2016

Parent-Implemented Intervention Using an Ipad To Enhance Expressive Language in Young Children

Yvette Renee Evans
Illinois State University, slpyvette@gmail.com

PARENT-IMPLEMENTED INTERVENTION USING AN IPAD TO ENHANCE EXPRESSIVE LANGUAGE IN YOUNG CHILDREN

Yvette Evans

215 Pages

Early childhood special educators face many challenges teaching young children with expressive language delays. One of those challenges is teaching parents effective strategies to address the expressive language delays in the home setting. The purpose of this multiple probe single-subject design study was to provide a systematic approach that included the use of mobile technology for parents to promote their child's expressive language development. To accomplish this goal, a four-week intervention implementing the Joint Attention Mediated Learning-Focus on Verbal Expression with Technology (JAML-FVET) strategy across four families was conducted. The researcher provided the intervention while training the parent. Specifically, the parents learned how to capture their child's attention, so the child was focusing on the language-based activity with an app (Make a Scene). The goal was for the child to acquire and independently use the targeted words with intent in the home environment. The results of the study indicated a causal relationship of the parent-implemented Joint Attention Mediated Learning-Focus on Verbal Expression with Technology (JAML-FVET) intervention and the child's

acquisition of two new words. In addition, generalization scores were at or above the intervention levels.

KEYWORDS: Expressive Language Disorders, Intervention, Language Acquisition, Mobile Technology, Co-Viewing

PARENT-IMPLEMENTED INTERVENTION USING AN IPAD TO ENHANCE EXPRESSIVE LANGUAGE IN YOUNG CHILDREN

YVETTE EVANS

A Dissertation Submitted in Partial
Fulfillment of the Requirements
for the Degree of

DOCTOR OF EDUCATION

Department of Special Education

ILLINOIS STATE UNIVERSITY

2016

PARENT-IMPLEMENTED INTERVENTION USING AN IPAD TO ENHANCE EXPRESSIVE LANGUAGE IN YOUNG CHILDREN

YVETTE EVANS

COMMITTEE MEMBERS:

Craig Blum, Chair

Christy Borders

Stacey Jones Bock

ACKNOWLEDGMENTS

Honestly, there are no words that express my gratitude to those that I am acknowledging. As I sit to write this page, I am overwhelmed with emotion. I have such a deep appreciation for those that walked with me (sometimes carrying) through this journey. It is their guidance, sacrifice, and willingness to share their valuable time that made this a memorable event in my life. They have touched my soul and helped me grow beyond my greatest hopes. To my committee members, Dr. Stacey Jones Bock and Dr. Christy Borders you both are true inspiration and friend. I want to grow up and be just like you. You have set the bar high and you do not let any barriers stop you from your goals. Your unfailing dedication for the children we serve is a beautiful testament of sacrifice and love. Not only are you scholars and engaging instructors, you have also inspired so many lives. In addition, Dr. Stacey Jones Bock accomplishes this while presiding over the Special Education Department. My heart felt gratitude to both of you. To Dr. Craig Blum, my dissertation chair and friend. I would not be at this point in my life without you. You challenged my intellect and pushed me beyond anything that I would expect for myself. You prepared me not only to be a scholar, but also to look beyond the limits and push forward. I know that I owe you so many apologies. You are the first person who nudged me over the edge of my self-parameters. At times, I lost hope in myself, but you kept walking with me. Instead of building bridges for me, you taught me how to build my own bridges to reach my goals. You had high expectations of me and I am so grateful. I would never have reached this accomplishment without you

To my research assistants and participating families. First, my research assistants Jodi Nibbelin and Jessie Potter. You made this process doable and made a difference in the participants' lives. To the participants, first I must extend my gratitude to Christy Koshareck. Your unfailing dedication in obtaining willing participants made this process less stressful. It was an honor to work with you. To the participating families, thank you for welcoming us into your home and providing the time away from your busy lives to participate in this study. I appreciate your trust in my abilities and dedication.

Most of all I want to acknowledge God and my family. I would not have started this process if it was not a leap of faith and completed this process by His grace. To my mom, you have demonstrated compassion for others, intellect, and resilience my whole life. You and I started out together and grew-up side-by-side. Thank you for being proud of me and providing me the strength to accomplish my goals. To my dad, thank you for continuously telling me how proud you are of my accomplishments. You are the first one that I called when I was accepted into the KAPPA DELTA PI International Honor Society and the Golden Key National Honor Society. I could not wait for you to make my frames in order to display the certificates. You also, took the time out to make me a desk that I spent hours writing on and appreciating its unique design. I know that you put love into each project. In addition, you provided a safe haven for me to just sit and write. I knew that I could call you at any time and you would be there for me. Whizzie (my Mary Poppins), thank you for believing in me and encouraging me every step of the way. I knew I could always go to you for reassurance and a much needed hug. Each step along the way you told me how proud you were of me and I cannot tell you how much that meant to me. Thank you for your love and support.

Above all, I acknowledge the three people that make up my world. They celebrated my accomplishments and cried with me during the rough times. I dedicate this degree to you. Brittany, you have made this all possible by inspiring me to push on. You are close to me and you have expanded my mind in so many ways. You are my beautiful, brilliant, and bold Brittany and I aspire to be as brave and compassionate as you are. May your academic journey be as rewarding as mine. Jordan, I have learned so much from you as I went through this process. You have such a beautiful mind and a passionate heart. Never stop learning! You are so close to me and I could not have done this without you. Thank you! Lastly, I want to acknowledge Rich my loving and supportive husband. You are my heart, soul and a pillar of strength. You are the most intelligent and compassionate person that I know. I apologize for the time that we lost when I was either absent minded, attending class, or writing. Thank you for holding me together. You are all a true blessing.

Y. E.

CONTENTS

Page

ACKNOWLEDGMENTS i

CONTENTS iv

TABLES x

FIGURES xi

CHAPTER

I. THE PROBLEM STATEMENT AND BACKGROUND 1

Home Environment Risk Factors for Language Delays 3
A Brief Description of the Components of Language 5
Expressive Language Definition and Constructs 8
Early Intervention Services 10
Defining Joint Attention and Associated Attributes 12
Joint Attention and Language Learning 15
Examination of Joint Attention-Mediated Learning Intervention 16
Key Strategies for Parent-Implemented Interventions 19
The Use of Technology in Early Intervention for Expressive Language 21
21st Century Technology and Developmentally Appropriate Practice 23
Joint Media Engagement 29
Significance of the Study 31
Purpose of the Study 31
Conceptualization of the Current Study 32
Rationale for Adaption of the JAML Intervention 33
Modifications to the JAML Intervention 36
Focus on Verbal Expression JAML with Mobile Technology Model 37
Research Questions 38

Question 1 38
Question 2 42
Question 3 42

Chapter Summary 42

II. REVIEW OF RELATED LITERATURE AND RESEARCH 44

Early Intervention 44

Generalization of Skills in Routine-Based Interventions in Early Intervention 46

Parent-Implemented Interventions 49
Methods for Conducting the Search for Related Literature 49
Key Terms 51
Description of Included Studies 52

Setting 52
Participants 53

Participation and Interventions 53
Research Design for the Literature Review 54
Measured Outcomes from the Literature Review 55
Overall Study Quality of Included Articles 55
Results of the Literature Review 56

Participant Characteristics 56

Parent-Implemented Interventions 67
Outcomes of Expressive Language Intervention 67
Parent-Implemented Interventions Description 68
Parental Stress and Expressive Language Outcomes 69
Outcomes of Parent-Implemented Methods 69
Parental Linguistic Output and Gains in Expressive Language 71
Outcomes of Parent-Implemented Interventions 72
Role of Joint Attention in Parent-Implemented Strategies 74
Joint Attention Intervention Models 75
Role of Technology in Caregiver Implementation 77
Limitations of this Review of Literature 79

III. RESEARCH METHOD 81

Experimental Design Overview 81
Purpose of the Study 82
Research Questions — Child Outcomes 83

Question 1 83

Research Questions — Parent Outcomes 83

Question 2 83
Question 3 83

Participants 84

Selection of Participants 84
Exclusion and Inclusion Criteria 85
Participant Demographics 86
Participant Descriptions 89

Parent/child dyad 1 89
Parent/child dyad 2 89
Parent/child dyad 3 89
Parent/child dyad 4 90

Setting 90
Materials 90

Make a Scene App 91
iPads 94

Research Team 94
Experimental Design 95
Measures 98

Independent Variable Measurements 98
Fidelity Measures for the Independent Variable 99

Technology procedural checklist 99
Coaching fidelity checklist 99
Parent implementation and outcome checklist 100

Interobserver Agreement Measures for the Independent Variable 103
Training the Assistants 105
Calculation of IOA Data 106

Dependent Variable Measurements 106

Targeted Words 108

Coding measurement of targeted words 109

Child Communication Outcome Procedure 111

IOA Measures for the Dependent Variable 113

Other Child Communication Measurements: CDI 114

Social Validity Measures 116
External Validity 117
Procedures 120

Prior to Baseline 120
Baseline Procedures 122
Intervention Procedures 122

Parent training 123

Intervention Components 124

Intervention Implementation Procedures 127

Home visits 130

Generalization Procedures 131
Post-intervention 132
Data Analysis 132

IV. RESULTS 138

Interobserver Agreement (IOA) of Measures 138

IOA of Independent and Dependent Variables 138

Procedural Fidelity 139

Procedural Fidelity: iPad Competency Checklist 139
Procedural Fidelity: Coaching Fidelity Checklist 140
Procedure Fidelity: JAML-FVET Activity Outcome Data Checklist 140
Baseline Phase: Preexisting Components of Intervention Prior to Training 140
Intervention Phase: Parent Implementation Procedural Fidelity Results 141
Procedural Fidelity During Generalization 144

Analysis of Performance Data 144

Within-Phase Measures 145
Between-Phases Measures 146

Dependent Variable Results 147

Question 1 147
Dependent Variable Descriptive Results: Within and Between the Phases 148

Dyad 1 within-phase descriptive measures for target word *up* 148
Dyad 1 within-phase descriptive measures for target word *help* 148
Dyad 2 within-phase descriptive measures for target word *up* 151
Dyad 2 within-phase descriptive measures for the target word *help* 151
Dyad 3 within-phase descriptive measures for the target word *go* 152
Dyad 3 within-phase descriptive measures for the target word *stop* 152
Dyad 4 within-phase descriptive measures for the target word *up* 153
Dyad 4 within-phase descriptive measures for the target word *please* 153

Question 2 154

Parent/child dyad 1 generalization 154
Parent/child dyad 2 generalization 155
Parent/child dyad 3 generalization 155
Parent/child dyad 4 generalization 155

Question 3 155

Parent/child dyad 1 social validity results 156
Parent/child dyad 2 social validity results 156
Parent/child dyad 3 social validity results 157
Parent/child dyad 4 social validity results 157

Summary of Child Outcome Data 158
Chapter Summary 158

V. CONCLUSION: SUMMARY AND RECOMMENDATIONS 160

Coaching and Parent Implementation of the Intervention 161
Impact of JAML-FVET on Child Outcomes 165

Generalization 166

Use of targeted words in the generalized condition 167

Social Validity 167
Limitations of the Study 168
Implications and Future Directions of the Study 173

Strategic Co-Viewing 173

Developmentally Appropriate and Socially Valid Outcomes 175
Recommendations for Further Research 176

REFERENCES 178

APPENDIX A: Procedural Checklist for the JAML-FVET Study 198

APPENDIX B: Consent to Participate in Research 200

APPENDIX C : Parent Permission Form 205

APPENDIX D : Loan Agreement 212

TABLES

Table		Page
1.	JAML-FVET Application to the Unified Tenets	35
2.	JAML Modifications for Focus on Verbal Expression with Technology	39
3.	JAML-Focus on Verbal Expression with Technology Action-Based Steps and Rationale	41
4.	Inclusion Criteria	52
5.	Results of Literature Review	58
6.	Demographics for Parent/Child Dyads	87
7.	Child Descriptions	88
8.	JAML-FVET Coaching Fidelity Checklist	102
9.	Schedule for One Parent/Child Dyad	133
10.	IOA Data for Independent and Dependent Variables	139
11.	Baseline and Intervention Results by Dyad	143

FIGURES

Figure		Page
1.	Language Components Adapted from Bloom and Lahey's (1978) Model	7
2.	Screenshots of Make a Scene Adapted from iTunes Innivo Mobile 2013	93
3.	Screenshots of Make a Scene Farm Adapted from iTunes Innivo Mobile 2013	94
4.	Technology Competency Checklist	101
5.	Continued JAML-FVET Activity Outcome Data Checklist	104
6.	JAML-FVET IOA Data Document	107
7.	IGDI Coding	112
8.	Pre-Intervention Social Validity Questionnaire	118
9.	Post-Intervention Social Validity Questionnaire	119
10.	Parent Implementation Checklist	128
11.	Example of Implementation	129
12.	Multiple Baseline Probe Chart	150
13.	Mean Values for Social Validity Per Dyad	156

CHAPTER I

THE PROBLEM STATEMENT AND BACKGROUND

The earliest characteristic of a language learning difficulty is most often a delay in the production of first words (Olswang, Rodriguez, & Timler, 1998). Young children (0-3 years of age) with an expressive language delay face many challenges. Their expressive language difficulty may be due to either a disability such as cerebral palsy, intellectual disability, or a disorder such as autism spectrum disorder (ASD). Environmental factors, such as a low-quality language interaction in the home, can also cause expressive language delays (Cartmil, Armstrong, Goldin-Meadow, Medina, & Trueswell, 2013). Interventions for young children are often parent-implemented, guided by an early interventionist in the natural environment that promotes language development. The interventions focus on a social-communicative framework that encourages shared language experience between the parent and child. Social-communicative acts have two constructs. The first construct is communication intent also defined as the function of communication such as to regulate someone's behavior or to share interest (Paparella & Kasari, 2004). For example, a child makes a request to open a bubbles container (requesting) and after the parent blows the bubbles, the child shares the excitement in that event (commenting). Interactions such as these teach the child about the function of a request. The second construct of social-communicative acts includes the means the child uses to communicate. Paparella and Kasari indicated that a

child's early means of communication begin with prelinguistic behaviors and vocal productions, and then develop into the use of language such as producing phrases that express their wants and needs. Furthermore, the ability of the parent and child to jointly coordinate attention and participate in a shared activity promotes prelinguistic skills and intentional communication. Young children with expressive language delay often do not develop their prelinguistic means of communication and lack social-communicative skills. Early interventionists look for new ways to encourage the development of social communication in young children. The use of digital technology may be a way for early interventionist to promote social communication between a parent and child.

The National Association for the Education of Young Children (NAEYC, 2012) stated in its position statement on technology, "Children's experiences with technology and interactive media are increasingly part of the context of their lives, which must be considered as part of the developmentally appropriate framework" (p. 6). One emerging concern is the *Pass-Back Effect*, named for the occurrence of parents passing mobile technology "back" to young children (Shuler, 2009). Frequently, parents use mobile applications (apps) as a distraction for their young children, even when they consider it not beneficial for their development. If parents use mobile devices as entertainment only, it is likely they are missing natural opportunities to foster social-communication skills and promote other skills related to a young child's development. Because the daily use of technology is more prominent in home-life with young children, it is a natural consideration of how early interventionists and educators might be able to incorporate the technology into interventions.

There is little empirical evidence to guide the interventionist in the use of technology. While organizations such as American Speech-Language-Hearing Association (ASHA) provide general guidance for speech-language pathologist use of apps, there is not enough empirical data to govern the practice (ASHA, 2015). Research is needed so early interventionists and educators can find ways to provide quality and effective parent-implemented interventions with today's digital technologies for young children with expressive language delays.

Home Environment Risk Factors for Language Delays

The influence of the home environment on the language development of young children is an important factor. Hart and Risley (1995) indicated that by the age of 3, children born into low-income families heard roughly 30 million fewer words than their more affluent peers due to fewer words spoken in the home. The authors stated:

> In a 5,200-hour year the amount would be 11.2 million for a child in a professional family, 6.5 million words in a working class family, and 3.2 million words for a child in a welfare family. In four years the average child in a professional family would accumulate 45 million words, and average child in a working class family would accumulate 26 million words, and an average child in a welfare family would accumulate 3.2 million words. (p. 8)

The authors concluded that "the average child on welfare was having half amount of experience per hour (616 words per hour) as the average working class child (1,251 words per hour) and less that on one-third (2, 153) from the child in professional families" (p.8). The lack of words heard correlated with the vocabulary gap between

social economic status (SES) categories. As the field moved forward, researchers found the underlying causes for the gap might be more complex (Cartmil et al., 2013).

One consideration, beyond SES, is the quality of parent-child interactions when learning language. Cartmil et al. (2013) examined conditions that supported language acquisition for young children. Cartmil and her colleagues predicted that families who provide a greater proportion of high-quality word-learning opportunities early in childhood produce better vocabulary outcomes in their children. Their study included 50 child/parent dyads using multiple regression analysis to examine the predictive relation of these variables: (a) the quantity of parent input, (b) the quality of parent input, (c) child vocabulary at 54 months, and (d) family SES. Each family dyad selected target words by videotaping a 90-min session with the family when the child was 14 and 18 months of age. They combined the words that the child was observed to say and the parents' report of the child's spoken words. Once each dyad determined their individual target words, they re-evaluated the child at 54 months. Their findings indicated a positive correlation between the quality over the quantity of input and the child's later vocabulary. Significantly, moving beyond Hart and Risley's (1995) conclusions, they found the quality of how parents speak to their children matters more than the quantity of the words they say. In addition, with SES controlled, quantity proved not to be a factor.

Another recent study conducted at Stanford University by Fernald, Marchman, and Weisleder (2013) indicated that by 18 months, children from homes (with lower SES home with parents who have less education than those in affluent homes) are already several months behind in their vocabulary and language-processing abilities. Fernald et al. stressed that these differences steadily accumulate, as 70% of brain development

transpires in the first 3 years of life. By the time children arrive at school, some are 2 years behind in language.

As demonstrated, the home environment is an important factor for the development of language skills for young children. The three studies discussed share the commonality of parent and child interaction. Early interventionists and educators must consider the importance of quality language experiences within the home environment. For children with language delays, instructing parents on interventions that promote quality social communication in their shared experiences is vital for improving expressive language outcomes.

A Brief Description of the Components of Language

The ability of a young child to communicate depends on an interplay of several factors. There are several main components needed for spoken conversation. First, Turnbull and Justice (2012) outlined the basics of speech and hearing below:

> *Speech* describes the neuromotor process that humans use to turn language into a sound signal that is transmitted through the air to a receiver. *Hearing* is the sensory system that allows speech to enter into and be processed as language by the human brain. (p. 15)

For young children to communicate through speech, they must be able to produce the sounds, use neuromotor brain function to sequence those sounds into words and phrases, and have adequate access to sound for the brain to process the speech and language (Turnbull & Justice, 2012). In addition, auditory perception or the brain's ability to differentiate sounds and the ability to comprehend language must be effective. Auditory perception is an essential cognitive function of the brain that makes it possible to respond

to communication partners and other environmental cues (Hulit & Howard, 1997; Kuhl, 2005). ASHA (1993) defined language as an essential component of conversation in this way:

> Language is the comprehension and/or use of a spoken (i.e., listening and speaking), written (i.e., reading and writing) and/or other communication symbol system (e.g., American Sign Language). Language can also be classified as receptive (i.e., listening and reading) and expressive (i.e., speaking and writing). (Language in Brief, par. 2)

Figure 1 depicts the three main language components form, content, and use. Below the three main components are the five main elements phonology, morphology, syntax, semantics, and pragmatics showing the interrelatedness of the elements of language. The *form of language* is how the sounds, words, and sentences are organized. Form includes *phonology* (how to make sounds and words), *morphology* (rules for the internal organization of words), and *syntax (*rules to regulate how sentences are organized). The *content of language* is the meaning related to the words and includes *semantics* (it is the meaning of individual words or combination of words). The *use of language* is the defined as the function and includes *pragmatics* (crafting language for social purposes) (Turnbull & Justice, 2012). Together speech, hearing, and language are the building blocks of communication.

The intent of the communicative act is categorized under the use of language and the means of the communicative act is categorized under the form of language.

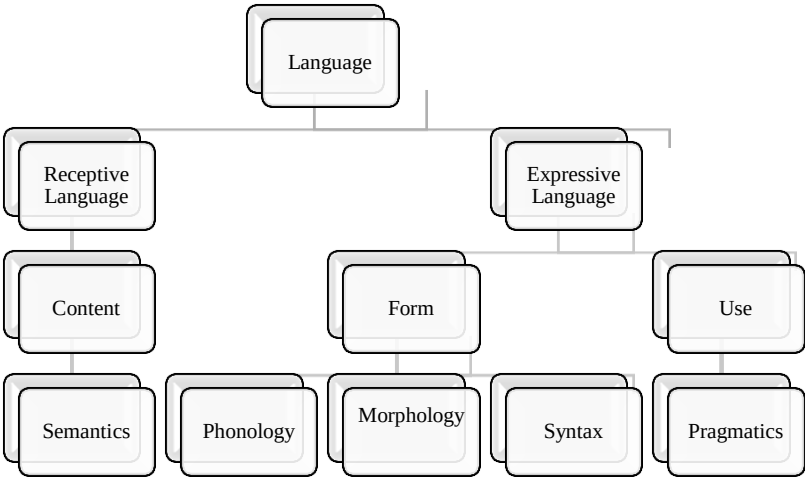

Figure 1. Language components adapted from Bloom and Lahey's (1978) model.

Each language domain has associated theories of development and a set of developmental milestones. ASHA (2012) provides general guidelines for parents regarding milestones associated with receptive and expressive language for 2 to 3-year-old children. The list below is an adapted version of those guidelines:

Milestones for receptive language (understanding and hearing):

- The child understands differences in meaning ("on-off," "in-out," "big-little," "up-down").
- The child follows two requests ("Get your shoes and put them by the door").
- The child listens to and enjoys hearing stories for longer periods of time.

Milestones for expressive language:

- The child has a word for almost everything (for a variety of purposes)
- The child uses two or three words phrases.
- The child uses k, g, f, t, d, and n sounds in words.
- Speech productions are understood by familiar listeners most of the time.
- The child often asks for or directs attention to objects by naming them.

• The child will ask why?

• The child may experience dysfluency.

Notably, young children achieve the milestones at different rates. Generally agreed on in the field of speech and language pathology, toddlers between the ages of 18 months and 2 years should reach the 50-word mark for expressive lexicon productions and begin to combine two words. Children who fail to produce 50 words and two-word combinations at 24 months might be delayed in expressive language development. Toddlers also begin to combine words for more advanced sentence forms using a combination of syntax features and grammatical morphemes (Brown, 1973). In addition, they gain the meaning of the words. Bloom and Lahey (1978) termed this as children applying *semantic-syntactic* rules. As demonstrated, language milestones for children 2 to 3 years old is a complex integration of several factors and are achieved at different rates.

Expressive Language Definition and Constructs

Young children with limited expressive vocabulary are a concern for parents and early interventionists. As indicated by the ASHA's (2012) guidelines regarding typical milestones, by the age of three, children should be able to express themselves in a shared communication experience. According to Bzoch and League (1970), if a child has not mastered expressive communication milestones by age three, a developmental concern with expressive language is apparent. However, expressive language disorder is difficult to define due to its multidimensional nature. An article published in the American Academy of Pediatrics by Fischel, Whitehurst, Caulfield, and DeBaryshe (1989) stated that "*developmental expressive language* disorder is a frequently occurring condition in

children, characterized by severe delay in the development of expressive language compared with receptive language and cognitive skills" (p. 218). The International Classification of Diseases, 10th Revision, Clinical Modifications codes (ICD-10 CM) is a coding system by the World Health Organization (2015) used by speech and language pathologists and audiologists to code diagnostic conditions and the associated treatments, defines *Expressive language* (ICD-10-CM F80.1) as:

> A disorder characterized by an impairment in the development of an individual's expressive language which is in contrast to his/her nonverbal intellect and receptive language development. The impairment may be acquired (i.e., due to a brain lesion or head trauma) or development (i.e., no known neurological insult). (para. 2)

There is not an agreement for a specific term related to this disorder. Within the fields of speech and language pathology and education, several terms appear interchangeable, including *late talkers, specific expressive delay, expressive language impairment*, and *developmental expressive delay*. Additionally, in the field of education the term *oral language* is used. According to National Early Literacy Panel (NELP, 2008) "*Oral language* refers to the ability to produce and comprehend spoken language" (p. 43). The National Center for Family Literacy (NCFL, 2009) described oral language as:

> A broad construct consisting of a variety of discrete language skills such as expressive and receptive vocabulary, grammar, definitional vocabulary, syntax, and listening comprehension. The skills associated with speaking and listening include the ability to understand the meaning of and use of appropriate words, and to group them into phrases and sentences following standard organizational rules

(grammar) that communicate a message that others can understand. We use words to express ourselves as well as to understand others. (p. 32)

Because of the diverse constructs used in education and early intervention around expressive language, it has been difficult for the field to develop a cohesive set of practices that address expressive language disorder.

Providing a workable definition along with further clarification of expressive language delay, Tsybina and Eriks-Brophy (2007) investigated terms used for expressive delay and concluded that the term *late talker* was most commonly used within the literature and provided the following statement:

> Taking into account the criteria used in a variety of research studies, to be identified as a late talker, children should have normal hearing, age-appropriate global development, lexicon below the 10th percentile for their chronological age (or fewer than 50 words), produce few or no two-word combinations, and may or may not have age-appropriate receptive language abilities. (p. 126)

While expressive language and expressive language disorders are defined in several ways, the constructs of expressive language appear to remain the same through each definition. Regardless of how it is defined, ensuring that young children meet their developmental milestones for expressive language is essential not only for daily living, but is a predictor of academic and literacy success (NCFL, 2009).

Early Intervention Services

Early intervention (EI) is an essential component that effectively addresses the needs of young children with expressive language disorders. The Early Intervention Program under the Individuals with Disabilities Education Act (IDEA, 2004) Part C

identifies and supports children birth through age three with disabilities and their families. EI provides resources and supports for families. To qualify for EI services a young child (0-36 months old) must meet the criteria for a developmental delay or be identified as at risk. Each state has its own definition of developmental delay and criteria for "at risk." For example, the Illinois Department of Human Services (n.d) criteria for eligibility includes a delay of 30% or more in one of the developmental domains (i.e., adaptive, communication, motor, social-emotional, and cognitive) and/or identification as at risk by having a diagnosis that would result in a delay (e.g., cerebral palsy). In addition, the child may be eligible if the parent has a medical diagnosis of a severe mental disorder or developmental delay. Once a young child meets the criteria, an Individualized Family Service Plan (IFSP) is developed and the identified services that address the child's need(s) within a family-based approach are implemented. EI services may include speech, occupational, developmental, social emotional, and/or physical therapy. Local agencies govern EI services for each region. They have the responsibility of acquiring the services required by eligible children and their families.

Early interventionists have the charge of providing quality services for young children with disabilities and their families (IDEA, 2004). According to Hebbeler et al. (2007), indicated 52% of the children enrolled in EI nationally receive speech and language therapy compared to the other services, (e.g., developmental, occupational, or physical therapy), thus speech therapy is most common. According to the U.S. Department of Education (2007), the primary mission for the IDEA Part C is to "build upon and provide support and resources to support family members and caregivers to enhance children's learning and development through everyday learning opportunities"

(p. 2). Families are an essential factor when planning and implementing services for young children with disabilities. Therefore, it is necessary that more research be conducted regarding effective methods that incorporate parent-implemented language interventions focusing on the needs of young children with expressive language delays. With the onset of the use of technology in the home, research is required in this area to find ways to incorporate technology while working with families in early intervention. The first step is to examine the elements needed for the emergence of expressive language, such as the effect of joint attention.

Defining Joint Attention and Associated Attributes

One key factor in learning expressive language is joint attention (Brauer, Call, & Tormasello, 2005). The study of joint attention (JA) began in 1970 with the investigation of triadic JA (sharing attention, following attention, and directing attention) in infants. Social cognitive researchers were interested in how infants incorporated outside entities into their social interactions with others (Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998). JA has several definitions throughout the literature. Mundy and Newell (2007) define JA as "an expression of the exquisitely honed human capacity to coordinate attention with a social partner, which is fundamental to our aptitude for learning, language, and sophisticated social competencies throughout life" (p. 239). JA is not only when the parent and child coordinate attention to each other and a third object or activity, but it is a larger process of continued observation of one another's attention, and the awareness that this attention is monitored by a social event.

Many models of JA view it as a primary communication tool, which serves as key building blocks in the development of social competence (Brauer et al., 2005; Dawson,

Osterling, Rinaldi, Carver, & McPartland, 2001; Mundy, 1995). This is important in language learning because JA is required for understanding communication partners' meaning and intentions (Mundy & Jarrold, 2010). Because of this, JA plays a functional and important role in early word learning along with other developmental domains. There are several key developmental milestones associated with JA. According to Mundy and Newell's (2007), a typically developing child responds to JA as early as 6 months of age and initiates JA around 10 months of age. The social cognition development model aligns with these findings of when the child is able to integrate the initiation of and response to JA. In this model, JA is important for the young child to develop intentionality with goal-directed behavior and the ability to monitor the goal-related behavior of others at 6-12 months. In addition, Kaplen and Hapfer (2006) indicated that children at 9 months of age begin to develop social coordination when they transfer their ability from an interacting with one person to interacting with others and another object. Kaplen and Hapfer indicated, "activities include simple pretend play games and simple imitative games" (p. 151). This major stepping-stone links several factors. The factors include the development of attention, attention manipulation skills, ability to sustain attention, and the development of behavioral understanding. By the age of 18 months, a typical developing child should complete the milestones for JA and be able to demonstrate shared intentionality. Kaplan and Hapfer also pointed out that as children reach the milestone for shared intentionality, they develop the basis for social and cultural learning.

The development of JA plays an intricate role in social and cultural learning including several cultural ecological factors. Cultural ecology, in this context, is how

social values in the environment can influence joint attention (Gavrilov, Rotem, Ofek, & Geva, 2012). Gavrilov et al. conducted a study that included sixty-two kindergarten students that examined the relationship between JA, cultural factors, and positive affect. An analysis of variance indicated that the children's initiation of JA toward social partners was dictated by levels of cultural ecology (i.e. parent education level, gender of the child, toy's social load, and traditional values). The authors' findings validated their hypothesis that cultural ecology relates to the children's initiation of JA. The gender and social load of the toy together moderated the initiation of JA by the child. Gender alone demonstrated no significant effect. The development of JA is an intricate process that incorporates children's innate abilities, social cognitive development, and their cultural ecology.

Beyond cultural ecology, there are several attributes associated with JA that are beneficial. One attribute noted is the frequency in which infants engage in JA as it relates to their language acquisition (Mundy et al., 2007). The ability to hold and sustain focus is an important function for cognition and yet another attribute for learning. Striano, Chen, Cleveland, and Bradshaw (2006) indicated that JA is also associated with the depth of information processing in infants, as well as with individual differences in childhood measures of intelligence, self-regulation, and social competence. In addition, activities with JA provide opportunities for parents to communicate the value of specific activities, encourage a sense of efficacy, and model productive characteristics (Takeuchi & Stevens, 2011). JA is a social-communicative event and is and an important milestone in language learning.

Joint Attention and Language Learning

There is a direct connection between the use of language (i.e. pragmatics) and JA. According to ASHA (1993), *pragmatics* is the use of language for different purposes. Pragmatics includes (a) the range of communicative functions (e.g., protest or comment); (b) frequency of communication; (c) discourse skills, such as turn taking, topic maintenance and change; and (d) ability to modify speech for different listeners and social situations (Paul, 2000). Pragmatic ability requires the use of JA. Carpenter and Tomasello (2000) explained the importance of JA and language learning this way,

> The reason that linguistic skills are so highly correlated with joint attentional skills is that language is nothing more than another type - albeit a very special type - of joint attentional skill; people use language to influence and manipulate one another's attention. (p. 7)

Carpenter et al. (1998) found that roughly half of an infants' variability in word comprehension and production was predicted by the amount of time the infants spent in joint attention interaction with their mothers. Because of this inherent strong relation between language and JA, it is only logical that JA needs to be considered in EI to improve expressive language.

Joint attention is inextricably tied to a child's ability to communicate with intent and demonstrate a shared experience. To sustain JA, it requires the child to comprehend not just an adult's intentions to some outside object or action, but also the adult's intentions toward the child's responsiveness to any outside object or action. These two components of JA are defined by Mundy and Newell (2007),

> *Responding to joint attention* (RJA) refers to the infants' ability to follow the direction the gaze and gestures of others in order to share a common point of reference. Alternatively, *initiating joint attention* (IJA) involves the infants' use of gestures and eye contact to direct others' attention to objects, to events, and to themselves. The function of IJA is to show or spontaneously seek to share interests or pleasurable experience with others. (p. 2)

Communication between a child and their communication partner requires use of both of these components of JA and is an essential for pragmatics of language. For example, the parent comments to the child about a favorite toy. The child responds by looking for the toy and then says, "my toy". The attention to the toy was initiated by the parent and the child responded by looking and commenting about the toy. Pragmatic communication that creates a shared experience, also relies on the child's ability to respond and initiate JA (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bruner & Sherwood, 1983; Carpenter et al. 1998). Further research regarding RJA and IJA demonstrates that responding *to* and initiating JA may significantly correlate with early vocabulary acquisition (Mundy, Kasari, Sigman, & Ruskin, 1995). Thus, the social-communicative aspects of language plays a direct role in creating an opportunity for the parent to construct an experience for the young child to respond to and initiate JA. The ability to engage in JA is a building block of language development, basic communication, and meaningful shared experiences as expressed through language.

Examination of Joint Attention-Mediated Learning Intervention

As discussed, JA plays a key role in language interventions. The Joint Attention-Mediated Leaning (JAML) is an intervention that addresses the prelinguistic components

of language learning through a relationship-based approach. The JAML intervention is a parent-implemented relationship-based approach for children with autism. This intervention "focuses on the social functions of preverbal communication, targeting engagement at progressively complex levels that begin just beyond the toddler's current capabilities" (Schertz, Odom, Baggett, & Sideris, 2013, p. 249). The JAML intervention is divided into five mediating learning principles with three phases for each principle. Schertz et al. (2013) adapted the following learning principles from Klein (2003). The principles apply to both the child and the parent.

The learning principles include:

> (a) *focusing* to sharpen their attention toward the competency addressed in the phases;
>
> (b) *organizing and planning* to internalize a sense of self-regulation and order to communicate socially;
>
> (c) *encouraging* to develop self-confidence related to the phase outcome;
>
> (d) *giving meaning* to discern nuances of interaction that are socially important to expand for understanding of objects/actions; and
>
> (e) *expanding* to interact more frequently in varied settings and with different people. (p. 250)

Schertz et al. (2013) described JAML as: "the process through which this intervention focus is on the delivery of the guided five principles to promote active engagement in "learning how to learn about social communication through the parent-child relationship" (p. 251). The outcomes expected for toddlers identified with ASD are to acquire key developmental precursors for JA through parent implementation. Schertz et al. (2013)

hypothesized that JAML may have longitudinal effects with ongoing specific support that impacts JA skills. The JAML plays a role in language development, and later, the quality of interactions for children with ASD.

Notably, the JAML intervention provides the basis for teaching toddlers the precursors of JA for preverbal social-communicative experiences. The model has progressed from Schertz and Odom's (2007) model. The first study with three parent-child dyads compared engagement in focus on faces, turn taking, responding, and initiating JA. Two of three toddlers acquired JA in parent-child interactions and the third achieved focus on faces and turn taking. The second single-case design study examined the JAML's effects on children's JA with 17 parent-toddler dyads (Schertz et al., 2013). This multiple-baseline design across four phase-linked targeted outcomes (the same as the first study) showed seven of the dyads had a generally consistent response to the JAML's original four phases. For the remaining 10 dyads, the same design was applied in three phases (i.e., focus on faces, turn taking, and joint attention) instead of the original four and it demonstrated experimental control for most participants (Schertz et al., 2013). The common pattern that emerged was that turn taking initially increased when the intervention focus was directly on turn taking, but is noteworthy that turn taking decreased as the JA emerged in the other phases. In their last study, they randomly assigned 23 parents and their toddlers to JAML intervention or a control condition. They used several pre- and post-intervention measurements including observational assessments and standardized developmental measures. They found the effects were significant for the focusing on faces and the joint attention phases. In addition, significant effects were found for receptive language on the standardized language

measure and moderate effect sizes occurred for expressive language. Notably, although there was a difference between the control group and the intervention group, a study with more statistical power would be able to observe specific differences in the intervention group. In summary, the JAML is an intervention that targets the prelinguistic elements of language development through parent-child interactions.

Key Strategies for Parent-Implemented Interventions

There are many parent implemented learning strategies for young children to acquire expressive language. Roberts and Kaiser (2011) completed a meta-analysis of effective parent-implemented strategies for language interventions. The authors examined the effect size for each study on parent-implemented strategies, calculated the effect for seven language outcome variables, and analyzed outcomes using a random effects model. Regarding parent training in language intervention, out of the 18 studies examined, the most commonly measured parent strategies that demonstrated positive outcome effects on the child's language development were (a) parent responsiveness, (b) use of language models (language strategy), and (c) adult rate of communication (quality of input and language strategy). The authors stressed that teaching parents strategies is a triadic approach composed of the language elements for parent-child interactions, parent implementation, and child outcomes.

Several parent-implemented interventions address expressive language and include the parent-child interaction language constructs identified in the research literature. The *Enhanced Milieu Technique* (EMT) intervention is an approach implemented by the parent in the natural environment. EMT demonstrated the highest prevalence throughout the literature review. This approach combines several techniques

in order to provide flexible adaptations to the child's communication needs. According to Kaiser and Roberts (2013), EMT includes (a) modeling, (b) expanding communication, (c) time delay to foster imitation of verbal production, and (d) prompting strategies (including asking a question) to promote unsupported practice. More than 50 studies that include variants of milieu techniques have been conducted (Kaiser & Trent, 2007). There is supporting evidence across research designs that EMT promotes both the linguistic complexity and social-communicative use of language by children with disabilities (Carpenter et al., 1998; Hancock & Kaiser, 2002). The EMT addresses several important elements of the parent-child interactions including parent responsiveness to the child's communication attempts, the use of specific language strategies (time delay, prompting, and modeling) and quality of the parent's language input.

Another evidence-based parent-implemented intervention is *interactive focused stimulation* (IFS). IFS was another intervention identified in the current literature review conducted on parent-implemented strategies for expressive language. The early interventionist guides the parents in choosing target words. By applying IFS, the parents are trained to use these words frequently throughout their daily routines to provide constant modeling. This provides linguistic input that is a highly concentrated on preselected language targets (Fey, 1986). According to Tannock, Girolametto, and Siegel (1992), this approach provides opportunities for children with language delays to learn through teaching parent implemented strategies that (a) foster episodes of joint activity, (b) involve activities that promote turn taking, and (c) promote children's understanding of the relation between language, form, and content. Further, by fostering JA activities, including turn taking, parents become responsive to their children's actions and

communicative attempts. In addition, modeling is an important factor in focused stimulation intervention as the parent models the word(s) in context throughout the day. In IFS it is essential that parents pay careful attention to their language output. Parents need to ensure that the targeted vocabulary is presented at rates that ensure their children are able to process the meanings of words, and provide the words through multiple opportunities to promote the acquisition of new language.

Lastly, the use of the Joint Attention-Mediated Learning (JAML) intervention is a communication based intervention for children. The goal of the JAML is to improve JA and preverbal communication skills, which in turn affect expressive language for children with ASD. Thus, the JAML intervention promotes language acquisition through parent-child interactions. First, the JAML promotes parent responsiveness throughout the intervention. Secondly, it offers specific language interventions such as modeling to provide the child with prelinguistic targets. Lastly, the parents are guided to produce quality language output that delivers rich contextual-based opportunities for prelinguistic language to create meaningful shared experiences. Each of these parent implemented interventions are important because their commonalities embody the essential features of any effective language interventions that takes place in the home environment.

The Use of Technology in Early Intervention for Expressive Language

While the key components of effective parent implemented interventions for expressive language delay are well defined, the use of technology applications for this purpose are not as well understood. The use of technology is not new for young children with expressive language disorders, but as new digital technologies emerge, it has been quickly evolving. The most well-examined technologies are within the use of alternative

and augmentative communication (AAC) as an intervention for children with communication disorders and their effectiveness is well documented (Binger, Kent-Walsh, Berens, Del Campo, & Rivera, 2008; Miller, Light, & Schlosser, 2006; Romski & Sevcik, 1996; Romski et al., 2010). For some children, AAC devices may be the primary means of communication; others may use AAC devices to clarify and expand their speech (McNairn & Shioleno, 2000). For a child to obtain an AAC system, it takes a team of professionals, along with the child's family to ensure that the child has the appropriate device and successful opportunities to communicate. Newer applications of AAC are on mobile devices. The advances in technology with the use of mobile apps may be more motivating for some children, thus providing them an opportunity to master new expressive vocabularies.

While there have been advances in the use of AAC technologies, the most significant changes have been in the use of apps on mobile devices. There is little known about these devices and the possibilities of effective use to improve expressive language. Marturana (2012) expressed concerns about the influx of apps and their efficacy, noting, "as the percentage of apps targeting toddlers are geared toward teaching vocabulary, the feasibility of embedding explicit family identified vocabulary instruction into apps to support toddlers with communication disorders has not been substantiated" (p. 11). Currently, the ability of software developers to produce new technologies that have the intent of addressing expressive language delays significantly outpaces researchers' ability to develop an extensive knowledge base to measure the effectiveness of these technologies. More research is required for the use of technologies for both school and home environments.

21st Century Technology and Developmentally Appropriate Practice

The increasing use of technology in young children's home and education environments is apparent. In *The Pockets of Potential*, Shuler (2009) stated, "Perhaps the most ubiquitous technology in children's lives today are mobile devices —tools such as cell phones, iPod devices, and portable gaming platforms that traverse home, school, and play via the hands and pockets of children worldwide" (p. 16). Shuler completed a report regarding the use of mobile technology in education. The document presented an inventory of more than 25 learning projects in the U.S. and internationally. The report completed by Shuler indicated ways in which mobile devices can help promote the knowledge, skills, and the perspectives children will need to compete and cooperate in the 21st century. Here are some conclusions from the report:

1. Mobile learning encourages "anywhere, anytime" for students to gather, access, and process information outside the classroom. The proper use of mobile devices can encourage learning in a real-world context, and help bridge school, after-school, and home environments.
2. Mobile learning improves 21st-century social interactions. The use of mobile technology has the power to promote and foster collaboration and communication, which is deemed essential for 21st-century success.
3. Mobile devices can help overcome many of the challenges associated with larger technologies, as they fit more naturally within various learning environments.
4. Mobile technology can enable a personalized learning experience. Not all children are alike; instruction should be adaptable to individual and diverse

> learners. There are significant opportunities for genuinely supporting differentiated, autonomous, and individualized learning through mobile devices. (p. 16)

Early interventionists might be able to capitalize on these benefits of mobile technology, including flexibility, social interaction, generalization across environments, and creating unique learning experiences.

While there are advocates for the use of technology with young children, there is controversy about its developmental appropriateness for young children and possible harmful effects. Consequently, NAEYC and the Fred Rodgers Center (2012) created a position statement on the use of technology and media for young children. The position statement discusses controversial issues such as screen time for young children. One of the key points outlined in the NAEYC statement is that content matters, and that Developmental Appropriate Practice (DAP) is essential. In order to provide guidelines, NAEYC developed the following recommendations for the use of technology and/or media with young learners:

1. Make sure the technology is used in developmentally appropriate ways, giving careful attention to the appropriateness and the quality of the content, the child's experience, and the opportunities for co-engagement.
2. It is important to provide a balance of activities in programs for young children, and use the technology with intentionality as they actively engage with those around them and their environment.
3. Limit the screen time and prohibit the passive use of television, videos, DVDs, and other non-interactive technologies and media in early childhood programs for

children younger than 2, and discourage passive and non-interactive uses with children ages 2 through 5.

4. Educate and guide parents in the use of technology, including the screen time recommendations from public health organizations for children from birth through age 5 when determining appropriate limits on technology and media.
5. Carefully consider the screen time recommendations from public health organizations for children from birth through age 5 when determining appropriate limits on technology and media use in early childhood settings. Screen time estimates should include time spent in front of a screen at the early childhood program and, with input from parents and families, at home and elsewhere.
6. Provide leadership in ensuring equitable access to technology and interactive media experiences for the children in their care and for parents and families. (p. 11)

The use of technology requires careful deliberation by early interventionist before they consider instructing caregivers. It is essential that DAP be used in planning and implementing technology-based activities. NAEYC (2009) highlighted key points of DAP for early interventionist to follow with the use of technology:

- The technology chosen must be appropriate to a child's current development.
- The use of the technology represents socially and culturally responsive teaching practices.
- The technology chosen must challenge the children enough to promote progress in the natural environment.

In addition to the NAEYC guidelines, the Division of Early Childhood (DEC) within the Council for Exceptional Children has specific standards and recommended practices for the use of technology for young children. According to DEC (2007), technology should be used to increase children's access to learning activities in the natural environment as well as to enhance child development in the motor, cognitive, communication, social, adaptive, life skill, play, health, and academic domains. Despite these guidelines, there is limited research in this area and further investigation of the use of technology in working with young children and their families is necessary.

An important consideration for early interventionists and educators is how prominent technology has become in the daily life of young children and families. NAEYC (2012) stated in their position statement, "Children's experiences with technology and interactive media are increasingly part of the context of their lives, which must be considered as part of the developmentally appropriate framework" (p. 6). According to Chiong and Shuler (2010), mobile devices (e.g., smartphones and tablets) are playing an increasing role in the daily lives of children and adults. In a study performed by Shuler (2012), an analysis of the apps downloaded from the Apple's iTunes store found that 58% of the top-selling educational apps focused on toddlers and preschool children. The availability of personalized applications is staggering. There are over 1.6 million apps available from the Apple's app store alone (Statista, 2015). Such widespread availability of tools embedded in our culture will have great impact on families and young children.

A language has evolved around technology that many families are now familiar with because it is part of their daily life. Vendors of software and mobile devices have

sought to use these terms to help their industry market these products to families. Previously referred to as a computer program or software, the term *app* arose for software on mobile devices, but is now considered a ubiquitous term for software applications on the personal computer and most digital devices (More & Travers, 2012; Purcell, Entner, & Henderson, 2010). Educators have also sought to define learning with mobile devices, attempting to capture the ubiquitous nature of these devices in individuals' lives. Marturana (2012) used the term *M-Learning*, described as learning that has the potential to occur anytime, anywhere, via a portable mobile device for a personalized and unique learning experience. The use of language around mobile technology and its wide- spread use suggest how embedded these devices are in our culture.

As previously discussed, technology is not only widely used with young children, but has many developmentally appropriate applications (Donohue, 2015; NAEYC, 2012; Parette & Blum, 2013; Parette, Blum, & Queensberry, 2013). Parette, Queensberry, and Blum (2009) noted that "using various technologies in a cadre of ways in daily life activities provides powerful models for technology use while also shaping the changing profile of our technology-based culture and this transformation a 'cultural zeitgeist'" (p. 41). Technology is part of young children's natural lives.

Recently there has been interest in families' perceptions of technology use in the home with children. Parents can offer unique insights into perceived value in which technology is used in the home. Rideout (2014) from the Joan Ganz Cooney Center conducted a national survey of 1,577 parents' estimates of their children's (aged 2 to 10 years) technology and the use across cultures (i.e., Hispanic-Latino, 682; White,

605; Black, 290) (Rideout, 2014). The survey covered the children's home use of television, DVDs, video games, books, e-readers, smartphones, tablets, and other mobile devices. The survey excluded use of media required for homework or as an assignment from school. The researchers found the following:

- Nearly half (44%) of the 2- to 10-year olds' screen media use was considered educational by their parents (56 min out of a total of 2:07 screen media per day). Eight in 10 children (80%) used educational media at least once a week, including a third (34%) who were daily users.
- Most parents thought their children had learned from educational media. Among parents of weekly educational media users: (a) more than half (57%) said their children has learned "a lot" about one or more subject areas (e.g., reading/vocabulary, math, or cognitive skills) from educational media; (b) fifty-four percent said their children "often" took specific actions as a result of their exposure to educational media, such as talking about something they saw (38%); (c) engaging in imaginative play based on it (34%), (d) asking questions about it (26%), or asking to do a project or activity inspired by it (18%).
- Educational media use occurred most frequently among very young children (1:16 a day by 2 to 4-year-olds), with a large drop-off in use as children got older (50 times a day by 5 to 7-year-olds, and 42 a day by 8 to 10-year-olds). As the children got older, the amount of time they spent with screen media increased (from 1:37 to 2:36 a day), and the proportion that was educational decreased (from 78% to 27%). (Rideout, 2014, pp. 8-9)

While parents' views of technology use may not be completely accurate, they do represent perceptions that may be key in understanding values and beliefs parents hold about the appropriate use of technology with children. These insights may be useful in constructing interventions in the home that use various applications. While the role of 21st Century technology in the family and our society is important, interventions that address expressive language delays must use more than just apps to accomplish desired outcomes.

Joint Media Engagement

The use of technology to engage family interactions is a rapidly expanding concept. The Joan Ganz Cooney Center at Sesame Street Workshop collaborated with the Learning in Informal and Formal Environments (LIFE) Center to provide a report on the assimilation of case studies regarding social engagement and the use of media. Takeuchi and Stevens (2011) used the term *joint media engagement* (JME) to describe the shared experience people have when using digital media. Having roots in the concept of JA, the purpose and the definition of JME is as follows:

> To extend the notion beyond television and more broadly describe what happens when people learn together with media. The mobile, networked, and asynchronous qualities of increasingly affordable digital technologies offer new opportunities to co-engage children and parents—especially those from underserved populations—with high-quality educational content. However, equity concerns persist for reasons that transcend mere access to these tools. The term *joint media engagement* (JME) refers to spontaneous and designed experiences of people using media together. (p. 10)

One of the main premises of JME is that experience may happen anywhere and at any time when there are people interacting together with media. To provide further clarification, Stevens and Penuel (2010) explained that the modes of JME include viewing, playing, searching (surfing), and reading. They suggested that technology is supportive to learning by providing access and creating shared meaning. In general, parents have the opportunity to follow their children's lead and spontaneously create opportunities to share perspectives and values as well as scaffold their performances. The authors provided seven guiding principles:

1. Kid-driven tools and experiences are an important factor.
2. Offering multiple planes of engagement to challenge and entertain all parties involved is important.
3. Differentiate roles so that each participant is suitably challenged and motivated.
4. Provide scaffolds and cues for the more capable partner.
5. Consider how a media resource can build on a child's past experiences.
6. Give the partners opportunities to co-create.
7. Consider the fit with existing routines, schedules and practices.

Takeuchi and Stevens (2011), indicated "researchers across a range of disciplines have highlighted the importance of JA for learning and meaning making (Barron, 2000; Brooks & Meltzoff, 2008; Bruner, 1983; Goodwin, 2000; Meltzoff & Brooks, 2007; Stevens & Hall, 1998)" (p. 5). However, JME by definition is well beyond the traditional definitions of JA and focuses on shared experiences people have when interacting with digital technologies together. These include co-creation, scaffolding, and joint interactive experiences that can lead to the new construction of knowledge among individuals, both

parent and child. Theoretically, early interventionists and educators can use JME activities that strategically support language development for young children experiencing language delays. Furthermore, joint parent-child social activities using apps on tablet devices combined with effective parent-implemented interventions may create unique opportunities to promote social-communicative interactions.

Significance of the Study

Early childhood special educators face many challenges. One of the challenges is teaching parents effective strategies to work with their young children on oral language skills. In addition, young children with language delays are immersed in environments with mobile technology that have potential opportunities for parents to engage them in language learning activities; however, parents frequently lack the knowledge to use the technology in relevant and developmentally appropriate ways to promote their children's language learning. Early interventionists and educators need empirically validated parent-implemented practices that they can capitalize on with JME to support new language development for children with language delays. Empirical research is needed to evaluate the potential of a parent-implemented intervention with mobile technology to address language delays in young children.

Purpose of the Study

This purpose of this study is to determine if there is a hypothesized functional relation of the JAML-Focus on Verbal Expression with Technology (JAML-FVET) intervention and the acquisition and use of targeted words for expansion of expressive language in the home environment. This study seeks to extend and change the nature of the JAML model by incorporating mobile technology into the intervention along with

specially designed techniques to expand expressive language for young children with expressive language delays. Within the course of this intervention, the interventionist instructs parents on effective use of language intervention practices in a planned expressive language-based activity with the iPad running the Make a Scene app. In addition, parents learn how to capture their children's attention so the children are focusing on language-based activities with the app in their home environments. This intervention emphasizes parent-implemented strategies to promote targeted expressive language skills with the goal of the children using them independently with intent in the home environment.

Conceptualization of the Current Study

The concepts of JA and JME provide significant theoretical grounding for this study. JA is known to be central to the development of language in toddlers (Carpenter et al., 1998; Schertz et al., 2013). JME expands on the concept of JA focusing on shared experiences people have with digital technologies. For the purpose of this study, JME provides a framework for the use of effective parent-implemented language intervention strategies with the app on an iPad. In other words, it is how parents and children jointly share media time, which is vital to addressing expressive language delays. Furthermore, while the media may have properties such as portability and digital flexibility to meet the individual needs, they cannot likely meet the needs of a child without a specific intervention structure directed at expressive language. Together these concepts are foundational to the hypotheses of this study.

As noted, the purpose of this study is to address expressive language delays in young children using a parent-implemented intervention. In order to do this in a way that

is consistent with the principles of EI, the JAML-JVET is designed around key aspects of EI as outlined by Odom and Wolery (2003). In this framework, they developed a *unified* theory of EI practice rooted in EI and early childhood special education. Odom and Wolery explained that "over the last decade, the field of early intervention/early childhood special education (EI/ECSE) has emerged as a primary service for infants and preschool children with disabilities and their families" (p. 164). Furthermore, the authors integrated theories from the fields of psychology and education that are identified as evidence- or value-based practices for EI and early childhood special education. See Table 1 for the related unified tenets that correspond with the activity- based approach of the JAML-FVET Model.

Rationale for Adaption of the JAML Intervention

As previous discussed, the JAML intervention is a parent-implemented intervention that focuses on improving JA with the result of improving language development for children with ASD. The JAML intervention also provides a developmentally appropriate systematic approach to initiating and responding to JA. Because the JAML intervention focuses on the needs of children with ASD, the approach necessitates modification for children with an expressive language delays. However, some of the components are sound because of the strong parent-implemented approach, the connection to effective practice in EI, and acknowledgment that JA is important in language development. Unlike the JAML intervention, which only focuses on pre-verbal social communication, a well-documented difficulty for children with ASD (Schertz et al., 2013), this study focuses on young children with expressive language delays. Hence, this intervention calls for a more language-based approach, but preserving some of the

benefits of the JAML intervention structure. Second, the interactive nature of apps on an iPad presents unique opportunities for parents and children to interact around language.

Table 1

JAML-FVET Application to the Unified Tenets

EI/ECSE Unified Tenet	JAML-FVET Application
Families and Homes Are Primary Nurturing Contexts	The JAML-FVET intervention is conducted in the home environment. Gradual release of responsibility model is used support natural use of intervention.
Strengthening relationships is an essential feature of EI/ECSE	JAML-FVET uses parent-child reciprocal communication and shared experience with technology to strengthen parent-child relationships.
Children learn through acting on and observing their environments	In the JAML-FVET, the parent models the action as the child observes and reacts to the activity.
Adults mediate children's experiences to promote learning	The JAML-FVET is a parent-implemented activity-based approach. The parents mediate the language learning experience.
Children's participation in more developmentally advanced settings, at times with assistance, is necessary for successful and independent participation in those settings	The intervention takes place in the home with a generalization component to routine-based activities. The parents build on children's expressive skills in developmentally appropriate practice.
EI/ECSE practice is individually and dynamically goal oriented	The parents are guided to provide the intervention with specific goals (outcomes) for their children's expressive language.
A developmentally instigative adult enhances transitions across programs	The JAML-FVET is to be used in the home environment for EI.
Families and programs are influenced by the broader context	During training, JAML-FVET asks parents about cultural, community, professional, and family relationships to enhance intervention service delivery and increase family focus.

Digital media are unique in that they are dynamic, flexible, and interactive and that they allow multiple access points for diverse learners (Parette & Blum, 2013). Hence, modifications to the JAML intervention are recommended to encompass additional language constructs and the use of digital media.

Modifications to the JAML Intervention

For the purpose of this study, there were modifications to the application of the JAML intervention model. In the Schertz et al. (2013) study, the researchers applied the model to children diagnosed with ASD. They measured the children's engagement at each phase of the model to increase the ability of the children to develop those precursors. Thus, Schertz and Odom (2007), focused on the "disruption in the development of joint attention that is unique to autism" (p. 1563). In the current JAML intervention model there are five Mediated Learning Principles: (a) focusing, (b) organizing /planning, (c) encouraging, (d) giving meaning, and (e) expanding that occur across three phases of intervention. The first phase is focusing on faces, then turn taking, followed by JA. After training, parents implement the mediated learning principles in routine-based activities of interest to the family. The phases of intervention are introduced sequentially and are criteria based (parents meet criteria prior to the one to be introduced). As seen in Table 2, several things are different with the JAML-FVET approach. First, rather than a criterion-based approach grounded in sequential JA skills, the JAML-FVET is a technology activity-based approach (Losardo & Bricker, 1994; Parette & Blum, 2013) focused on language learning. The parents replicate a technology-centered language learning activity with their children that they have learned from the interventionist. Second, the participants fall into a larger category of children

with expressive language disorders. Thirdly, the primary focus of this study is to gain the child's attention with more emphasis on the social-communicative component of the model. Fourth, the Schertz and Odom (2013) model included the family's autonomy to choose the activity. In the current study, the activity is selected (for the purposes of control during experimentation and to focus the study on technology), but families have autonomy in choosing when to complete the intervention, and they also select the routine for generalization. Lastly, since the mediated activity is the use of technology, the researcher selected the app to use. In this study, the original JAML principles are implemented, although the procedures outlined were adapted in order to instruct parents on focusing and engaging their children with the use of technology as a mediating object. For example, to organize and plan was not an actual step in the procedure, but a key learning concept expressed to the parents to be included across activities (focus on faces, turn taking, and JA). In addition, the learning principle of expanding and encouraging was modified as a procedural step to provide parents with specific instruction on expanding their children's vocal production. Encouragement is a key principle that is embedded throughout both of the intervention procedures. To provide further illustration, the following table demonstrates the modifications to the JAML model with the use of technology to support expressive language.

Focus on Verbal Expression JAML with Mobile Technology Model

This study was conceptualized by incorporating key principles from the JAML and the JME conceptual principles. Table 3 illustrates the JAML-FVET action-based steps. In theory, this model for intervention incorporates the JAML intervention, expressive language techniques (interactive focus stimulation and EMT), and mobile technology (iPad with Make a Scene app) to promote oral language for young children

with expressive delays. It has been hypothesized that incorporating the JAML intervention, which is established and empirically supported, with the use of mobile technology will provide an additional avenue to promote parent-mediated interventions. Specifically, focusing on toddlers with expressive language delays centering on social-communicative constructs.

Research Questions

This study examined a parent-implemented JAML intervention with the use of mobile technology to improve language abilities of young children with expressive language delays in their natural environments.

Question 1

Is there a functional relation between parents' implementation of a JAML-FVET intervention with mobile technology (iPad with the Make a Scene app) and expressive communication?

Measurement by: The frequency of the intentional verbal use of the targeted vocabulary in the shared activity using the iPad.

Hypothesis: The child's expressive language lexicon will increase; specifically, the acquisition and use of the targeted vocabulary.

Table 2

JAML Modifications for Focus on Verbal Expression with Technology

Steps of JAML-FVET	JAML	Modifications for JAML-FVET
Setting up the Environment: The parent removes all possible distractions in the environment and provides the iPad in an accessible area. Face-to-Face contact is established with joint attention to the app. Excitement is expressed for the activity and joint attention.	**The JAML** model asks the parent to set up the environment and use predictable routines for each phase in the sequence (i.e., face-to-face contact, turn taking, and then add a triadic joint attention to object).	**JAML-FVET** focuses on setting up the language-based app activity. Encouragement is provided once joint attention is established. Similar to JAML except for set up, it is a singular repeated joint media engagement activity.
Focus In: Direct the child to attend to the parent, then the object (iPad) in order to gain the child's attention to the parent first and then to the iPad/activity.	**The JAML model** focuses attention on face-to-face contact, then turn taking, then a triadic joint attention to object (e.g., toy) phase (i.e., parent initiation to object, child initiation to object, face-to-face looks) in that sequence.	**JAML-FVET** is a repeated joint media engagement activity where attention is focused on app and the language activity. This is a departure from the focus on joint attention only and preverbal communication in JAML.
Turn Taking, Modeling, and Encouraging Social Communication: Using, **"First-Then**" language for the parent to use with the child in order to foster understanding of the order of the activity steps (e.g., Sally, **first** sit, **then** iPad.). Followed by modeling of the expressive lexicon target with a time delay (5 sec) to provide the child an opportunity to respond. The phrase "Your turn" is used to cue the child, promoting the social- communicative action of responding with the targeted vocalization. Praise is provided for expression of target language.	**The JAML model** incorporates turn taking during phase 2, and phase 3 triadic joint attention, but not the initial phase, face-to-face phase. Modeling is built in through incorporating the focusing, organization, and planning mediated learning principles across face-to-face, turn taking, and triadic joint attention phases. Modeling is focused on joint attention skills such as looking at the face, object, taking turns, etc. Rituals and routines are set up to make modeling of joint attention skills more explicit and increase practice. Encouragement is provided for responses to joint attention modeling and turn taking.	**JAML-FVET** has parents' model target words verbally when interacting with the app on the iPad. Explicit modeling of joint attention skills is not emphasized, but joint attention is required for this activity. Parents are instructed with coaching to maintain joint attention and use **first-then** language to provide language to support comprehension.

(Table Continues)

Steps of JAML-FVET	JAML	Modifications for JAML-FVET
Expand and Prompt for Continuation: The parent expands the use of the targeted word(s) (without modeled support) by asking a question to the child that elicits the targeted word(s) (e.g.," Where is the duck?"), then prompt for continuation of the task by asking the child, "more or all done?" (allow 5-sec wait). Repeat the prompt if needed (allow 5-sec wait). Identify with the child what he or she did that caused the success and praise success.	The **JAML model** operationalizes the notion of expansion to encourage more frequent and sustained looks, longer duration for turn taking, and to generalize joint attention across people, places, and times, and with a higher degree of fluency. In the last phase, triadic joint attention, parents use words to label joint attention objects and encourage verbalizations as joint attention becomes established. The JAML model also gives meaning to joint attention by drawing attention to turn taking routines, excitement about the social aspect of joint attention, etc. Furthermore, the JAML model encourages joint attention through showing pleasure for joint attention, responding with affection for face-to-face contact, and keeping turn taking activities simple and in the context of what a child does best (e.g., solitary play).	**JAML-FVET** focuses expansion on the child's expressive production without the modeling along with the child using expressive language to initiate continuation of the activity. Giving meaning to language targets is established through language expansion activities. This is a significant departure from JAML, which focuses on expansion as it relates to joint attention.

Table 3

JAML-Focus on Verbal Expression with Technology Action-Based Steps and Rationale

Setting up the Environment	**Rationale**
a. There is little distraction in the environment (e.g. quiet place in the house without TV or others talking). b. The instructions for the activity are visible with the target words and the iPad where it can be reached. c. Sitting face to face or directly beside the child d. Express excitement!	The focus is on the parent and the child. Instruct the parent on the key aspects of a "distraction free" environment with limited noise, visuals, and/or variables that would take the child's attention away from the activity. Sitting face to face provides the child with important non-verbal cues along with a direct modeling of the production of sounds by the parent. Additionally, excitement is an important factor throughout the intervention to keep the child's engagement.
2. **Focus In** a. The parent uses direct language, "LOOK" and tells the child to look at their face and then the iPad. b. The parent highlights the particular part of the app or activity by expressing excitement. c. The parent proceeds after the child looked at them, then the iPad.	**Rationale** The use of parent directive language helps to promote understanding with explicit instruction for the child. The parent expresses excitement about a particular aspect of the app or of the activity to draw the child into the activity (e.g. "Let us make a picture for grandma", or "This cow needs our help").
3. **Turn Taking, Modeling, & Encouraging Social Communication** a. The parent provides the expectation, "We are going to take turns, first mommy reads or plays, and then it is your turn." The parents must say **FIRST- THEN**. b. The parent models the target action or phrase using the targeted word, then(s) prompted the child by saying, "**Your turn…** with the use of the targeted word(s). c. Wait for the child's response (count to 3) and proceed to the next step if the child vocalizes. If the child does not, provide them a choice of two (e.g. "Duck in or out") and wait for a response. If this does not promote the child to vocalize go back to step 3a.	**Rationale** After the environment is set, the child has a shared focus with the parent on the activity, and then the parent instructs the child on the sequence of the activity with explicit expectations for the child. The use of *First-Then*, helps to support the child's understanding by providing direction. The parent models the target word(s) with the action required in the activity of making a scene (e.g. As the parent pushes the duck into the water and says, "duck in"). Then prompts the child by saying "Your turn" …. This will foster social reciprocity supported by modeling.
4. **Expand and Prompt for Continuation** a. The parent expands the use of the targeted word(s) (without modeled support) by asking a question to the child that elicits the targeted word(s) (e.g.," where is the duck?") Then prompt for continuation of the task by asking the child "more or all done?" Repeat the prompt if needed. b. Identify with the child what they did that caused the success and praised.	**Rationale** The parent asking a question to the child elicits the production of the targeted words without the support of modeling. This is an important component of responding to joint attention with a social-communicative function. Finally, the parent waits to see if the child initiates for continuation of the activity. The parent may be required to prompt, "more or all done".

Question 2

Did the children continue to use the targeted words in the generalization phase?

Measurement by: The frequency of the intentional verbal use of targeted vocabulary in the shared activity using the iPad.

Hypothesis: The parents will be able to use the strategies outlined in the intervention within a routine-based activity in their natural environments.

Question 3

What is the parents' perception of the use of mobile technology as an intervention for their children's communication?

Measurement by: Analysis of results of a caregiver survey administered before and following the completion of the intervention.

Hypothesis: The caregivers will identify the benefits of the implementation of the JAML intervention with mobile technology as a convenient and effective tool to promote expressive communication.

Chapter Summary

There are several factors to consider when providing interventions to children with an expressive language delay. The first factor is to provide interventions that align with federal recommendations regarding the inclusion of natural environments and the emphasis on instructing parents on interventions to embed within their routines. The second factor is incorporating evidence based parent implemented interventions that contain elements of prelinguistic language development interventions that are centered on social communication between the parent and the child. The JAML intervention and JME both contribute to social communication. The third factor is the increasing use of

mobile devices in the home environment. Instead of the parent using the device as a form of distraction or entertainment, the early educator can provide ways to support the child's communication and engagement with the parent using a mobile device.

This study proposes the use of a JAML-FVET intervention with slight modifications by instructing parents on a systematic process of obtaining their children's focus and engagement using an app as the mediating object to increase children's expressive communication. The experimental design is a single-subject multiple-probe design across activities replicated across participants. Through three phases, the parents are instructed on the implementation of the intervention with the use of the Make a Scene app and generalization of targeted vocabulary within routine activities. The effect of the parent-implemented intervention is measured by examining the acquisition of targeted expressive vocabulary of the children. The results of the study may provide early educators and interventionists with a systematic approach to instructing parents on the use of mobile technology as a tool to support early learning and procurement of new skills.

CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

The purpose of this chapter is to review related literature on early intervention (EI), focusing on a systematic descriptive review of parent-implemented interventions. The focus of this review is the effects of parent-implemented interventions on children 0 to 5 years of age diagnosed with expressive language disabilities. In addition, information is included regarding the role of technology and joint attention interventions for young children.

The first section of this chapter includes a discussion of the importance of EI services and routine-based interventions. The second section is an overview of current literature (within the last 10 years) on parent-implemented interventions for children with language delays and the reported effects of those interventions. Finally, the third and fourth sections include a review of the findings on joint attention and the role of technology in parent-implemented interventions.

Early Intervention

The importance of EI services is demonstrated through federal law and has long term benifits. Federal law defines EI by mandates that are in place for children birth to 3 years of age. Wright and Wright (2014) provides a practical definition of EI:

> *Early intervention* is the process of providing services, education and support to young children who are deemed to have an established condition. This would include those who are evaluated and deemed to have a diagnosed physical or

> mental condition (with a high probability of resulting in a developmental delay), an existing delay or a child who is at-risk of developing a delay or special need that may affect their development or impede their education. The purpose of early intervention is to lessen the effects of the disability or delay. Services are designed to identify and meet a child's needs in five developmental areas, including physical development, cognitive development, communication, social or emotional development, and adaptive development. (para. 4)

The EI program provides quality services for young children with disabilities and their families (IDEA, 2004). The services are to occur in the child's natural environment. According to Part C of the IDEA: "To the maximum extent appropriate to the needs of the child, early intervention services must be provided in natural environments, including the home and community settings in which children without disabilities participate." (34 CFR §3. 3. (2(b)). By definition, natural environments mean "settings that are natural or normal for the child's age peers who have no disabilities." (34 CFR. 303.18) According to the U.S. Department of Education IDEA (2011), the primary mission of Part C of the IDEA is to "build upon and provide support and resources to support family members and caregivers to enhance children's learning and development through everyday learning opportunities" (p. 2). A legal foundation for providing EI services is well established. EI services address developmental domains of young children, provided in the child's natural environment, and support families to enhance learning through daily opportunities.

Beyond the legal basis for EI, Karoly, Kilburn, and Cannon (2005) conducted a study on the long and short term benefits of early intervention programs. The authors

focused on programs that provided services for children prenatal through kindergarten. Out of 20 studies their findings indicated:

> Nineteen early intervention programs demonstrated significant and often sizable benefits in at least one of the following domains: cognition and academic achievement, behavioral and emotional competencies, educational progression and attainment, child maltreatment, health, delinquency and crime, social welfare program use, and labor market success. (p. 2)

The authors indicated that parent training, intensive programing, and smaller staff-to-child ratios in early intervention programs yield better results.

Generalization of Skills in Routine-Based Interventions in Early Intervention

As stated, working with the families is an important aspect of EI services. The federal guidelines stated above dictate that services are provided in the child's natural environment, thus supporting generalization of interventions in routine-based activities. This chapter explores studies regarding the effectiveness of early interventions and demonstrates that embedding intervention for generalization into routines supports erudition for young learners as an effective way for educators to teach strategies to the parents. Daily routines are an important factor that contribute to early learning. According to Keilty (2008), when a child is familiar with the routines, the intervention for that child should focus on scaffolding new and more complex learning. Generalizing the interventions within daily routines enables the interventionist to scaffold new and more complex experiences. Keilty (2008) also indicated that routine activities used during home visits are uniquely individualized based on the family's interests and priorities. This is important because when providing EI services, the family is the center

focus. In addition, Jannings, Hanline, and Woods (2012) emphasized that "routines that occur within the natural environments for young children provide the most effective framework to support and sustain early intervention activities" (p. 14). The home environment allows the child to learn in the context of familiar surroundings and activities. Furthermore, research has suggested that EI occurring in the natural environment is more effective than the traditional models of clinic-based treatment (Raab & Dunst, 2004). Providing services in the natural environment that generalize strategies in daily routines requires that the parents provide the interventions.

Parent-implemented interventions, compared to educator/interventionist-led interventions, have many benefits in addition to providing the interventions in the natural environment (McDuffie et al., 2013). First, a child learning in naturalistic contexts with naturally occurring reinforcements is more likely to generalize to new situations and maintain these situations over time (Kaiser, Hancock, & Hester, 1998). In addition, parent-training programs are cost-effective and provide a higher intensity of exposure to intervention content than is possible in clinician-implemented treatments (Ingersoll & Gergans, 2007). As discussed, extensive research supports parent-implemented strategies for young children at risk or with disabilities in their natural environments. When planning and implementing strategies for young children with communication delays, the family plays a role in providing the interventions.

In addition to the research, which suggests working closely with families and generalizing interventions within the context of natural routines, federal law dictates delivery of EI services utilizing a family-focused approach. Hence, this takes the focus from a clinic-based/interventionist-implemented model to a home-based

consultative/collaborative model (Keitly, 2008). Generally, in the clinic-based models, the early interventionist, rather than the parent, provides the interventions. McWilliams (2010) indicated that problems still exist regarding overspecialization and, therefore, with a lack of functional goals with a continued utilization of the clinical-based model rather than a family-centered approach. For example, the services are to take place in the child's natural environment. Furthermore, the goals of these services are to address the young child's functional participation in routines (e.g., bathing, meals, and recreation) within that natural environment. However, individuals trained to work with young children with disabilities (e.g., speech and language therapists, developmental therapists, physical therapists, and occupational therapists) often provide the interventions in the clinical setting or in the natural setting with little regard for parent training.

Roberts and Kaiser (2011) conducted a meta-analysis on the effectiveness of parent-implemented language strategies in order to support this claim. They reviewed literature focusing on interventions provided to increase language skills for children birth through 5 years. They found that seven of the 18 studies reviewed did not include home-based sessions and the remaining 11 studies provided an average of four hours of home-based training across the entire duration of each intervention that was provided by the interventionist. In addition, they highlighted the difficulties related to the fidelity of the application of the intervention in the home with the parent providing the intervention. More research is required to provide ways for the interventionist to support generalization of the parent-implemented strategies in the home environment with fidelity. Notably, further exploration of coaching and supporting the parent, as the parent generalizes the

intervention, in a format that fosters a relationship-based activity focusing on promoting the child's communication would be beneficial.

Parent-Implemented Interventions

Early interventionists along with early childhood educators who support children in the daycare and preschool settings are challenged to find ways to provide systematic interventions that are parent-implemented. The scope of this review highlights key mediating or moderating factors found in the literature such as joint attention, and efficacious strategies to promote the development of expressive language in young children. This systematic review of literature focused on how educators can facilitate parent participation in early intervention. Parent-mediated/implemented intervention strategies were examined, and the effects of these interventions on expressive language outcomes for young children.

Methods for Conducting the Search for Related Literature

In order to provide specificity, the review had explicit criteria regarding the settings, participants, parent participation/interventions, research designs, and measured outcomes. To begin the search, criteria were set for inclusion and exclusion of articles regarding their content on participants, settings, interventions, research designs, and outcomes measured. Based on the methods set for the criteria, the search was conducted to identify parent-facilitated (parent-implemented) interventions for children 0 to 5 years of age with disabilities. Using a Boolean search, only articles that were peer reviewed within the last 10 years were included with key search terms derived using the process below (see section on Key Terms). First, Illinois State University's Milner Library website was used for this review. The articles were retrieved from the Education

Resource Information Center (ERIC) database due to its wide scope of sources, including childhood studies, dissertations, psychology/behavioral sciences, communication, library and information science, public administration, social work, and urban studies (Institute of Education Sciences, 2014). According to ERIC, since October 2013, more than 188,700 PDF articles were online, and the site is updated on a monthly basis. In addition, Institute of Education Sciences Selection Policy indicated selection criteria that include rigorous and relevant content.

> Content considered to be rigorous will have undergone a review process and present a method and a scholarly approach that is reasonable and sound to the field. To be considered relevant, a source and/or its materials must have a demonstrable bearing on the field of education, and the four centers at the Institute for Education Science (IES): The National Center for Education Evaluation and Regional Assistance (NCEE), the National Center for Education Research (NCER), the National Center for Education Statistics (NCES), and the National Center for Special Education Research (NCSER).
>
> (p. 2)

Second, key terms were identified and entered into the ERIC search engine. Third, reference lists of relevant studies were reviewed for possible article candidates, along with a meta-analysis (Roberts & Kaiser, 2011) and literature reviews. Finally, abstracts were reviewed for inclusion criteria as described in the section, Description of Included Studies. When the abstract did not provide the information required, the full text was reviewed. Studies that met the criteria were downloaded (in full-text format) and filed under their areas of relevance for further annotation. Studies that did not meet the

criteria, but provided relevance to the subject matter were selected for future purposes beyond the scope of this review. For example, some studies included all of the criteria, although the participants for the study were age 6 or 7. Therefore, these studies were not included in this review.

Key Terms

Terms utilized in the search related to the study's research questions and highlighted specific phrases to ensure cohesiveness of the concepts:

a. How educators can facilitate parents' participation in EI and how that participation can affect EI outcomes for children birth through 5 who are at risk or with a disability
b. In addition, focus on key mediating or moderating factors such as self-regulation, joint attention, and efficacious strategies to promote the development of expressive language in young children.

First, for the initial Boolean search the key terms *early intervention*, and *expressive language*, and *parent-facilitated* were entered; however, due to the broad scope of these concepts, "*for children with expressive language disorders/disabilities*" was added to provide specificity. This did not yield an adequate number of search results within the established criteria above. So the search strategy was modified to increase the number of results. In the next Boolean search the key phrase *parent-implemented interventions for expressive language* was entered. Initially, there were over 6,131 matches for *parent-implemented strategies for expressive language*. After searching with several combinations of descriptors and/or key terms (i.e., early *intervention*, *parent-*

implemented, *self-regulation*, *joint attention*, *routine-based*) were entered to narrow results. This resulted in the inclusion of 17 studies that met the criteria below.

Description of Included Studies

The criteria established the defining variables for this review. See Table 4 for a summary of the inclusion content characteristics. Overall, the review consisted of 12 experimental group design studies (including randomized and pre-/posttest), three single-subject multiple baseline design studies, two published pilot studies, and two literature reviews of empirical research (that were used as a reference and not included in the data).

Table 4

Inclusion Criteria

Element	Identified Criteria
Participants	0 to 5 years of age Identified with a disability/delay or at risk (e.g., low socio-economic status)
Intervention	Parent-facilitated component
Setting	Include studies that were based in the home or with parent-facilitated generalization to the home from the school or clinic
Design	Empirical studies with quantitative measures (group and single-subject) Experimental designs with quantitative and qualitative measures Published in peer-reviewed journals Dissertations Meta-analysis and/or literature review
Outcomes	Expressive language outcome measurements (standardized, observational, and/or elicited)

Setting

The candidate articles included studies that incorporated home-based interventions that supported the theme of parent involvement. Originally, the search was

narrowed to only the home environment. Due to limited results, the search was expanded to include school and/or clinic; however, review criteria required a home component either for generalization of skills or for parent training. Studies were excluded if they were conducted only in a clinic or a school setting without any connection to the home environment.

Participants

The studies were restricted to young children from 0 to 5 years of age. The young children were identified by standardized testing with expressive language disabilities, and/or disabilities that affected the ability to communicate, or were at risk due to low social economic status (SES) concerns. Although, there are other factors associated with high-risk criteria (e.g., prematurity and family history), to narrow the scope of this review, only low SES was included. Studies were excluded that involved children older than 6, children who were typically developing. For example, Kashinath, Woods, and Goldstien (2006) examined the effects of generalized teaching strategies in daily routines for young children with autism. The authors demonstrated that parent-implemented interventions in the natural environment had positive effects on child communication outcomes; however, their sample population expanded to 7-year-old children (although several children were less than 5-years-old), which was beyond the scope of this review and, therefore, excluded.

Participation and Interventions

Studies were included that incorporated parents providing the intervention (parent-mediated or parent-implemented) to their children and/or the educators/interventionists providing interventions with generalization to the home where

the parents provided the components of the interventions. This resulted in excluding studies that included the educator/interventionist solely providing the intervention for the young child without a generalized component in the home environment. For example, Vallotton et al. (2012) conducted a study examining the effects of parent stress on the expressive language of at-risk young children with results from the National Early Headstart Research and Evaluation (NHSRE) study regarding children that participated in the Head Start Program. Although this study incorporated parents and the effects of parents in relation to at-risk young children, it did not meet the criteria for parent-implemented strategies or the effect of the implementation of interventions on expressive language outcomes and was, therefore, excluded. Furthermore, this study was also excluded because it did not include participation in or generalization to the home environment.

Research Design for the Literature Review

Empirical research designs and one descriptive literature review of relevant information were included. Designs that were purely qualitative were excluded from this review, because the focus was on quantitative studies. However, mixed-methodology designs that incorporated quantitative and qualitative components were included. For an example of an excluded study, Gillis, Luthin, Parette, and Blum (2012) discussed the use of *VoiceThread* to promote language for at-risk young children or children with disabilities in early education settings. In this study report, the authors presented a conceptual representation and not an empirical design and the study was, therefore, excluded.

Measured Outcomes from the Literature Review

Reviewed studies included those that measured expressive language outcomes as they related to parent-implemented interventions with a home-based component. Expressive language measures included constructs of expressive language, including: (a) communication acts (functional use of language); (b) mean length of utterance, number of words/signs produced spontaneously; (c) conversational reciprocity; (d) imitation of spoken language and/or sign; and/or (e) overall improvement in expressive language. The measurements included standardized, observational, and/or parent-reported measures. In the studies measuring more than expressive communication, only the results of the expressive communication were reported. Studies that were excluded involved measurements of receptive language only and/or a focus on outcomes not related to expressive communication (e.g. behavioral).

Overall Study Quality of Included Articles

The Division of Early Childhood Council (2014) provided quality indicators that were used to categorize the identified studies. The categories provided criteria for group comparison (e.g., randomized experiments, non-randomized quasi-experiments, regression discontinuity designs) and single-subject research. The purpose of using the quality indicators was to provide a current standards-based approach that is accepted in the field of special education to measure evidence-based studies.

> The intent of identifying quality indicators essential for methodologically sound and trustworthy intervention studies in special education is not to prescribe all the desirable elements of an ideal study, but to enable special education researchers to

determine which studies have the minimal methodological features to merit confidence in their findings. (Division for Early Childhood, 2014, p. 2)

Two of the studies did not meet the criteria for the DEC standards, because one was a literature review of empirical data (not a meta-analysis), and the other was an analysis using multi-attribute utility reporting.

In summary, the majority of the studies included sufficient information in the areas of critical features of content for settings, description of the practice for replication, and independent and dependent measures. Outcome measurements and data analysis were "moderately sufficient" for the studies. Overall, the studies consistently lacked the inclusion of enough information regarding the participants for generalization, critical features of the intervention agent(s) for replication, fidelity measures, and information regarding the attrition considerations used for internal validity. Refer to Table 5 for the summary of the results of this literature review.

Results of the Literature Review

Participant Characteristics

The total number of participants across the 17 studies was 886 young children. The range included children 1 to 5 years of age, with an exception of a longitudinal study that included prenatal participants. The mean age was difficult to calculate because the participants' age information was often presented as a range, rather than as specific ages. However, the majority of the studies examined children 2 to 3 years of age, closely followed by children who were 3 to 5 years of age. As shown in Table 5, participant characteristics varied across studies.

Regarding the identified disabilities, the majority of the studies included children specifically with the diagnosis of an autism spectrum disorder (ASD) (n=6). The next most frequently identified categories were developmental disabilities (n=4) including children with Down's Syndrome (n=4) and children at risk due to low SES (n=4). In addition, children with ASD were included in the description of developmental disability in the majority of the studies. Thus, this may have overrepresented children with ASD and underestimated children with developmental disabilities. The next categories by frequency included both children diagnosed with language disorders (n=2) and children specifically diagnosed with cerebral palsy (n=1). In addition, the preponderance of the children identified had 10 or fewer spoken or signed words.

Table 5

Results of Literature Review

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Aldred, Green, Ensley, & McConachie (2012)	N=25, 2-5 yrs., ASD	Experi-mental, pre-post	Child's commun-ication acts	Over 12-month intervention period, formal parent-mediated intervention training. Combined: shared attention, match language, predictable sequences in routines, language elaboration, conversation reciprocity	Parent-Child Interaction Measure (PCI), Macarthur Communication Development Inventory (CDI)	Increase in parent synchrony was associated with increase in children's active participation in the interaction as measured by total child communication acts, (r = .39, p = .043)	Reliability between the two coders was 77 for "other talking".	No social validity measures were identified in the study
Chao, Bryan, Burstein, & Ergul (2006)	N=41, 3-5 yrs., Dx: At-Risk	Experi-mental, Pre-post with control	Language expression and behavior performance	Family-Centered Intervention Model. Teacher prepared family-centered activities weekly to embed in routines	Test of Early Language Development (TOLD-3), Eyberg Childhood Behavior Inventory	Statistically significant difference on the ECBI Intensity Scale, F (1, 6.37, p=. 016, ND Problem Scale, F (1, 38) =5. 15, p=. 029. Significant increase in expressive language post measures for treatment group	N/A	Teachers and parents indicated the intervention was a useful and effective approach

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Guttentag et al. (2014)	N=361, 2.5 years, At-risk mothers, prenatally and continued until children reached 2.5 years of age	Experi-mental; half were randomly assigned to the high-intensity (HI) home visitation coaching and half to low-intensity (LI) condition referrals	Parental responsive-ness, Expressive language of the child	The Play and Learning Strategies (PALS) curriculum used for parent training with different intensity of support	Landry Parent Interaction Scales, Preschool Language Scale-3, The Brief Infant-Toddler Social-Emotional Scales, Cognitive Scales of the Bayles Scales of Infant Toddler Development	Children in the high-intensity condition showed improvements in expression at a faster rate than children in the low-intensity group; change in group means from 4 to 30 months resulted in an effect size of d =.34	Interrater for training 80% or greater, generaliza bility coefficien ts ranged for mother/ch ild Dyads from .63 to .75	Not specifically measured, although they reported one comment from a participant who recommended the program to new mothers
Haebig, McDuffie, & Weismer (2013)	N=40, 24-39 months, Dx: ASD	Experi-mental, using bivariate correlate-ions, Longitude-inal (1 yr.)	Expressive & receptive language	Parent language input following gaining attention, Parent language input response to child communitive acts	MacGarther Bates, Preschool Language Scale-4	Parent input following focused attention: only parent follow-directives significant (r =. 67, p<. 05, one tailed) for language production, Parent response to acts: significant bivariate correlations for language expansion, (r =. 51, p<.001)	The g coefficien t is 6 considere d acceptabl e between coders .77 for “other talking” and .956 and 1.0 for all other categories	Specific social validity values were not reported

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Ingersoll, Dvortcsak, Whalen, & Sikora (2005)	N=3, 30-46 months, Dx: ASD	Single-subject multiple-baseline	Spontaneous speech	Developmental Social-Pragmatic Model (DSP) performed in the clinic (2 days per week for 50 min for 10 wks of intervention) with generalization measures for parent implement-tation weekly	Structured observation adapted from the Functional Emotional Assessment Schedule	Children demonstrated an increase in spontaneous speech above baseline with the implementation of the intervention with therapist and parents who were not trained in the technique	Fidelity measures set at (4 out of 5) 80%, collected on 10% of treatment sessions	Social validity was not specifically measured
Ingersoll & Wainer (2013)	N=24, 3-5 yrs, Dx: ASD	Experi-mental, Pre-post	Spontaneous language use	Project imPACT to teach parents a variety of developmental naturalistic behavior interventions by group training and coaching at school	Social-Communicative Checklist, Social Responsive Scale, Observation of parent-child, Behavior Rating Scale, Parent Stress Index	Child used significantly more language during free play ($t(22) = -2.71$, $p < .05$, $d = .56$) and in routine- based activities ($t(16) = -2.51$, $p < .05$, $d = .57$) at post vs. pre treatment	Overall parent-implemented fidelity $t(22) = 7.88$, $p < .001$, $d = 1.64$	Participants rated program high in perceived effectiveness and acceptability

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Kaiser & Roberts (2013)	N=77, 30-54 months, Dx: Intellectual Disabilities-(ASD & Down Syndrome)	Experimental random group design, Parent and therapist vs. therapist only, Data: 6 mos., and 12 mos.	Expressive and Receptive outcomes	Enhanced Milieu- (Time delay, modeling, and-modeling), 12 home-based sessions with coaching in a play activity	Preschool Language Scale -3, Expressive Vocabulary Test, Peabody Picture Test, Language Sample, MacArthur Bates	Parents showed greater use of the EMT strategies at home than therapist. Effect sizes ranged from d = 0.10 to d = .32 at 12 mos.	Measures collected 20% of sessions for both parent and therapist groups; therapist 100% and parents 80% using observational checklist	Social validity was not specifically measured
Konza, Maloney, & Grafton (2010)	N= 7, 2-4 yrs., Significant language delays	Experi-mental Pre-post	Parent-child interactions , Parent perception of the program	It Takes Two to Talk child-directed speech, scaffolding program for 12 weeks	Clinical Evaluation of Language Fundamentals Preschool (CELF-3), parent evaluations, focus group interviews, and video analysis	Frequency count of parent-child interactions indicated five of the seven children matched the number of communications with their mothers	Not reported for the visual analysis	Parents rated the program 4 out of 5 on a 5-pt scale and perceived positive changes in their children's language production

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Mahoney, Perales, Wiggers, & Herman (2006)	N=50, 12-54 months, Dx: Dev. Disabilities (20 with ASD & 30 with DD)	Experimental pre-post- 1-year study	Children's responses with key pivotal behaviors	Response teaching/active learning in routines: reciprocity, contingency, shared control, & affect- weekly 1-hr. sessions (33)	Transdisciplinary play-based assessment, Temperament and Atypical Behavior Scale, Infant Toddler Social Emotional Assessment, and videotaped observations	Proportional Change Index (PCI) indicated the children made a 69% gain in expressive language skills.	Not reported for the videotaped observations	Not reported
Pennington et al. (2009)	N=11, 19-36 months, Dx: Cerebral Palsy	Quasi-experi-mental across four data points: two pts taken before the training, two pts after the training in a repeated measure design	Mother's actions & child movement for initiation & request	Hanen Program More than Words (child directed approach)	5 Point Speech Production Scale, MacArthur Bates Communication Development Inventory, Parent Sense of Competence Scale	Children produced higher proportions of responses at They produced higher proportion of initiations at Time 3 than Time 2, $t(10)=3.150, p=.005, d=0.950$	Agreement between raters was observed for mothers' moves ($k = .76$, $p = < .01$), children's moves ($k = .78$, $p = < .01$), mothers' functions ($k = .75$, $p = < .01$), and child functions ($k = .77$, $p = < .01$). Speech Production Rating Scale by the two raters blind to each other's coding ($r = .773$, $p < .001$)	No specific measurement was reported for social validity

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Prelock, Calhoon, Morris, & Platt (2011)	N=4, Age: 37-69 months, N=3, Age: 2-3 yrs., Dx: ASD	Pilot Studies, pre-post evaluated at four data points, qualitative comparison of two Joint Attention Programs; behaviorist approach & parent-child relationship; provided 8-week training sessions	Child social interaction and vocabulary, Perceptions of intervent-ionist	Parent training in Hanen Program More than Words (MTW) (8 sessions), training parents in joint attention with behavior-based/ naturalist approach	Mullen Scales of Early Learning, CDI: Words & Gestures, Parent question, Questionnaire for interventionist and parents, and videotaping	Children increased on pretest measures for social and symbolic communication acts, Interventionist rated positively for the parent-focused intervention	Not reported for either pilot study	Parents felt video & home visits were helpful and strongly agreed that expectations were met, each MTW strategy was effective and positively affected their children, Interventionist & parents reported they were satisfied with interventions

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Rogers et al. (2006)	N=10, Ages: 20-65 months, ASD (10 words or fewer)	Single- subject design - randomized selection	Expressive language	Denver Model (which merges behavioral, developmental, and relationship-oriented intervention), and PROMPT	MacArthur Communicative Development Inventory (CDI; -- Vineland Scales, -ADOS, -Mullen Scales of Early Learning Mullen, The Social Communication Questionnaire	Significant gain was defined as follows: (1) child obtained a score of 2 or 3 on the ADOS at pre-treatment, and (2) child obtained a score of 0 at posttreatment. Eight of ten demonstrated functional, spontaneous use of five novel words	Two coders rated behaviors on more than 40% of tapes and inter-rater reliability examined using weighted kappas were as follows: spontaneous words: .82–.88; spontaneous phrases: .92–.96, imitated words: .88–.92; imitated phrases: .82–.88; communicative function: 64–.68; treatment fidelity of each therapist was assessed and fidelity was achieved at 85% or better on three consecutive pilot sessions	No specific social validity measures were reported
Romski et al. (2011)	N=53, Age= 20-40 months, Dx: language delay (10 or fewer words)	Experi-mental, Pre-Post, Augmentativs. Spoken language	Spoken language	Training with Aug. Device vs. traditional language treatment	MSEL, Sequential Inventory of Communication Development, Clinical Assessment of Language Comprehension	Multiple attributes measured. One attribute showed significant gains in target augmented word use after just 18 sessions of parent-coached intervention and maintained their target augmented word use at 24 sessions $p > .5$)	The number of target words identified correlated very highly between each version of the transcript ($r = .99$, $p < .001$); Kappa for the agreement between the two coders were .98, .97, and 1.00 for AC-I, AC-O, and SC	No social validity measures were specifically measured

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Stoner, Meadan, Angell, & Daczewitz (2012)	N=5, Age: 24-38 months, Dx: Down Syndrome, DD, & ASD	Multi-Attribute Utility Approach	Child expressive language	Use of naturalistic and visual strategies	PLS-4, MLU, TTR, Percentage of intelligibility	Results were positive, 25 of the 28 attributes or outcomes met the established criteria	The sum of the weighted utility points for each attribute was .41—far above the .36 stakeholders had desired	Parents reported a high level of satisfaction
Vallotton & Ayoub (2011)	N=120, Age:14-36, Dx: At-risk low income	Longitud-inal Study with Growth Trajectory	Expressive language	Self-regulation strategies	Child Language Exchange System, Bayley's BDI (observer rated)	Vocabulary at 24 months has a strong positive effect on the overall level of girls' self-regulation skills through toddlerhood (see the parameter estimate for the interaction between gender and 24-month vocabulary)	Not calculated	Social validity measures were not specifically reported
Vallotton et al. (2012)	N=40, Age: 23-40 months, Dx: At-risk	Experimental pre-post with control	Symbolic gestures	Signs Program	MacArthur (CDI), Parent Stress Inventory, Observation measures	The effect of being in the infant sign group increased by 47% the child cues to which mothers responded appropriately at Time 2, an effect size of 1.12	The small number of codes in each of the coding schemes set a low upper-limit for the Kappa; the average reliability across the tapes was K = .70	Social validity measures were not specifically reported

(Table Continues)

Authors	Participant	Method	Dependent Variable	Intervention	Measure(s) Used	Results	IOA	Social Validity
Wright, Kaiser, Reikowsly, Roberts, & Detting (2013)	N=4, 23-29 months, Down Syn-drome	Multiple baseline across partic-ipants	Child expressive language, Joint Attention, Symbolic Behavior	JASPER-Sign, Joint Attention, Symbolic Play, & EMT	Mullen Scales, PLS-4, MacArthur	Children showed an average gain of 10-21 words from baseline	Overall agreement on implementation averaged 98%; agreement for sign infusion measures averaged 99%, and overall agreement on scoring the six JASPER behaviors was 96%	Social validity measures were not specifically reported

Parent-Implemented Interventions

The majority of the parent-implemented intervention studies (n=8) included or incorporated elements of EMT (Enhanced Milieu Technique). The next most frequent interventions included Joint Attention-Mediated Models and the Hanen Program (n=4). The use of focus stimulation (n=2) was the next common strategy, followed by the use of sign language (Baby Signs) (n=1), augmentative devices (n=1), and response teaching (n=1). The preponderance of the studies included a combination of strategies, rather than an isolated method of intervention.

Intervention implementation studies varied in reporting their specific procedures and/or lacked transparency regarding their implementation of the procedures. As stated, overall, they lacked specific clarification on validity and reliability measures. The most common element reported was the number of sessions.

Of the number of sessions that were reported, the majority of the interventions occurred in 12 sessions or fewer with the educator/interventionist coaching the facilitation, closely followed by interventions with 12 or more sessions. In addition, a small portion of the studies included observational methods performed by the researcher with limited coaching (low-intensity) and a number of the studies did not provide a clear and transparent description of their procedural methods.

Outcomes of Expressive Language Intervention

The majority of the studies examined the effects on a combination of expressive language constructs and/or expressive language as a whole entity, rather than specific constructs. A tally was completed regarding the specific constructs addressed in each study. The most frequent dependent variable was communication acts that encompassed,

(a) conversational reciprocity, (b) joint attention, and/or (c) initiation of request. The second most frequent expressive language constructs measured were (a) spontaneous words, (b) Mean Length of Utterance (MLU), and/ or (c) the presentation of targeted words.

Parent-Implemented Interventions Description

Overall, the EMT method demonstrated significant presence in the literature as a way for educators to facilitate parent participation to promote expressive language outcomes. It is not a surprise that EMT was identified in the majority of the studies as an intervention that demonstrates positive outcomes for expressive language. According to Kaiser and Roberts (2013), more than 50 studies incorporating elements of milieu instruction have been conducted, and EMT has been shown to be an evidence-based practice for working with children with developmental disabilities (including ASD). In addition, Kaiser indicated that EMT is more effective than drill-practice methods for early language learners (Yoder, Kaiser, & Alpert, 1991). EMT is also a strategy that has been demonstrated as effective across a variety of different populations. In this review, EMT was identified in studies with young children at risk, with cerebral palsy, significant language delays, or developmental (including ASD) and intellectual disorders (see Table 5). EMT is an accumulation of several naturalistic tactics and often incorporates the practice of routine-based interventions. According to this literature review, it is one of the most often used parent-implemented strategies.

As discussed, EMT uses a combination of strategies. The main elements of EMT as described by Robert and Kaiser (2011) include the arrangement of the environment to facilitate communication, modeling, expanding communication (scaffolding), time delay,

and a series of prompting strategies. EMT tactics were identified within this literature review in several programs including the Hanen program (It Takes Two to Talk), Play and Learning Strategies (PALS) and the Denver Model. In addition, EMT was frequently noted as a combined approach with the Joint Attention Model, the use of iPads, and augmentative devices for parent implementation.

Parental Stress and Expressive Language Outcomes

In addition to parent training, an interesting theme arose in the literature on the implications of parental perception related to stress. Several studies measured the perceived stress of parents having children with disabilities. This included the perceptions of stress related to the parents implementing the strategies, and/or the perceptions of their stress after the interventions were completed. To illustrate, Romski et al. (2010) identified a correlation between the identified stress levels of parents of children with ASD and their children's expressive language abilities. The authors found that higher expressive language skills of their children resulted in less stress perceived by the parents. In another study, Loretta et al. (2006) found that children's cognitive ability and the diagnosis was a strong contributor to parental stress. The study outlined the parent's perceptions on contributing factors of parenting a young child with a disability. Consequently, a common theme appeared that the impact of parent stress affected learning outcomes. More research is needed in this area, along with effective practices to help support parents at home and in their communities.

Outcomes of Parent-Implemented Methods

Overall, the results indicated parent-implemented interventions resulted in positive effects on expressive language outcomes for children who are at risk or have

disabilities. Although this review did not include measurements regarding the parents, the literature revealed themes that focused on parent measurements. According to Roberts and Kaiser (2011), four main components correlated with parent-child interactions that were associated with language development: "(a) amount of time for the parent-child interactions, (b) the quality of the linguistic inputs, (c) responsiveness to the child, and (d) use of the language learning" (p. 180). While the studies resulted in positive overall effects of parent-implemented expressive language interventions, there were noted concerns regarding Roberts and Kaiser's four main components within this body of literature.

The first area of concern regarded parent fidelity in the implementation of the interventions. The studies in this body of literature included several terms to describe teaching parents' interventions such as parent-implementation strategies, coaching methods, and collaboration. However, none of the studies actually cited an adult-learning program model. Thus, there is no standard way to instruct parents in the facilitation of interventions that would constitute fidelity. To further this discussion, Pretis (2011) elaborated on this topic by stating, "The effect sizes of parent programs or involvement, due to methodological issues and mediator variables still vary significantly between the programs" (p. 73). In addition, the author described the evidence-based practice for parent facilitation including the importance of shared understanding and shared decision making between professionals and parents. This was described as a main predictor of positive outcomes. Respectively in this literature review, 1 out of 16 studies used the method described in Pretis.

In summary, parent involvement produces positive outcomes related to expressive language skills for young children. However, the techniques that educators implement to facilitate parent learning require additional research focusing on the fidelity of implementation of the intervention by the parent. In addition, the studies need to include measurements related to long-term outcomes across settings and elements of time.

Parental Linguistic Output and Gains in Expressive Language

An additional finding within the literature related to the parents' linguistic output and its correlation to later language gains in their children. The literature indicated a positive relationship between language exposure during parent-child interactions and children's vocabulary growth. To support this finding, in a seminal study, Hart and Risley (1995) demonstrated that the number of words a child is exposed to during early language development affects later achievement. They demonstrated that the number of words spoken by parents had an effect on the expressive language of their children. In other related studies in this review, the quality of parent-child interactions were measured. For example, Haebig et al. (2013) reported that after controlling for parent education, child engagement, and initial language level, only parent directives for language that followed the child's focus of attention accounted for the variance in predicting both comprehension and production one year later. Hence, their findings demonstrated that the quality of parent-directed speech as they respond to their children is a key factor in later language gains. The authors reported that children with ASD who had limited verbal skills benefited from parent language input that followed the children's interest, as compared to children with more verbalizations in which no effect was demonstrated.

In addition, another study examining young children with Down syndrome (Mahoney et al., 2006), demonstrated a linear relationship between the degree to which mothers changed the responsiveness of their linguistic output and their children's pivotal behavior response. In regards to these studies, parent input was a common outcome measured as it related to gains in expressive language skills for young children.

Overall, this review supported Roberts and Kaiser's (2011) meta-analytic findings. It is not only the number of words, but also, more importantly, the quality of those parent-child interactions that demonstrated a positive effect on expressive language outcomes. Again, more research is needed in this area focusing on the variables that facilitate "quality" of those interactions across disabilities and severity of the disabilities.

Outcomes of Parent-Implemented Interventions

The results from this literature review support the findings of Roberts and Kaiser's (2011) meta-analysis that parent-implemented strategies generalized; as a result, these strategies have positive effects on language skills of young children. A few variations were noted. For example, the largest effect size was for expressive morphosyntactic skills. In contrast to this review, communication acts were the most frequently measured with larger effect sizes. However, Roberts and Kaiser's concluded that no single language construct was significantly larger than other language constructs.

Furthermore, it was surprising that the studies within this body of literature did not include conversational reciprocity. Expressive language focuses on communication between the child and parent. Hence, the interaction between the parent and child would dictate conversational exchange in regards to the promotion of expressive language. Second, when looking at the diversity of communication acts and modes of

communication (e.g., sign language, gestures, and AAC), conversational reciprocity goes across various modes of communication. Finally, reciprocity promotes engagement and joint attention (Mahoney et al. 2006). Thus, the inclusion of conversational reciprocity is a viable construct for expressive communication.

In this review, the most frequent language construct measured was communication acts, which is the functional use of language. The elements placed in this category were requesting, demonstrating communicative intent, forming/answering questions, and making demands. In retrospect, young children with ASD were most frequently studied and communication acts are a primary concern for children in this category. Therefore, this may indicate a correlation between the population most frequently represented and the language construct most frequently measured.

A notable finding observed was that ASD appeared to be over represented across this review of literature. The majority of the studies specifically examined children with ASD. Additionally, studies that included children with developmental disorders included children with ASD in their population sample. This is not surprising. An ERIC search using the term *autism* resulted in 9,974 hits compared to cerebral palsy, which resulted in 1,330 hits. This demonstrated a large body of research on ASD compared to other types of disabilities.

Another interesting finding was that none of the studies in this review examined children with sensory impairments (vision or hearing). It may be postulated that the key words were not specific enough to target all possible disability categories. The results dictated a need for more in-depth analysis of children with a variety of disorders, along

with children who demonstrate two or more primary diagnoses with language impairments, such as young children with both ASD and a hearing loss.

Role of Joint Attention in Parent-Implemented Strategies

JA is a skill required for effective communication. In addition, it was cited as an important component related to learning development in many of the studies in the current literature review. JA is a developmental construct that is essential for young learners. JA is developed early in life and parents play an important role in the development of JA. In turn, it is difficult for early interventionists and early educators to employ their strategies with young learners who do not attend. Practitioners and educators agree that JA is more than just eye contact; it requires engagement. JA includes many facets with underlying skills that span developmental domains.

As stated earlier, according to Gavrilov et al. (2012), JA is when the parent and child coordinate attention to each other and a third object or event and is believed to play a functional and critical role in early word learning along with other essential developmental domains. The elements of JA directly influence expressive language. This is supported by several studies, including Haebig et al. (2013). In this study, the authors focused on the parent's language input that followed the child's focused attention. They demonstrated that the child made gains in expressive language in the early stages of language development. Thus, they recommended teaching parents JA skills. Pennington et al. (2009) also described that using the Hanen Programs (an evidence-based parent-implemented program for young children) increased JA, which improved social responsiveness between the parent and the child. Wright et al. (2013) taught parents the Joint Attention Symbolic Play Engagement Regulation (JASPER) model as an

intervention for toddlers diagnosed with ASD, demonstrating an increase in the rate of spontaneous communication by the young children.

The presence of parent-implemented JA models is not surprising. In order for young learners to have effective expressive language skills, it is important for them to develop the ability to attend, specifically, to participate in JA activities early in their development.

Joint Attention Intervention Models

Two commonly used parent-implemented JA intervention models for improving language outcomes in young children are the JASPER and the JAML interventions that were discussed previously. The first commonly used parent-implemented intervention is the JASPER, developed by Kasari, Gulsrud, Wong, Kwon, and Locke (2010), that embeds joint attention elements with language interventions. It is a systematic approach, during, which parents implement strategies to promote quality exchanges of JA around their children's interests and developmental play levels. The JASPER intervention teaches parents to engage in multiple strategies at the same time to increase the time spent jointly with their children (Kasari et al, 2010). The strategies used in the JASPER include following the child's lead, expanding on the child's utterances, using environmental arrangements, imitating the child's play acts, and establishing play routines. In a randomized controlled study, Kasari, Freeman, and Paparella, (2006) found that this JASPER model extended the children's attention with others, and was associated with progress in JA initiations, play flexibility, and developmental level of play (Kasari et al., 2006). Notably, children who received the targeted JA intervention showed greater language growth over the course of 12 months than did children in the control group

(Kasari et al., 2006). In a 2011 study report by Wright et al. (2013), the authors indicated that by teaching parents the JASPER model children demonstrated positive outcomes in an observed increase in the rate of signing and the number of spontaneous communication attempts (sign and verbal).

The second prominent parent-implemented JA model intervention is the JAML model developed by Schertz and Odom (2007). The purpose of this intervention was to target foundational preverbal social communication within the parent-child relationship in toddlers with ASD. As stated in the first chapter, the JAML has five key learning principles (focusing on faces, organizing and planning, encouraging, giving meaning, and expanding) that are achieved across the four phases of the intervention (focusing on faces, taking turns, responding to joint attention, and initiating JA). In the initial study, Schertz and Odom completed a multiple baseline study with three parent-child dyads that compared child performance across four phases of intervention. The study involved nine to 26 weeks of intervention and 11 to 16 in-home parent-coaching sessions. The authors indicated, "All toddlers improved performance and two showed repeated engagement in joint attention, supporting the effectiveness of developmentally appropriate methods that build on the parent-child relationship" (Schertz & Odom, 2007, p. 1573). In a follow-up study by Schertz et al. (2013), the authors examined 23 parent-child dyads. The children were toddlers diagnosed with ASD. They implemented the JAML intervention model. The toddlers improved on two measures of preverbal social communication and on standardized language measures not targeted in the JAML intervention. The results included large and moderate effect sizes across a range of variables.

Role of Technology in Caregiver Implementation

In relation to other interventions, the use of technology to facilitate parent involvement is an emerging practice. Two of the studies (Cardon, 2012; Marturana, 2012) used a technology-based approach to facilitate parent involvement. This is an intriguing concept, since the primary focus is on ways to facilitate parent involvement. The use of technology may be a viable motivating component in order to gain and maintain the parents' interest in implementing treatment strategies. The incorporation of adult learning models, coaching techniques, and collaboration strategies combined with the use of technology is a possible solution to decreased parent engagement in language interventions. For example, Cardon showed that parents were able to create video models on an iPad with minimal training and implemented the Video Model Imitation Training (VMIT) with fidelity to promote imitation skills in young children with ASD. In another study by Marturana (2012), a program called Teaching Early Language Learning with Technology (TELL-Tech) was investigated. In this study, the use of Mobile Device Learning (M-Learning) was examined to promote synchronous learning between the instructor and the parent to promote collaboration in routine-based activities. The TELL-Tech approach combined M-learning, assistive technology, and caregiver-implemented communication intervention (EMT) with the use of a mobile device. Specific technology applications included the use of a videoconferencing app that provided real-time, face-to-face access between the instructor and the parents, along with a storytelling app to teach specific vocabulary in everyday routines. In addition, a program called Language Environment Analysis (LENA) was utilized. As indicated by Marturana (2012), the LENA program provides a language analysis by having the child

wear a small recording device that records the child's interaction in real time. In turn, the LENA program records and analyzes the data on the number of child vocalizations, number of adult words in the environment, and the number of child conversational turns. The results of this study demonstrated the promising use of technology. The parents showed that with the use of videoconferencing, they were able to instruct their children with the EMT strategies above baseline during the intervention phases. Furthermore, the analysis revealed that the children demonstrated gains in expressive language.

Taking a closer look at Internet-based use for instructing parents, Meadan, Meyer, Snodgrass, and Halle (2013) took an interesting perspective on the use of technology to reach rural areas. The strategies for this study were extended from the PiCS program (Stoner, Meadan, Angell, & Daczewitz, 2012). The authors proposed *Internet-Based Parent-Implemented Communication Strategies* (i-PiCS) program to coach parents via the Internet on evidence-based strategies to promote social engagement with young children with ASD. The authors set the groundwork for future investigation into a unique format for instructing parents in rural areas. As discussed, the use of technology for interventions is emerging. However, it is important to ensure that the use of the technology is developmentally appropriate for the child.

As discussed in Chapter I, DAP is an important consideration for implementing technology with young children. Donohue (2015) provided valuable considerations when considering the use of technology with young children. A few of the considerations for the use of technology with young children are to ensure effective learning opportunities, balance of technology and learning experiences, and a co-engaging experience for parent-child interaction. It must be emphasized that when working with young children and

their parents, it is important to develop an engaging and social relational experience that is a beneficial learning opportunity for the child.

Limitations of this Review of Literature

There are several limitations to this literature review. The first limitation is the lack of specific information for fidelity among the studies. In similar terms, the key word search was limited to specific terms. For instance, there are several terms for *parent-facilitated* including: *parent-mediated, family-centered, parent-implemented*, and *caregiver-provided*. Similar semantic issues were related to identification of mediating and moderating factors for expressive language. Second, because many of the interventions were multicomponent it was difficult to discern what element of the interventions listed actually affected the outcomes. In addition, some studies did not include the specific expressive language constructs measured. In some cases, the authors only provided post treatment data with overall standardized scores rather than a detailed description of the expressive language constructs measured. Third, the included studies encompassed a range of methodical designs and quality. A narrowed search would result in measures that are more specific. This review incorporated several group and single-subject designs and two pilot studies. The fourth limitation encompassed the study designs. As Roberts and Kaiser (2011) indicated, "the review is only as good as the studies included in the analysis" (p. 196). Furthermore, the majority of the studies did not include a description of the measures to control extenuating variables. As demonstrated, only four studies reviewed fulfilled the CEC criteria for a sound study. Many of the studies (including single-subject designs) did not include sufficient

information regarding the demographics of the population sample. This, combined with a small sample size, has an effect on the validity of the outcomes.

CHAPTER III

RESEARCH METHOD

This chapter includes a discussion of the methods used to conduct this study. It is divided into the following sections: (a) experimental design overview, (b) purpose of the study, (c) participants, (d) setting, (e) materials, (f) researcher, (g) experimental design, (h) measures, (i) procedures, and (j) data analysis. The What Works Clearing House (WWC), gathered a national panel of experts that produced a set of guidelines to determine quality standards for single-case/subject experimental designs. The *What Works Clearing House Single-Case Study Standards* (Kratochwill et al., 2010) was used as a guide to ensure a valid and reliable experimental design.

Experimental Design Overview

Single-subject research has a history in special education and has a central role in the progress of evidence-based practice (Horner et al., 2005). Specifically, single-subject research designs strive to demonstrate a functional relationship. As defined by Kennedy (2005), "a functional relationship is the presentation of experimental control over the dependent variable by the independent variable" (p. 30). In other words, there is strong evidence that demonstrates that the intervention (independent variable) is what caused the change in the variable(s) (dependent variable) measured. According to Kratochwill et al. (2010), three key features outline single-case study designs:

- the case is a unit of intervention or data analysis,
- within the design, the case provides its own control for purposes of comparison, and
- the outcome variable is measured repeatedly within and across different conditions or levels of the independent variable. (p. 14)

To address the key features outlined by Kratochwill et al., the following is a detailed description of the components of this research design.

Purpose of the Study

The purpose of this study was to determine if there was a hypothesized functional relation between the JAML-FVET intervention and the acquisition and use of targeted words for expansion of expressive language in the home environment. This study sought to extend and change the nature of the JAML intervention model by incorporating mobile technology into the intervention along with best practice techniques to expand expressive language for young children with expressive language delays. Within the course of this intervention, the researcher instructed parents on effective use of language intervention practices in a planned expressive language-based activity with the iPad running the Make a Scene app. In addition, parents learned how to capture their children's attention, so the children focused on the language-based activity with the app in the home environment. This intervention emphasized parent-implemented strategies to promote targeted expressive language skills with the goal of the children using them independently with intent in the home environment. This study used a single-subject design across two activities and replicated across four parent/child dyads. The specific research questions that guided this study are outlined here.

Research Questions — Child Outcomes

Question 1

Is there a functional relation between the implementation of the JAML-FVET intervention with mobile technology (iPad with the Make a Scene app) and the acquisition of two targeted words?

Measured by: The frequency of the intentional verbal use of targeted vocabulary in the shared activity using the iPad.

Hypothesis: The child's expressive language lexicon will increase, specifically the acquisition and use of the targeted words.

Research Questions — Parent Outcomes

Question 2

Did the children continue to use the targeted words in the generalization phase?

Measured by: The frequency of the intentional verbal use of the targeted vocabulary in the shared routine activity.

Hypothesis: The parents will be able to use the strategies outlined in the JAML-FVET intervention within natural routines to elicit the targeted words.

Question 3

What are the parents' perceptions of the use of mobile technology as an intervention for their children's communication?

Measured by: The parents complete a survey prior to the intervention and at the completion of the intervention.

Hypothesis: The parents will identify the benefits of the implementation of the JAML-FVET intervention with mobile technology as a convenient and effective tool to promote communication.

Participants

Selection of Participants

The participants for this study were four parent/child dyads that were recruited from a local early education program in central Illinois. The Principal Investigator (PI) sent a proposed protocol to the Institutional Review Board (IRB) at Illinois State University for review before the recruiting of participants. Once the IRB approved the protocol, the participants were recruited and selected. To be included in this study, the participants met the following criteria:

- enrolled in the early education program with an Individual Family Service Plan (IFSP), or Individualized Education Plan (IEP),
- the child was between the ages of 2.5 and 3.5 years of age,
- the child had no known diagnosis of ASD,
- English was the only language spoken in the home,
- identified with an expressive language delay of 30% and/or a discrepancy of not less than one standard deviation between expressive and receptive language scores,
- had fewer than 50 words with limited (fewer than six) two-word productions (single-word stage),
- no identified hearing impairment, and

- adequate oral motor skills for speech, without any structural abnormalities that would impair the ability for the child to produce speech.

There were two steps built into the protocol to ensure the criterion was met. First, the local agency was provided with a checklist to be used for the first initial screening as the researcher recruited the participants (Appendix A). The second check consisted of the researcher calling the families after the permissions were provided by the local agency and asking the eligibility criteria questions before setting up the initial meeting. After the possible participants met both sets of criteria check points they were scheduled for a meeting during which they would sign the Informed Consent Form (Appendix B) and the Parental Permission Form (Appendix C) to participate in the research project.

Exclusion and Inclusion Criteria

The participants were enrolled in either early intervention or an early childhood program. Each child was required to have an IFSP or an IEP and be receiving services for an expressive developmental delay. Specifically, a gap between expressive and receptive language was required. There were several checkpoints to ensure a difference between expressive and receptive language. The first was the results from the standardized testing conducted for the IFSP or IEP, which included the results of the latest Battelle Developmental Inventory 2nd Edition (BDI-2). The BDI-2 provided information for the adaptive, personal social, motor, and cognitive domains. The second testing tool was the Rossetti Infant Toddler Language Scale (Rossetti, 2006) that provided scores for receptive and expressive language skills. Finally, for a more current depiction of the child's receptive and expressive language skills, the Communication Developmental Inventory (CDI) was administered during the pre-baseline phase. The

scores recorded were from the children's latest early intervention reports. Testing for three out of the four participants took place within the last five months; however, dyad 4's testing took place six months prior to the onset of the study. Due to the rapid developmental rate of language normally associated with children of this age and his mother's report that child 4 had made significant gains within the last few months, the Rossetti Infant Toddler Language Scale was administered during the pre-baseline phase. The test was administered to ensure this child's eligibility for the study and to obtain a more accurate depiction of his language skills. These can be seen in Table 6.

Participant Demographics

Four parent/child dyads participated in this study. The participants included families representing diverse demographic status. Specific demographics are delineated in Table 6 and Table 7. All four of the child participants were males ranging in ages between 2.6 years and 3.2 years at the start of the study. Regarding ethnicity, two of the four were white, one child was bi-racial, and the last child was African American. Three of the children lived with their biological parents and one was recently adopted. His adopted mother knew little about his biological parents or placement prior to the child coming into their home. All of the participants lived within the same geographical location except for one who resided in a nearby small town. The parents' levels of education ranged from high school to higher education. The parents were asked to provide a range of their combined household income. Their combined household income ranged from $15,000 to $91,000 and above per year. In addition, the participants spoke English in the home and had a total of two to five children in their households.

Table 6

Demographics for Parent/Child Dyads

Characteristics	Dyad 1	Dyad 2	Dyad 3	Dyad 4
Age in Years	3.2	2.6	2.7	2.6
Child Diagnosis	Expressive Delay	Expressive Delay	Expressive Delay	Expressive Delay
Gender	Male	Male	Male	Male
Hearing/Vision	Within Normal Limits	Within Normal Limits	Within Normal Limits	Within Normal Limits
Language Spoken in the Home	English	English	English	English
Ethnicity	White	Bi-Racial	White	African American
Parents' Level of Education	Both parents have a college degree	Both parents have a college degree	Both parents have a college degree	Both parents have high school degrees
Income Range	$91,000 & above	$48,000-58,000	$91,000 & above	20,000
Occupation	Mom= Nurse Dad= Instructor	Mom=Stays at home Dad= CT X-Ray Technician	Mom= Part-time bartender & volleyball coach Dad=Account Director	Mom=Bus Driver Dad=Cook
Number of Children in the Household	3	5	2	4

Table 7

Child Descriptions

Characteristics	Dyad 1	Dyad 2	Dyad 3	Dyad 4
Duration in Early Intervention	1 Year	1 Year	4 Months	1 Year
Rossetti Infant Toddler Language Scale	10.20.15 @ 34 mos.	11/17/15 @ 27 mos.	9.9.15 @ 27 mos.	1.14.16 @ 30 mos. **
Expressive*	21 mos. 38% delay	17 mos. 37% delay	14 mos. 48% delay	19 mos. 36% delay
Receptive*	33 mos.	27 mos.	24 mos.	27 mos.
Battelle Developmental Inventory /Date	10.20.15 @ 34 mos.	12.15.15 @ 27 mos.	9.9.15 @ 27 mos.	8.5.15 @ 25 mos.
Expressive*	12-18 mos. 40% delay 30 mos.	18 mos. 38% delay 25 mos.	14 mos. 48% delay 24 mos.	15 mos. 40% delay 29 mos.
Receptive*				
Adaptive*	27.5 mos.	24-28 mos.	29.5 mos.	24 mos.
Social-Emotional*	27 mos.	25-28 mos.	25 mos.	23 mos.
Motor*	18-30 mos.	31-25 mos.	27-29 mos.	28 mos.
Cognitive*	24-30 mos.	24-25 mos.	26.7 mos.	27 mos.
Communication Developmental Inventory /Date	1.4.16 3.2 mos.	1.4.16 2.6 mos.	1.8.16 2.7 mos.	1.21.16 2.6 mos.
Receptive	327/396	342/396	384/396	390/396
Expressive	33/356	13/356	33/396	37/396

Note. * = age equivalence; ** = administered by the researcher at the start of the study

Participant Descriptions

Parent/child dyad 1. The first parent/child dyad consisted of both biological parents in their 30s. The mother worked part-time as a nurse and the father was an instructor at a local community college. As a family, they enjoyed playing board games and reading. The parents reported that the child had no prior health concerns and his vision and hearing were within normal limits. The child participated in the early intervention program for approximately 1 year and received speech therapy services once a week. He was referred to an occupational therapist due to fine motor concerns when he transitioned into the school district's early education program. His mother described him as loving, funny, interactive, and playful.

Parent/child dyad 2. The second parent/child dyad consisted of foster parents who had recently adopted the child. The mother stayed at home and the father was an x-ray technician at a local hospital. The family enjoyed being outside and playing board games. His official adoption date was 1.28.16. It was reported that he had five ear infections the summer of 2015. No other health concerns were noted. He participated in early intervention for 1 year prior to this study. He received speech-language services for his expressive language delay, developmental therapy services for his lack of attention to adult- directed commands, and occupational therapy for sensory integration concerns. All of his therapies were conducted twice a month with the therapists coming to his home. His mother described him as active, self-directed, and said that he could be stubborn.

Parent/child dyad 3. The third parent/child dyad consisted of biological parents who spoke English in the home. The family enjoyed being outside and traveling. There

were no reports of ear infections or any other significant medical concerns. He participated in early intervention for 4 months prior to the onset of this study and received speech-language therapy once a week. His mother described him as strong willed, outgoing, and funny.

Parent/child dyad 4. The fourth parent/child dyad consisted of both biological parents. They indicated that they enjoyed watching television as a family. No ear infections or any other significant illnesses were reported besides asthma. He had participated in early intervention for approximately 1 year prior to the onset of this study and received weekly speech-language therapy. The testing for early intervention eligibility was conducted on 8.5.15 with concerns for expressive language. Since his testing was conducted nearly 6 months prior to this study and his mother reported that his language had significantly improved in the last 6 months, the Rossetti Infant Toddler Language Scale was conducted on 1.14.16 to determine the child's eligibility for this study. His parents described him as fun and energetic.

Setting

In order to deliver developmentally appropriate practice, the intervention took place in the participants' homes. The NAEYC (2009) indicated that developmentally appropriate practices focus on children's current developmental milestones, their natural environments, along with social and cultural ecology considerations. This study was conducted in the participants' homes.

Materials

There were several materials used for this study. The Make a Scene app by Innovo Mobile (2013) and iPad were the digital tools used for the intervention. The

forms for documentation and data collection included (a) Technology Safety Procedure Checklist, (b) Use of iPad Competency, (c) JAML-FVET Implementation Guide for the families, (d) JAML-FVET Outcome Data Document, (e) IOA Collection Data Form, (f) Coaching Fidelity Checklist, and (g) pre-post Social Validity surveys. The *McArthur-Bates Communicative Development Inventory* (CDI) *Gestures and Words* (Fenson et al., 2007) was used as a measure for screening purposes. In addition, the Rossetti Infant Toddler Scale was used for one participant. Further discussion regarding the material chosen for this study follows.

Make a Scene App

The Make a Scene software by Innivo (2013) application affords several key features. This app provides an engaging interactive format for the participants. The parent and child work together to make a scene by choosing characters and placing them in desired locations. This promotes a shared experience with a common outcome of creating a scene. In addition, the child may choose what scene he would like to create, thus fostering a motivating format to encourage participation. The program is multi-media and interactive in nature. It has both audio and video output with sounds that are associated with the scenes and characters. In addition, there is a tactile feature. The child touches the desired character and manipulates the "sticker" to the desired location. There are multiple opportunities for turn taking, expanding content, and requesting. The visuals/graphics are appealing and developmentally appropriate for a young child. Individual screens are easy to manipulate, context-rich, and do not provide an extensive amount of visual information that may decrease the young child's ability to focus on the intended target. According to Innivo Mobile (2013), here are a few of its key features:

- over 100 ‘stickers/characters,’
- 13 different backgrounds,
- 9 foregrounds,
- Multi-touch enabled,
- save scene as an image to your device,
- share your scenes with friends on Facebook, twitter, and e-mail,
- retina graphics support,
- automatic depth of field,
- easy-to-use toolbar and menus,
- descriptive audio,
- engaging animations,
- life-like sound effects,
- background sounds to bring the experience to life,
- ability to move and rearrange ‘stickers,’ and
- ability to remove individual ‘stickers’ or reset all ‘stickers’ and position them once again. (Retrieved from: http://www.makeasceneapp.com/app/pets/)

There are 12 apps with a variety of scenes for each theme of the app with associated characters from scenes to select from, thus enabling the child to choose an interactive experience with his parent. The Make a Scene app themes range from pets to under the sea adventures. See Figures 2 and 3 for a sample of the program's visual interface. While the Make a Scene app has these features, these features were an attribute to this study due to the ability to engage the parent and child in an interactive task to elicit the targeted vocabulary.

The role of this app was to provide a platform for the parents to use the JAML-FVET intervention. A jointly shared experience between parent and child (i.e., Joint Media Engagement), structured through a language intervention, was fostered to help the child acquire the targeted word or words in response to the highly scaffold, multimedia, context-rich, and interactive platform that the app provided. In addition, the app is user-friendly and easily integrated into the JAML-FVET intervention in order to elicit the target words. The app is developmentally appropriate for young children and has characteristics of technology that uses universal design for learning; hence, it allows flexible access within the child's ability (Parette & Blum, 2013). The users for this app are children under the age of 5 (toddlers and preschoolers); thus it displays developmentally appropriate pictures and concepts to the user. The interface is user friendly and used on several different devices, including iPhone, iPad, Android, and BlackBerry by the Internet.

Figure 2. Screenshots of Make a Scene adapted from iTunes Innivo Mobile 2013.

Figure 3. Screenshots of Make a Scene Farm adapted from iTunes Innivo Mobile 2013.

iPads

The iPads were secured from funds provided by a Dissertation Completion Grant awarded to the researcher in the Fall semester of 2015 by the Illinois State University Graduate School. The iPads purchased were the Apple iPad Air with the iOS 8 operating system. This model includes a 9.7-inch (diagonal) LED-backlit, multi-touch display with IPS technology, 2048-by-1536 resolution at 264 pixels per inch (ppi), and a fingerprint-resistant coating (https://www.apple.com/iPad-air/specs/).

Research Team

The primary researcher for this study is an American Speech and Hearing Association- Certified Speech and Language Pathologist with an evaluator endorsement for early intervention, who has met the criteria and enrolled in the early intervention program as a provider. She is a doctoral candidate at Illinois State University. In addition, the primary researcher has a license in the state of Illinois with over 12 years of experience working in the early intervention program, and 15 years as a Speech and Language Pathologist. The primary researcher also supervises graduate students in the Department of Communication Science and Disorders and is an instructor for the Department of Special Education at Illinois State University. The researcher teaches

courses related to working with families, communication strategies for children with disabilities, assessment, intervention for young children with disabilities, and the use of technology for special education.

In addition to the primary researcher, there were four assistants from the Departments of Special Education and Communication Science and Disorders. The research assistants were completing their degree requirements for master and undergraduate levels, and the fifth research assistant was the Director of the Special Education Assistive Technology Center at Illinois State University with a Master's Degree in Special Education. The role of the research assistants were to assist the researcher in collecting data.

Experimental Design

This study employed a single-subject multiple-probe design with several components to demonstrate a functional relation between the parent implementation of the JAML-FVET intervention and the children's acquisition of two target words. There were several reasons why a multiple-probe design was preferred for this study. First, a multiple-probe design does not have a long baseline period. This is an important factor since the intervention took place in the homes of the participants, thus the multiple-probe design was less obtrusive. The second reason was that a reversal design was not applicable for this study. Word learning is not a reversible behavior. Last, according to Morgan and Morgan (2009) multiple-probe designs are preferred over multiple-baseline designs for certain studies that include:

> A behavior that has not yet been established in a client's repertoire or behavior that may show extreme reactivity, one or two simple probes may serve quite

> adequately as baseline evaluations of the behavior. Thus, the intervention can be delivered with less delay, and data obtained during treatment can still be reasonably compared with the levels of behavior obtained through the pre-intervention probe measures. (p. 151)

In response, this study focused on the acquisition of new words. The children did not have the targeted words in their expressive lexicon prior to the intervention. In addition, a multiple-probe design demonstrates that when an intervention is applied, a behavior change happens, and when there is no intervention, there is not a change. This was an important feature for the researcher as she coached the parent to manipulate the independent variable when necessary. As discussed, the multiple-probe design has several relevant features for this study.

This multiple-probe has a staggered baseline design with careful planning for baseline logic. The primary purpose of the multiple-probe design is to provide intermittent observations of outcomes allowing opportunities for the parents to use the intervention, and for coaching to occur throughout the study. By staggering the beginning of the intervention, it holds threats to validity such as maturation (Gast, 2010). The guidelines and measures for this study were developed to follow the three components of baseline logic including prediction (in baseline), verification of the prediction (in the intervention phase), and replication of the outcome of the intervention, in order to establish experimental effect (Gast & Spriggs, 2010). By incorporating these components to this multi-probe design it provides a more representational study, because it controls for several extraneous variables resulting in internal validity. The probe assessment was the parent's implementation of the four main steps for the JAML-FVET

and the child's response by the acquisition of two targeted words. The collection of the probes occurred on the following schedule: (a) intermittently in the baseline phase, (b) twice a week in the training/intervention phase, and (c) concurrent probes for generalization at each intervention phase for each dyad. Using a staggered approach to the introduction of the intervention, each parent/child dyad served as its own control to compare the changes to the dependent variables from baseline through the intervention phases.

The collection of the data probes took place in the home for both the intervention and generalization phases. Due to the nature of working with families in their homes (varied schedules) rather than a clinic setting, the schedule was determined by the parents' availability. The generalization probes were concurrent, because the dependent variable in this study was evaluated during the same day or time both within the iPad interaction and in a daily routine (Parette, Blum, & Boeckman, 2009). Each dyad was probed during a coaching session with and iPad and in a non-coaching play routine for generalization.

Several guiding factors applied to this multiple-probe design. The baseline data collection occurred for all participants during the first week. The first parent/child dyad was chosen at random. When the first dyad completed five baseline probes they proceeded into the intervention phase. The next parent/child dyad that demonstrated baseline stability went into the intervention phase after the first dyad completed the first intervention interval. This sequence occurred until all dyads were in the intervention phase. The generalization probes occurred 37.5% (3 out of the 8 sessions) of the time in the intervention phase. The IOA data collection occurred 25% of the time, which is

slightly over the Kratochwill et al. (2010) recommendation of 20% of all sessions during the baseline and intervention phases. Since there were 13 (including baseline) sessions, the IOA data were collected three times over the baseline and intervention phases for each parent/child dyad. The intervention phase ended when the parent/child dyad demonstrated an experimental effect over eight opportunities (data collection twice a week for 4 weeks). The Improvement Rate Difference (IRD) criteria was set at 82 % or above. The IRD is calculated as "the difference in these phase-specific improvement rates: 100% (Phase B), 0% (Phase A) = 100%" (Parker, Vannest, & Brown, 2009, p. 139). However, the phases ended after the dyad met performance criteria.

Measures

Independent Variable Measurements

The independent variable was the parent implementation of the JAML-FVET intervention using the iPad with the Make a Scene app. The parents worked with their children in the Make a Scene app activity in order to elicit targeted words. Each activity was a vehicle for the parents to initiate the strategies outlined in the JAML-FVET intervention, create a social-communicative activity, and provide the opportunity for continued coaching by the researcher. The focus was the parents' ability to implement the JAML-FVET intervention, in order to promote the acquisition of targeted words. As stated in the first chapter, there were slight modifications to the original JAML model. Generally, the JAML key learning components were used for this intervention with the addition of technology and targeting verbal language.

Fidelity Measures for the Independent Variable

Several methods were in place to measure the intervention and training fidelity. First, the observational code was established. According to Kennedy (2005), *observational code* refers to "the types of behaviors and other events that will be a focus of observations" (p. 95). Thus, the participants and the researchers completed several checklists with specific observational codes including the following checklists that measured the independent variable.

Technology procedural checklist. The Technology Procedural Checklist was used to demonstrate competency with the use of the technology (see Figure 4) including the iPad and the Make a Scene app. After baseline data collection was completed, the parents participated in a brief training by the investigators on how to use the iPad and app. The training consisted of the primary and secondary investigators demonstrating the operations of the iPad and Make a Scene app, followed by the parents demonstrating their ability to operate the technology. The criterion for technology administration accuracy was set at 100%. The training continued with further demonstration until parents reached the set criterion.

Coaching fidelity checklist. The Coaching Fidelity Checklist was used to verify the reliability of the implementation of the coaching to the parent on the intervention. In addition, the Coaching Fidelity Checklist was used to ensure that the researcher complied with the procedures outlined for the home visit. An additional observer completed the checklist twice during the intervention phase. See Table 8 for the Coaching Fidelity Checklist.

Parent implementation and outcome checklist. The JAML-FVET Outcome Data Checklist was used to verify the reliability of parent implementation of the intervention and the child's outcome of targeted words produced. This form served several purposes including gathering baseline, gathering intervention data, and parent procedural reliability. The data collection occurred using whole interval, which was 10 minutes. The researcher completed this checklist during direct observation throughout the baseline and intervention phases of the study. The checklist was used to generate a baseline level of the parent-child interaction while participating in an iPad activity and a routine.

Use of iPad	Yes	No	Suggestions
1. Turn on the iPad			
2. Scroll through to find the Make a Scene app  **Screenshots of Create a Scene Farm** ***Adapted from iTunes Innivo 2013 Innivo Mobile***			
3.Push the figure  **Screenshots of Create a Scene Farm** ***Adapted from iTunes Innivo 2013 Innivo Mobile***			
4. When the scene is completed turn off the iPad.			
Date Completed _____	Family Dyad #__		Completed by: _____

Figure 4. Technology competency checklist

Table 8

JAML-FVET Coaching Fidelity Checklist

Did the Coach:	Yes	No
Set the Stage		
1. Identify the purpose of the session		
2. Review the JAML-FVET steps		
3. Indicate the target vocabulary words		
4. Show enthusiasm and provide praise throughout the session		
Observe and Reflect		
1. Provide performance based feedback on the parent's use of the JAML-FVET with the iPad and in a routine		
2. Ask at least one reflective/interpretive question related to a positive performance based action		
3. Ask the parent to share their perceptions on how their independent sessions are progressing.		
Problem Solve and Action Based Planning		
1. Assisted the parent to identify the problem		
2. Collaborated to produce two different possible solutions		
3. Summarize the session		

Note. Adapted from: Marturana, E. (2012). Use of mobile device applications to teach caregivers to embed naturalistic teaching strategies in daily routines, (Doctoral dissertation). Florida State, Tallahassee, FL.

This took place prior to the introduction of the intervention to establish patterns and occurrence of parent/child interaction while using an iPad. To decrease the possibility of familiarity that would interfere with baseline data, the researcher had an iPad with a developmentally appropriate app for each parent to work with in interaction with his or her child. The app was not from the Make a Scene collection. First, the researchers obtained baseline levels for the parents' behaviors and set criterion levels higher than the baseline levels to pinpoint changes from the baseline phase and to determine data trends and stability. To calculate a percentage of performance criterion met by each parent/child dyad, the researchers added the total of items scored as "yes" and divided that number by the number of items (17 items). This yielded an administration procedural reliability percentage. See Figure 5 for the checklist. The researchers scored each of the opportunities by direct observation. Since continued coaching took place within the intervention sessions, if a parent did not meet the performance criterion established, the session continued with direct instruction from the researchers. The parents were required to reach a performance above 82% and maintain this level of performance for the last three data points of the intervention phase. The researchers continued to coach and instruct the parents until the administration criteria was established.

Interobserver Agreement Measures for the Independent Variable

In order to monitor the consistency of how the independent variable was measured, the researcher incorporated IOA measures. This refers to "the degree to which

iPad Routine

JAML-FVET Outcome Data Checklists Start Time: ___
End Time: ___ Dyad #: _____ Date: _____ Probe #: _____
Sequences in 10 Min. ___ Completed by: _____

Directions: Total of 10 minutes continuous coding.

Adult Implementation: For each step indicate Yes or No. Place + for each occurrence.

Child outcomes: Indicate the target word, mode, and the method each time it occurs.

1. Setting up the Environment	**Yes**	**No**	**Additional observations**
a. There is little distraction in the environment			
b. The instruction sheet for the activity is visible with the target words on the sheet and the iPad is where it can be reached			
c. The adult is sitting face to face or directly beside the child			
d. The adult expressed excitement throughout the activity			
TOTAL SETTING UP THE ENVIRONMENT	#	#	Number of yes___/ 4=
2. Focusing In	**Yes**	**No**	**Additional Observations**
a. The adult was direct by saying, **"LOOK"** and directed the child to look at his/her face and then the iPad.			
b. The adult highlighted the particular part of the app by pointing and expressing excitement.			
c. The adult proceeded with the turn taking phase after the child looked at them, then the iPad.			
TOTAL FOCUSING	#	#	Number of yes___/ 3=____

3.**Turn Taking / Model: Parent Action**	**Yes**	**No**	**Observation** (number of prompts)
a. The adult says, **"first-then" (**e.g., "we are going to take turns**, first** mommy, **then** you")			
b. The adult said the target word(s) as s/he did the action and then said, **"your turn"** to the child- giving the child a 3-sec delay for a response.			
c. If no attempt by the child, the adult repeats "your turn" (for up to 3xs)			
d. If no response, then the adult goes back to 3a			
e. If the child attempted the word, the adult praised him by saying, "**good words**" and proceeded to Phase 4			
Total: _____/5=_____			

Turn –Taking / Modeling: Mode: SW=single-word, G =gesture, MW= Multiword: Method: S=spontaneous, VP=verbal, GP=gestural

Target Word 1	**Target Word 2**	**Mode (SW, G, V, MW)**	**Method (S,VP, GP)**
		SW SW SW SW G G G G G G G G G V V V V V V V V MW MW MW MW	S S S S S S S S S VP VP VP VP VP GP GP GP GP GP
		SW SW SW SW G G G G G G G G V V V V V V V V MW MW MW MW	S S S S S S S S S VP VP VP VP VP GP GP GP GP GP
Total: _____	Total: _____		

(Figure Continues)

4. Check It & Prompt: Parent Action	**Yes**	**No**	**Observation** (number of prompts)
a. The adult asked a question to elicit target word (no model) and provided 3-sec. delay for a response			
b. If no response from the child, the adult provided a choice of 2			
c. If no response, the adult went back to 2a (loss of attention) or 3a maintained attention)			
d. If the child attempted, the adult praised him by saying **"good words**" and continued with another sequence of the activity			
e. After a 10-min. duration, the adult prompted for continuation of the activity or ended and said, **"more"** or **"all done"** and followed the child's lead			
Total: _____ / 5=_____			

Check It & Prompt: Child Outcomes Target Words			
Target Word 1	**Target Word 2**	**Mode (SW, G, V, MW)**	**Method (S,VP,GP)**
		SW SW SW SW SW G G G G G G G G G VV V V V V V V V V V V MW MW MW MW MW	S S S S S S S S S S VP VP VP VP VP VP GP GP GP GP GP
		SW SW SW SW SW G G G G G G G G G V V V V V V V V V V MW MW MW MW MW	S S S S S S S S S S VP VP VP VP VP VP GP GP GP GP GP
Total: _____ Total: _____			

Figure 5. Continued JAML-FVET activity outcome data checklist

two or more independent observers report the same observed values after measuring the same events" (Cooper, Heron, & Heward, 2007, p. 113). The primary researcher provided training to the research assistants prior to the study. The IOA criterion was set at 82% (Kratochwill et al., 2010).

Training the Assistants

The primary investigator delivered specific instructions to the research assistants regarding the coding procedures and criteria for each application. The research assistants watched videos lasting approximately 10 minutes of parent-child interactions from the Individual Growth Developmental Inventory (IGDI) program's (Carta, Greenword, Walker, & Buzhardt, 2010) training website. The assistants completed two, 10 minute

sessions observing a child with the researcher. The criterion for accuracy was set at 82%. If the criteria were not met, additional observations occurred.

Calculation of IOA Data

To calculate IOA data, the total interval agreement measure was used. According to Kennedy (2005), to calculate total agreement, the researchers add the number of the behavior occurrences that the primary observer recorded, then add up the number of occurrences from the second observer. Once the totals are calculated, the number of nonoccurrence (after recording the number of times the secondary observer also recorded the event) are calculated. Finally, the number of agreed occurrences were divided by the sum of occurrences and nonoccurrence and multiplied by 100 to obtain a percentage. Here is the formula for Percentage Agreement = "Number of Agreements/ (Number of Agreements + Disagreements) x 100" (Kennedy, 2005, pp. 116-117). See Figure 6 for the JAML-FVET IOA Data Document.

Dependent Variable Measurements

According to Horner et al. (2005), for a high-quality single-subject design the dependent variable must contain the following elements:

> (a) described with operational precision, (b) measured with a procedure that generates a quantifiable information, (c) a valid measurement that is described with replicable accuracy, (d) measured repeatedly over time, and (f) data on the reliability of interobserver agreement associated with each dependent variable are collected. (p. 167)

For the purposes of this study, the acquisition of targeted words was measured.

Date:	**Probe #:**	**Primary Observer:**	**Secondary Observer:**
IOA Parent Implementation Fidelity Data			
Total # of yes for Primary Observer: _____			
Total # of yes for Secondary Observer: _____ Total # of disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			
IOA Child Outcomes Data			
Total # of target word 1 (without additional prompt) for Primary Observer: _____			
Total # of target word 2 (without additional prompt) for Secondary Observer: _____			
Total # of disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			
Date:	**Probe #:**	**Primary Observer:**	**Secondary Observer:**
IOA Parent Implementation Fidelity Data			
Total # of yes for Primary Observer: _____			
Total # of yes for Secondary Observer: _____ Total # of disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			
IOA Child Outcomes Data			
Total # of target word 1 (without additional prompt) for Primary Observer: _____			
Total # of target word 2 (without additional prompt) for Secondary Observer: _____			
Total # of disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			
Date:	**Probe #:**	**Primary Observer:**	**Secondary Observer:**
IOA Parent Implementation Fidelity Data			
Total # of yes for Primary Observer: _____			
Total # of yes for Secondary Observer: _____ Total # of Disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			
IOA Child Outcomes Data			
Total # of target word 1 (without additional prompt) for Primary Observer: _____			
Total # of target word 2 (without additional prompt) for Secondary Observer: _____			
Total # of disagreements: _____			
Percent Agreement = Number of Agreements/ (Number of Agreements + Disagreements) x 100			

Figure 6. JAML-FVET IOA data document

To align with single-case design (SCD) standards, each of the outcome variables were measured systematically with the collection of IOA data in each phase on at least 25% of

the data points in the baseline and intervention conditions (Kratochwill et al., 2010). The following information describes the outcome variables.

Targeted Words

Before the baseline phase was completed, the parent chose two target words that the child did not currently have in his expressive lexicon or were not observed during the baseline phase to elicit throughout the intervention. One of the target words had to be a word that served a communication function such as to initiate communication (e.g., ask for assistance, continuation of an activity, and/or to regulate others' behavior) and the other target word was to provide a contextual function (e.g., prepositions such as in, out, up, and down or a verb). The primary investigator provided the parents with a list of developmentally appropriate words taken from the CDI that were within the established criteria, (carefully considering the children's phonological, syntactic, and semantic development) that were specifically for their children. For the specific steps of choosing the targeted words, see the Procedure section. The words were required to meet the following criteria:

- The primary investigator identified six words for the parent to choose from; two words that were appropriate for their family culture and relationships, thus words they would be able to use across routines (e.g., eating, dressing, playing, and transitions).
- The words chosen served a communication function in order for the child to make requests, and/or initiate turn taking (e.g., help, more, my turn, please, go, and all done) and the other for content (location/preposition or verb) were suggested.

- The children did not have those words in their current spontaneous vocabulary as indicated by the parents, completion of the CDI, and direct observation.

Since each family had its own unique culture and lifestyle, the researcher worked with the parents to collaborate on ideas for ways to embed the words into their routines. After the parents selected the targeted words from the researcher's approved list, the parents gave examples of when and how they would elicit the words during routines. The primary investigator provided suggestions to the parents. This continued throughout the intervention. Lastly, the parents wrote down the words in their parent implementation guide and referenced the guide during their intervention time with their children.

Coding measurement of targeted words. To code the use of targeted words within the activity, definitions of communication expression were adapted from the Individual Growth and Development Indicators program (Carta et al., 2010). Only two areas of the IGDI applied for the coding methods in this study, since the outcome measurement was the use of vocalizations, the gesture (g) was not applicable for this study. The single word (SW) and multiple word (MW) descriptions related to the measured child outcome. The IGDI provided the criteria for coding. The IGDI is a detailed coding system used for young children to identify authentic child communication behaviors in the natural environment. It was created by incorporating the standards from the National Center on Student Progress Monitoring (2006) and the Division for Early Childhood (2007) recommendations for curriculum, assessment, and program evaluation. To establish validity of the IGDI, the authors completed the following tasks: (a) literature review, (b) national social validation survey, (c) pilot testing/initial trial, (d) toy forms identification and selection, (e) administrative feasibility and user testing, (f) cross-sectional study

design validation, and (g) longitudinal study design validation (Carta et al., 2010). The measurement of the criterion validity demonstrated the correlation with commonly used assessments for children ranging from birth to 3 years of age. Regarding the criterion, "validity was correlated at 0.062 and 0.51 to the Preschool Language Scales (PLS-3) and the parent-administered assessment Caregiver Communication Measure of Early Communication" (p. 173). In addition, "reliability measures for interobserver reliability estimated on each indicator ranged from 90% (ECI) to 95% (EPSI), notably within acceptable levels of sensitivity, validity, and reliability" (p. 172). The IGDI demonstrated a useable, valid, and reliable measurement. Several distinctive features of the IGDI were indicated by Carta et al., (2010), including:

- The skills assessed by IGDI were linked to evidence of their social validity and predictive utility.
- The data from separate administrations were comparable within children and between children.
- The accuracy of IGDI results was enhanced by reliability in the coding and recording of children's behaviors through interassessor agreement, internal consistency, and/or alternative forms.
- The measure was efficient and economical for practitioners.
- The Individual Growth Development Inventory (IGDI) is sensitive to children's individual differences, including sensitivity to individual growth over time and intervention.

To provide a concise description of a vocal production of the targeted words, the vocalizations had to meet the criteria outlined. See Figure 7 for specific details.

Child Communication Outcome Procedure

To begin, two forms of documentation captured the outcome procedure data. The two forms included (a) JAML-FVET Outcome Data Checklist (see Figure 5) and the JAML-FVET IOA Data document (see Figure 6). The JAML-FVET Outcome Data Checklist served two purposes. The first purpose was to gather data on the parents' implementation fidelity and the second purpose was to document the children's responses. The second form (JAML-FVET IOA Data document) included the IOA data for parent procedural fidelity and Child Outcomes. The data collection took place within and across different conditions throughout the study: (a) at each baseline session, (b) after each intervention provided by the parent, and (c) during probe sessions with the researchers. Thus, a comparison was made between the number of targeted words tallied during the intervention phase intervals and the number of targeted words during the baseline measure intervals to obtain the frequency of words used over time. Each parent/child dyad served as its own control for the purposes of comparison between the baseline and intervention conditions.

The researchers followed two steps in recording the children's responses. First, the researchers set a timer for 10 minutes to record the responses during the intervention. Second, the researchers recorded the communication code and the method of the response.

Gestures Include	Gestures Exclude
Taking an object from a caregiver	Reaching for toys the partner is not holding or is only holding to stabilize it
Pushing away or rejecting an object	Moving toys in a way that does not involve interaction with the partner
Reaching toward a partner or object the partner is holding	Physical movements that appear to be coincidental
Pointing to an object or person	Physical movement showing excitement or pleasure that is not in direct communication with the partner (e.g., waving arms, rocking back and forth)
Nodding or shaking head to indicate "yes" or "no," shrugging shoulders	
Gestures made in conjunction with vocalizations, single or multiple-words	
Vocalizations Includes	**Vocalizations Excludes**
Laughing out loud	Crying
Animal sounds, e.g., "moo," when looking at a cow	Involuntary noises (e.g., hiccups, burps)
Transportation/motor sounds, e.g., "Vroom," when looking at a car	Vocalizations that occur with a recognizable word or word combinations
Sounds such as "ah," "da," "eee," etc.	
Vocalizations that serve as fillers, such as "mm" or "huh"	
Single-word Utterance Includes	**Single-word Utterances Excludes**
An utterance in which only one word is understandable	Vocalizations that serve as fillers, such as "mmm," or "hmm"
Continuous repetition of a single word, e.g., "go, go, go" (code only one even if they are separated by more than one breath)	Sentences or a phrase combining multiple understandable words
Compound words, e.g., "mailbox,"	Nouns in other languages preceded by an article are coded as a multiple word (e.g., "la playa")
Ritualized duplications, e.g., "bye-bye," "uh oh,"	
Two part proper names, e.g., Big Bird	
Sequentially describing or naming objects, e.g., "block, red, blue, girl"	
Standard sign language, code as appropriate for single words	
Multiple-word Utterance Includes	**Multiple-word Utterance Excludes**
Words should fit together in a meaningful way that approximates a phrase or way that approximates a phrase or sentence, e.g., big truck.	Unless coder can state exactly what the child said, code as V
Does not need to be grammatically correct, e.g., "me go to store"	If no words are understood, code as V
Does not need to have adult meaning, "cow rides tractor"	Utterance in which only one word is understood, code as W
Standard sign language, code as appropriate for multiple-word utterances	Utterance in which no words are understood, code as V

Note: Adapted from *Individual Growth and Development Indicators Individual Growth, Carter et al., 2010.*

Figure 7. IGDI coding

The *mode* included how the child expressed the targeted word(s) and the *method* included whether the child produced the word spontaneously or following parent prompting. See Figure 7 and the narrative above for the coding procedures for the mode of the targeted words. Regarding the method of elicitation, there were two main areas for coding. The first included the child producing the word. The *Spontaneous* (S) definition included the child producing the utterance in context without any supports and without elicitation. In contrast to the spontaneous production of the targeted word(s), the *Prompted* (P) definition included the parent's provision of additional support for the child to produce the word. The prompt was either a *verbal prompt* (VP) by providing a choice of two using the targeted word or sentence completion or the use of a *gestural prompt* (GP) that included the use of any contextual cueing (e.g., looking, or pointing). A direct elicitation was not accepted (Carta et al., 2010). A direct elicitation was when the parent provided a command to say the word. For example, if the parent said, "Say more," this would not account for a word that the child said spontaneously or prompted.

IOA Measures for the Dependent Variable

In this study, five research assistants, trained in coding the identified variables, collected the IOA data (see Figure 6) to obtain a percentage as the statistical measure of assessor consistency. The researcher used portions of the IGDI (Carta et al., 2010) to code the dependent variable of the children's responses. First, the research assistant followed the outline in the IGDI Communication training, which included watching videos. The videos were located at http://www.igdi.ku.edu/training/ECI_training/ECI-practice-videos.html. After the research assistants viewed and independently coded two

10-minute segments accurately with 82% or higher accuracy, they practiced IOA measures with the primary researcher to established reliability.

Observation drift occurs when the original descriptions/definitions used by investigators in a behavioral code shift during the course of a study (Kazdin, 1982; Kennedy, 2005). To avoid investigator drift for each measure, the researcher followed Kennedy's (2005) recommendations that included ongoing review of observational codes by the investigators. IOA data were collected during 25% of the observations, which for approximately 13 sessions was three times over the course of the baseline and intervention phases.

Other Child Communication Measurements: CDI

Since the selection process included children that were previously diagnosed with an expressive language delay, a formal evaluation was not conducted; however, the CDI was administered as a screener. The purpose for the CDI was a screening measure for the selection of the targeted words. The CDI took approximately 20-40 min for the parents to complete. The CDI is a standardized, norm-referenced, parent-report measure of early language and communication. There are two parts of the CDI. The first is Words and Gestures for children up to 18 months and the other is Words and Sentences for children 19 months to 36 months. There is an option to use either part of the CDI for children not within the chronological age suggested. According to Fenson et al. (2007), the Words and Gestures form may be used:

1. If interested in comparing a child's standing on vocabulary comprehension, and/or gestures with grammatical skills past the age of 18 months or

2. If there is reason to expect language development proceeding more slowly than the typical rate of development. (p. 13)

The Words and Gestures form examines vocabulary comprehension, vocabulary production, and the use of communicative and symbolic gestures. It was chosen as the screening tool rather than the Words and Sentences form for the following reasons: (a) children in the study had expressive language delays, thus the Words and Sentences form was too advanced for their current skill sets; (b) it was used to establish how the children were communicating including the use of actions and gestures and the number of words, plus the structure of those words (Fenson et al., 2007). The Words and Sentences form does not examine the use of actions and gestures, but the development of words and the use of grammar. In addition, Fenson et al. indicated:

> Words and Gestures form may be used for children who have few expressive skills with a chronological age higher that 18 months in order to assess communicative and symbolic skills and with children suspected of having language impairments or delays (p. 10).

The Words and Gestures form has two parts in order to measure various aspects of the acquisition of vocabulary and grammar. According to Fenson et al. the first part is a checklist of 396 vocabulary words the child understands, produces, and/or signs within 19 different semantic categories. The second part examines the use of communicative and symbolic actions/gestures. This section provides an opportunity to examine communication that does not demand verbal expression. The application to clinical features includes a screener for language delay, evaluation of a range of ages for children with language delays, design interventions, progress monitoring, and research.

The CDI: Words and Gestures Record form was normed on approximately 1,089 children with 544 girls and 545 boys (Fenson et al., 2007, p. 52). The authors indicated that it was a representative sample of demographics from the 2000 United States Census Bureau. In addition, the authors reported a higher representation of white children, although a wide range of ethnicity and education levels was included.

Regarding reliability and validity measures, Fenson et al. (2007) used a variety of methods to measure reliability and validity. A few of the results are mentioned below. The authors reported that the CDI: Words and Gestures internal consistency for "vocabulary scales was high with .95, .96, and .96 alpha values and test-retest measures that yielded correlations above .80 for each age group" (p. 101). Regarding content validity, the authors stated they used "developmental literature and parent reports from the prior version of the CDI to examine the features of the CDI" (p. 103). "Concurrent validity was determined by assessing the results of the parent report versus the child's performance on standardized testing along with laboratory measures of the relevant dimension of language development" (p. 104). Each of the areas were measured individually. Overall, these were highly correlated with other measures (Fenson et al, 2007). Lastly, the authors reported that the predictive validity for the Words and Gestures portion of "the CDI vocabulary scores were correlated at .69 (p.>.0001)" (p. 112). Generally, the CDI provided a reliable and valid instrument to use for screening purposes.

Social Validity Measures

The collection of social validity data occurred to measure the social acceptability of the study's outcomes and procedures. Data were specifically collected on the

meaningfulness and relevance of the intervention. According to Horner et al. (2005), social validity in an effective single-subject research design has several components:

- the dependent variable has high social importance,
- demonstrates that the independent variable can be applied with fidelity across time,
- report by the interventionist that it is acceptable, feasible with the resources provided, effective, and the interventionist will continue to use the intervention after the study is completed, and
- the intervention demonstrates effect to define clinical need.

A social validity questionnaire was provided to the parents before the intervention (see Figure 8) and again after the implementation of the intervention as a postintervention measure (see Figure 9). The survey focused on the parents' perceptions of the JAML-FVET intervention including usability of the intervention, ease of administration, their perceptions of benefit from the intervention, and the feasibility of implementing the intervention in the family's daily routines. In addition, the parents shared their thoughts on the use of the mobile technology including the acceptability of mobile technology as an intervention tool, their use and ease of manipulation of mobile technology, and their children's exposure to mobile technology.

External Validity

In this single-subject multiple-probe design, external validity was replicated across four parent/child dyads. This replication allowed additional opportunities to generalize the parent-implemented use of the JAML-FVET intervention with mobile technology in varied home environments. Social validity data were collected to help

Pre-Intervention Social Validity Questionnaire					
These questions will provide us with essential information regarding the project. Please circle the number that corresponds with your answer. Your information will remain confidential.					
Use of Technology	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I believe that with my guidance apps on an iPad can help with my child's expressive language.	1	2	3	4	5
2. My child has access to my mobile technology (e.g. I give my child the iPhone or iPad to play with) at least two times a week.	1	2	3	4	5
3. I use a mobile technology device (e.g., smartphone, iPhone, iPad, or Kindle) at least two times a week.	1	2	3	4	5
4. I know how to help my child learn new language with apps on my mobile device	1	2	3	4	5
5. I believe that I influence my child's expressive language.	1	2	3	4	5
6. I feel comfortable working with my mobile device.	1	2	3	4	5
7. Currently, I feel the use of the mobile device is convenient.	1	2	3	4	5
8. My child has difficulty making requests and with verbal expression	1	2	3	4	5
9. I enjoy spending time with my child on an iPad, tablet, or other mobile device.	1	2	3	4	5
10. Any other information you would like to share.					
Family Dyad #_____	Date Completed _____		Reviewed by _____		

Figure 8. Pre-intervention social validity questionnaire

Post-Intervention Social Validity Questionnaire					
These questions will provide us with essential information regarding the project. Please circle the number that corresponds with your answer.					
	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I believe that with my guidance apps on the iPad can help my child's expressive language.	1	2	3	4	5
2. I use a mobile technology device (e.g., smartphone, iPhone, iPad, or Kindle) at least two times a week.	1	2	3	4	5
3. My child has access to my mobile technology (e.g., I give my child the iPhone or iPad to play with) at least two times a week.	1	2	3	3	5
4. I believe that I influence my child's expressive language.	1	2	3	4	5
5. I know how to help my child learn new language with apps on my mobile device.	1	2	3	4	5
6. My child is making more requests (and using more expressive language) than prior to the intervention.	1	2	3	4	5
7. I will continue to use the JAML-FVET and app together to improve my child's expressive language.	1	2	3	4	5
8. I feel the use of the JAML-FVET with the app was easy to use.	1	2	3	4	5
9. I enjoyed spending time with my child on the iPad during the language activities.	1	2	3	4	5
10. The use of the mobile device was convenient; I was able to incorporate the technique in our daily routines.	1	2	3	4	5
11. Any other information that you would like to share?					
Family Dyad #_____	Date Completed _____		Reviewed by _____		

Figure 9. Post-intervention social validity questionnaire

determine if the intervention was parent friendly and had the potential for practical application. It will take additional reflections for this study with other children and in other settings to determine the true generalizability of the intervention; however, the specific procedures and fidelity of implementation data used in the study provided information for successful replication.

Procedures

Prior to Baseline

The first phase included activities prior to the baseline phase. The researcher met the parent/child dyad in their home for the initial meeting. The pre-baseline activities involved several components. First, the participating parents learned about the study's purpose, design, and procedures. Full disclosure of the research was provided. In addition, the parents reviewed their acknowledgment of their responsibilities during the study. The parents completed the pre-intervention social validity survey, which included elements to gather information from the parents on technology use in the home regarding the children's use and preferences (Parette & Blum, 2013). Based on the data acquired about the child's communication ability, the primary investigator chose six possible target words for the parents to pick for the entirety of the study. The procedure included:

1. The parents completed the CDI and identified all words in each semantic category the child used. The primary investigator read the instructions from the CDI record form:

> "Please go through the list and mark the words you have heard your child use. If you have heard your child pronounce the word in a different way, (e.g., poon/ spoon) mark the word anyway. Keep in mind that this is a

"list" of all the words that are used by a variety of children and do not worry if your child uses only a few right now." (p. 2)

2. After the CDI was completed, the primary investigator examined the words identified with specific attention to the child's phonological repertoire and sound sequence abilities. In addition, the primary investigator reviewed the report from the IFSP/IEP regarding the expressive component areas.

3. After gathering the information followed by analysis, the primary investigator identified six words for the parents to choose. However, only two out of the six chosen were targets for the study using the criteria stated above. The remaining words were for expansion if the child obtained the targeted words prior to the completion of the intervention.

Due to the nature of this study, at least one of the targeted words was to serve a communicative function for the JAML-FVET model (e.g., more, go, help, my turn, all done, again, open, stop, look, and finish). The other word was specifically, an action or a location (e.g., up, on, in, out, down, off, bump, eat, drink, and push). In addition, words chosen that could be generalized to a routine (e.g., a meal or a play routine).

Once the parents chose the primary words, the parents wrote them down in their parent implementation guide and the primary investigator worked with the parent to identify ways to elicit the targeted words in a routine. "Now that you have the two targeted words for this study, tell me in what routines you will be able to work with your child to say the words." The investigator wrote down the ideas for the parents to use as a reference. Lastly, the primary investigator scheduled a time with the family to begin the baseline phase.

Baseline Procedures

In this multiple-probe baseline design, the researcher examined the effect replication across participants in two different phases (i.e., baseline and intervention). To address possible threats to internal validity and establish a functional relation, the intervention was staggered over time. In the baseline phase, the researchers observed parent-child interactions while they were on a different app (e.g. Starfall ABC) to determine if the parents were naturally using characteristics of the intervention prior to intervention.

In this study, the baseline data collection was conducted in a staggered fashion with a minimum of five data points. The establishment of "true" baseline performance occurred for each phase. If baseline stability (i.e., level, trend, and variability) within these observations was not established, an additional three observations occurred. Baseline continued for each successive participant for at least two intervention data points of the dyad that precedes them.

Intervention Procedures

JAML-FVET is a parent-implemented intervention with coaching by a researcher in how to use the intervention with a young child. Consistent with the multiple-probe design of the study the intervention was staggered allowing at least two intervention data points to be gathered before the next participant dyad began the intervention. This staggering introduction of the independent variable continued until each of the four parent/child dyads were in the intervention phase, allowing for analysis of experimental effect within and across the series (Horner et al., 2005). The intervention phase lasted for

approximately four weeks. The probes occurred twice a week totaling approximately eight probes over the duration of the intervention.

Parent training. The researcher instructed the parents by using the Gradual Release of Responsibility Model (Pearson & Gallagher, 1983). The model consists of the following steps: (a) the researcher demonstrates the method with the child as the parent observes, (b) the parent demonstrates understanding of the strategy by implementing the technique as the researcher provides support, and (c) the parent demonstrates the intervention without assistance. Using the Gradual Release Method provided a systematic approach to instructing the parents in the intervention. Given the nature of this method, parent training was more intensive at the start of the study and less intensive as the parent acquired the skills. For each dyad, parent training began as soon as intervention began.

Gradual release procedures. The procedure for instructing the parents went as follows:

1. The researchers prepared the environment as outlined in the instructions for the JAML-FVET intervention and then proceeded to follow the instructions with the child. Since the parents provided the intervention, possible behavior concerns were addressed through discussion with the parent to identify other possible foreseeable barriers.
2. After a demonstration by the researcher, (following the procedures outlined in the Parent Implementation Checklist (see Figure 10) of the JAML-FVET intervention with the Make a Scene app, the parent implemented the strategy with the child. The researchers provide direct instruction to the parents.

a. The parents practiced as the researcher provided feedback and encouragement. Researcher script: "Now that you have seen me implement the steps on the checklist, it is your turn. First, review the checklist again and follow the steps as you lead your child through the activity. I will be here to guide you through each step. Please do not hesitate to ask me any questions."
b. The researcher and the parent continued ongoing collaborative efforts addressing potential barriers related to implementation of the intervention with fidelity.

When the parent indicated s/he was comfortable with the implementation and did not require direct instruction, the parent demonstrated the procedure to the researcher without assistance. It was required that the parents demonstrate the teaching procedure with 82% or higher administration accuracy. This is distinct from fidelity, as this only applies to the initial training, and fidelity is a separate variable. Further instruction was provided to the parents if they did not meet this criterion during the initial training and on-going support was provided to ensure parents maintained fidelity.

Intervention Components

First, the parents completed a loan agreement with Illinois State University (see Appendix D) stating they would adhere to the appropriate use of the iPad. In order to maintain experimental control, the parents were not allowed to download any additional applications to the iPad or use the iPad for any other purpose. The researcher demonstrated the use of the iPad and instructed the parents to turn it on/off, retrieve the Make a Scene app, and then manipulate the characters in the app. Following the initial

instructions, the parents demonstrated competence with the technology. The Technology Competency Checklist (see Figure 4) ensured that the parents demonstrated successful use of the iPad and the ability to maneuver through the Make a Scene app at the 100% administration criterion. Instruction continued until the parents met the criterion.

Following the training and introduction of the Make a Scene app, an open discussion format took place that provided information regarding the study. The talking points included: (a) definition of joint attention with key related information from the original JAML study (Schertz & Odom, 2007), and (b) the link between joint attention and language development with emphasis on the pragmatic function of words within the natural environment (Turnbull & Justice, 2012).

Instructions for the JAML-FVET were provided to the parents via hard copy to guide them on the application of the use of an iPad as they focused on their target words. The researcher included the following talking points on the core principles of the JAML-FVET:

1. *Language Learning in the Home & What to Expect*: Overview of the importance of parent-implemented activity-based and routines-based language intervention to improve young children's language learning. In addition, an explanation of coaching, process, and concepts such as gradual release of responsibility.
2. *Organize and Plan the Environment*: Structure time and space so the child anticipates the activity as important, and expected during planned play sessions. Mark beginning and end of session with rituals such as asking the child, "more or all done".

3. *Focusing:* Help child focus on both an object of mutual interest (iPad) and your face, emphasizing the social and reciprocal nature of "showing" interesting things to each other.
4. *Turn Taking with Modeling:* Turn-taking activities aimed to promote reciprocity, a component of joint attention, and included imitation of child-initiated gestures, responding to child actions as if they as intended interactions, and embedding your actions following the child's interest. Pause for the child's response after your initial turn.
5. *Checking and Prompting:* Checking activities provide your child with the opportunity to use their target word. You will check your child's language use by prompting him to say the targeted words in context of the activity, as you encourage his attempts, by asking him a question to elicit the word. Toddlers learn best when they feel successful. You can help your child experience success by making activities challenging enough but not too hard, by pointing out what he did that caused his success, by expressing affection when he is successful, and by showing him that you are confident that he can succeed.
6. *Generalization:* The researcher discussed with the parent how JAML-FVET can be used across a variety of routines and how generalization is important to expand language use.

The Parent Implementation Checklist (Figure 10) was provided to the parents as a visual representation (visual support) of each step of the intervention. The parents were asked to date and check each area completed while they practiced the intervention. For clarification, it was not required that the parents memorize the procedures. They were

asked to perform the intervention with fidelity using the Parent Implementation Checklist at least three times over the course of a week; thus the parents provided the intervention without coaching for a minimum of 12 times over the course of the intervention phase. Figure 11 provides a scenario of the implementation of the intervention.

Intervention Implementation Procedures

The researcher coached the parents as they implemented the intervention and collected data twice a week over a period of four weeks. The parents conducted the intervention at least three times a week and more if the child was not progressing. The researcher collected all data on fidelity of the independent variable and the dependent variable by direct observation during the intervention. The intervention took place in the participants' homes. The researcher set each parent/child dyad's criterion levels higher than the baseline levels, so that a change was evident. Therefore, immediate data coding and analysis took place to identify baseline levels and data trends for each parent/child dyad. The researcher analyzed data trends to determine the stability or trend direction of the child's frequency of use of the targeted vocabulary and the parent's use of the JAML-FVET during routine activity (play) for generalization. By completing the analysis of the level, trend, and variability from the start to the end of intervention, the researcher was able to determine if there was a functional relationship between the intervention and the dependent variables along with the strength of that relationship.

Instructions: Keep this checklist next to you while you complete the activity and reference it when needed. Each step must take place as indicated and the words for you to use are highlighted along with specific actions that are required. Use the bottom section for any notes about your child's performance or questions that you have for the researcher.					
1. **Setting up the Environment: My Target Words Are…** A. _____ B. _____					
a. Use an area in your home with little distractions.					
b. Keep the instructions visible with the iPad located where you and your child can reach it.					
d. Sit face to face or directly next to your child.					
e. Express excitement ☺					
2. **To Begin: Focus In**					
Action	Dates	Completed			
a. SAY					"LOOK" and direct your child to look at your face and then the iPad
b. Do					Direct their attention to a picture within the app by expressing excitement.
c. Do					Once your child looks at you then the iPad begin turn taking.
3. **Turn Taking with Modeling**					
a. SAY					"We are going to take turns, first mommy reads or plays, and then it is your turn". "**FIRST- THEN**"
b. DO					Complete two rounds of **turn taking THEN hold back the iPad, so your child cannot access it**. **WAIT to see if they use a word to request to continue**. ☺ If they respond by saying the target word, praise and continue to step 4. IF NOT…
c. SAY					☹ If they do not say the target word--**give them the choice again** (target word or all done) with 5-second wait. If they gesture to continue, do only one turn taking cycle and provide the choice again (target word or all done). If no response, go back to step 2.
4. **Expand their Production & Prompt to for Continuation**					
a. SAY					ASK them a question, so they can say their target word without your model
b. DO					**Then hold back the iPad and wait to see if they make a request to continue.**
c. DO					☺ If they make the request begin the activity again OR (if they do not…
d. SAY					**"More or all done"** and wait for the response.
e. DO					If no response, then model the choice again. If no response ends the activity.

Figure 10. Parent implementation checklist

<table>
<tr><td colspan="2">Setting Up the Environment: Jordan's parents decided to work on the intervention after dinner each day. They worked together and made sure the table was cleaned off and the iPad was where everyone could reach it. Jordan's dad sat Jordan on his lap and his mother was sitting in front of them as they proceeded with the intervention sequence.</td></tr>
<tr><td colspan="2">Jordan's Target Words: Up, Go, More</td></tr>
<tr><td colspan="2">To Begin: Focus In</td></tr>
<tr><td>"Jordan, let's make a picture."

The parent holds up the iPad with the two apps.

"Look, do you want to play with the pets or play with the people?" Jordan points to the pets. "You want the pets, good choice."</td><td> 

Screenshots of Create a Scene Adapted from iTunes Innivo Mobile 2015</td></tr>
<tr><td>"We are going to take turns; first Daddy will play, then it is your turn. "FIRST- THEN."</td><td rowspan="2"></td></tr>
<tr><td>Once Jordan looked at his mother and then at the iPad, his mother began turn taking with modeling.</td></tr>
<tr><td colspan="2">3. Turn Taking with Modeling</td></tr>
<tr><td>We are going to take turns; first Mommy plays, and then it is your turn "FIRST- THEN."
The parent moves the character, models the child's target word, and says, "go up, now it is your turn."</td><td> 
Screenshots of Create a Scene Pet Adapted from iTunes Innivo Mobile 2015</td></tr>
<tr><td>Jordan completed two rounds of turn taking THEN his mother held back the iPad, so Jordan could not reach it and waited to see if he would use one of the target words (more, go, or up). Jordan pointed at the iPad to continue. His mother modeled "more" and waited. Jordan pointed and smiled. Jordan's mother prompted him by providing a choice, "all done or more?" Jordan verbally attempted "more." His mom praised him by saying, "Good talking, you told me more" and went back to the scene.</td><td> 
Screenshots of Create a Scene Adapted from iTunes Innivo Mobile 2015</td></tr>
<tr><td colspan="2">4. Check It & Prompt to End or Continue</td></tr>
<tr><td colspan="2">Jordan's mom continues and says. "Look at all the dogs, we need more dogs." She moves the dog up to the tub saying, "go up "Jordan's mother ask, "Where did the doggie go?"
Jordan responds, "up." Jordan's parents praise him and repeat the sequence until he loses interest or they wish to finish the activity.</td></tr>
</table>

Figure 11. Example of implementation

To maintain experimental control, the researcher instructed the parents on the systematic implementation of the intervention and continued the instruction through the intervention

phase. The parents were not to download any additional programs on the iPad. In addition, the researcher collected data during 10 minutes of the parent implementation of the intervention (teaching activity), and during a 10-minute play routine (non-teaching) activity for generalization.

There were eight sessions conducted by the researcher to coach the parent implementing the intervention along with direct observations for data collection and 12 sessions provided by the parent without coaching. There were three probes across participants. The first was to measure the child's expressive language outcome (i.e., frequency of the use of the targeted words) with the use of the iPad running the Make a Scene App and during a chosen routine. The second was the parent's fidelity in administering the intervention. The final probe measured the parent's ability to generalize the intervention to a separate activity (i.e., play).

The researcher probed the parent's fidelity of implementation and the outcome of the child's target word production using the JAML-FVET Data Collection Checklist. Once stability was established within the intervention phase (i.e., the data demonstrated a consistent level and trend with limited variability) the parent/child dyad moved into the final phase. If the child did not progress after the additional coaching, the parent/child dyad moved on to the final phase.

Home visits. During the intervention phase, the researchers instructed the parents to implement the intervention when they were not present. Coaching and problem solving occurred during the home visit sessions. Home visit sessions used the parent-intervention procedures described above and were twice per week for four consecutive weeks once intervention began. During the home visit, parents were asked to implement

the intervention at least three times during the week. The parents were also to use the key phrases during their routines in order to elicit target words. When the researchers visited the homes, the sessions lasted approximately 35 minutes. First, the researchers discussed the parents' perceptions of the progress related to the intervention. This was the time for the parents to discuss the progress from the previous week, any barriers they experienced, and the parents' self-analysis of their performance in providing the intervention.
In addition, the parents demonstrated the intervention with their children during the home visit. The researcher would monitor for fidelity of implementation, collect data on the child's use of the targeted words, and provide necessary feedback and support. The parent's positive interactions with, their child were highlighted, and written instructions and feedback to the parents were provided.

Generalization Procedures

Generalization was defined by Kennedy (2005) as "the extent to which a functional relationship extends to other behavior-environment relations that vary in some dimension" (p. 54). The parents were asked to incorporate the intervention model as a part of a natural routine. Parents were offered to implement the intervention during snack, play, or other routine of choice. All of the parents chose to generalize the target words to a play routine. So that there was continuity, parents were asked to conduct the play routine at a same time each day they conducted the intervention in the generalized setting. Generalization instructional probes occurred concurrently during the last three observations within the intervention phase. Concurrent generalization probes have a rich history in the technology literature to evaluate various conditions (Parette, et al., 2009). Instruction for generalization was concurrent, so that the technology-based activity could

reinforce instruction in the generalized play routine. Thus, it was necessary to take data on the generalization probes concurrently, rather than a phase that comes after the initial acquisition of the target words in the technology-based activity.

The parents were asked to use the same procedure for generalization as they did for the intervention. The parent followed the procedural checklist while in a play activity. For example, the parent would engage their child in a play routine with blocks using the same four steps, but instead of the activity being focused on the iPad, the focus was on playing with building blocks.

Post-intervention

The last phase consisted of collecting post-intervention measures. Following the intervention phase, the researcher met with the parents and provided them with the Post-Intervention Social Validity Survey. The researcher answered any last questions, gathered the iPads, and thanked the parents for their participation in the study. See Figure 10 for an example of implementation of the study for one parent/child dyad.

Data Analysis

The purpose of this study was to determine whether a functional relation existed between the parent-implemented strategy for the JAML-FVET intervention with the Make a Scene app and the acquisition of targeted words. Using single-case design standards outlined by the *What Works Clearinghouse* (Kratochwill et al., 2010), there were four steps involved for quality visual representation. The steps were: (a) predict baseline patterns, (b) examine within-phase data pattern, (c) compare the data from each phase with the data from the next, and (d) integrate the information from each phase of the study to determine if there are at least three demonstrations of effect.

There are six variables associated with the four steps mentioned above for conducting a visual analysis. According to Kennedy (2005), it is important to analyze the

Table 9

Schedule for One Parent/Child Dyad

Week	Activity	Description
1	Pre-baseline	1. The primary investigator explained the purpose and the procedures to the parents and the parents completed the necessary IRB forms to participate in the study. 2. Parents completed the social validity pre-intervention survey 3. Parents completed the CDI and chose the two targeted words 4. The parents selected the routine for the investigators to observe (meal or play routine)
2-3	Baseline Measures	The baseline phase consisted of the researcher conducting five direct 10 minute observations (probes). This was to establish initial patterns of behaviors that address the intervention (with the iPad) and another observation in a play routine.
3-7	Intervention	1. The researcher visited the homes and coached the parents as they implemented the intervention twice a week for 4 weeks for approximately 10 min. In addition, the parents conducted the intervention three times a week. 2. IOA data were collected for 25% of the sessions, which is three times in the home including the baseline phase. 3. The generalization probes occurred concurrently with the intervention phase. Generalization probes were conducted for at 40%, which occurred the last three sessions of the study. 4. The intervention phase ended after a minimum of five probes with enough data to determine the presence and strength of a functional relationship between the intervention and change in the dependent variables. Post- intervention social validity measures were collected.

level, trend, and variability of the data within the phase. "The level is an average of the data within a phase and calculated as the mean or mode" (p. 197). In this study, the researcher determined the levels of the children's communication outcome data (acquisition of the targeted words) within the phases by calculating the mean number of

the targeted words spontaneously used by the children. To establish the level change within the phase the *absolute level change* was "calculated by subtracting the smallest number of words from largest number of words within a phase" (Gast & Ledford, 2014, p. 181). This indicates the amount of change that occurred during the phase. In addition, the *level stability* was "calculated to determine the of variability or range in a data series" (Gast & Ledford, 2014, p. 179). This was completed by calculating the *stability envelope*. "This is when "80% of the data points fall within 25% range of the median level of all data point values of the condition, applied researchers would consider this stable" (Gast & Ledford, 2014, p. 179). The stability envelope was used to determine stability of the data series. The mean, mode and stability envelope were calculated using the last five data sets in the intervention phase (Gast, 2010).

The data trend examines the direction and extent of the slope. The trend was visually inspected by examining the slope and the magnitude using the *freehand method.* According to Gast and Ledford (2014), this is completed by first observing the data line and then drawing a line in the middle. The freehand method was chosen over the split-middle method because "the split-middle method was not established to be used with equal interval graph data" (Gast & Ledford, 2014, p. 182). The intervention occurred in equal intervals over time. For visual analysis the slope direction was described in one of these three terms, "*accelerating, decelerating or zero-accelerating* indicating the direction of the slope" (Gast & Ledford, 2014, p. 182). The *magnitude* of the slope was also visually inspected and referred to as high, medium, or low. "A high magnitude slope is a rapidly ascending or descending. A low magnitude slope indicates the data is gradually accelerating or decelerating" (Kennedy, 2005, p. 198). However, the

magnitude and trend are relative to baseline. For example, to visually demonstrate a high magnitude effect, the trend line during the intervention phase would be rapidly accelerating relative to a stable or zero-accelerating baseline.

The last within-phase measurement is variability. Kennedy (2005) defined *variability* as "the degree of the individual data points that deviate from the overall trend" (p. 281). Variability is described as high, medium, or low and is calculated by using the range or the standard deviation around the mean.

In addition to within phase measurements, assessment continued on the data for the between-phase patterns. The immediacy of effect compares the last three data points of the baseline phase with the first three data points of the intervention. According to Kennedy (2005), "the greater the immediacy effect, the briefer a phase can be and the more convincing is the functional relation" (p. 204). If the immediacy effect is slow or gradual, additional probes occur to control for internal validity. During the intervention phase, when the parent/child dyad data demonstrated an established level and trend, they progressed to the post-intervention phase of the study. Regarding the measurement of effect size, according to Kratochwill et al. (2010), "an *effect* is demonstrated if manipulation of the independent variable is associated with predicted change in the pattern of the dependent variable" (p. 20). The determination of effect size remains controversial. There are concerns with determining the measure of effect in single-subject designs:

> Effect-size estimates are available for most designs involving group comparisons, and in meta-analyses, there is widespread agreement about how these effect sizes (*ES*) should be expressed, what the statistical properties of the estimators are (e.g.,

> distribution theory, conditional variance), and how to translate from one measure (e.g., a correlation) to another (e.g., Hedges' g). This is not true for SCDs; the field is much less well developed, and there are no agreed-upon methods or standards for effect size estimation. (Kratochwill et al., 2010, p. 21)

The *Improvement Rate Difference* (IRD) calculates the difference from the baseline to the intervention. According to Parker et al. (2009), the IRD is the difference between two improvement rates (IR).

> An improved data point in the baseline phase is defined as one that ties or exceeds any data point in the treatment phase. An improved data point in the treatment phase is defined as any, which exceeds all data points in the baseline phase. The maximum IRD score is 100% or 1.00, in which case all intervention phase scores exceed all baseline scores (in an improvement direction). IRD is calculated as the difference in these phase specific improvement rates: 100% (Phase B) – 0% (Phase A) = 100%. (p. 139)

For further information regarding the IRD, see the following information regarding effect size in the Data Analysis section. Since there is not a current agreement for the measure of the effect size, in this study IRD was calculated. According to Parker et al. (2009) there are several advantages:

> IRD's advantages include (a) accessible interpretation as the difference in improvement rates between baseline and treatment phases; (b) simple hand-calculation; (c) compatibility with PND from visual analysis; (d) known sampling distribution, so confidence intervals are available; (e) proven track record (as risk difference) in hundreds of evidence-based medical research studies; (f) few data

distribution assumptions; and (g) application to complex single-case research designs and multiple data series. (p. 138)

There are disadvantages to this approach. According to Wendt (2009), the disadvantages of the IRD include:

- conventions for calculation not always clear for more complex and multiple data series,
- baseline "improvement" is a misleading concept, and
- it needs validation and comparison to existing measures. (p. 16)

Although there are disadvantages to this measurement, the advantages outweighed the disadvantages as it pertained to the constructs of this study.

In summary, the researcher crafted a design to determine the presence and strength of a functional relation between the intervention and the children's communication outcomes (acquisition of two targeted words). The design included a variety of methods for reliability, social validity, and data analysis for within and between phases.

CHAPTER IV

RESULTS

The purpose of this study was to determine if a functional relation existed between parent implementation of the JAML-FVET intervention with the Make a Scene app and children's acquisition of two new words. First, information regarding procedural fidelity including IOA data is presented. Next, documentation of the measures for the baseline and intervention within phases are provided. This is followed by an examination of data between phases with a summary of the results across the four dyads. Finally, the results of the social validity measures are presented for each dyad.

Interobserver Agreement (IOA) of Measures

IOA of Independent and Dependent Variables

IOA data were collected for both procedural fidelity of the parent-implemented intervention (independent variable) and the targeted words (dependent variable). For all IOA data, there were two observers during a home visit and the independent and dependent variable were co-observed when they occurred during the visit. For each dyad IOA data were collected for 23% of sessions (3/13 fidelity observations, 3/13 Target Word 1 observations, and 3/ 13 Target Word 2 observations) during the entire study (i.e., baseline and intervention phases). IOA was calculated using the total interval agreement method (Kennedy, 2005) with an acceptance criterion set at 82%. All of the IOA data met the acceptable criterion except for Dyad 3 (78% for the word *go*) as seen in Table 10 IOA Data for Independent and Dependent Variables.

Table 10

IOA Data for Independent and Dependent Variables

	Independent Variable	Dependent Variables	
Dyad	Parent Fidelity Percentage: Mean (Range)	Target Word 1 Percentage: Mean (Range)	Target Word 2 Percentage: Mean (Range)
N	13	13	13
1	97% (92-100)	82% (75-100) Up	87 % (60-100) Help
2	98% (94-100)	100% (100) Help	82% (66-100) Up
3	98% (94-100)	78% (60-100) Go	100% (100) Stop
4	97% (92-100)	93% (80-100) Please	93% (80-100) Up

Procedural Fidelity

To establish the procedural fidelity for the phases of this study (i.e., baseline and intervention with continuous generalization probes), several instruments that were dichotomous checklists (yes/no) were created. To calculate the procedural fidelity percentage of using the observation tool (JAML- FVET Data Activity Outcome Checklist), the number of observed procedural steps was divided by the number of possible procedural steps and multiplied by 100 (Gast, 2010).

Procedural Fidelity: iPad Competency Checklist

The iPad Competency Checklist as depicted in Chapter III Figure 4 was developed to ensure parents have the basic competency in the use and safety of the iPad. This procedural fidelity measure was observed once prior to intervention. Each parent scored 100% accuracy on the competency checklist.

Procedural Fidelity: Coaching Fidelity Checklist

The Coaching Fidelity Checklist as seen in Chapter III Table 8, was administered during 25% of the observations over the course of the intervention (i.e., 2/8 intervention sessions observed). Out of 10 tasks, the coaching fidelity score ranged from 90%-100% accuracy for each session observed across the four dyads, which met the criteria of 90% accuracy.

Procedure Fidelity: JAML-FVET Activity Outcome Data Checklist

The JAML-FVET Data Checklist was used during all phases (i.e., baseline, intervention, and generalization) of the study. This checklist consisted of a total of 17 steps over the four phases of the intervention (i.e., Setting up the Environment, Focusing in, Modeling, and Check It). The checklist included the elements necessary to execute the intervention. Refer to Figure 5 in Chapter III for the checklist.

Baseline Phase: Preexisting Components of Intervention Prior to Training

Because parents were familiar with iPads and used them with their children, to determine if any components of the intervention existed prior to the coaching and parent training, the parent behavior was monitored on a different app than the Make a Scene App that was used during the intervention. No coaching or training was offered during the baseline phase. In Table 11, the baseline results are displayed by dyad. The parent was observed five times during baseline. The mean range for parent fidelity was 10.5%-19% of implementation. Dyad 3 had the highest standard deviation at 7.8 and dyads 1 and 2 had the lowest at 2.7 each. All of the parents except for dyad 4 demonstrated the elements of setting up the environment and gaining their child's attention. The parents in

dyads 2 and 3 also demonstrated turn-taking and praised the child for their verbal attempts. In addition, the parent in dyad 2 ended the activity by saying "all done".

Intervention Phase: Parent Implementation Procedural Fidelity Results

Table 11 displays the performance data results for the intervention phase of the independent variable. The same 17 steps of the intervention were measured over eight probes for the parent's implementation of the intervention with the use of the iPad. The steps completed were presented in a percentage. The intervention was introduced in a staggered fashion for experimental control.

There were four main steps of the intervention. The first two steps (Setting Up and Focusing In) did not require the child to vocalize. The first phases were meant for the parent to set up the environment for the intervention and get the child's attention. Overall, the parents performed well in the first two-step categories, except for dyad 4, who had other distractions in the environment. Generally, the families followed the steps to ensure that the environment was free from distractions; they sat face to face or directly next to the target child, and expressed excitement throughout the intervention. During the Focusing In steps, the parents got their children's attention, directed them to a particular part of the app, and expressed excitement. Consequently, the parents' performance for the last two phases presented with some variation. The parents completed the steps for Modeling by using the concept of "first-then" by saying "first my turn and then your turn" and repeated if necessary. Overall, the parents appeared to have difficulty remembering to say "good words" in response to the child's vocalizations. Coaching continued until the parents incorporated the phrase into their implementation of the Modeling steps. The last step category was Check It. Generally, the parents did well

with these steps. Difficulty seemed to arise when the parents were to ask their children a question in order to elicit the targeted words without providing them a model

.

Table 11

Baseline and Intervention Results by Dyad

Dyad	Baseline				Intervention				
	Mean (SD) (N=5)	Median	Absolute Value (Range)	Stability Envelope	Mean* (SD)*	Median*	Absolute Value (Range)	Stability Envelope *	IRD
Dyad 1									
Fidelity	17% (5)	18	0 (12%-18%)		76% (19.3)	74%	53 (47%-100%)		100%
Up	0	0	0	100%	*2 *(.81)		2 (1-3)	*80%	100%
Help	0	0	0	100%	*3.2 *(1.3)		4 (0-5)	*60%	83%
Dyad 2									
Fidelity	19% (2.7)	18	0 (18%-24%)		89.5% (10.5)	91%	24 (76%-100%)		100%
Up	0	0	0	100%	*3.8 *(1.3)		2 (0-5)	*80%	88%
Help	0	0	0	100%	*4.2 *(1.3)		4 (0-5)	*100%	88%
Dyad 3									
Fidelity	19% (7.8)	24	18 (6%-24%)		94.7% (5)	94%	12 (88%-100%)		100%
Go	0	0	0	100%	*4.2 *(1.3)		6 (0-6)	*80%	88%
Stop	0	0	0	100%	*5 *(1.2)		7 (0-7)	*80%	88%
Dyad 4									
Fidelity	10.8% (2.7)	12	-6 (6%-12%)		88.7% (5.9)	91%	6 (82%-94%)		100%
Up	0	0	0	100%	*4 *(0)		2 (2-4)	*100%	100%
Please	0	0	0	100%	*4.2 *(.83)		4 (1-5)	*100%	100%

Note. *= N of the last five data points in the series for the mean, standard deviation, and stability envelope of for the child outcomes. N=8 for the absolute

Dyads 1 and 2 had more difficulty than the rest of the dyads, providing a question to elicit the targeted word *help*. Directional words such as *up, stop,* and *go* seemed to provide the parents with more context to form the questions within the limitations of the app. In addition to eliciting the target word via a question, dyads 1 and 4 had difficulty ending the intervention by asking the children "more or all done?"; thus additional coaching was necessary.

Procedural Fidelity During Generalization

The last procedural fidelity measure was related to the generalization of the intervention for a chosen routine. Three concurrent generalization probes occurred at the end of the intervention phase for each dyad. To keep the measurements consistent, the JAML-FVET Data Checklist was used for each generalization check. Although there were only three data points to measure, the mean of the percentage was calculated for each dyad. Dyads 3 and 4 had the highest procedural fidelity at 98%, dyad 1 was 94%, and dyad 2 had the lowest at 92% during generalization.

All of the parents demonstrated the ability to gain their child's attention and provide the turn-taking component. Dyads 1 and 4 demonstrated difficulties with setting up the environment (i.e. little distraction, sitting and keeping the instruction sheet visible). In addition, dyads 2 and 4 struggled with keeping the instruction sheet visible and asking a question to elicit the target words.

Analysis of Performance Data

To answer the research questions, a multiple-probe single-subject research design was used and replicated across four parent/child dyads. To examine evidence of a relation between the independent variable (parent implementation of the JAML-FVET

intervention) and the dependent variable (child's acquisition of two new words), the data were analyzed within conditions, across conditions, and as a group to examine intervention effects.

Within-Phase Measures

The within-phase measures included analysis of the level (i.e., absolute value of the data pattern of the dependent variable). This included level stability and level change. Level stability was calculated using a stable envelope of 80%-25% formula, in other words if 80% of the data falls within 25% of the median, the observed condition is considered stable (Gast & Ledford, 2014). Finally, the level change was measured by absolute level change within the condition, which is the amount of change within a condition (i.e., baseline and intervention). This was completed by "identifying the ordinate values of the first and the last data points and then subtracting the smallest from the largest, noting if the change in the level is improving or deteriorating" (Gast & Ledford, 2014, p. 181). The next visual analysis measurement within the phase was trend (the slope and magnitude of the data pattern) which indicated progress over time (Kennedy, 2005). This was reported as the direction and the magnitude of the slope. The estimate of trend direction was measured by visual inspection. It was calculated by using the freehand trend estimation of the data path which was indicated as accelerating, decelerating, or zero-celerating (Gast & Ledford, 2014). Trend magnitude was calculated by visual inspection of the trend line and is referred to as high, medium, or low (Kennedy, 2005). Variability is determined by visual inspection of the data points that deviate from the overall trend and the standard deviation. Variability is reported as high (data points are scattered from the median), medium (moderately scattered), or low

(points are close to the median line) (Kennedy, 2005, p. 198). Low variability of the data was desired. To quantify the variability, the standard deviation is reported for each dyad across conditions. Since the parents were learning the intervention and the children were acquiring a word they did not have previously, the last five data points were used to calculate the mean, standard deviation, and the stability envelope of the child outcomes (Gast & Spriggs, 2010).

Between-Phases Measures

According to Kennedy (2005), there are several ways to measure effect across phases. The first is the immediacy of effect. This provides information on how rapid the change was from baseline to intervention phases, by comparing the levels and trends of the two phases (Kennedy, 2005). Measuring across phases provides information to determine the effect (change) in the conditions (baseline to intervention) as either immediate or slow (Kennedy, 2005). In other words, the researcher determines how quickly there was a change in the dependent variable in response to manipulation of the independent variable. In addition, there was an assessment of the means of the baseline and the intervention phases (Kennedy, 2005). Second, the data trend was observed. The trend was measured by observation of the baseline and the intervention trend lines. This is reported as accelerating, decelerating, or zero-celerating (Gast & Ledford, 2014).

The next between phases measure was effect size. To measure the effect size, IRD was calculated. "The maximum IRD score is 100% or 1.00, in which case means the intervention phase scores exceed all baseline scores (in an improved rate direction). IRD is calculated as the difference in the phase-specific improvement rates" (Parker et al., 2009, p. 139). Parker et al. (2009) recommends that rather than categorizing IRD effect

size into small, medium, and large effect, that anything below a .50 is considered small with a questionable effect. In summary, the IRD demonstrates an effect by examining the difference between the baseline and intervention phases and is used as one of the between phase measurements.

Dependent Variable Results

Question 1

Is there a functional relation between the implementation of the JAML-FVET intervention with mobile technology (iPad with the Make a Scene app) and the acquisition of two targeted words?

The dependent variable was the children's acquisition of two new targeted words derived from the parents' implementation of the intervention. Visual analysis of the child outcomes (i.e., acquisition of two new words) was inspected for changes from the baseline behavior to after the introduction of the intervention. Child performance data were graphed according to the frequency of the children's verbal responses during the Check It steps of the JAML-FVET intervention (see Figure 12). The first two categories of the steps of the intervention (i.e., Setting up the Environment and Focusing in) were primarily for the parent to implement and did not elicit the child's vocalization. The last two major components of JAML-FVET, are Modeling and Check It. In the Modeling component, the child was expected to say the targeted words after the parent modeled the word during the turn-taking task. The specific coding criteria for the words vocalized was presented in Table 10. During the Check It steps, a word was counted only if the child produced it after the parent asked a question to elicit the targeted word without a model. Only the Check It step outcomes were graphed and examined because the child was

required to say the word without a model, indicating that they had acquired the word for that parent implemented session.

For the Check It step, the data within the baseline phase indicate that there was a predictable pattern that demonstrated a consistent level and trend with little variability (see Table 11). The mean score for the baseline level was 0, since the children did not have the words in their current vocabulary and did not acquire the words within the baseline phase.

Dependent Variable Descriptive Results: Within and Between the Phases

Dyad 1 within-phase descriptive measures for target word *up*. The child said the target word *up* 13 times without a model during the intervention phase. Referring to Table 11, the child produced the target word during the last five data points an average of 2 times per session with a standard deviation of .81. The stability envelope was 80%, which met criteria. Visual analysis of the trends indicates a zero-celerating slope with a low magnitude in the beginning and then gradually increased. The data demonstrates that the child acquired the new word slowly and maintained the word through the intervention.

Dyad 1 within-phase descriptive measures for target word *help*. The child did not begin working on the word *help* until the third intervention session. His parents requested that they focus on the word *up* before beginning a new word. He said the word *help* 16 times during the Check It step. Observing Table 11, the child said *help* on average of 3.2 times per session with an overall absolute value of 5. The data did not meet the criteria with only 60% of the data within 25% stability envelope. The slope was

ascending with a high magnitude within the beginning of the phase and a maintained the magnitude toward the end of the intervention. This indicates that the child had an initial response to the intervention and continued to increase the frequency of his use of the word, contributing to the lower stability number.

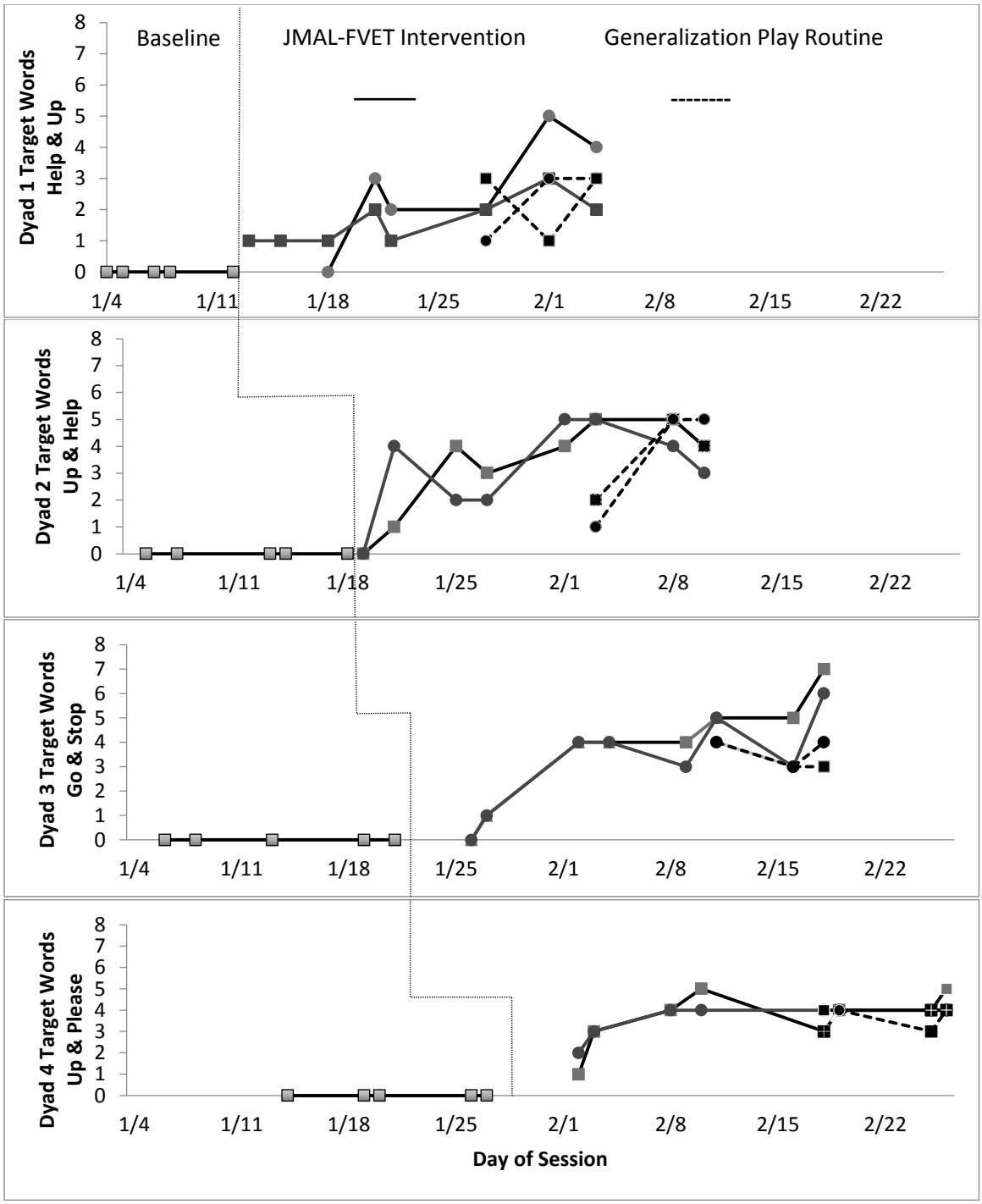

Figure 12. Multiple baseline probe chart: Dyad 1 up = ■ & help = ●, Dyad 2 up = ● & help = ■, Dyad 3 stop = ■ & go = ● Dyad 4 up = ● & please = ■

appeared stable with an 88% stability envelope and a standard deviation of .70.

Between-conditions descriptive measures for the check it steps. The immediacy of effect for the word *up* in the Check It steps indicates a slow change. The trend demonstrates a slight acceleration with high magnitude toward the end of the intervention phase. The IRD was 100% indicating a large effect. The immediacy of effect for the word *help* in the Check It steps indicates an immediate change. The mean for the baseline phase was 0 and the mean for the intervention phase was 3.2. The trend demonstrates a slight acceleration with high magnitude toward the end of the intervention phase. The IRD for the last five data points was 83%, which indicated a moderate effect.

Dyad 2 within-phase descriptive measures for target word *up*. This child said the target word *up* 25 times without a model. As reported in Table 11, the average use of the word for the last five sessions was 3.8 times with a range of 5. The data met the criterion for stability with 80% stability envelope for the last five data points. Visual analysis of the trend indicates the outcome data displayed an ascending slope with medium magnitude. This indicated that the child acquired the word and continued to increase his frequency.

Dyad 2 within-phase descriptive measures for the target word *help*. This child produced the target word *help* 26 without a model. Referring to Table 11, the child used the word an average of 4.2 times over the last five data points. The data demonstrated little variability with 100% stability envelope for the last five data points. Visual analysis of the trend displays an ascending slope with a moderate to high magnitude. This indicates that the child responded rapidly to the intervention and maintained an increase of frequency through the intervention.

Between-conditions descriptive measures for the check it steps. The immediacy of effect for the target word *up* in the Check It steps indicates a change. Mean performance in the baseline phase was 0 and the mean in the intervention phase was 3.8. The trend demonstrates acceleration during the first half and stability with more variability over the second half of the intervention. The IRD was 88%, with all but one of the data point values exceeding those in the baseline phase. This demonstrates a large effect.

The immediacy of effect for the target word *help* indicated a change. The mean performance in the baseline phase was 0 and the mean in the intervention phase was 4.2 with an increase in data point values. The trend demonstrates acceleration with high magnitude. The IRD was also 88%, with all but one of the data point values exceeding those in the baseline phase. This demonstrates a large effect.

Dyad 3 within-phase descriptive measures for the target word *go*. This child produced the target word 26 times without a model. Observing Table 11, for the last five data points the child used the word an average of 4.2 times per session. The stability envelope around the median level demonstrated an effect with and IRD score of 88%. Visual analysis of the trend displayed an ascending slope with a high magnitude that increased over the duration of the intervention. This indicates that the child responded with the acquisition of the new word and then slowly increased his frequency of use.

Dyad 3 within-phase descriptive measures for the target word *stop*. This child produced the target word 30 times without a model. Analysis of the last five data points demonstrated that the child used the word an average of five times during the sessions. The stability envelop was 100%, which exceeded the criterion. Visual analysis of the

trend indicates an ascending slope with a rapid magnitude. This shows that the child responded immediately to the implementation of the Check It steps and continued to increase the frequency of use of the word through the intervention phase.

Between-conditions descriptive measures for the check it steps. The immediacy of effect for the target word *go* in the Check It steps indicates a change. The mean performance level in the baseline phase was 0 and the mean in the intervention phase was 4.2 with an increase in data point values for the last five data points. The IRD was 88%, demonstrates a large effect. The trend demonstrates acceleration with a high magnitude.

The immediacy of effect for the target word *stop* in the Check It steps indicates a rapid change. Mean performance in the baseline phase was 0 and the mean in the intervention phase was 5 with an increase in data point values in the last five data points. The trend demonstrates acceleration during the first half and stability over the second half of the intervention phase. The IRD was 88%, demonstrating a large effect.

Dyad 4 within-phase descriptive measures for the target word *up*. The child produced the target word 29 times without a model. Referring to Table 11, in the last five data points the child used the word an average of 4.0 times during the sessions. In addition, the criterion of 80% was met with a stability envelope of 100%. Visual analysis of the trend displays a zero-celerating slope with a low magnitude. This indicates that the child acquired the word, then maintained the frequency of use of the target word.

Dyad 4 within-phase descriptive measures for the target word *please*. The child produced the target word 29 times without a model. Referring to the Check It steps in Table 11, during the last five sessions the child produced the word with an average of 4.2 times during the sessions with a range of 4. The stability envelope fell at 100%,

which demonstrated little variability. Visual analysis of the trend displays an ascending slope with a moderate magnitude. There was a rapid increase and the word production and then it stabilized over the remainder of the intervention. This indicates that the child acquired the word and continued to use the word through the intervention.

Between-conditions descriptive measures for the check it steps. The immediacy of effect for the target word *up* indicates a rapid change. The mean in the baseline phase was 0 and the mean in the intervention phase was 4.0. The trend demonstrates acceleration during the first half and stability over the second half of the intervention phase. The IRD was 100%, with all data point values exceeding those in the baseline phase. This demonstrates a large effect.

The immediacy of effect for the target word *please* in the Check It steps indicates a rapid change. Mean performance data in the baseline was 0 and the mean in the intervention phase was 4.2 indicating an increase. The trend demonstrates acceleration with high magnitude. The IRD was 100%, demonstrating a large effect.

Question 2

Did the children continue to use the targeted words in the generalized condition? Generalization occurred concurrently during the last three sessions in the intervention phase. All of the parents chose play (e.g., reading a book, blowing bubbles, or playing a game) for their generalization task. Although only three data points were collected for generalization, the following information was gathered.

Parent/child dyad 1 generalization. During the Check It steps, the child said *up* seven times and *help* six times over the course of the three probes. The means for the Check It steps were 2.3 for *up* and 2 for *help*. The stability envelope was 66% for the

words *up* and *help*. There was a rapid immediacy of effect, no overlapping data, and 100% IRD relative to baseline.

Parent/child dyad 2 generalization. During the Check It steps, the child said *up* 10 times and *help* 11 times over the course of the three probes. The means for the Check It steps were 3.3 for *up* and 3.6 for *help*. The stability envelope was 66% for both of the target words. There was a rapid immediacy of effect, no overlapping data, and 100% IRD.

Parent/child dyad 3 generalization. During the Check It steps, the child said *go* 11 times and *stop* 10 times over the course of the three probes. The means for the Check It steps were 3.6 for *go* and 3.3 for *stop*. The stability envelope was 100% for *go* and 66% for *stop*. There was a rapid immediacy of effect, no overlapping data, and 100% IRD.

Parent/child dyad 4 generalization. During the Check It steps, the child said *up* 12 times and *please* 10 times over the course of the three probes. The means for the Check It steps were 4.0 for *up* and 3.3 for *please*. Both of the target words had a stability envelope of 100%. There was a rapid immediacy of effect, no overlapping data, and 100% IRD.

Question 3

What is the parents' perception of the use of mobile technology as an intervention for their children's communication?

The parents completed a survey in the pre-baseline phase and again after the intervention ended. There were 10 questions on a five-point Likert Scale totaling a

possible 50 points. See Figure 13 for pre and post-intervention data means. All of the dyads appeared to demonstrate a positive change from pre to post-intervention measures. The following is a summary of each dyad's results.

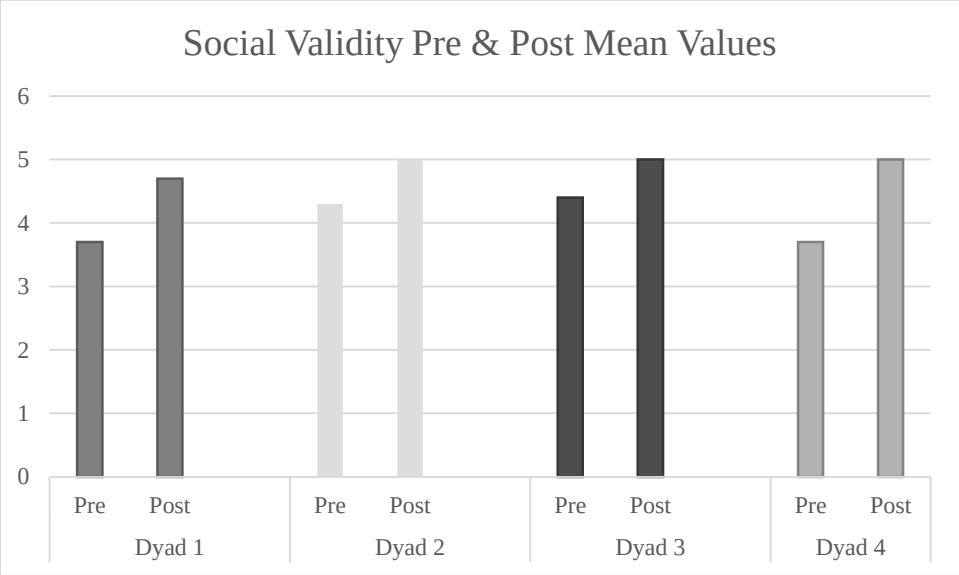

Figure 13. Mean values for social validity per dyad

Parent/child dyad 1 social validity results. The pre-intervention measure yielded a mean of 3.7 and a mean of 4.7 for the post-intervention measure indicating a possible change from pre-to post-post intervention. Additional questions were asked in the post-intervention survey regarding the use of the JAML-FVET intervention. The parents provided a score of 3/5 regarding their continued use of the intervention and 4/5 regarding the ease of implementing the intervention. The parents were asked to write any observations they made while they participated in the study. The parent in dyad 1 wrote the following comment, "I believe the focus of two attainable words we incorporated, and focused on, also in daily routines led to his success."

Parent/child dyad 2 social validity results. The pre-intervention measure yielded a mean of 4.3 and a mean of 5.0 for the post-intervention measure indicating a

possible change from pre-to post-post intervention. Additional questions were asked in the post-intervention survey regarding the use of the JAML-FVET intervention. The parents provided a score of 5/5 regarding their continued use of the intervention and 5/5 regarding the ease of implementing the intervention. The parents were asked to write any observations they made while they participated in the study. The parent in dyad 2 wrote the following comment, "I feel like it opened the flood gates of speech for my child. He isn't as shy about repeating words. He's excited to use his new words in daily routines. We will continue this technique on our own."

Parent/child dyad 3 social validity results. The pre-intervention measure yielded a mean of 4.4 and a mean of 5.0 for the post-intervention measure indicating a possible change from pre-to post-post intervention. Additional questions were asked in the post-intervention survey regarding the use of the JAML-FVET intervention. The parents provided a score of 5/5 regarding their continued use of the intervention and 5/5 regarding the ease of implementing the intervention. The parents were asked to write any observations they made while they participated in the study. The parent in dyad 3 wrote the following comment, "This is a great way to educate him while playing and doing an activity he enjoys. This style (use of iPad) keeps his interest longer."

Parent/child dyad 4 social validity results. The pre-intervention measure yielded a mean of 3.7 and a mean of 4.7 for the post-intervention measure indicating a possible change from pre-to post-post intervention. Additional questions were asked in the post-intervention survey regarding the use of the JAML-FVET intervention. The parents provided a score of 5/5 regarding their continued use of the intervention and 5/5 regarding the ease of implementing the intervention. The parents were asked to write any

observations they made while they participated in the study. The parent in dyad 4 wrote the following comment, "My son did well. He is making more sounds. I believe the iPad helped."

Summary of Child Outcome Data

Demonstration of experimental control was observed due to the replication of the parent-implemented JAML-FVET intervention across four parent/child dyads. All dyads demonstrated a large effect with the IRD meeting the criteria. The child in dyad 3 demonstrated the greatest absolute value of seven for the target word *stop.* In addition, dyad 3 demonstrated the highest accuracy percentage for parent implementation of the intervention at 94.7 %. The child in dyad 3 said his targeted word (*stop*) more often with a frequency of 30 times through the course of the intervention. In comparison, the least number of words spoken was by dyad 1 for the target word *up* at 13 words over the course of the intervention. It was also noted that dyad 1 had the lowest percentage of correct steps administered by the parent at 76% this will be discussed in Chapter V.

Each child acquired the two targeted words, although their individual outcomes ranged. The total number of words produced spanned from 13-30 in one session. The mean number of a targeted word spoken in the last five sessions ranged from 5.0-2.0 for the Check It steps.

Chapter Summary

This chapter included a presentation of results regarding IOA, procedural fidelity, child outcomes, and social validity. The data analysis methodology was explained and the results for each dyad followed. Regarding validity measures, the IOA individual data measurements for parent fidelity of providing the intervention ranged from 60% to 100%

with mean averages for the sessions that fell within the 80% criterion. The parents' demonstrations of competence in operating the iPad with the Make a Scene app were all at 100% and the coaching procedural fidelity ranged from 90%-100% accuracy. Procedural fidelity of each dyad parent's implementation of the JAML-FVET intervention ranged from 75% to 94.7%. Chapter V includes a discussion of these results in relation to this study's outcomes along with limitations of the study and implications for practice and further research.

CHAPTER V

CONCLUSION: SUMMARY AND RECOMMENDATIONS

Young children with expressive language delays often do not develop their prelinguistic means of communication and lack social-commutative skills. Families are an essential factor when planning and implementing services for young children with disabilities. According to the U.S. Department of Education (2011), the primary mission for the IDEA Part C is to "build upon and provide support and resources to support family members and caregivers to enhance children's learning and development through everyday learning opportunities" (p. 2). Early interventionists frequently use parent-implemented approaches with coaching delivered in the natural environment to ensure positive outcomes (Ingersoll & Gergans, 2007; Kaiser & Roberts 2013; McDuffie et al., 2013). As new personal and digital technologies become available (i.e., tablets and apps), and early interventionists are attempting to use them to support young children; it is evident that there is a need for well-designed studies to help professionals understand how to best use these tools with young children.

In this study, the effects of the parent-implemented JAML-FVET intervention with the use of the Make a Scene app on the acquisition of two new words for children with expressive language delays was examined. The children were between the ages of 2.5 and 3.5 years with no known hearing, vision, or oral motor concerns. The study employed a multiple probe design replicated across four parent/child dyads. This study examined the use of evidence-based, parent-implemented strategies combined with the

use of technology to address language acquisition skills for children with expressive language delays.

According to the visual analysis of the data, all four dyads demonstrated a functional relation between the parents' implementation of the intervention with coaching and their children's acquisition of two new words. Although there was some variation within and between study phases for each of the dyads, they all demonstrated prediction with the stability of the data during the baseline phase. The dyads demonstrated verification by a change from baseline to intervention behavior, and replication of the intervention occurred with the same controlled variables across participants.

Coaching and Parent Implementation of the Intervention

According to Roberts and Kaiser (2011), parent training is a triadic approach composed of parent training (including the language constructs for parent-child interactions), parent implementation (of strategies), and child outcomes. There are several evidence-based practices that rely on parent implementation (e.g., Hanen Program, EMT, and JMA) and, as stated, little is known about the use of mobile technology in conjunction with parent-implemented, evidence-based practices. There were four main steps of the intervention. The first two steps (Setting Up and Focusing In) did not require the child to vocalize. The first phases were meant for the parent to set up the environment for the intervention and get the child's attention. Overall, the parents performed well in the first two step categories. Generally, the families followed the steps to ensure that the environment was free from distractions, they sat face to face or directly next to their child, and expressed excitement throughout the intervention. During the Focusing In steps, the parents got their child's attention,

directed them to a particular part of the app, and expressed excitement. The parents completed the steps for 'modeling' by using the concept of "first-then" by saying "first my turn and then your turn" and repeated it if necessary. The last step category was Check It. The child outcome data were based on their responses in the Check It steps. The parents were to ask their children a question in order to elicit the targeted words without providing them a model and offer them praise in response to the use of the target word.

During the course of the study, the parents demonstrated strengths and challenges as they implemented the intervention. Although, overall the parents did well implementing the intervention, dyad one had the lowest procedure fidelity with a mean of 76% and did not meet the criteria. The parents in dyad 1 were often distracted by their other children, and required additional coaching due to lack of attentiveness. The deficiency of procedural reliability may have influenced the outcome for dyad 1. Poor procedural reliability can limit the effectiveness of an intervention calling into question its results (Gast, 2010). One challenge the parents demonstrated was keeping the parent implementation guide next to them during the intervention. The parents were asked to keep the parent implementation guide with each step outlined next to them as they implemented the intervention. In addition to the twice-a-week implementation with the researcher, they were asked to implement the intervention at least three times during the week and use the parent implementation guide with the checklist to record their sessions including their children's responses. Generally, the parents began the intervention using the checklist and kept the list next to them as the implemented the intervention. However, the majority of the parents did not ensure that the checklist was next to them as

the study progressed. The researcher reminded the parents on several occasions to refer to their checklist as they implemented the intervention. In addition, only two dyads used the parent implementation guide to record their children's responses during their independent practice sessions. This implied that the other two dyads did not practice as instructed. Although, the parents did not practice as instructed, there was still a demonstrated effect between baseline and the intervention phase. In the future, creating methods of gathering fidelity data that are easier for parents to implement may be beneficial. For example, the use of apps that allow procedural reliability to be collected on the iPad may be easier for the parents to use. The researcher continued to ask the parents about their documentation of their independent sessions; however, they indicated that either they forgot or it was not convenient for them. The researcher worked with the parents to address solutions to this challenge. Mobayed, Collins, Strangis, Schuster, and Hemmester (2000) discuss the challenges of the training needs regarding the fidelity of parent-implemented interventions. The authors stressed that the child's ability to learn the new skill appears related to the parent's accuracy of the delivery of the intervention. It is essential that the parent proceeds with the training process at a rate that the child is able to comprehend. In addition, further research is needed on effective ways for early interventionist to instruct parents on effective implementation procedures and have a strong goodness of fit to the family environment.

Another challenge was the distractibility of the environment. Dyads 1 and 4 had additional family members present during the sessions. Frequently, the children's siblings interrupted the sessions to ask questions to their parents or to observe the sessions. The researcher asked on several occasions for the siblings not to be present

during the sessions. The parents and researcher attempted to provide activities for the siblings during the sessions. Regarding setting up the environment, the parents in dyad 4 were reminded to turn off the television and clear a space specifically for the activity in order for their child to focus on the intervention. In addition, further research is needed on how to meet each unique family culture needs, life management skills, and ways siblings may be involved in the interventions.

An additional challenge was the parents' response to their children's behavior when the children refused to participate. The parents' responses differed from one dyad to another. Dyads 2 and 3 used rewards as a form of behavior management. Adversely, dyads 1 and 4 did not have a method for behavior management. The researcher focused on each individual family's needs regarding behavior management and provided suggestions to engage their child in the intervention.

Finally, the parents in dyads 1 and 4 demonstrated difficulty praising their children throughout the intervention by using the phrase "good words" and ending the session stating "more or all done." The researcher coached the parents by referring to their parent implementation guide and then asking the parents to repeat the Check It steps. This continued until the parents implemented the steps with the required phrases.

There were many strengths that emerged from the parent implementation of the intervention. Overall, the parents in each dyad got their child's attention, participated in turn-taking, and asked a question to elicit their child's target word. In addition, the parents followed the steps when the child did not produce the target word on the first attempt (i.e., provide choices of two). Furthermore, the researcher observed the parents taking time out for their child and participating in a shared activity. Each dyad spent at

least 10 minutes focusing on the activity, thus participating in a shared experience. In addition, the parents indicated that they believed participating in the study was a positive experience.

Impact of JAML-FVET on Child Outcomes

The goal of this study was the acquisition of two new words through a strategic and systematic set of early intervention methods using a developmentally appropriate app for young children on an iPad. All of the children met the goal of acquiring two new words, and this effect was replicated in the multiple probe design. The number of times the child produced the targeted words varied per session mostly due to the children's language level, interest levels, and their willingness to participate along with the effectiveness of the parents' behavior management strategy. The range for the overall frequency of the child saying the targeted words varied from 13 to 30 total words a session. The child in dyad 1 said his words less frequently than the other children and the child in dyad 3 had the highest total for the Check It step with a frequency of 30 target words. Although modeling the word was not the final measurement for the outcome data, the modeling steps required the child to say the targeted word after the parent modeled the word while manipulating the app. The parent and child were required to take turns as the parent modeled the target word and the child vocalized the word. The child in dyad 1 had the most difficulty acquiring the targeted words, even in the modeling steps. The child was later diagnosed with Apraxia; thus he had difficulty sequencing the sounds to form the words. At his parents' request, the word *up* was targeted first. His parents indicated they were concerned that focusing on two words would be too difficult for him. At first, his words were approximations and then with repetition they became closer to

the adult form of the words. For example, during the first week of intervention the child pronounced the word *up* as /pu/; it was consistent and still followed the guidelines established to code it as a word production. By the third week, the child was able to say *up* in the adult form.

The children in dyads 2, 3, and 4 quickly acquired their targeted words as demonstrated in the Check It steps with accurate speech production. The child in dyad 2 began using his target words within his daily routines in week 3 without being prompted. As noted in the informal observation notes, the children in dyads 2 and 3 began using two-word phrases (combining their targeted words) by week 4 of the intervention. Dyad 3 parents asked for additional words, since their child quickly acquired his targeted words and appeared bored with the repetition of the intervention. Further research is needed to reconstruct the model to promote scaffolding, so that the young child can progress with further expressive language.

Generalization

Each dyad demonstrated the ability to generalize the intervention to a play routine. Regarding generalization, the same documentation was used to collect the data as the parent fidelity and the coding measures for the children's responses in the baseline and intervention phases. All of the families chose play routines for generalization contexts; this may be due to the convenience of the time of day, family culture, routines, and resources available. All four parents implemented the JAML-FVET protocol in the generalized condition without coaching. The parents implemented the intervention in the in the concurrent generalization condition over the three sessions ranging in percentage of accuracy from 76% to 100% and the means ranged from 92%-98%. This may indicate

that the frequency and intensity of coaching may dissipate over a period of time, since the parents demonstrated the ability to implement the intervention without coaching. This was beyond the scope of this study; however, it was notable that the parents implemented the intervention without coaching exceeding the fidelity criteria after only six sessions. This is a similar finding to Schertz and Odom (2007) where they found that the parents were able to generalize intervention implementation for each phase of the intervention to various settings (e.g., restaurant, kitchen, and back yard play).

Use of targeted words in the generalized condition. All the children demonstrated some increase of the frequency of the production of their targeted words. When the generalization period began, rather than starting at baseline levels, the children produced target words in the generalized condition (i.e., play routine) at or near the same level as the intervention condition (i.e., Make a Scene app). This demonstrates that there is potential to generalize the JAML-FVET intervention beyond the use of an iPad into daily routines. Although the intervention was generalized to play routines, further research is needed for a variety of routines (i.e., meals, bedtime, and dressing), and a maintenance of generalization beyond concurrent instruction.

Social Validity

The pre-intervention social validity questionnaire was provided to each family in the current study prior to the baseline phase and the post-intervention social validity questionnaire was given at the last session. An analysis of common themes of the post-intervention parent survey within and across the four dyads appeared to have positive outcomes on their children's communication as well as satisfaction with the procedures and technology. All four dyad parents reported that their children increased their

spontaneous communicative attempts. The parents also commented on their involvement and how they believed the intervention positively impacted their children.

Each dyad parent provided encouraging feedback regarding the ease of administration and the positive impact it had on his or her child's vocabulary acquisition. The parents in dyad 1 commented that they were successful since they could generalize the intervention by incorporating it in their daily routines. Dyad 2 responded that the intervention "opened up the flood gates of speech for my child." The parent indicated the child was not only using the targeted words during the intervention, but was independently using the targeted words in his daily routines. Dyad 3 indicated that the intervention was a great way of teaching her child because he was doing an activity (working on the iPad) that he enjoyed. Furthermore, the parent in dyad 4 commented that he believed the use of the iPad led his child to attempt more sounds. The parent perceptions of the intervention has implications to early intervention practice. The intervention encourages the use of technology for parent-implemented strategies and it promotes language acquisition in daily routines.

Limitations of the Study

This study demonstrated that the use of the JAML-FVET intervention with mobile technology (iPad with the Make a Scene app) may be an effective tool in early intervention service delivery. In addition, it was acceptable to the parents as a means to teach new vocabulary to children aged 2.5 to 3.5 years with expressive language delays. However, there are several limitations to this study.

This study is a single-subject design, and most single-case designs are small *N* studies. The validity of single-case studies does not rest on large sample size, but rather

the structure of the design and systematic replication of the effect (Kratochwill et al., 2010). Nonetheless, repeated replication is essential regardless of the research approach to provide confidence in the research results (Gast & Ledford, 2014). This study was limited to eight probes. Future studies should evaluate over longer time frame, and work to resolve parent fidelity issues with all participants. Dyad 1 and dyad 3 had a low IOA for one observation reducing the reliability of the observations for those participants. In addition to longer time frames for intervention, a maintenance phase should be added to evaluate over a long-term effect of generalization instruction. The subjects were obtained from a local pediatric agency that primarily served children birth through 3 years of age. This provided a limitation not only on geographical location, but also on the selection of participants for the study. While the participants were chosen from a local early intervention agency, the agency itself serves the early intervention program in the State of Illinois and is similar to other states' early intervention agencies.

This study focused on young children with language delays between the ages of 2.5 to 3.5 years because of the limited research on this population. While it may be intriguing to consider how a similar intervention with older children might be effective, there are large developmental differences between children this age and older children (e.g., 5 years of age). In young children with expressive language delay, the gap between what they understand, and what they are able to express may cause increased frustration for them and their families. In addition, it was the intention to target expressive language delay because it spans multiple disabilities, thus providing a wider scope of children with disabilities and not limited to a single population.

Another limitation is that the parents were not required to video-record their practice sessions and this was recorded only by parent report, nor were there safeguards in place to ensure that the parents completed the required three practice sessions throughout the week. Nevertheless, the parents were asked to use their parent implementation guide to check off steps and date them as they implemented the intervention. While video-tape would have produced the most exact observations, it is not naturalistic. Arguably, following an intervention protocol with a child is not completely naturalistic; however, it is the least intrusive of the two approaches. It is unlikely early interventionists would constantly video-tape their clients to establish fidelity.

The actual reliability and validity of the pre and post social validity measures are unknown. However, the questions were targeted as socially important and related to the study. The Likert Scale was used to provide a convenient format for the parents to respond and a way for the pre- and post-intervention responses to be measured.

Additional limitations in empirical research are the variability in the natural environments and differences among the research participants. In this study, the intervention took place in the participants' homes. Natural variations in resources, family culture, and opportunities may have influenced the results of this study. For example, there was a delay in the initiation of treatment between dyads 3 and 4 due to parents having scheduling concerns. The intervention was not initiated until the end of the week rather than at the beginning of the week. As noted in Chapter IV, maturation effects are likely not a factor because there was little variability in the first data points. According to Kennedy (2005), maturation effects are particularly a concern with young children and

language development. It may be difficult to rule out maturation factors as a possible variable rather than the effects of the intervention. Another limitation is that even though the parents were asked to practice the intervention at least three times a week, some of the parents admitted they did not find the opportunity three times a week to practice due to outstanding circumstances. Although, the parents did not practice as instructed three times a week, the data demonstrated that the children produced the two targeted words as intended. In addition, dyads 1 and 4 had two different people administrating the intervention, while in dyads 2 and 3, only the mother provided the intervention. Another consideration related to the environment was the amount of distraction during the sessions. Dyad 1 had interference from siblings and the parents in dyad 4 were often asked to turn the television off during the intervention, which upset the child. In both cases, additional coaching was provided. It is unclear from the data that if there was a relationship between environmental distractions, fidelity, and outcomes. While there were several factors that may have been an influence fidelity, dyad 1 and dyad 4 had strong fidelity, and moderate outcomes despite environmental instruction. Further, it is possible that with longer and more intensive coaching, fidelity would improve and in turn improve outcomes.

Furthermore, to address family priorities, parents assisted in the selection of the targeted vocabulary words. The targeted words for some children may have been more challenging than the targeted words for the other children. For example, the child in dyad 1 had difficulty sequencing sounds into words, thus he had a smaller vocabulary than the children in the other three dyads. In addition, his parents requested that only one word be targeted at a time. Although the child had difficulty sequencing sounds, he consistently

produced this approximation of the targeted words. For this reason, it was coded as word production, and did not affect the results. In addition, since the parents asked to focus on one word at time, by the third session, both words were targeted and the child did produce both targeted words.

Another limitation regarding the research participants was the unique temperament of each parent and child along with natural maturation. The children in dyads 1 and 3 appeared to have shorter attention spans and required additional positive reinforcement to complete the 10-minute interval, in comparison to the children in dyads 2 and 4 who appeared to require less positive reinforcement. The parents in each dyad had different parenting styles and approaches to obtaining their children's attention throughout the intervention. Generally, during the 10-minute interval the parent and child completed three rotations of the intervention; however, this would vary depending on the child's temperament and the parent's fidelity of intervention implementation. Furthermore, due to the ages of the children, natural maturation cannot be ruled out as a possible contributing factor for the acquisition of their two new words.

An additional limitation was the intervention design with the use of the technology. When the children acquired their targeted words and used them in generalization with automaticity, they appeared to become bored (as evidenced by their behavior; thus, additional positive reinforcement was required by the parents) with the elicitation of the same targeted words. For example, dyads 2 and 3 children acquired their words in more rapid fashion than the children in the other two dyads and the parents began to elicit the combination of the two targeted words, which then progressed to naming the objects in the app paired with their targeted words. In the future, the model of

the intervention needs to allow for scaffolding of the words produced by the child. In addition to the repeated elicitation of the targeted words, the children appeared to become bored by the use of the same app over the four weeks. However, keeping the same app was used for experimental control; the use of other similar apps to help the children maintain their motivation is warranted. Furthermore, the intervention is designed first for the parent to provide a model with turn-taking steps and then ask a question without providing the support of modeling. Once the child acquired the word, the modeling steps appeared to cause more of a distraction to the parent and the child. It is suggested to modify the intervention once the child demonstrates acquisition of the targeted word, scaffolding his production into longer phrases.

Implications and Future Directions of the Study

Strategic Co-Viewing

The current study also has implications related to *The New Coviewing: Designing for Learning through Joint Media Engagement* by Lori Takeuchi and Reed Stevens (2011). They provided a report on the assimilation of case studies regarding social engagement and the use of media. JME focuses on shared experiences people have when interacting together with digital technologies that promote social engagement. Typically, these experiences are highly interactive creating shared meaning, and learning during media activities. They suggested that technology is supportive of learning by providing access and creating shared meaning. This study supports the use of technology (iPad) with social engagement between the parent and the child, along with creating a shared experience that focuses on the expressive language of the child. In addition, JME is based on the principles of JA which is also the foundation of this intervention.

Arguably, this study expands the standard concept of co-viewing and JME to incorporate methods of intervention to address expressive language deficits in young children. This study employed an array of effective interventions that included elements of JA, which is one of the foundations of language acquisition (Mundy & Jarrold, 2010; Paparella & Kasari, 2004). Specifically, three key elements from the JAML model were incorporated into the intervention (i.e., focusing on faces, turn taking, modeling, and scaffolding). In addition, the child's zone of proximal development (Vygotsky, 1978) was embedded in the intervention by taking the sounds/words and scaffolding them into the targeted words.

This parent-implemented intervention suggest that parents can support their child's vocabulary acquisition through a sequential, and activity-based strategic co-viewing of a developmentally appropriate app. Hence, strategic co-viewing is the use of set of evidence-based systematic learning principles in the context of two individuals engaged in a shared media activity. The app is not the important factor; it is the parent's implementation of the intervention in the context of the app that is salient. The researcher observed parents holding their child on their lap or sitting side-by-side as they implemented the systematic steps of the intervention. Specifically, the steps that included turn-taking created a shared experience; as the parent and the child focused on each other when they took turns manipulating the app. The app contributed a developmentally age appropriate tool for the parent to implement the intervention that was engaging, interactive (sounds and manipulation of the characters), along with motivating for the parent and the child. The combination of the app and the parent's implementation of the intervention created a learning experience. Taking the implications of the intervention

under consideration, the intervention is a viable approach for those in early education and related fields for children with expressive language delays.

Theoretically, early interventionists and educators can use JME activities that strategically support language development for young children experiencing language delays. Referring to Table 1, the tenets for early intervention practice (Odom & Wolery, 2003), EI services have direct implications to JME. For example, EI/ECSE practice is individually and dynamically goal oriented; adults mediate children's experiences to promote learning; children learn through acting on and observing their environments; and strengthening relationships is an essential feature of EI/ECSE. Bringing together the tenets of early intervention services and JME demonstrate a similarity regarding assisting families to promote a social communicative foundation for learning.

Developmentally Appropriate and Socially Valid Outcomes

This study contributes to the limited empirical research on the use of iPads as a vehicle for parent-implemented interventions. As indicated, digital media are distinctive in that they are dynamic, flexible, and interactive in order to allow multiple access for diverse learners (Parette & Blum, 2013). While organizations such as the American Speech-Language-Hearing Association (ASHA) provide general guidance for speech-language pathologist use of apps, there is little empirical data to govern the practice (ASHA, 2015). In addition, NAEYC (2012) indicated that the growing role of technology in the education and daily lives of young children is an essential focus for those who support young children and their families. This study provided support for the use of iPads with a structured and sequential, developmentally appropriate model that parents can use to instruct their children. This is supported by NAEYC (2009) that

indicated that within the framework of DAP, interactive technology and media are tools that can promote effective learning and development when they are used intentionally by early childhood educators.

The current study's findings also support the social validity of the use of iPads to increase expressive language as perceived by the parents. Results of the pre-post-intervention social validity measures indicate that parents felt that they could use technology to support their children's language development. All of the parents indicated they felt their children made expressive language gains, the intervention was convenient and easy to implement, and they enjoyed working with their children using the iPads. In addition, the parents expressed they were able to embed the intervention in their daily routines.

Recommendations for Further Research

This study provides an introduction to the development of evidence-based practice using technology as a vehicle for parent-implemented intervention. More single subject replications are needed to better understand the effectiveness and the clinical benefits of this intervention procedure. Larger samples, that replicate the method analyzing growth and factors that influence language outcomes may provide further insights (Mirman, Dixon & Magnusun, 2008). The study also requires replication across different populations, ages, genders, and settings. Furthermore, a longitudinal study to demonstrate the sustainability of the parent implementation and the long-term impact of the vocabulary.

In addition, after the modification of this intervention model that incorporates safeguards regarding the limitations of the design (i.e., different apps and less repetition

of the steps), further research is warranted to examine the effectiveness of the modifications. Along the same lines, with the wide array of available apps for children (i.e., 80,000 indicated by Apple, 2016), more research is needed regarding the usefulness of identifying developmentally appropriate apps to elicit specific outcomes (e.g., receptive language, cognitive development, dysfluency, reading, dual language learning, and executive function) for a wide variety of populations (e.g., pervasive development disorders, social emotional challenges, and cognitive impairment) and the effectiveness of the use of those apps for parent implementation across routines and for coaching implementation as an instructional strategy. For example, the My Story (Bright Bot, 2016) app enables the parent and child to construct a story using their own pictures and voices. This would provide more concrete access and meaning to the targeted words. In addition, the story can be modified to scaffold the learning opportunity for the child.

Regarding the use of technology, further research regarding the platform of the technology would be viable. Mobile device users can access learning apps in a variety of diverse contexts to interact with their environments or with others (Marturana, 2012). It is my experience that more parents have access to smart phones than to iPads. Although the screen size is smaller in smart phones than in iPads, smart phones are more readily available and may be used across settings within families' daily routines. In addition, the parents would be able to share the technology (app) with other family members for additional continuity of the intervention.

REFERENCES

Aldred, C., Green, J., Emsley, R., & McConachie, H. (2012). Brief report: Mediation of treatment effect in a communication intervention for pre-school children with autism. *Journal of Autism & Developmental Disorders*, *42*, 447-454. doi:10.1007/s10803011-1248-3

American Speech-Language-Hearing Association. (1993). *Definitions of communication disorders and variations*. doi:10.1044/policy.RP1993-00208

American Speech-Language-Hearing Association. (2012). *How does your child hear and talk?* http://www.asha.org/public/speech/development/23/

American Speech-Language-Hearing Association. (2015). *Applications (apps) for speech-language pathology practice*. [Press release]. Retrieved from http://www.asha.org/SLP/school Applications for Speech-Language-Pathology-Practice/

Apple. (2016). iPads in education. Retrieved from: http://www.apple.com education/apps-books-and-more/

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *The Journal of the Learning Sciences, 9*(4), 403-436.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols*. In E. Bates, L. Benigni, I. Bretherton, L. Camaioni, & V. Volterra, *The emergence of symbols: Cognition and communication in infancy* (pp. 65-66). New York, NY: Academic Press.

Binger, C., Kent-Walsh, J., Berens, J., Del Campo, S., & Rivera, D. (2008). Teaching Latino parents to support the multi-symbol message productions of their children who require AAC. *Augmentative and Alternative Communication, 24*, 323-338.

Bloom, L., & Lahey, M. (1978). *Language development and language disorders*. New York, NY: Wiley.

Brauer, J., Call, J., & Tomasello, M. (2005). All great ape species follow gaze to distant locations and around barriers. *Journal of Comparative Psychology, 119*, 145-154.

Bright Bot Inc. (2016). My story. [Mobile application software]. Retrieved from: https://itunes.apple.com/us/app/my-story-book-creator-school/id449232368?mt=8

Brooks, R., & Meltzoff, A. N. (2008). Infant gaze following and pointing predict accelerated vocabulary growth through two years of age: A longitudinal, growth curve modeling study. *Journal of Child Language, 35*, 207-220.

Brown, R. (1973). *A first language: The early stages*. London: George Allen & Unwin

Bruner, J. (1983). *Child's talk*. New York, NY: Norton.

Bruner, J., & Sherwood, V. (1983). Thought, language and interaction in infancy. *Frontiers of Infant Psychiatry*, 38-55.

Bzoch, K., & League, R. (1970). *Expressive language scale for the measurement of language skills in infancy.* Gainesville, FL: Tree of Life Press.

Cardon, T. A. (2012). Teaching caregivers to implement video modeling, imitation training via iPad for their children with autism. *Research in Autism Spectrum Disorders*, 6, 1389-1400. doi:10.1016/j.rasd.2012.06.002

Carpenter, M., Nagell, K., Tomasello, M., Butterworth, G., & Moore, C. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development*, 1-174.

Carpenter, M., & Tomasello, M. (2000). Joint attention, cultural learning, and language acquisition: Implications for children with autism. In A. M. Wetherby & B. M. Prizant (Eds.), *Communication and language issues in autism and pervasive developmental disorder: A transactional developmental perspective* (pp. 31-54). Baltimore, MD: Brookes.

Carta, J. J., Greenwood, C. R., Walker, D., & Buzhardt, J. (2010). *Using individual growth developmental inventories (IGDIs): Monitoring progress and improving intervention for infants and young children*. Baltimore, MD: Brookes.

Cartmil, E. A., Armstrong III, B. F., Goldin-Meadow, S., Medina, T. N., & Trueswell, J. C. (2013). Quality of early parent input predicts child vocabulary 3 years later. *PNAS, 110* (28), 11278-11283. doi:10.1073/pnas.1309518110

Chao, P., Bryan, T., Burstein, K., & Ergul, C. (2006). Family-centered intervention for young children at-risk for language and behavior problems. *Early Childhood Education Journal*, *34*(2), 147-153. doi:10.1007/s10643-005-0032-4

Chiong, C., & Shuler, C. (2010). *Learning: Is There an App for That? Investigation Young Children's Usage and Learning with Mobile Devices and Apps*. New York, NY: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from http://joanganzcooneycenter.org/upload_kits/learningapps_final_110410.pdf

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Dawson G., Osterling J., Rinaldi J., Carver L., & McPartland, J. (2001). Brief report: Recognition memory and stimulus-reward associations: Indirect support for the role of the ventromedial prefrontal dysfunction in autism. *Journal Autism Developmental Disorders, 31,* 337-341.

Division for Early Childhood, Council for Exceptional Children. (2007). *Promoting positive outcomes for children with disabilities: Recommendations for curriculum, assessment, and program evaluation*. Retrieved from: http://dec.membershipsoftware.org/files/Position%20Statement%20and%20Papers/PrmtPosOutcomesCompanionPaper.pdf

Division for Early Childhood, Council for Exceptional Children. (2014). *DEC recommended practices in early intervention/early childhood special education.* Retrieved from http://www.dec-sped.org/recommendedpractices.

Division of Early Childhood, Council for Exceptional Children & National Association of Education of Young Children. (2009). *Early childhood inclusion: A joint position statement of the Division for Early Childhood (DEC) and the National Association for the Education of Young Children* (NAEYC). Retrieved from: http://www.naeyc.org/files/naeyc/file/positions/DEC_NAEYC_EC_updatedKS.pdf

Donohue, C. (2015). Technology and digital media as tools for teaching and learning in the digital age. In C. Donohue (Ed) *Technology and digital media in the early years: Tools for teaching and learning* (pp .24-25). Washington, DC: Routledge.

Fenson, L., Marchman, V. A., Thal, D. J., Dale, P. S., Reznick, J. S., & Bates, E. (2007). *MacArthur-Bates communicative development inventories: User's guide and technical manual* (2nd ed.). Baltimore, MD: Brookes.

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science,16*, 234-248. doi:10.1111/desc.12019

Fey, M. E. (1986). *Language intervention with young children*. Boston, MA: Boston College-Hill.

Fischel, J. E., Whitehurst, G. J., Caulfield, M. B., & DeBaryshe, B. (1989). Language growth in children with expressive language delay. *Pediatrics*, *83*, 218-227.

Fred Rogers Center. (2012). Technology and interactive media as tools in early childhood programs serving children from birth through age 8. *Children*, (January), 1-15.

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences*. New York, NY: Routledge.

Gast, D. L, & Spriggs A. D. (2010). Visual analysis of graphic data. In D. L. Gast (Ed.), *Single subject research methodology in behavioral science* pp.166-198. NewYork, NY: Routledge.

Gast, D. L., & Ledford, J. R. (2014). *Single case research methodology: Applications in special education and behavioral sciences*. New York, New York. Routledge.

Gavrilov, Y., Rotem, S., Ofek, R., & Geva, R. (2012). Socio-cultural effects on children's initiation of joint attention. *Frontiers in Human Neuroscience*, *6*, 1-10. http://doi.org/10.3389/fnhum.2012.00286

Gillis, A., Luthin, K., Parette, H. P., & Blum, C. (2012). Using Voicethread to create meaningful receptive and expressive learning activities for young children. *Early Childhood Education Journal*, *40*, 203-211. doi:10.1007/s10643-012-0521-1

Goodwin, C. (2000). Practices of seeing: Visual analysis: An ethnomethodological approach. In T. van Leeuwen & C. Jewitt (Eds.), *Handbook of visual analysis* (pp. 157-182). London, UK: Sage Publications.

Guttentag, C. L., Landry, S. H., Williams, J. M., Baggett, K. M., Noria, C. W., Borkowski, J. G., & Ramey, S. L. (2014). "My baby & me": Effects of an early, comprehensive parenting intervention on at-risk mothers and their children. *Developmental Psychology*, *50*,1482-1496. doi:10.1037/a0035682

Haebig, E., McDuffie, A., & Weismer, S. (2013). The contribution of two categories of parent verbal responsiveness to later language for toddlers and preschoolers on the autism spectrum. *American Journal of Speech-Language Pathology*, *22*(1), 57-70. doi:10.1044/1058-0360(2012/11-0004)

Hancock, T. B, & Kaiser, A. P. (2002). The effects of trainer-implemented enhanced milieu teaching on social communication of children who have autism. *Topics in Early Childhood Special Education, 22*(1), 39-54.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children.* Baltimore, MD: Brookes.

Hebbeler, K., Spiker, D., Bailey, D., Scarborough, A., Mallik, S., Simeonsson, R. & Nelson, L. (2007). *Early intervention for infants and toddlers with disabilities and their families: Participants, services, and outcomes*. Menlo Park, CA: SRI International.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71,* 165-179.

Hulit, L., & Howard, M. (1997). *Born to talk: A introduction to speech and language development* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Individuals with Disabilities Education Improvement Act of 2004, P.L. No. 108-446, 118 Stat. 2647 (amending 20 U.S.C. §§ 1400 et seq.)

Illinois Department of Human Services. (n.d). *Attachment Early intervention service report guidelines*. Retrieved from:http://www.dhs .state.il.us/page.aspx?item=31521

Ingersoll, B., Dvortcsak, A., Whalen, D., & Sikora, D. (2005). The effects of a developmental, social-pragmatic language intervention on rate of expressive language production in young children with autism. *Focus on Autism and Other Developmental Disabilities, 20,* 213-222.

Ingersoll, B., & Gergans, S. (2007). The effect of a parent-implemented imitation intervention on spontaneous imitation skills in young children with autism. *Research in Developmental Disabilities: A Multidisciplinary Journal*, *28*, 163-175.

Ingersoll, B., & Wainer, A. (2013). Pilot study of a school-based parent training program for preschoolers with ASD. *Autism: The International Journal of Research & Practice*, *17*, 434-448. doi:10.1177/1362361311427155

Innivo Mobile. (2013). *Make a scene* (Version 1.2) [Mobile application software]. Retrieved from http://itunes.apple.com/

Institute of Education Sciences. (2014). *ERIC selection policy*. Education Resource Information Center. Retrieved from http://eric.ed.gov/pdf/ERIC_Selection_Policy.pdf

Jannings, D., Hanline, M., & Woods, J. (2012). Using routine-based interventions in early childhood special education. *Dimensions of Early Childhood 40*(2), 13-23. Retrieved from: http://www.southernearlychildhood.org/upload/pdf/

Kaiser, A. P., Hancock, T. B., & Hester, P. P. (1998). Parents as co-interventionists: Research on applications of naturalistic language teaching procedures. *Infants & Young Children, 10,* 46–55.

Kaiser, A., & Roberts, M. (2013). Parent-implemented enhanced milieu teaching with preschool children who have intellectual disabilities. *Journal of Speech, Language & Hearing Research, 56*(1), 295-309. doi:10.1044/1092-4388(2012/11-0231)

Kaiser A. P., & Trent, J. A. (2007). Communication intervention for young children with disabilities: Naturalistic approaches to promoting development. In S. L. Odom, R. H. Horner, M. E. Snell, & J. B. Blacher (Eds.), *Handbook of developmental disabilities* (pp. 224-246). New York, NY: Guilford Press.

Kaplen, F. & Hafner, V. (2006). The challenges of joint attention. *Interaction Studies, 72*, 35-69 Retrieved from: http://homes.di.unimi.it/~boccignon /GiuseppeBoccignonewebpage/IUM2_2013 files

Karoly, L. A., Kilburn, M., & Cannon, J. S. (2005). *Proven results, future promise*. (Issue Brief). Retrieved from RAND Corporation: http://www.rand.org/pubs/research_briefs/RB9145.html

Kasari, C., Freeman, S., & Paparella, T. (2006). Joint attention and symbolic play in young children with autism: A randomized controlled intervention study. *Journal of Child Psychology and Psychiatry, 47*, 611-620. doi:10.1111/j.1469-7610.2005.01567.

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders, 40*, 1045-1056.

Kashinath, S., Woods, J., & Goldstein, H. (2006). Enhancing generalized teaching strategy use in daily routines by parents of children with autism. *Journal of Speech, Language, and Hearing Research, 49,* 466-485. doi: 1092-4388/06/4903-0466

Kazdin, A. E. (1982). *Single-case research designs: Methods for clinical and applied settings*. New York, NY: Oxford University Press.

Keilty, B. (2008). Early intervention home-visiting principles in practice: A reflective approach. *Young Exceptional Children, 11*(2)*,* 29-40. doi: 10.1177/109625060731193

Klein, P. S. (2003). A mediational approach to early intervention: Israel. In S. L. Odom, M. J.Hanson, J. A. Blackman, & S. Kaul (Eds.)*, Early intervention practices around the world* (pp 69–89). Baltimore: Paul H. Brookes.

Kennedy, C. (2005). *Single-case designs for educational research*. New York, NY: Pearson Education.

Konza, D., Maloney, C., & Grafton, P. (2010). It takes two to talk: A focused intervention program for parents and children with language delays. *International Journal of Interdisciplinary Social Sciences*, *5*, 225-236.

Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf

Kuhl, P. (2005). Early speech perception and later language development: Implications for the "critical period." *Language Learning and Development, 1,* 237-264.

Loretta, S., Askin, D., Yu, C., Garinger, J., Mulaire-Cloutier, C., Scharf, L., Schwartzman, L., Konyk, D., & Feldman, A. (2006). Factors affecting parenting stress among biologically vulnerable toddlers. *Issues in Comprehensive Pediatric Nursing, 29,* 131-156.

Losardo, A., & Bricker D. (1994). Activity-based intervention and direct instruction: A comparison study. *American Journal of Mental Retardation, 98*, 744-765.

Mahoney, G., Perales, F., Wiggers, B., & Herman, B. (2006). Responsive teaching: Early intervention for children with Down syndrome and other disabilities. *Down Syndrome Research and Practice 11*(1), 18-28.

Marturana, E. (2012). *Use of mobile device applications to teach caregivers to embed naturalistic teaching strategies in daily routines*. (Unpublished doctoral dissertation). Tallahassee, FL: Florida State University.

McDuffie, A., Machalicek, W., Oakes, A., Haebig, E., Weismer, S., & Abbeduto, L. (2013). Distance video-teleconferencing in early intervention: Pilot study of a naturalistic parent implemented language interventions. *Topics in Early Childhood Special Education, 33,* 172-185. doi:10.1177/0271121413476348

McNairn, P., & Shioleno, C. (2000). Augmentative communication—Part 1: Can we talk? Parents' perspectives on augmentative and alternative communication. *The Exceptional Parent, 30*(2), 72-73.

McWilliams, R. (2010). *Routine-based early intervention: Supporting young children and their families.* East Peoria, IL: Brookes.

Meadan, H., Meyer, L. E., Snodgrass, M. R., & Halle, J. W. (2013). Coaching parents of young children with autism in rural areas using Internet-based technologies: A pilot program. *Rural Special Education Quarterly*, *32*(3), 3-10.

Meltzoff, A. N., & Brooks, R. (2007). Eyes wide shut: The importance of eyes in infant gaze-following and understanding other minds. In R. Flom, K. Lee, & D. Muir (Eds.), *Gaze following: Its development and significance* (pp. 217-241). Mahwah, NJ: Erlbaum.

Miller, D., Light, J. C., & Schlosser, R. W. (2006). The impact of augmentative and alternative communication intervention on the speech production of individuals with developmental disabilities: A literature review. *Journal of Speech, Language, and Hearing Research, 49*, 248-264.

Mirman, D., Dixon, J. A., & Magnuson, J. S. (2008). Statistical and computational models of the visual world paradigm: Growth curves and individual differences. *Journal of Memory and Language, 59*(4), 475-494

Mobayed, K., Collins, B., Strangis, D., Schuster, J., & Hemmester, M. (2000). Teaching parents to employ mand-model procedures to teach their children requesting. *Journal of Early Intervention, 7*(23),165-179. doi: 10.1177/10538151000230030601

More, C. M., & Travers, J. C. (2012). What's app with that? Selecting educational apps for young children with disabilities. *Young Exceptional Children, 16* (2), 15-32. doi:10.1177/1096250612464763

Morgan, D. L., & Morgan, R. K. (2009). Multiple-baseline designs. In D. L. Morgan & R. K. Morgan (Eds.), *Single-case research methods for the behavioral and health sciences* (pp. 125-161). Thousand Oaks, CA: SAGE Publications, Inc. doi: http://dx.doi.org/10.4135/9781483329697.n6

Mundy, P. (1995). Joint attention and social-emotional approach behavior in children with autism. *Developmental Psychopathology,* 7, 63-82.

Mundy, P., Block, J., Delgado, C., Pomares, Y., Hecke, A., & Parlade, M. (2007). Individual differences and the development of joint attention in infancy. *Child Development, 78*, 938-954.

Mundy, P., & Jarrold, W. (2010). Infant joint attention, neural networks and social cognition. *Neural Networks, 23,* 985-997.

Mundy, P., Kasari, C., Sigman, M., & Ruskin, E. (1995). Nonverbal communication and early language acquisition in children with Down syndrome and in normally developing children. *Journal of Speech, Language, and Hearing Research, 38*, 157-167.

Mundy, P., & Newell, L. (2007). Attention, joint attention, and social cognition. *Current Directions in Psychological Science, 16*, 269–274.

National Association for the Education of Young Children. (2009). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8* (position statement), pp. 1-31. Washington, DC: Author.

National Association for the Education of Young Children. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. Retrieved from http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf

National Center for Family Literacy. (2009). *What works: An introductory teacher guide for early language and emergent literacy instruction. Based on the national early literacy panel* report. Retrieved from http://www.familieslearning.org/NELP/pdf/What%20Works.pdf

National Center on Student Progress Monitoring. (2006). *Review of progress monitoring tools: Standards.* National Center for Progress monitoring. Retrieved from http://www.studentprogress.org/

National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel: A scientific synthesis of early literacy development and implications for intervention*, pp. 1-260. Washington, DC: National Center for Family Literacy. Retrieved from http://lincs.ed.gov/publications/pdf/NELP Report09.pdf

Odom, S., & Wolery, M. (2003). A unified theory of practice in early intervention/early childhood special education: Evidence-based practices. *The Journal of Special Education, 32*3, 164-173.

Olswang, L. B., Rodriguez, B., & Timler, G. (1998). Recommending intervention for toddlers with specific language learning difficulties: We may not have all the answers, but we know a lot. *American Journal of Speech-Language Pathology, 1*, 23-32.

Paparella, T., & Kasari, C. (2004). Joint attention skills and language development in special needs populations: Translating research to practice. *Infants & Young Children, 17*, 269-280.

Parette, H. P., & Blum, C. (2013). *Instructional technology in early childhood: Teaching in the digital age*. Baltimore, MD: Brookes.

Parette, H. P., Blum, C., Boeckmann, N. M. (2009). Evaluating assistive technology in early childhood education: The use of a concurrent time series probe approach. *Early Childhood Education Journal, 36*, 5-12. doi: 10.1007/s10643-009-0319-y

Parette, H. P., Blum, C., & Quesenberry, A. C. (2013). The role of technology for young children in the 21st century. In H. P. Parette & C. Blum, *Instructional technology in early childhood* (pp. 1-28). Baltimore, MD: Brookes.

Parette, H. P., Quesenberry, A. C., & Blum, C. (2009). Missing the boat with technology usage in early childhood settings: A 21st century view of developmentally appropriate practice. *Early Childhood Education Journal, 37*, 335-343. doi 10.1007/s106430090352

Parker, R. I., Vannest, K. J., & Brown, L. (2009). The improvement rate difference for single case research. *Exceptional Children, 75,* 135-150.

Paul, R. (2000). Predicting outcomes of early expressive language delay: Ethical implications. In D. V. M. Bishop & L. B. Leonard (Eds.), *Speech and language impairments in children: Causes, characteristics, intervention and outcome* (pp. 195-209). Hove, UK: Psychology Press.

Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology, 8*, 317-344.

Pennington, L., Thomson, K., James, P., Martin, L., & McNally, R. (2009). Effects of It Takes Two to Talk--the Hanen program for parents of preschool children with cerebral palsy: Findings from an exploratory study. *Journal of Speech, Language & Hearing Research*, *52*, 1121-1138. doi:10.1044/1092-4388(2009/07-0187)

Prelock, P., Calhoon, H., Morris, H. & Platt, G. (2011). Supporting parents to facilitate communication and joint attention in their young children with autism spectrum disorders. *Topics in Language Disorders, 31,* 210-234. doi: 10 1097/TLD060113e1822

Pretis, M. (2011). Meeting the needs of parents in early childhood intervention: The educational partnership with parents--good practice and challenges. *Journal of Policy and Practice in Intellectual Disabilities*, *8*(2), 73-76.

Purcell, K., Entner, R., & Henderson, N. (2010). The rise of apps culture. *Pew Internet & American Life Project*, 14. http://www.pewInternet.org/2010/09/14/

Raab, M., & Dunst, C. (2004). Early intervention practitioner approaches to natural environment interventions. *Journal of Early Intervention, 27*, 15-26.

Rideout, V. (2014). *Learning at home: Families' educational media use in America*. The Joan Ganz Cooney Center, (January). www.joanganzcooneycenter .org/.../2014/.../jgcc_learn

Roberts, M. Y., & Kaiser, A. P. (2011). The effectiveness of parent-implemented language interventions: A meta-analysis. *American Journal of Speech-Language Pathology*, *20*, 180-199. doi:10.1044/1058-0360(2011/10-0055)

Rogers, S. J., Hayden, D., Hepburn, S., Charlifue-Smith, R., Hall, T., & Hayes, A. (2006). Teaching young nonverbal children with autism useful speech: A pilot study of the Denver Model and PROMPT Interventions. *Journal of Autism & Developmental Disorders*, *36*, 1007-1024. doi:10.1007/s10803-006-0142

Romski, M. A., & Sevcik, R. A. (1996). *Breaking the speech barrier: Language development through augmented means*. Baltimore, MD: Brookes.

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech, Language, and Hearing Research, 53,* 350-364. doi: 10.1044/10924388(2009/08-0156)

Romski, M., Sevcik, R. A., Adamson, L. B., Smith, A., Cheslock, M., & Bakeman, R. (2011). Parent perceptions of the language development of toddlers with developmental delays before and after participation in parent-coached language interventions. *American Journal of Speech-Language Pathology*, *20*, 111-118. doi:10.1044/10580360(2011/09-0087)

Rossetti, L. (2006). *The rossetti infant toddler-language scale: A measure of communication and interaction*. East Moline, Illinois: LinguiSystems Inc.

Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: A parent-mediated developmental model. *Journal of Autism and Developmental Disorders*, *37*, 1562-1575. doi:10.1007/s10803-006-0290-z

Schertz, H. H., Odom, S. L., Baggett, K. M., & Sideris, J. H. (2013). Effects of joint attention mediated learning for toddlers with autism spectrum disorders: An initial randomized controlled study. *Early Childhood Research Quarterly*, *28*, 249-58.

Shuler, C. (2009). *P*ockets of potential: Using mobile technologies to promote children's learning. *Joan Ganz Cooney Center*, (January), 1–56. Retrieved from papers://8823b2b3-0f26-4eac-b58e-76a95997f0e0/Paper/p762

Shuler, C. (2012). iLearn II: An analysis of the education category of Apple's app store, New York: *The Joan Ganz Cooney Center at Sesame Workshop*

Statista: The Statistics Portal (2015). *Number of apps available in leading app stores asof July 2015*. Retrieved from http://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/

Stevens, R., & Hall, R. (1998). Disciplined perception: Learning to see in technoscience. In M.Lampert & M. L. Blunk (Eds.), *Talking mathematics in school: Studies of*

teaching and learning (pp. 107-149). Cambridge, UK: Cambridge University Press.

Stevens, R., & Penuel, W. (2010, October). *Studying and fostering learning through joint media engagement*. Paper presented at the Principal Investigators Meeting of the National Science Foundation's Science of Learning Centers, Arlington, VA.

Stoner, J. B., Meadan, H., Angell, M. E., & Daczewitz, M. (2012). Evaluation of the parent-implemented communication strategies (PiCS) project using the multiattribute utility (MAU) approach. *Educational Assessment, Evaluation and Accountability, 24*(1), 57-73. doi: http://dx.doi.org/10.1007/s11092-011-9136-0

Striano, T., Chen, X., Cleveland, A., & Bradshaw, S. (2006). Joint attention social cues influence infant learning. *European Journal of Developmental Psychology, 3*,289-299.

Takeuchi, L., & Stevens, R. (2011). *The new coviewing: Designing for learning through joint media engagement*. New York, NY: The Joan Ganz Cooney Center at Sesame Workshop and LIFE Center.

Tannock R., Girolametto, L., & Siegel, L. S. (1992). Language intervention with children who have developmental delays: Effects of an interactive approach. *American Journal on Mental Retardation, 97*, 145-160.

Tsybina, I., & Eriks-Brophy, A. (2007). Current issues in research on children with expressive language delay. *Contemporary Issues in Communication and Science Disorders, 34*,118-132. doi: 1092-5171/07/3402-0118

Turnbull, K., & Justice, L. (2012). *Language development from theory to practice* (2nd ed.). Upper Saddle River, NJ: Pearson.

U.S. Department of Education, Office of Special Education Programs. (2007). *Annual report to Congress on the implementation of the Individuals with Disabilities Education Act*,*selected years, 1992 through 2006, and Individuals with Disabilities Education Act (IDEA) database*. Retrieved from http://tadnet.public.tadnet.org/pages/712

U.S. Department of Education, National Center for Education Statistics. (2013). *Digest of education statistics, 2012 (NCES 2014-015), Chapter 2*. Retrieved from: http://nces.ed.gov/fastfacts/display.asp?id=64

U.S. Department of Education, National Center for Education Statistics. (2011). *The Individuals with Disabilities Education Act (IDEA) Regulations: Part c.* Retrieved from: http://www2.ed.gov/policy/speced/reg/idea/part-c/index.html

Vallotton, C., & Ayoub, C. (2011). Use your words: The role of language in the development of toddlers' self-regulation. *Early Childhood Research Quarterly, 26*, 169-181.

Vallotton, C. D., Harewood, T. T., Ayoub, C. A., Pan, B. B., Mastergeorge, A. M., & Brophy-Herb, H. (2012). Buffering boys and boosting girls: The protective and promote effects of early Head Start for children's expressive language in the context of parenting stress. *Early Childhood Research Quarterly*, *27*, 695-707.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wendt, O. (2009). *Calculating effect size for single subject experimental designs: An overview and a comparison*. [PowerPoint slides]. Retrieved from http://www.campbellcollaboration.orgartman2/uploads/1/Wendt_calculating_effct_siz.pdf

World Health Organization. (2015). International classification of diseases, 10th revision. (ICD-10-CM F80.1) Retrieved from http://www.icd9data.com/2015/Volume1/290-319/30316/315/315.31.htm

Wright, C., Kaiser, A. P., Reikowsky, D. I., Roberts, M. Y., & Oetting, J. (2013). Effects of a naturalistic sign intervention on expressive language of toddlers with Down syndrome. *Journal of Speech, Language & Hearing Research*, *56*, 994-1008. doi:10.1044/10924388(2012/12-0060)

Wright, P. W., & Wright, P. D. (2014). *Wrightslaw: Special education law*. Hartfield, VA: Harbor House Law Press.

Yoder, P. J., Kaiser, A. P., & Alpert, C. (1991). An exploration study of the interaction between language teaching methods and child characteristics. *Journal of Speech and Hearing Research, 34*, 155-167.

APPENDIX A

PROCEDURAL CHECKLIST FOR THE JAML-FVET STUDY

Inclusion Criteria Checklist for the JAML-FVET Study

Directions: Here is a list of inclusion criteria to help you organize as you contact families to see if they meet the criteria for the study.

	Inclusion Criteria						
	Family						
	Date contacted						
1	The child is enrolled in the early intervention program with an Individual Family Service Plan (IFSP) or an Individual Education Plan (IEP)						
2	The child must speak English in the home						
3	The child is identified with an expressive language delay of 30% and/or a discrepancy of not less than one standard deviation between the expressive and receptive language score.						
4	The child has less than 50 words with less than five two-word production.						
5	Child must be between 30 months and 43 months of age at the start of the study.						
6	Parents must be willing to have interventionist in the home and attend individual trainings for the duration of the study.						
	Interested in the study and provided verbal permission for Yvette Evans to contact them by calling their phone.						

Exclusion Criteria

- There is a diagnosis of Autism Spectrum Disorder
- The child speaks a language other than English in the home
- The has a hearing impartment
- The child has impaired oral motor skills for speech, structural or neuromotor abnormalities that would impair his/her ability to produce speech.
- Inability to attend parent training or have interventionist in the home
- Children cannot be older than 44 months of age at the start of the study, or younger than 30 months

APPENDIX B

CONSENT TO PARTICIPATE IN RESEARCH

Consent To Participate In Special Education Research

Hello,

My name is Yvette Evans. You are invited to participate in a research study. I am working toward my doctorate degree in Special Education. This is a partial fulfillment of the requirements of the degree. Dr. Craig Blum is my Dissertation Chair. He is guiding me through this research project. This is a consent for participation your participation in this study. I will read this aloud as you follow along with your personal copy. This is different than giving permission for your child to participate we will be discussing the risks and benefits to your own participation rather than your child's. I will read this aloud as you follow along with your personal copy. After I finish reading, please ask any questions. It is important that you have an understanding of the purpose of the study, time allocated for the study, description of the study, your responsibilities in the study, the risk of being in the study, how I will protect your confidentiality, and your rights during the study.

Purpose of Study

The purpose of this research is to teach parents a strategy to work with their child with an expressive language delay using an iPad running the Make a Scene app. This is a parent-implemented intervention. This means you will be trained in an intervention and then implement with your child. The focus is teaching your child two new words that he/she has not used before that would help to expand their expressive language.

Procedures

If you agree to be in this study, your participation will involve the following:

1. The duration of the study will be approximately ten weeks
2. The researchers (two research assistants and myself) will come to your home twice a week for the ten weeks. The research assistant will be one of two graduate students from Illinois State University working on a degree in Communication Science Disorders or Special Education.
3. Yvette Evans will teach you a method to work with your child using the Make a Scene app to prompt the use of the two target words from your child and the same method during a routine of your choice (snack or play time). In addition, Ms. Evans will coach you throughout the intervention. You are not expected to memorize the method; Ms. Evans will provide you with instructions for you to use.
4. You are required to administer the intervention independently at least four times a week with your child at a time that fits into your schedule.
5. At each home visit, we will go through any questions that you have, followed you completing the intervention with your child as I observe and collect data on your implementation of the intervention. I will coach you through the intervention. Finally, I will provide you with any ideas to improve your implementation.
6. You will be asked to complete two survey's regarding your thoughts on the method and your child's participation with the use of technology. In addition,

you will be required to complete a checklist each time you implement the intervention with your child.

7. You will be observed periodically to assist you in correct implementation of the parent-implemented program and data will be collected during this time.

Participation and Withdrawal

1. Your participation is voluntary and you are free to decline participation without any consequences.
2. You are free to stop participation in the study at any time for any reason. You are free to skip any question, ask not to be observed, not to complete any required forms at any time during the study for any reason.
3. If you are uncomfortable with any of the training materials, or how to implement them with your child, you may ask for extra assistance or withdraw from the study.
4. As stated, there is no penalty if you do not want to participate in the study. I am not affiliated with your child's early education organization. If you withdraw the referring agency will not be notified.

Potential Risks to You

1. In any study there is a potential risk to the participants here are risk that is involved in this study;
2. You may feel emotional stress due to completing the intervention process with the researchers present.
3. You may feel responsible that if the intervention does not produce a positive outcome for your child.
4. You may feel pressure or stress to improve your child's language skills.
5. Your child will be exposed to various risks as part of participating in a parent-implemented research study and you may feel responsible for placing your child at risk.
6. While there will be built in protection of your confidentiality there is a risk of your identity being exposed.
7. Researchers will be in your home and you will lose some of your privacy.

Protection and Minimization of Risk

Minimize Risk of Emotional Stress:

1. Ms. Evans will provide you with all of the information regarding the study, discuss expectations, and provide you a timeline with clear instructions.

2. Ms. Evans will help to problem solve each intervention session, including behavioral techniques to support participation from your child. Ms. Evans will also provide you with instructions on each step of the intervention.

3. If you feel emotional stress (e.g. frustration, or learning fatigue) Ms. Evans will work with you to work to address your concerns.

4. To counter the risk of emotional stress of learning, the parents are provided with the Parent-Implementation Guide to use a resource as they implemented the intervention.

The guide is to serve as a visual support to reduce frustration. In addition, coaching occurs throughout the intervention. The parents are not expected to memorize the intervention or to conduct the intervention without the use of the parent guide. If the parent guide is not a viable support for the parent, the Co-PI will adjust the support to adhere to the parent's preferred mode of obtaining information (e.g. create a video, change the format of the parent guide, or develop an audio tape with descriptive details of the steps).

5. The parents are asked each session regarding their thoughts and perceptions regarding the implementation of the intervention, thus a constant check regarding emotional stress is built into this design

Minimize Risk of Confidentiality and Privacy

We will do everything we can to protect your privacy.

- To minimize this risk, any information regarding your or your child will not be shared beyond the two research assistants, Dr. Blum, and Ms. Evans.
- No information regarding your participation, withdrawal, or any other information at any time will be shared with the referring agency.
- Your name will be taken out and an assigned number is placed, instead of your name. This is as an identifying marker throughout the study. I will take your name out and place the identifying number in on each document, including all documents when you agree to participate. If you decide not to participate, I will give you back all documents that I have obtained thus far.
- The documents are kept in my locked file cabinet at Illinois State University. After the study is finished and I have completed the analysis, I will shred all paper documents after two years.
- It is the intent of the researcher to publish and/or share the results to other professionals; a pseudonym will be used for the reporting of all data, and there will be no specific reference that identifies where you live (e.g., data would be reported by saying this study took place in a Midwestern State).
- In addition, since we will be coming into your home, we want to make sure that we respect your privacy. We will schedule the visits during convenient times for you, so that you do not miss work or there is minimal interference with your daily life. We will call before our scheduled visits to make sure that the appointment still works in your schedule. We will not come to your home unless you confirm that the time for our appointment will still work with your schedule. After two missed visits, or if you do not confirm the appointment with us, then your participation in the study will cease.

Potential Benefit to You

There are benefits to participate in this study.

1. You may acquire a new skill to address your child's communication needs.

2. If your child improves, you may have a sense of emotional gratification associated with successful completion of the intervention.

Contact Information
If you have any questions or concerns about this study, or if any problems arise that I can address, my phone number is _____ and my email is _____.
If you have further questions or problems, please contact Dr. Blum at Illinois State University, _____ or email him at _____.
If you have any questions or concerns about your rights as a research participant, please contact the Illinois State University Institutional Review Board at _____ and their email is_____.

I do not wish to participate in the study:
I have read this informed consent form and have been given the opportunity to ask questions. I have decided I do wish to participate in this study. You do not have to sign this in order to refuse to participate.

Participant's signature_____ Date: _____

Participant's signature_____ Date: _____

Confirmation of Research Subject
I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study. You must sign here in order to participate in this study.

Participant's signature_____ Date: _____

Participant's signature_____ Date: _____

A signed copy of this consent form will be given to you at our next meeting.

APPENDIX C

PARENT PERMISSION FORM

Parent Permission for Your Child to Participate In Special Education Research

Hello,

My name is Yvette Evans. I am working toward my doctorate degree in Special Education and I am conducting a study in partial fulfillment of the requirements for the degree. Dr. Craig Blum is my Dissertation Chair. He is guiding me through this research project. I will read this aloud as you follow along with your personal copy. It is important that you have an understanding of the purpose of the study, time allocated for the study, description of the study, your responsibilities in the study, the risks and benefits of your child being in the study, how I will protect your confidentiality, and your rights during the study. After I finish reading, please ask any questions.

Purpose of Study

The purpose of this research is to evaluate the effectiveness of teaching parents a strategy to improve expressive language with their child with an expressive language delay. The strategy will incorporate known effective practice and the Make a Scene app on an iPad. This is a parent-implemented intervention. This means you will be trained in an intervention and then implement with your child. You will be assisted by Ms. Evans in how to do this effectively, but the responsibility for daily implementation will fall on you. The intervention is designed to be convenient for your daily life, and to provide you with the support you need to intervene with your child effectively. The focus of this parent-implemented intervention is teaching your child new words that he/she has not used before that would help to expand their expressive language.

What is Asked of Your Child?

1. The duration of the study will be approximately thirteen weeks, though may vary slightly depending on your child's responsiveness.
2. The intervention is designed to improve your child's expressive language.
3. Your child will be asked to work with you and the researchers (two research assistants and myself) in your home twice a week for the seven weeks (equivalent to approximately 14 sessions) for approximately 45 minutes. The research assistants will be two graduate students from Illinois State University working on a master's degree in Communication Science Disorders or Special Education.
4. We will expect your child to be able to sit for a duration of 10-15 minutes while participating in the activity and respond to your commands and follow simple directions using the iPad with the Make a Scene application (under your supervision). This activity is designed to be appropriate for children that are two to four years of age.
5. We will ask your child to participate in this method at least four times throughout the week at a time, at time that is convenient for your family and child.
6. Training and coaching is provided to you so you know how to respond to your child during the learning activity.
7. There are activities that take place on the iPad as well as activities that take place in a family routine.

8. Your child will be observed, and data will be collected on their expressive language progress, as well as background information such as age, language ability, ethnicity, disability, race, gender will be gathered for the purposes of the study.
9. A pre-intervention and post intervention-language survey (about your child) will be administered.
10. There will be a period of baseline data, which means that your child will not receive the intervention during that time. This period typically lasts for two to four weeks. This procedure is experimental, and this type of data collection it to help evaluate if the intervention is actually working.
11. Once your child has completed baseline, they will begin intervention, this period will last 6-8 weeks depending on how responsive your child is to the intervention.

Participation and Withdrawal

1. Your child's participation is based on you granting permission, but you are not required to grant permission.
2. You are free to stop your child's participation in the study at any time for any reason.
3. If you do not feel comfortable having your child performing any action or answering any questions, please say so, and feel free to stop intervention, data collection, or any procedure as soon as you feel uncomfortable with the procedure
4. If at any point, you believe that any intervention procedure is producing discomfort or not beneficial to your child you should stop procedure immediately.
5. You will be present during all interactions research staff have with your child, and if you feel your child is not benefiting, feeling discomfort, or you believe your child does not want to participate, you can stop the intervention immediately.
6. While most of the intervention will be carried out by a parent or guardian; for any demonstration of intervention by research staff with your child, you are required to be present.

Potential Risks to Your Child

1. Your child may get tired or hungry during the tasks.
2. Your child may feel emotional or upset when performing some of the intervention task. .
3. Your child may feel emotional stress due to completing the intervention process with the researchers present.
4. It is unknown if the child will make progress or respond to this intervention and the use of iPads is experimental, and its impact on young children needs more research.
5. Without adult supervision, iPads could pose safety threat to a young child.
6. If you allow the child to play with, use the iPad independently, or place it in an unsafe place where the child can access it while charging this can expose your child to a safety risk or hazard.

7. If you do not follow safety protocols outlined in the parent training, your child's participation in the study will be terminated and there is risk of losing the potential benefits under those circumstances.
8. There is a risk of breach of confidentiality or that that there is a violation of your privacy.
9. After two missed visits, or if you do not confirm the appointment with us, then your child's participation in the study will cease. Hence, failure to participate in the study comes with the risk of loss benefits outlined below.
10. Since this is a parent-implemented intervention, if you do not follow the instructions and coaching, there is a risk that your child may not receive the potential benefits.

Protection and Minimization of Risk

1. Your child can rest/take a break for a snack at any time,
2. You may tell the researchers at any time if you feel that your child needs to take a break or stop for the session.
3. The activity will be stopped if the child demonstrates resistance (e.g. the child will not stay seated, the child cries, and/or the child screams) or any other behavior that the parent states is resistance will be considered resistance.
4. You will identify behaviors and strategies though training to support your child effectively if they develop resistance.
5. No research staff will interact with your child without you being present.
6. If at any point you believe that any intervention procedure is producing discomfort, your child does not want to do any part of the intervention or activity, or it is not beneficial to your child you should stop procedure immediately.
7. All research staff will must stop a procedure with your child anytime they are directed to stop by you.
8. There is no penalty if you do not want to participate in the study, and any services you have now or in the future will not be withdrawn or affected for your non-participation.
9. The agency who referred you will not be informed of your decision to participate, not participate, or withdraw from the research study.
10. We have no affiliation with your child's early education organization.
11. Ms. Evans will not see your child for therapy in the future.
12. If you decide to withdraw your child from this study, the researchers will ask if the information already collected from your child can be used for the study.
13. We will make every effort to accommodate your child's learning experience throughout the intervention.
14. Even though there is little research on the use of iPad with young children, there are studies that support it along with guidelines established by the National Association of the Education for the Young Children that we will abide to during the study.
15. You are required to be with your child at all time while you are interacting with them on the iPad.

16. You will are required to only use the apps provided the iPad and not download and apps that may be harmful to your child. Password protection measures to prevent this and others use the iPad will be enabled.
17. The iPad is not for other uses such as searching the Internet.
18. The safety features enabled on the iPad before we give it to you. In addition, you will go through a training regarding the safe use of an iPad with young children before you are permitted to use it during intervention with your child.
19. The iPad is for parent or guardian interaction with the child in the study and for no other purpose (e.g., loan to a friend, a fiends use, siblings use, your personal use etc.)
20. For your child's safety, if you or anyone in your home, family member, friend etc. is observed violating any safety protocol, the intervention study will terminated and the iPad will be returned at that time.

Minimize Risk of Privacy and Confidentiality

We will do everything we can to protect your child's privacy.

1. Any private information (e.g., Name, address, email, phone number etc.) regarding your or your child will not be shared beyond the two research assistants, Dr. Blum, and Ms. Evans.
2. All data will be kept on password protected computer with no identifying information connected to it.
3. Any private information needed for record keeping will be kept in a file cabinet and not on a computer connected to the Internet.
4. Your child's name is replaced by an assigned number, instead of his/her name. This is as an identifying marker throughout the study. Ms. Evans will take your child's name out and place the identifying number in each document. If you decide not to participate, Ms. Evans will give you back all documents that I have obtained thus far.
5. The documents are kept in Ms. Evans and/or Dr. Blum's locked file cabinet. After the study is finished and I have completed the analysis, the will be shredded by research staff after 2 years.
6. It is the intent to publish and/or share the results with other professionals; a randomly selected fictional name will be used and at no time will your names or other personal be revealed.
7. Information that will be published is all data that includes demographic information, but no specifics about locality personal identification will be published or shared.
8. In addition, since we will be coming into your home, we want to make sure that we respect your privacy. We will schedule the visits during convenient times for your child to minimize interference with your child's daily life. We will call before our scheduled visits to make sure that the appointment still works in your child's schedule. We will not come to your home unless you confirm that the time for our appointment will still work with your child's schedule.
9. We will not share your home location or other information about your home or home life with anyone outside the research team.

10. Within the research team, we will only discuss information about the intervention, information relevant to successful outcomes for your child, and successful implementation of the study. We will not discuss extraneous private information that may observed because someone is in your child's home.
11. An exception to our promise of confidentiality is that we will report evidence of child abuse or neglect.

Potential Benefit to Your Child

1. It is possible your child will acquire new words in his/her verbal vocabulary to express wants and needs, and overall communication in the home between parent and child is improved.
2. Although this is not a direct benefit to your child, the results of the study may be useful to other parents, early educators, early interventionists.
3. The study may improve our knowledge of how to use technology improve expressive communication and advance research in this area.

Contact Information

If you have any questions or concerns about this study, or if any problems arise that I can address, my phone number is _____ and my email is _____. If you have further questions or concerns, please contact Dr. Blum at Illinois State University, _____ or email him at ____. If you have any questions or concerns about your rights as a research participant, please contact the Illinois State University Institutional Review Board at _____ and their email is _____.

PARENT PERMISSION OPTIONS

I **DO NOT** GIVE PERMISSION

I have read this parent permission form for my child to participate in a research project for special education and have been given the opportunity to ask questions. I **DO NOT** GIVE PERMISSION for my child to participate in the study (not signing is the same as not giving permission. You are not required to sign this document for refusal.

Parent or Guardian signature_____ Date: _____

I DO give Permission for my Child to be a Research Participant in this study

I have read this parent consent form for my child to participate in a research project for special education and have been given the opportunity to ask questions. I **DO** GIVE PERMISSION for my child to participate in the study. Your signature is required for parent permission.

Parent or Guardian signature_____ Date: _____

A signed copy of this consent form will be given to you at our next meeting.

APPENDIX D

LOAN AGREEMENT

Safety Training Procedures and iPad Loan Agreement

Please read the following information regarding the use of technology with young children. After you are finished reading, we will discuss key points. In addition, I will be happy to answer any questions that you have regarding the information provided. While there are advocates for the use of technology with young children, there is controversy about its developmental appropriateness for young children and possible deleterious effects. Consequently, the National Association for the Education of Young Children (NAEYC) and the Fred Rodgers Center (2012) created a position statement on the use of technology and media for young children. The position statement discusses controversial issues such as screen time for young children. One of the key points outlined in the NAEYC statement is that content matters, developmentally appropriate practice is essential. "Interactive Technology and media are tools that can promote effective learning and development when they are used intentionally by early childhood educators, within the framework of developmentally appropriate practice (NAEYC 2009). In order to provide guidelines, NAEYC (2012) developed the following recommendations for the use of technology and/or media with young children:

1. Make sure the technology is used in developmentally appropriate ways, giving careful attention to the appropriateness and the quality of the content, the child's experience, and the opportunities for co-engagement.
    a. Developmentally appropriate practice, often shortened to DAP, is an approach to teaching grounded in the research on how young children develop and learn and in what is known about effective early education. Its framework is designed to promote young children's optimal learning and development.
2. It is important to provide a balance of activities in programs for young children, and use the technology with intentionality as they actively engage with those around them and their environment.
3. Limit the screen time and prohibit the passive use of television, videos, DVDs, and other non-interactive technologies and media in early childhood programs for children younger than 2, and discourage passive and non-interactive uses with children ages 2 through 5.
4. Educate and guide parents in the use of technology, including the screen time recommendations from public health organizations for children from birth through age 5 when determining appropriate limits on technology and media.
5. Screen time estimates should include time spent in front of a screen at the early childhood program and, with input from parents and families, at home and elsewhere. (p. 11)

The use of technology requires careful deliberation by the early educator before they consider instructing the caregivers. It is essential that developmentally appropriate practices (DAP) used in planning and implementing technology-based activities. NAEYC (2009) highlights key points of DAP for early educators to follow with the use of technology:

- The technology chosen must be appropriate to a child's current development.

- The use of the technology represents socially and culturally responsive teaching practices.
- The technology chosen must challenge the children enough to promote progress in the natural environment.

In addition to the NAEYC, the Division of Early Childhood (DEC) within the Council of Exceptional Children has specific standards and recommended practices for the use for technology for young children. According to DEC (2007), technology should be used to increase children's access to learning activities in the natural environment as well as to enhance child development in the motor, cognitive, communication, social, adaptive, life skill, play, health, and academic domains. Despite these guidelines, there is limited research in this area and further investigation of the use of technology in working with young children and their families is necessary. The intervention that I will teach you follows all of the above guidelines and suggestions for the use of mobile technology with young children.

iPad Safety and Use Agreement

One Apple iPad and charger are being lent to the parent and are in new condition. It is the parents' responsibility to care for the equipment and ensure that it is retained in a safe environment. This equipment is, and at all times remains, the Property of Illinois State University and is herewith lent to the parent for study purposes only to the extent of the JAML-FVET study. Inappropriate use of the machine may result in the parent losing their right to use the iPad, and participate in the experiment. We are disabling all features except the installed apps, nonetheless, would like to review these requirements with you and ask you acknowledge your responsibilities and the importance of safety.

<u>Responsibilities Outlined</u>

- I will not deface or destroy this property in any way. The equipment will be returned when requested.
- I will only use the iPad for the discussed amount with my child only for the purpose of the study.
- I will only use the Make a Scene Application unless otherwise instructed by the Co-PI
- I will not attempt to add, delete access, or modify other user's accounts on the iPad or any of the current apps.
- Identification labels have been placed on the iPad. I will not remove or modified them. If they become damaged or missing I will contact the Co-PI for replacements. Additional stickers, labels, tags, or markings of any kind are not to be added to the machine.
- I agree to use best efforts to assure that the Illinois State University's property is not damaged or rendered inoperable by any such electronic virus while in my possession.
- **I will supervise my child's use of the iPad at home.**
    - My child will be supervised at all times while on the iPad
    - All cords and plugs will be stored in a place my child cannot reach and under no circumstances and any conditions will my child be permitted access to the cord or the plug.
    - The iPad will be stored in a place my child cannot reach

    - I will only allow my child the use of the iPad for the purpose of this study with the Make a Scene application while I am working with them.
    - I will follow the required amount of time for my child's interaction with the iPad through the duration of the intervention.
    - I acknowledge that an iPad can be dangerous device if not supervised by an adult, that I _____ and _____ will be the only adults who use this iPad with my child for any reason. All adults must undergo this safety training and be a participant in the study in order to use the iPad with my child.
- I will not let my child play with the iPad alone.
    - I will not let my child play with plug or cord at all or plug the iPad into the wall for charging
- I will not attempt to repair the iPad, nor will I attempt to clean it with anything other than a soft, dry cloth.
- I will make sure I recharge the iPad battery somewhere out of the reach of my child.
- I will treat the iPad with care by not dropping it, getting it wet, leaving it outdoors, or using it with food or drink nearby.
- I will not lend the iPad to anyone, not even my friends or family; it will stay in my possession at all times.
- I will not use my iPad with personal email accounts. Ex: Gmail, Hotmail.
- I will not remove programs or files from the iPad.
- I will not give personal information when using the iPad.
- I will keep the iPad in a protective case at all times.
- I will not use the Internet while on this iPad.

By signing this agreement, I will abide by all of the above provisions for the use of the iPad._____ _____

Parent Signature Date

_____ _____

Parent Signature Date

_____ _____

Co-PI Signature