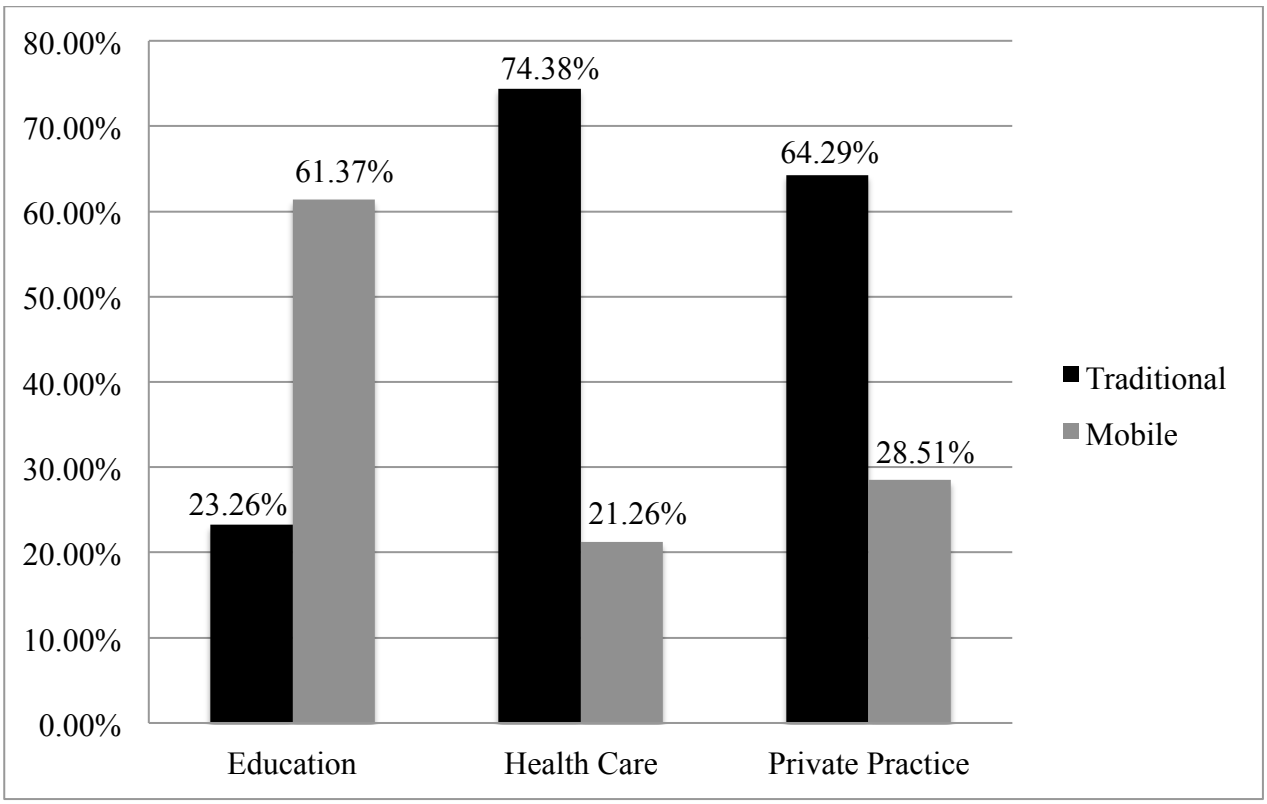


*Figure 4*. Percentage of AAC evaluations resulting in traditional vs. mobile devices by practice setting.

Lastly, data were analyzed to determine the percentage of mobile devices provided as AAC outside of the transdisciplinary assessment process. For each practice setting, the number of mobile devices SLPs indicated were provided as an AAC device following a transdisciplinary team assessment was divided by the total number of mobile devices provided following an AAC assessment. These data were also reported across the past two years. Results of this analysis are displayed in Figure 5.

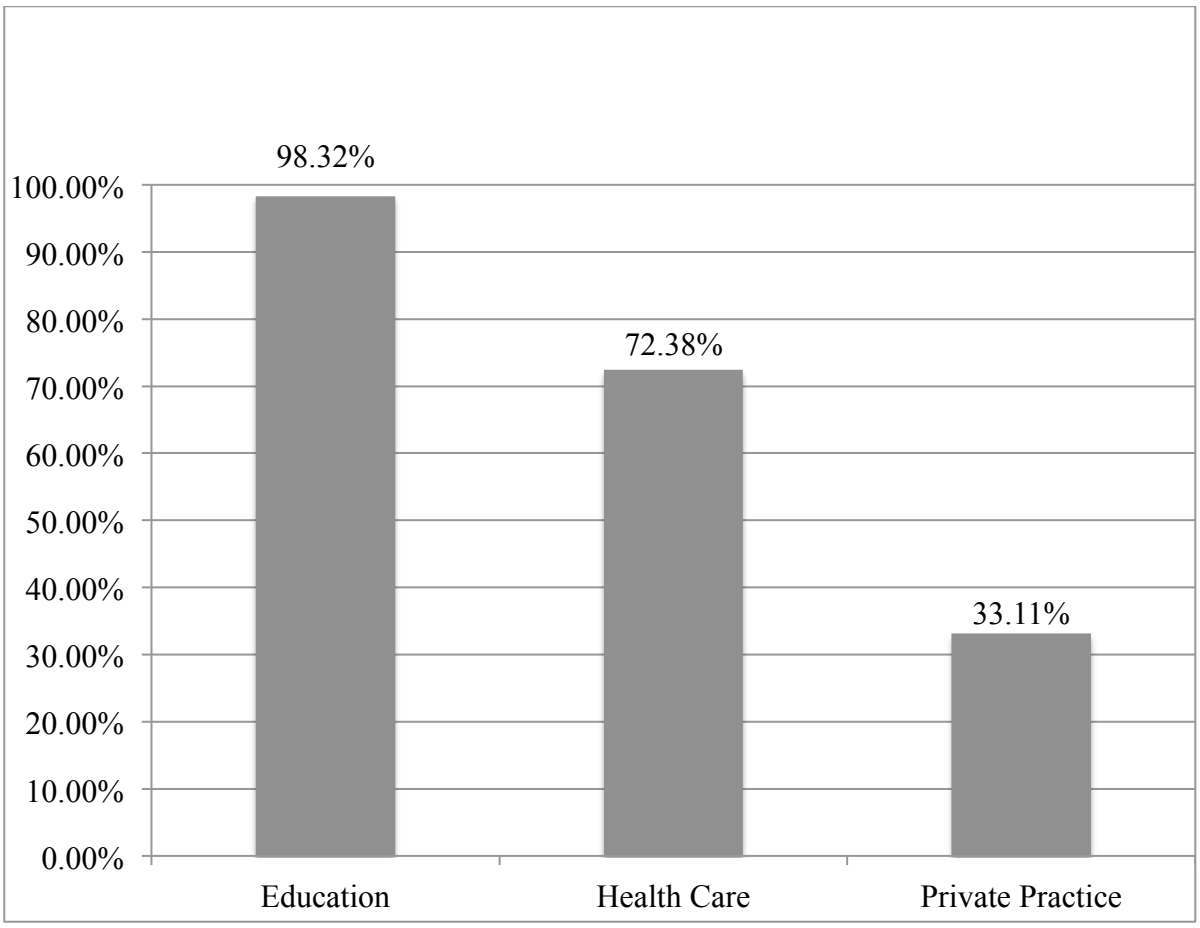


*Figure 5.* Percentage of mobile device evaluations done as part of a transdisciplinary team per practice setting.

# CHAPTER FIVE: CONCLUSIONS

## Overview

This chapter provides a discussion of each research question posed in the present study in relationship to the research outlined in the literature review. The implications of the research findings are presented, followed by the limitations of this study and recommendations for future research.

## Discussion

The purpose of this descriptive and causal-comparative research study was to determine the quality of transdisciplinary assessment practices as evaluated by SLPs for the provision of mobile technology as AAC for individuals with CCN, as well as to collect data related to the provision of mobile technology as AAC across SLP practice settings of education, health care, and private practice. The assessment of functional communication skills requires careful consideration of the factors impacting the individual with CCN's participation within and across daily contexts (Light & McNaughton, 2014; Rowland et al., 2016). ASHA (2004) endorses models of assessment for AAC that comprehensively consider an individual's participation across contexts and social partners, while identifying barriers and supports for effective communication within a transdisciplinary model (Andik et al., 2018; Beukelman & Mirenda, 2013; Light & McNaughton, 2012, 2014). Transdisciplinary assessment is a crucial best practice given the varied sensory, social, cognitive, academic, motor, language, and/or behavioral components that potentially impact an individual's communicative competence (Beukelman & Mirenda, 2013; Brady et al., 2016; Chung & Stoner, 2016; Kovach et al., 2016).

Transdisciplinary assessment teams must collaborate effectively to facilitate clinical decisions that blend professional expertise, resulting in meaningful and effective interventions

(Bruce & Bashinski, 2017; Liu et al., 2018; Ogletree at al., 2017). SLPs are the professionals most often at the center of the transdisciplinary assessment process for AAC given the specialized training they receive for assessing and facilitating communication skill development (ASHA, 2016d; Lund et al., 2017). The targeted outcome of quality transdisciplinary assessment practices for AAC is the matching of the technology that best supports and improves functional communication skills for the individual with CCN by the SLP (Beukelman & Mirenda, 2013). Today's technologically advanced climate of mobile technologies has resulted in an influx of access to potential AAC devices with little to no research into how these advancements have impacted transdisciplinary assessment practices by SLPs (Meder & Wegner, 2015). In addition, no research has been completed to compare what difference exists across practice settings in the quality of transdisciplinary assessment for mobile technology as AAC.

**Null Hypothesis One**

The first research question examined if there was a significant difference across practice settings in the overall quality of transdisciplinary assessment practices by SLPs for mobile technology as AAC. The mean score of the TDMQ measured the quality of the team process. SLP practice settings were defined as education (early intervention, preschools, K-12 schools) health care (hospitals, skilled nursing facilities, outpatient clinics, doctors' offices, home health services), and private practice. The researcher found there were statistically significant differences in SLPs rating of the quality of transdisciplinary assessment for mobile technology across practice settings. The highest rating of the quality of transdisciplinary assessment practices was by SLPs in the education setting. SLPs in education settings rated the quality of their assessment practices significantly higher statistically than SLPs in both the health care and

private practice settings. A statistically significant difference was not found when comparing SLP ratings in the health care and private practice settings.

Based on these results, the first null hypothesis was rejected. Team-based practices are critical for successful assessment and intervention for individuals with CCN and align with best practices provided by the ICF conceptual framework (Brady et al., 2016; Bruce & Bashinksi, 2017; Ogletree, 2017; WHO, 2001). Research clearly outlines the importance of team planning to integrate the plethora of information required for assessing an individual's functional communication skills and deficits within this framework (Rowland et al., 2012). These results may indicate a potential lack of strategies to facilitate the level of collaboration necessary for a quality assessment process by team members (Golom & Schreck, 2018). Transdisciplinary teamwork requires members to complete both independent and shared work paired with collective accountability and shared responsibility among professionals working with AAC (Pless & Granlund, 2012).

The higher quality of assessment practices reported by SLPs in education may indicate a greater expectation of interprofessional practices in this setting. School districts are mandated to consider and evaluate a student's functioning within the context of an educational team (U.S. Department of Education, 2018). IEP planning under the regulations put forth in the IDEA requires an integrative process involving multiple professionals to determine whether or not a child with a disability is making effective progress academically, socially, and behaviorally, and requires specially designed instruction (Klang et al., 2016). This process supports the outcomes targeted through the ICF of maximizing functioning and participation within the child's daily contexts, and may be facilitating the development of skills required to create highly functioning transdisciplinary teams (Fried-Oken & Granlund, 2012).

While levels of quality of transdisciplinary assessment were higher in education, practitioners in this setting only identified quality *to a moderate extent*. Practitioners in the private practice and health care settings were experiencing quality transdisciplinary assessment practices *to a small extent* and *to a very small extent* respectively. This is somewhat alarming, given that transdisciplinary practice done well facilitates higher quality outcomes for individuals being assessed (Dow, Ivey, & Shulman, 2018). Ogletree et al. (2017) assert that transdisciplinary practice requires the structure that supports collaboration paired with individual commitment to collaborative practices, a factor apparently lacking in the health care and private practice settings in the context of assessment for mobile technology as AAC. Further research is needed to investigate the cause of these differences across practice settings, explore causal factors related to the mobile technology specifically in relationship to the quality of transdisciplinary assessment practices, and to examine the impact lower quality practices have on the outcomes for the individual with CCN (Ogletree et al., 2017).

**Null Hypothesis Two**

The first research question also sought to investigate any differences in the quality of transdisciplinary assessment when mobile technology was the recommendation of the team across SLP practice settings within the facets quantified through subscales measuring aspects integral to the team process: decision making, team support, learning, and developing quality services. As previously noted, SLPs in the education setting experience the highest quality of transdisciplinary practices overall. This was a consistent finding across all subscales of the TDMQ as well. The decision making subscale asked questions related to how well practitioners were supported within teams to make recommendations, consistently apply standards and policies, and have clinical decisions validated. This is a critical component of coordination

within the ICF framework as professionals must determine which factors are impacting optimal functioning for an individual as AAC interventions are planned that will allow for the sharing of meaningful information across social contexts (Rowland et al., 2016). Within the education setting, the transdisciplinary process was found to facilitate decision making *to a moderate extent* while in the private practice setting it was *to a small extent*, and in the health care setting *to a very small extent*. Based on these results, the second null hypothesis was rejected. This finding supports other research indicating that while interprofessional collaboration is valued among a variety of rehabilitative professionals, barriers exist to effective practices in health care settings (De Vries, 2016). Golom and Schreck (2018) question whether or not reimbursement models impacting SLPs within health care and private practice settings foster the core requirements of effective transdisciplinary work; additional research is needed to determine if this model is a limiting factor to quality transdisciplinary practices in these settings.

The team support subscale asked questions related to whether or not the team process allowed colleagues to support one another through the sharing of ideas, advice, and success. Practitioners in the education setting experienced team support *to a moderate extent* and those in health care and private practice settings experienced team support *to a small extent*, with private practice mean scores slightly higher than those in the health care setting. While scores by those in education were highest, even these scores indicate barriers to effective teamwork clearly being experienced across all settings in the context of AAC evaluations for mobile technology. Barriers may exist due to the need for evaluation to be conducted across multiple days, the time needed for face-to-face collaborative planning, or the collaboration required to create innovative intervention plans across professionals (Dow et al., 2018). SLPs in health care and private

practice settings may also be isolated from other professionals depending on the organizational framework within which they function (Golom & Schrek, 2018).

The items of the learning subscale include insights into how the team process allows professionals to keep current with frequently changing policies, strategies, perspectives, and equipment within AAC. The ICF model encompasses all aspects of physical functioning and structures required for the development of interpersonal interaction for a robust community life; this requires ongoing learning of multiple facets of development and interventions (Ogletree et al., 2017; Pless & Granlund, 2012). These aspects of the team process were again highest for those in education (*to a moderate extent*), followed by those in private practice (*to a small extent*), and rated lowest by those in health care setting (*to a very small extent*).

The subscale of developing quality services investigates how well the team process allows for effective problem solving, quality services, and generating new ideas with colleagues in AAC. Those in education settings experienced aspects of developing quality services *to a moderate extent*, while those in private practice and health care settings experienced them *to a small extent* during the AAC evaluation process that resulted in a mobile technology recommendation. It is important to note that for the *developing quality services* subscale, a significant finding was found between the education and health care settings only, however the comparison of education to private practice ($p = .035$) would have been significant if a Bonferroni correction had not been employed, which lowered the alpha level to $p < .01$. Further investigation is warranted in this area, as a significant difference between the education and private practice settings could exist. High quality and dynamic collaborative teaming practices were not being experienced *to a vast extent*, *to a very great extent* or *to a great extent* by SLPs across practice settings for the evaluation of individuals with CCN for mobile technology as

AAC. This finding indicates there are concerns regarding SLPs ability to provide clinical recommendations that integrate multiple professionals' perspectives, which consequently may limit positive outcomes for the individuals being assessed (Chung & Stoner, 2016; Liu et al., 2018; Ogletree et al., 2017).

**Research Question Two**

Research question two sought to investigate the difference in the percentage of individuals with CCN using mobile technology as AAC without a prior assessment across the practice settings of education, health care, and private practice. Lack of assessment violates EBP for AAC based on the foundational tenets of the ICF. The comprehensive model of the ICF allows an individual's health and functioning to be described in a way that will maximizes participation given effective transdisciplinary assessment and intervention (Pless & Granlund, 2012). Research has indicated a significant increase in a consumer-oriented, also known as a platform-first, model of AAC, which circumvents the evaluation process (Costello et al., 2013; Meder & Wegner, 2015). The upsurge of mobile technology being purchased by parents without prior assessment has a cascade of effects on implementation, intervention, and outcomes (Caron, 2015; Gosnell et al., 2011). Meder and Wegner (2015) solicited parents or caregivers of children using AAC on a mobile device through postings on websites such as Autism Society of America and United Cerebral Palsy. Of the 64 responses, 35 participants reported owning an iPad or other iDevice and 64% of those devices were purchased without an assessment.

In this study, SLPs were surveyed across practice settings and asked to provide the number of individuals on their caseloads using mobile technology as AAC without prior assessment over the past two years. In the education setting, nearly one-quarter of individuals using mobile technology as AAC were not matched to the device based on an assessment

(22.46%). Additionally, in private practice settings, 13.12% of individuals with mobile devices as AAC did not have prior assessment and in health care settings, 12.94% of individuals with CCN were not assessed. While not as high in percentage as the Meder & Wegner study, these results are an indication that those results did not represent an isolated phenomenon and the impact of mobile technology is being experienced nationwide by SLPs across all practice settings. This is a concerning trend, given bypassing the assessment process frequently results in frustration, ineffective intervention, and abandonment of the device by the individual with CCN (Bradshaw, 2013; Light & McNaughton, 2013). Being inappropriately matched to technology is not merely ineffective; it may result in negative consequences for the individual with CCN by creating a difficult to overcome adverse relationship with technology that could, if the individual were appropriately matched, enhance functional communication outcomes (Beukelman & Mirenda, 2013; Cockerill et al., 2014; Light & McNaughton, 2013).

## Implications

Quality transdisciplinary assessment practices for AAC are foundational to the holistic evaluation of the functioning, disability, and contextual factors impacting the maximization of communicative effectiveness for individuals with CCN (Brady et al., 2016; Chung & Stoner, 2016; Fried-Oken & Grandlund, 2012; Light & McNaughton, 2014; WHO 2007). Investigating the condition of transdisciplinary assessment practices in the current culture of increasingly platform-first provision of AAC is critical, as a lack of quality threatens the integrity of the process that subsequently results in effective AAC implementation (AAC-RERC, 2011; Fannin, 2016; Meder & Wegner, 2015; Ricci et al., 2017). The results of this study add to the research by showing the overall quality of transdisciplinary assessment practices as evaluated by SLPs

across practice settings is moderate at best in the education setting, with statistically significant higher quality in the education setting than either health care or private practice settings.

This outcome is of considerable concern for the provision of effective communication supports for individuals with CCN. It is an established best practice for AAC delivery that comprehension transdisciplinary assessment creates the most successful outcomes. While it is unclear from these findings if it is the rise of mobile technology causing this deficit of quality in transdisciplinary assessment practices or some other factor, the paucity of research investigating assessment practices for AAC given mobile technology advancements is concerning. Individuals with CCN are a vulnerable population requiring careful and systematic consideration of their skills and needs to provide functional means of communicating. Communication is critical, not only for having one's basic needs met, but for allowing active participation in one's family and community through employment, social interactions, and meaningful relationships.

Careful consideration of the survey data gathered revealed that overwhelmingly SLPs in the education setting experience a greater level of transdisciplinary effectiveness. The data did not indicate why the assessment practice is higher in quality in education settings. Additional research is needed to better understand what factors are impacting these results. SLPs in private practice and health care settings may be able to increase the quality of their transdisciplinary experiences based on greater understanding of the factors leading to higher quality experiences by SLPs in education settings. Overall lower means of quality in the private practice and health care settings may indicate a lack of access to other professionals, or an overall lack in collaborative practices as a whole, for the assessment of mobile technology as AAC. It may also indicate that SLPs in these settings require additional education to establish positive interprofessional practices (Morris & Matthews, 2014).

Even though the quality of the transdisciplinary assessment process is higher for SLPs in the education setting, there are also a higher percentage of individuals using mobile technology as AAC without any assessment at all in that setting. In fact, there are almost twice as many individuals in the education setting using mobile technology as AAC without an assessment (22.46%), as there are in the private practice (13.12%) or the health care (12.94%) setting. Funding streams, access to other professionals, collaborative training, professional development, and a myriad of additional factors could be influencing these findings. Additional research is necessary to understand the factors driving this significant difference.

**Discussion of Additional Analysis**

Additional analysis was completed to determine the difference in the percentage of AAC evaluations completed by SLPs in the past two years that resulted in the recommendation for a traditional AAC device as opposed to a mobile device as AAC across practice settings. Results indicate that there were significantly more mobile devices recommended as an AAC device in the education setting (61.37%), than in the health care (21.26%) and private practice (28.51%) settings combined. This difference warrants considerably more research. Mobile devices are less expensive, more readily available, and require less documentation (e.g., insurance approval, formalized evaluations, etc.) than traditional devices (Hershberger, 2011). This may be a factor in the increase in percentage of recommendations for mobile technology in the education settings given the IDEA requirement that AAC be provided through public funding if warranted (U.S. Department of Education, 2018).

It is a time consuming and challenging process to secure medical funding for AAC devices through health insurance and many insurance carriers do not fund mobile devices as AAC. This may be a key factor in recommendations made for specific AAC devices in the

health care setting. However, mobile technology options have the potential to be more powerful than traditional AAC devices with improved features such as smaller size, portability, and easier access than traditional devices (Alzayer et al., 2014; Bradshaw, 2013; Lorah et al., 2013; Shane et al., 2012). It is unclear from this study if funding source or another factor is driving these differences in device selection across practice settings. In addition, the fact that substantially fewer evaluations result in the recommendation of mobile devices as AAC in both private practice and health care settings may be correlated to the lower levels of quality in transdisciplinary assessment practices experienced in these settings as found in the present findings.

Finally, additional analysis was completed to investigate the percentage of mobile devices that were recommended following a thorough transdisciplinary assessment process. Research indicates that increasingly, mobile devices are being provided as AAC outside of a thorough and complete evaluation by a team of professionals (Hershberger, 2011; McNaughton & Light, 2013; McBride, 2011; Meder & Wegner, 2015; Rummell-Hudson, 2011). SLPs in the education setting reported that 98.32% of all evaluations conducted resulting in the recommendation of a mobile device as AAC were done as part of a transdisciplinary team. In the health care setting, 72.38% of recommendations for a mobile device as AAC were done as part of a transdisciplinary team while a mere 33.11% of those by SLPs in private practice were as part of the team process. More research is needed to determine what factors are influencing this range of differences in mobile technology recommendations across SLP practice settings.

## Limitations

There are several known limitations to this study. First, the study relied on self-report of respondents, accurate interpretation of survey questions, and precise data reporting. Second, the

mean years of experience in the field of AAC by those SLPs included in the random sample of study respondents was low across all practice settings (education, 2.78 years; health care, 2.43 years; private practice, 2.62 years). Third, a much higher percentage of SLPs in the health care and private practice settings rated the quality of transdisciplinary assessment at the lowest level (1, *not at all*) resulting in a violation of homogeneity of variances. Additionally, the conclusions of this study should not be generalized beyond this population. Lastly, the TDMQ itself may have been a limitation. The TDMQ instrument has only been implemented in one research study since its development and the researchers noted additional study was required to confirm re-test reliability (Batorowicz & Shepherd, 2011).

## Recommendations for Future Research

1. Further research is needed to determine causal factors related to the differences in the quality of transdisciplinary assessment across practice settings.
2. Follow up studies should investigate factors driving the increase in provision of mobile technology without assessment in the education setting.
3. Correlation studies related to the quality of the transdisciplinary assessment practices and the effectiveness of outcomes and interventions in the context of mobile technology as AAC could be conducted.
4. Additional correlative studies to compare differences in the quality of transdisciplinary assessment practices for mobile technology versus traditional devices across practice settings.
5. Conduct a qualitative study to further analyze SLP perceptions of transdisciplinary assessment practices and the factors influencing the overall rating of quality in the context of mobile technology as AAC across practice settings. Additionally, qualitative

analysis may be used to explore what factors SLPs may identify to improve the quality of transdisciplinary assessment practices in the health care and private practice settings.

6. Quantitative or qualitative study specifically centered on health care and private practice settings to explore any intrinsic barriers that may be limiting interprofessional team-based assessments is warranted.
7. Further investigation into the influence of practice setting on device recommendations may be beneficial to identify biases or barriers to selection based on appropriate matching of the individual to the best device for him or her.
8. Follow up studies may be warranted to explore what occurs following the assessment process, including whether or not families adhere to the device recommendation of the team and if any correlation exists between higher quality assessments and family adherence to team recommendations.

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# APPENDIX A: Permission to Use and Reproduce the Survey Instrument

Taylor & Francis
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Our Ref: P061218-04/IJIC

12/06/2018

Dear [redacted]

**Material requested: Appendix - Team Decision Making Questionnaire in**
**Beata Batorowicz & Tracy A. Shepherd (2009)**
**Measuring the quality of transdisciplinary teams**
***Journal of Interprofessional Care*, 22 (6): 612-620.**
**DOI:** 10.1080/13561820802303664

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# APPENDIX B: Institutional Review Board Exemption

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

April 24, 2019

Laura Mansfield
IRB Exemption 3762.042419: The Quality of Transdisciplinary Team Assessment Practices for Mobile Technology as Augmentative and Alternative Communication

Dear Laura Mansfield,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under exemption category 46.101(b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

> (2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
>
> > (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

[redacted]

**G. Michele Baker, MA, CIP**
*Administrative Chair of Institutional Research*
**Research Ethics Office**

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# APPENDIX C: Consent Form

The Liberty University Institutional
Review Board has approved
this document for use from
4/24/2019 to --
Protocol # 3762.042419

## CONSENT FORM

The Quality of Transdisciplinary Team Assessment Practices for Mobile Technology as Augmentative and Alternative Communication

Laura Mansfield
Liberty University
School of Education

You are invited to be in a research study to investigate the impact of mobile technology on assessment practices for augmentative and alternative communication devices. You are a possible participant if you hold a current CCC-SLP and have conducted an AAC evaluation in the past two years or have had individuals with complex communication needs using AAC devices on your caseload in the past two years. Please read this information and ask any questions you may have before agreeing to participate.

Laura Mansfield, a doctoral candidate in the School of Education at Liberty University, is conducting this study.

**Background Information:** The purpose of this study is to gather critical data related to the quality of assessment practices for mobile technology devices being used as augmentative and alternative communication as a means to improve outcomes for individuals with complex communication needs.

**Procedures:** If you agree to be in this study, I would ask you to do the following things:

1. Click yes below and complete the survey that follows. It should take you 10-15 minutes to complete the survey.

**Risks:** The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

**Benefits:** Participants should not expect to receive a direct benefit from taking part in this study. Benefits to society include individuals with complex communication needs receiving higher quality assessments for the provision of mobile augmentative and alternative communication devices.

**Compensation:** Participants may be compensated for participating in this study. Participants completing the survey within the first two weeks will have the option to send an email to the researcher after survey completion for the chance to win one of two $25 Amazon gift cards. Email addresses will not be associated with responses to maintain anonymity.

**Confidentiality:** The records of this study will be kept private. Research records will be stored securely, and only the researcher and her dissertation chair will have access to the records.

- Participant identity information will not be collected as a part of the survey.
- Data will be stored on a password locked computer and may be used in future presentations. After three years, all electronic records will be deleted.

The Liberty University Institutional
Review Board has approved
this document for use from
4/24/2019 to --
Protocol # 3762.042419

**Voluntary Nature of the Study:** Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time, prior to submitting the survey, without affecting those relationships.

**How to Withdraw from the Study:** If you choose to withdraw from the study, please exit the survey and close your internet browser. Your responses will not be recorded or included in the study.

**Contacts and Questions:** The researcher conducting this study is Laura Mansfield. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at ljmansfield@liberty.edu. You may also contact the researcher's faculty chair, Dr. Michelle Barthlow, at mjbarthlow@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

***Please notify the researcher if you would like a copy of this information for your records.***

**Statement of Consent:** I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

## APPENDIX D: Descriptive Tables

Table D1

*Descriptive Data for Decision Making Subscale of the TDMQ Practice Settings*

| Item | Practice setting | Mean | Med | Mode | *SD* |
|---|---|---|---|---|---|
| **Decision Making** | | | | | |
| 1. . . . obtain support in clinical/technical decision making? | Education | 4.42 | 4.5 | 4 | 1.88 |
| | Health Care | 2.93 | 2.0 | 1 | 2.14 |
| | Private Practice | 3.03 | 3.0 | 1 | 1.99 |
| 2. . . . make consistent recommendations for all clients? | Education | 4.28 | 4.5 | 5 | 1.80 |
| | Health Care | 2.93 | 2.0 | 1 | 2.14 |
| | Private Practice | 3.10 | 3.0 | 1 | 2.01 |
| 3. . . . apply standards consistently across your AAC team? | Education | 4.42 | 5.0 | 5 | 1.84 |
| | Health Care | 2.93 | 2.0 | 1 | 2.19 |
| | Private Practice | 3.08 | 3.0 | 1 | 2.13 |
| 4. . . . takes personal onus off decisions regarding prescriptions? | Education | 3.78 | 4.0 | 6 | 2.04 |
| | Health Care | 2.47 | 1.0 | 1 | 1.99 |
| | Private Practice | 2.52 | 1.5 | 1 | 1.87 |
| 5. . . . validate my clinical/technical decisions? | Education | 4.90 | 4.0 | 6 | 1.70 |
| | Health Care | 3.08 | 2.0 | 1 | 2.24 |
| | Private Practice | 3.42 | 3.5 | 1 | 2.18 |
| 6. . . . apply policies consistently within your own caseload? | Education | 4.42 | 5.0 | 6 | 1.89 |
| | Health Care | 2.80 | 1.0 | 1 | 2.26 |
| | Private Practice | 2.97 | 3.0 | 1 | 2.01 |
| 7. . . . apply policies accurately? | Education | 4.37 | 5.0 | 6 | 1.81 |
| | Health Care | 2.87 | 2.0 | 1 | 2.21 |
| | Private Practice | 3.05 | 3.0 | 1 | 2.04 |
| Average for Decision Making | Education | 4.37 | 4.6 | 6 | 1.65 |
| | Health Care | 2.86 | 2.2 | 1 | 2.05 |
| | Private Practice | 3.02 | 2.9 | 1 | 1.87 |

*Note.* Scale 7 (to a vast extent), 6 (to a very great extent), 5 (to a great extent), 4 (to a moderate extent, 3 (to a small extent), 2 (to a very small extent), 1 (not at all).

Table D2

*Descriptive Data for Team Support Subscale of the TDMQ across Practice Settings*

| Item | Practice setting | Mean | Med | Mode | *SD* |
|---|---|---|---|---|---|
| **Team Support** | | | | | |
| 8. . . . provide support with colleagues' clinical/technical decision making | Education | 4.55 | 5.0 | 6 | 1.78 |
| | Health Care | 3.02 | 2.0 | 1 | 2.30 |
| | Private Practice | 3.53 | 4.0 | 1 | 2.17 |
| 9. . . . share innovative ideas | Education | 4.70 | 5.0 | 6 | 1.91 |
| | Health Care | 3.25 | 3.0 | 1 | 2.37 |
| | Private Practice | 3.70 | 4.0 | 1 | 2.29 |
| 10. . . . obtain clinical/technical advice | Education | 4.30 | 5.0 | 6 | 1.88 |
| | Health Care | 3.07 | 2.0 | 1 | 2.41 |
| | Private Practice | 3.28 | 3.0 | 1 | 2.11 |
| 11. . . . become more competent in AAC | Education | 4.72 | 5.0 | 6 | 1.80 |
| | Health Care | 3.15 | 2.0 | 1 | 2.42 |
| | Private Practice | 3.50 | 3.0 | 1 | 2.30 |
| 12. . . . share success | Education | 5.03 | 5.0 | 6 | 1.82 |
| | Health Care | 3.37 | 3.0 | 1 | 2.48 |
| | Private Practice | 3.72 | 4.0 | 1 | 2.34 |
| Averages for Team Support | Education | 4.66 | 5.0 | 6 | 1.64 |
| | Health Care | 3.17 | 2.4 | 1 | 2.31 |
| | Private Practice | 3.55 | 4.0 | 1 | 2.15 |

*Note.* Scale 7 (to a vast extent), 6 (to a very great extent), 5 (to a great extent), 4 (to a moderate extent, 3 (to a small extent), 2 (to a very small extent), 1 (not at all).

Table D3

*Descriptive Data for Learning Subscale of the TDMQ across Practice Settings*

| Item | Practice setting | Mean | Med | Mode | *SD* |
|---|---|---|---|---|---|
| **Learning** | | | | | |
| 13. . . . keep current with knowledge regarding changing policies? | Education | 4.15 | 4.0 | 6 | 1.82 |
| | Health Care | 2.87 | 2.0 | 1 | 2.30 |
| | Private Practice | 3.12 | 3.0 | 1 | 2.03 |
| 14. . . . learn about application of new AAC technology/strategies? | Education | 4.25 | 5.0 | 6 | 1.75 |
| | Health Care | 2.82 | 2.0 | 1 | 2.20 |
| | Private Practice | 3.30 | 3.0 | 1 | 2.18 |
| 15. . . . obtain various clinical/technical perspectives? | Education | 4.48 | 5.0 | 6 | 1.74 |
| | Health Care | 2.95 | 2.0 | 1 | 2.21 |
| | Private Practice | 3.42 | 3.5 | 1 | 2.17 |
| 16. . . . keep current with AAC equipment and new technology in this field of clinical practice? | Education | 4.20 | 4.0 | 4 | 1.82 |
| | Health Care | 2.87 | 1.5 | 1 | 2.33 |
| | Private Practice | 3.10 | 3.0 | 1 | 2.03 |
| Averages for Learning | Education | 4.27 | 4.0 | 6 | 1.67 |
| | Health Care | 2.88 | 2.0 | 1 | 2.22 |
| | Private Practice | 3.23 | 3.3 | 1 | 2.04 |

*Note.* Scale 7 (to a vast extent), 6 (to a very great extent), 5 (to a great extent), 4 (to a moderate extent, 3 (to a small extent), 2 (to a very small extent), 1 (not at all).

Table D4

*Descriptive Data for Developing Quality Services Subscale of the TDMQ across Practice Settings*

| Item | Practice setting | Mean | Med | Mode | *SD* |
|---|---|---|---|---|---|
| **Developing Quality Services** | | | | | |
| 17. . . . develop effective problem solving in AAC? | Education | 4.60 | 5.0 | 6 | 1.80 |
| | Health Care | 3.02 | 2.0 | 1 | 2.21 |
| | Private Practice | 3.52 | 3.0 | 1 | 2.34 |
| 18. . . . ensure quality of services? | Education | 4.65 | 5.0 | 6 | 1.81 |
| | Health Care | 3.13 | 2.0 | 1 | 2.26 |
| | Private Practice | 3.77 | 4.0 | 1 | 2.32 |
| 19. . . . generate new ideas with colleagues? | Education | 4.65 | 5.0 | 6 | 1.96 |
| | Health Care | 3.13 | 2.5 | 1 | 2.30 |
| | Private Practice | 3.77 | 3.5 | 1 | 2.36 |
| Averages for Developing Quality Services | Education | 4.63 | 5.0 | 6 | 1.81 |
| | Health Care | 3.09 | 2.3 | 1 | 2.20 |
| | Private Practice | 3.68 | 3.7 | 1 | 2.29 |

*Note.* Scale 7 (to a vast extent), 6 (to a very great extent), 5 (to a great extent), 4 (to a moderate extent, 3 (to a small extent), 2 (to a very small extent), 1 (not at all).