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Facilitating Language Development in Late-Talking Toddlers: A Study of Caregiver Training and Intervention Effectiveness

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FACILITATING LANGUAGE DEVELOPMENT IN LATE-TALKING TODDLERS: A STUDY OF CAREGIVER TRAINING AND INTERVENTION EFFECTIVENESS

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ABSTRACT

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The prevalence of late language emergence (LLE) in young children is high, comprising 10 to 20% of toddlers. Late language emergence refers to children who do not use at least 50 single words and 2-word phrases at the age of two. Current best practices for the under-three population with or at risk of having disabilities include the use of family-centered services in early intervention. One method of EI for LLE is caregiver-implemented interventions, where the caregiver learns techniques or strategies to help support their child's expressive language development. This service delivery model prioritizes building the family's capacity to support their child's development in natural environments and during natural routines. This study investigated the effectiveness of training caregivers to deliver an expressive language intervention with their late-talking toddlers. The intervention, Vocabulary Acquisition and Usage in Late Talkers (VAULT), uses principles of statistical learning to promote expressive language. Using low-pressure interactions, the intervention agent models target words at a very high frequency in varied contexts.

The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers. The study used a multiple-probe multiple baseline

across participants design with three caregiver-child dyads. Caregivers were trained online through video-conferencing to use the six components of VAULT with their late-talking children, then recorded themselves playing with their children while practicing the components of VAULT twice per week. The caregiver's use of the VAULT components were measured and reported to the family in weekly performance-based feedback provided via electronic communication. Visual analysis consistent with single-case research methodology was used to determine the effectiveness of the training and performance-based feedback on the caregivers' use of the VAULT components and changes in the children's expressive vocabulary. In addition, semi-structured interviews were conducted to investigate caregiver perceptions of the VAULT intervention.

The findings revealed caregiver success in implementing VAULT's focused stimulation component and improvements over baseline in using the other five VAULT components. One child produced a target word during a maintenance session, and all caregivers reported changes in their children's prelinguistic skills. Additionally, all three caregivers found the intervention to be meaningful. This study highlights the feasibility of training caregivers to implement this expressive vocabulary intervention with their late-talking toddler. This study also includes implications for future practice and suggestions for future research.

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CHAPTER 1

INTRODUCTION

Language acquisition is a complex process that primarily occurs without our awareness. Children are bombarded by input from their environment but seemingly pick up language rules and vocabulary with little effort. Through interactions with caregivers and other children, infants and toddlers track the structure and learn information about language without explicit instruction (Plante & Gómez, 2018; Romberg & Saffran, 2010). Infants and toddlers use multiple cues from their environment--auditory, but also what they can see, touch, and interact with--to organize language in a way they can begin to use it (Romberg & Saffran, 2010).

Within the first year of life, typically developing infants begin to use predictable and consistent syllables they have extracted from adult models of language (Lany & Saffran, 2010). Soon after their first birthday, children begin to produce single words. The implicit learning performed in language acquisition is done at such a rapid pace that typically developing children's vocabularies increase from only a few words around 12 months of age to around 1,000 words at 3 years old. Typically developing children use many two-word phrases by 2 years old and three- or more-word phrases by 3 years old (Paul, 1996). There is wide variability in how and when children develop language, but parents are often concerned when it is not developing as expected.

Late Language Emergence

Late language emergence (LLE), more commonly known as "late-talking," refers to a delay in spoken language in young children that occurs when a child has not demonstrated

expected communication milestones by 18-24 months (Zubrick et al., 2007). The criteria for identifying a child with LLE within the literature varies, but one of the most commonly accepted definitions of LLE is a child with fewer than 50 words and a lack of two-word phrases at 2 years old (Hayiou-Thomas et al., 2014; Kelly, 1988; Paul, 1993). Late talkers demonstrate age-expected skills in other areas of development (e.g., cognitive skills, gross and fine motor skills, etc.), and the language delay cannot be explained by other diagnoses such as autism spectrum disorder or hearing loss (DeVeney et al., 2017). Research is unclear on the definition of LLE as solely an expressive language delay or a mixed receptive and expressive language delay; both populations of toddlers have been included in research on LLE (Fisher, 2017). It is relatively common, with approximately 10-20% of children exhibiting LLE (Collisson et al., 2016; Zubrick et al., 2007), which increases to 35-40% for twin children (Taylor et al., 2018).

Unfortunately, the cause of LLE in the absence of other diagnoses is unknown. Research into identifying potential risk factors for LLE has given conflicting results. In several studies, gender (specifically, male) and a positive family history of LLE have been associated with late talking (Collisson et al., 2016; Zubrick et al., 2007). However, a meta-analysis on risk factors for late talkers revealed that gender and family history had a nonsignificant effect on late language emergence (Fisher, 2017). In addition, the same meta-review found that a child's receptive language skills impacted their expressive language skills, while socioeconomic status had little impact (Fisher, 2017).

The limited and conflicting information on which children will show delayed expressive language skills is further complicated by determining which children's language skills catch up without intervention. At 2 years of age, it is challenging, if not impossible, for clinicians and researchers to determine which children with LLE will develop typical language skills. As many

as 60% of children diagnosed with LLE go on to score within an average range on language measures by preschool (DeVeney et al., 2017). However, research has indicated that the later a child is identified as having language difficulties, the more likely it is that those difficulties will persist throughout their childhood (Duff et al., 2015; Hayiou-Thomas et al., 2014; Paul, 1993).

There is consensus in the research that persistent delays in expressive language skills have risks of adverse long-term outcomes in communication, literacy, and academic achievement (DeVeney et al., 2017; Duff et al., 2015). If LLE persists into the school years, a child is often diagnosed with developmental language disorder (Kautto & Mainela-Arnold, 2022). Developmental language disorder, previously referred to as specific language impairment, may share the same or similar deficits as LLE in the early ages. However, recent research suggested that the core deficit in procedural memory difficulties in developmental language disorder may not be present in LLE (Kautto & Mainela-Arnold, 2022). Other research suggested that children who show persistent language difficulties at 4 years old continue to have delays in language at later ages (Duff et al., 2015), so it may be the core deficits in developmental language disorder that cause later language difficulties rather than solely the fact that a toddler did not begin to use words at the same time as their age-matched peers.

Researchers and early interventionists have identified several protective factors that, when used, can help encourage language development in young children. For example, Collisson et al. (2016) found that the earlier families read to their young children, the less likely they were to have later difficulties with expressive vocabulary. They also identified the use of frequent play opportunities and a child attending a childcare center as protective factors against LLE (Collisson et al., 2016). Other factors positively associated with language development include frequent caregiver-child interactions, caregivers' responsiveness, and quality linguistic input

(Roberts & Kaiser, 2012). Unfortunately, some toddlers will show delayed verbal communication skills despite access to a language-rich environment and caregivers' use of known protective measures.

Early Intervention

The Individuals with Disabilities Education Act (IDEA) is the federal law that mandates services for children and students with disabilities (IDEA, 2004). More specifically, Part C of the IDEA funds and assists states in providing early intervention services for infants and toddlers with disabilities and their families from birth to 2 years old. Early intervention services are designed for the needs of young children with a disability in physical, cognitive, communication, social-emotional, or adaptive development (IDEA, 2004). The program aims to provide eligible children and their families with the necessary support and services to facilitate their development. This federal legislation requires that states provide a comprehensive system of services that includes screening and evaluation, family-centered services, Individualized Family Service Plans, direct services, service coordination, and case management.

Family-Centered Practices

The Division for Early Childhood (DEC) is a professional organization for those working with families and young children with disabilities. In order to support families and advance the development of children at risk of developmental delays or disabilities, the DEC advocates for evidence-based practices and policies. Their *Recommended Practices* (Division for Early Childhood, [DEC] 2014) provides guidance to early intervention providers and families on best practices for improving outcomes for young children with disabilities. Two topic areas of DEC's *Recommended Practices* that are particularly relevant to this dissertation include providing early intervention services in the child's natural environment and emphasizing family-centered

practices (DEC, 2014). The DEC's *Recommended Practices* for the environment where young children receive services align with the IDEA requirement that early intervention services be provided in natural environments to the maximum extent possible (IDEA, 2004). The IDEA specifically includes the child's home as a natural environment, but also states that services may be provided in other childcare settings where typically developing children have access (IDEA, 2004). Similarly, DEC's *Recommended Practices* emphasizes providing services in natural environments and during naturally occurring activities in order to encourage the child and caregiver's participation in meaningful learning experiences (DEC, 2014).

Family-centered practices, defined as the active participation of caregivers in planning and implementing services, are a fundamental component of early intervention (DEC, 2014; IDEA, 2004; Dunst et al., 2014; McCarthy & Guerin, 2022). This is based on the belief that young children are best supported within the family using methods of collaboration between interventionists and caregivers (McCarthy & Guerin, 2022). The DEC's *Recommended Practices* prioritize family-centered practices through responsive, respectful, and individualized services. It emphasizes the importance of using evidence-based interventions, services, and supports designed to build the caregivers' capacity to support their child through collaborative goal-making and implementation of services (DEC, 2014).

Models of Early Intervention

Clinician-implemented services are a traditional approach to LLE in early intervention. In this model, the speech-language pathologist (SLP) provides intervention services directly to the child, with minimal caregiver involvement (Zubrick et al., 2007). These interventions are often individualized to the child's specific needs and may involve various strategies and techniques to

improve their language skills. Clinician-implemented services can be provided in various settings, but they are most often thought of as clinic- or school-based.

One way for early interventionists to adopt family-centered practices is to use a caregiver-implemented model of services. In caregiver-implemented services for LLE, an SLP trains, coaches, supports, and provides feedback to caregivers implementing the intervention (DeVeney et al., 2017). Caregiver-implemented services are often provided in natural settings during natural routines, aligning well with both DEC *Recommended Practices* and the IDEA's intent for family-centered services (DeVeney et al., 2017).

Vocabulary Acquisition and Usage for Late Talkers

Vocabulary Acquisition and Usage for Late Talkers (VAULT) (e.g., Alt et al., 2014) is a clinician-implemented intervention for LLE. In VAULT, clinicians model target words at a high frequency in various linguistic contexts (e.g., Alt et al., 2020). The goal of VAULT is to improve the child's expressive vocabulary by targeting words important to the child and family. Several studies on VAULT have focused on SLP implementation of its principles while measuring child outcomes on expressive vocabulary. However, only one feasibility study examined how well caregivers are able to use VAULT with their late talking toddlers (Mettler et al., 2022).

While implementation by SLPs has been successful for LLE, specifically with the VAULT protocol, there is limited information on caregiver implementation of VAULT. Mettler et al. (2022) conducted an early feasibility study on training caregivers to use the intervention. The researchers trained caregivers virtually on the VAULT components and provided weekly live virtual coaching sessions. This early study is promising because each caregiver used VAULT principles with fidelity early in the study, and changes in the children's expressive vocabulary were observed. However, Mettler et al. (2022) used only components of a multiple

baseline design, limiting the study's methodological use of control. In addition, Mettler et al. (2022) utilized solely live coaching sessions to measure changes in caregiver implementation, with the caregivers verbally reporting that they completed home practice. Therefore, questions remain regarding how to best teach and coach caregivers in implementing the intervention with their child.

Statement of the Problem

While some toddlers with LLE eventually catch up to their peers, many children continue to exhibit language difficulties well into their school years and are at a higher risk for persistent language difficulties. Unfortunately, it is difficult for early childhood professionals to predict which late talkers will improve their language skills without intervention (Hayiou-Thomas et al., 2014). Therefore, providing access to evidence-based early intervention is critical for all toddlers with LLE, as early language development significantly impacts a child's long-term language skills.

Historically, SLPs have been the primary intervention agent for LLE interventions. However, caregiver-implemented interventions may be more appropriate for children under the age of 3 because they align more closely with the IDEA's (2004) requirements for family-centered practices. Following the IDEA (2004) requirements and DEC guidelines can improve outcomes for children and families and lead to more successful interventions. Therefore, it is essential that LLE interventions utilize family-centered practices in early intervention, including providing services in natural environments with familiar caregivers.

Purpose of this Study

Caregiver-implemented interventions for LLE are understudied, especially given how common LLE is among 2-to-3-year-olds. This dissertation attempted to fill a gap in research on

interventions for LLE by using a multiple-probe, multiple-baseline design examining the ability of caregivers to implement VAULT components through training and frequent performance-based feedback. The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers.

Research Questions

There were four research questions that guided this dissertation:

Q1 Is there a functional relation between training and feedback on the increased level of caregivers' use of the VAULT focused stimulation dose rate at home with children who are late talkers?

Q2 To what extent do caregivers achieve fidelity to the other five components of VAULT during the course of the intervention?

Q3 To what extent do the late talking children learn the target words during the course of the intervention?

Q4 To what extent did the caregivers find the VAULT intervention to be valuable and practical?

Hypotheses

The hypotheses for the research questions were:

H1 There is a functional relation between the training and feedback on the increased caregiver use of VAULT's focused stimulation dose rate.

The hypothesis for the first research question was that there is a functional relation between the training and coaching provided to caregivers on the VAULT focused stimulation dose rate and the increased use of it during play sessions with their child. This means that after the caregivers participate in the VAULT training, they will be able to use the dose rate successfully when the researcher gives consistent performance-based feedback. This hypothesis

was based on studies of other successful caregiver-implemented interventions for children with LLE and other communication disorders (Carson et al., 2022; McDonald et al., 2019; Mettler et al., 2022; Roberts & Kaiser, 2015).

H2 When the caregivers receive training and performance-based feedback on the other five VAULT components, they will demonstrate the use of the components during their play sessions with their child.

Similar to achieving fidelity to the VAULT dose rate, it was hypothesized that caregivers will be able to successfully use all of the VAULT components during play sessions with their children after receiving training and performance-based feedback. The performance-based feedback included information on how the caregivers use the other five components successfully. This hypothesis was based on the Mettler et al. (2022) study in which caregivers used all components during a live coaching session.

H3 When the caregiver's use of VAULT principles increases, there will be an increase in the number of target words spoken by the child.

If the caregivers successfully implement VAULT components with fidelity, it was hypothesized that there will be an increase in the number of target words spoken by the child during the play sessions. This hypothesis was based on previous studies of VAULT in which the late talking toddlers showed an increase in their expressive vocabulary during the intervention (Alt et al., 2014, 2020, 2021; Munro et al., 2021; Ng et al., 2020). Conversely, it was expected that if the caregivers do not implement the components of VAULT, the child's verbal production of the selected target words will not increase.

H4 Caregivers will find VAULT valuable because it prioritizes vocabulary that is meaningful to their lives and can be used in their regular routines and activities.

The third and final research question is a social validity question intended to be open-ended to learn about the caregivers' perspective of VAULT. The researcher anticipated that the

caregivers will find the intervention meaningful because it prioritizes the vocabulary they have selected and is used in natural activities within their homes. The researcher also expected to obtain information on how VAULT components can be used in their daily lives.

Rationale

Vocabulary Acquisition and Usage in Late Talkers has been established as an effective intervention for late talkers during their toddler years in increasing their expressive vocabulary (Alt et al., 2014, 2020, 2021; Munro et al., 2021; Ng et al., 2020). In the clinician-implemented studies of VAULT, the target words were often chosen in part by caregivers, but other than that, caregivers have little involvement in the intervention. However, Part C of the IDEA (IDEA, 2004) and the DEC *Recommended Practices* (DEC, 2014) support caregiver-implemented interventions as one method of family-centered practices for young children. Mettler et al. (2022) first attempted to address the gap in research regarding caregivers' ability to implement VAULT, but questions remain regarding the feasibility of the intervention and best practices for implementation.

Researcher Stance

The researcher earned a Master's Degree in Communication Sciences and Disorders and works as an SLP with infants and toddlers in early intervention. As an SLP in EI, the primary responsibilities are to provide evidence-based early intervention services to young children with delays or disabilities and their families. In doing so, the researcher has experience working with children with LLE and their families, providing general language stimulation and focused stimulation techniques. In addition, the researcher uses family-centered services by providing caregiver training on intervention techniques and strategies. She prioritizes responsive intervention intended to empower caregivers.

Definition of Terms

Caregiver-implemented interventions: Caregiver-implemented intervention refers to a treatment approach that involves teaching caregivers to provide effective support and intervention for a child with disabilities. As it relates to LLE, caregivers are trained and coached by an SLP to deliver specific interventions or techniques to their child in the home or community settings (DeVeney et al., 2017).

Family-centered services: Family-centered services in early intervention refer to an approach to providing services to children with disabilities and their families. Family-centered services focus on collaborating with families to identify their needs and priorities and provide individualized intervention and support to the family (McCarthy & Guerin, 2022).

Late-language emergence: Late language emergence (LLE), also known as late talking, occurs when a child has not demonstrated expected communication milestones by 18-24 months (Zubrick et al., 2007), specifically fewer than 50 words and a lack of 2-word combinations at 2 years old (Paul, 1993). Children with LLE have age-expected skills in other developmental domains (Zubrick et al., 2007), and delay in language cannot be explained by another diagnosis, such as autism spectrum disorder or hearing impairment (DeVeney et al., 2017).

Part C of the Individuals with Disabilities Education Act (IDEA): Part C of the IDEA is a federal program in the United States that provides early intervention services for infants and toddlers with disabilities or developmental delays (IDEA, 2004).

Performance-based feedback: Performance-based feedback provides specific information about an individual's performance based on observable behaviors, actions, or outcomes (Barton et al., 2013).

Play: In the context of this study, play is defined as the caregiver's and child's mutual engagement in age-appropriate activities that are interesting to the child (Lifter et al., 2011).

Virtual training: In this study, virtual training is provided on a secure online platform that allows for real-time interaction between the researcher and participants in order to gain information and knowledge. This synchronous interaction parallels in-person training (Akamoglu et al., 2020).

Vocabulary Acquisition and Usage in Late Talkers (VAULT): When implementing VAULT, the intervention agent (either clinician or caregiver) models target words at high frequencies in a variety of linguistic contexts during play. Each target word is modeled in a grammatical utterance, and the child is not required to imitate the word during the sessions. The goal of VAULT is to increase the child's expressive vocabulary (Alt et al., 2014, 2020).

List of Acronyms

CDI: MacArthur-Bates Communication Development Inventories

DEC: Division for Early Childhood

EMT: enhanced milieu training

FCEI: family-centered early intervention

IDEA: Individuals with Disabilities Education Act

LLE: late language emergence

MCHAT: Modified Checklist for Autism in Toddlers

SLP: speech-language pathologist

VAULT: Vocabulary Acquisition and Usage in Late Talkers

Conclusion

According to the IDEA (2004), early intervention services should prioritize using family-centered practices. These services are critical in addressing early language gaps in children who demonstrate LLE, but unfortunately, many current LLE interventions are intended to be implemented by an SLP or other early interventionists. The shortage of evidence for caregiver-implemented interventions specifically for LLE has left a research-to-practice gap in feasible ways to train caregivers to implement interventions for this population. Because late talkers comprise approximately 10-20% of the toddler population, this gap is important for early interventionists to address. This dissertation explored the caregivers' use of the VAULT intervention for LLE and the subsequent impact on expressive vocabulary.

CHAPTER II

LITERATURE REVIEW

Late language emergence (LLE) refers to children who do not use at least 50 single words and two-word phrases at the age of 2 in the absence of other diagnoses. The cause of LLE is unknown, but it is relatively prevalent, occurring in approximately 10-20% of toddlers (Collisson et al., 2016; Desmarais et al., 2008; Paul, 1993; Zubrick et al., 2007). Late talkers exhibit typical development for their age in other domains (such as cognitive, gross, and fine motor skills, etc.), and their delayed language acquisition cannot be attributed to other conditions like autism spectrum disorder or hearing impairment (DeVeney et al., 2017).

Various interventions are available for LLE, with most of them delivered by an SLP within a clinic setting. In addition, the majority of research on interventions for LLE has focused on SLPs as the primary intervention provider rather than caregiver-implemented interventions. However, caregiver-implemented interventions may be more appropriate for children under 3 years old because they align more closely with Part C of the IDEA and the DEC's *Recommended Practices* for family-centered services (DEC, 2014; IDEA, 2004). Given the limited research on caregiver-implemented interventions for LLE, this study aimed to understand: (a) how online caregiver training on VAULT with weekly performance-based feedback can be implemented; (b) how caregivers' use of the VAULT principles improves their child's expressive vocabulary; and (c) whether caregivers find the VAULT intervention to be meaningful.

This chapter will review the literature regarding family-centered early intervention (FCEI) in the United States, evidence for caregiver-implemented interventions, virtual services

in early intervention, and feedback to improve performance. Empirical evidence for LLE interventions and the VAULT intervention will also be examined. The chapter will conclude with a discussion of the theoretical framework for the VAULT intervention.

Late Language Emergence

Late language emergence, also known as late talking, refers to children's delayed onset of language development. While every child develops at their own pace, certain developmental milestones in communication are generally expected at different ages. Late language emergence occurs when a child uses fewer than 50 words and lacks two-word phrases at 2 years old (Hayiou-Thomas et al., 2014; Kelly, 1988; Paul, 1993). By definition, children with LLE demonstrate age-expected skills in other developmental domains, and the delay in expressive language is not due to other diagnoses (DeVeney et al., 2017). Late language emergence is relatively common, with studies suggesting that 10-20% of young children experience a delay in language development compared to their peers (Collisson et al., 2016; Zubrick et al., 2007). This means that at least 1 child may experience difficulty acquiring language for every 5 to 10 children.

Many children with language delays will catch up to their typically developing peers, but it is important to recognize that some children will require ongoing intervention and support to acquire language. Approximately 60% of children exhibiting LLE will go on to develop typical language skills (DeVeney et al., 2017). However, it is difficult for early intervention providers to identify which children will require services to acquire language. A delay in communication can have a significant impact on the child’s overall development. Children who struggle learning to acquire language may experience later difficulties in communication and literacy skills (DeVeney et al., 2017; Rescorla, 2002, 2009).

Research has shown promising effects in improving the expressive language of late talking toddlers. A systematic review of interventions for LLE found that treatment can improve outcomes on formal language measures, target word use, and mean length of utterance with medium to large effect sizes (Cable & Domsch, 2010). A more recent systematic review found that 93% of reviewed studies reported improvements in expressive vocabulary, and some also reported improvements in receptive vocabulary (Carson et al., 2022). Several language-enhancing techniques are commonly used and studied in the literature, including enhanced milieu strategies (Hancock & Kaiser, 2006), generalized language stimulation (Delaney & Kaiser, 2001), and focused stimulation (Girolametto et al., 1996b). It is important to note that these methods or strategies are not necessarily mutually exclusive and can be combined to support language acquisition.

Bilingualism and Language Development

Bilingualism, the ability to speak and understand two languages, has been a topic of interest in the field of language development and delays (Byers-Heinlein & Lew-Williams, 2013). One misconception and commonly held concern by caregivers is the notion that dual-language learning might cause confusion or language delays in children (Hay et al., 2021). Contrary to this misconception, research suggests that bilingualism does not lead to language delays but may increase linguistic flexibility. Language disorders occur in bilingual children at the same rate as monolingual children (Bedore & Peña, 2008; Fibla et al., 2022), and dual-language learners achieve the same language milestones as their monolingual peers (Byers-Heinlein & Lew-Williams, 2013). A bilingual child might demonstrate a smaller vocabulary in each language because their exposure to the languages is split, meaning they hear vocabulary words less often in one language than a monolingual child (Côté et al., 2022). However, when

languages are considered together, bilingual children tend to have similar vocabularies as monolingual children and meet typical language development milestones (Byers-Heinlein & Lew-Williams, 2013; Côté et al., 2022).

Family-Centered Early Intervention

The IDEA of 2004 is the federal law in the United States that mandates the provision of special education and related services to children with disabilities. Part C of the IDEA (2004) pertains to early intervention services for infants and toddlers with developmental delays or disabilities or those at risk of developmental delay or disabilities and their families. It provides federal funding to states to support developing and implementing comprehensive and FCEI. The early intervention services are designed to promote the child's development and improve the family's capacity to support their child. Part C of the IDEA requires that states establish a comprehensive, multidisciplinary, and individualized evaluation process to determine a child's eligibility for services. If a child is found eligible, an Individualized Family Service Plan is developed in collaboration with the child's family to identify their strengths, needs, and services that will be provided (IDEA, 2004).

One of the critical principles of IDEA is that early intervention should be family-centered, meaning that services should be designed to support the needs and goals of the child and their family. Family-centered early intervention services involve working collaboratively with families to identify their concerns, priorities, and resources and to develop a plan that meets the needs of the child and the family. Family-centered practices described in Part C of the IDEA (2004) include:

1. Family involvement in planning and decision-making: Parents are considered equal partners in the planning and decision-making process for their child's early

intervention services. They are involved in identifying their child's strengths and needs and in developing an Individualized Family Service Plan that describes the goals and services that their child will receive. Families are encouraged to participate in service delivery to promote their child's development and to learn strategies for supporting their child's progress. In addition, families are encouraged to provide feedback on the service delivery process to ensure that services meet their needs and their child's needs (DEC, 2014; Epley et al., 2011; IDEA, 2004).

2. Culturally and linguistically responsive services: Part C services must be responsive to the cultural and linguistic diversity of the families they serve. Early intervention providers should work to provide families services in their preferred language to ensure that communication is effective and accessible. In order to provide responsive services, early intervention providers need to be aware of cultural norms, beliefs, and values that may impact how families view disability and how they approach care and education (DEC, 2014).
3. Support for family well-being: Part C services are designed to support the whole family's well-being, not just the child with a disability. They are based on an approach that recognizes families' vital role in their child's development. Early intervention providers should offer resources and support to help families cope with the stress and challenges of caring for a child with a disability and to promote their overall physical and emotional health (Bailey et al., 1998; Dunst et al., 2007).
4. Intervention services in natural environments: Part C services should be delivered in natural environments, such as the family home, community settings, and other places where the child and family regularly participate. Natural environments provide

> opportunities for children to learn and develop in the context of their everyday experiences. This helps to ensure that services are relevant and meaningful to the family's daily life. In addition, providing services in natural environments helps promote the child's inclusion in their community, helps promote family involvement in the service delivery process, and helps promote the use of natural supports and resources (DEC, 2014).

Early intervention services under Part C of the IDEA are provided through a collaborative process between families, service providers, and other professionals. This process ensures that families actively participate in their child's early intervention. Collaboration involves sharing information, resources, and expertise among families and professionals from different disciplines in an effort to develop and implement services for the child and family (Dunst, 2002). The service providers involved with families depend on their needs and can include SLPs, physical therapists, occupational therapists, developmental interventionists, early childhood special educators, nutritionists, and others. Additionally, services are designed to support families in becoming advocates for their child's needs, and families should be provided with support and training to help them understand their child's disability. This can include early childhood professionals providing training and coaching on accessing community resources and navigating the early intervention and special education systems.

According to the DEC *Recommended Practices*, FCEI services are designed to address the needs and priorities of the whole family, recognizing that families are a child's primary source of support and learning (DEC, 2014; Dunst, 2002). These services are based on the understanding that families are experts on their children and that they should be the primary decision-makers in the services and supports provided. Family-centered services are designed to

empower families to make informed decisions and to support their children's development and learning (DEC, 2014).

The DEC *Recommended Practices* (2014) provide guidance for early intervention professionals on implementing effective FCEI services. First, providers should establish positive, collaborative relationships with families based on mutual trust and respect. This involves engaging families in ongoing communication and supporting their involvement in the decision-making process. Professionals should always partner with families to identify their priorities, concerns, and resources. Second, families should receive services responsive to their cultural and linguistic backgrounds. In order to do this, early intervention providers need to understand and respect the diversity of families and ensure that services are both accessible and relevant. Furthermore, family-centered services should be flexible and responsive to families' changing needs and priorities. Fourth, family-centered services should empower families to make informed decisions about their child's development and learning. Finally, early intervention providers should provide ongoing support to families through frequent communication and progress monitoring. By implementing these FCEI practices, practitioners can support families in promoting their child's development and achieving positive outcomes for the whole family (Epley et al., 2011; Guralnick, 2011).

Research has consistently supported caregiver training as a family-centered practice in early intervention services. Training caregivers in intervention techniques or strategies can build the caregivers’ ability to provide ongoing support to their child without the early intervention provider present, enabling the child to learn in a variety of settings (Dunst et al., 2014). Positive child outcomes in their communication skills have been associated with caregiver training (Roberts et al., 2019). In addition, caregivers who participate in caregiver training sessions

generally report that early intervention meets their needs and are satisfied with the services they receive (Epley et al., 2011).

The most common service location for early intervention services is the family's home. Home visits allow early intervention providers to better understand the family's environment, routines, and support systems and then individualize services to meet the specific needs of the child and family. However, in some cases, early intervention services are not able to be provided at home. When it is provided outside of the home, involving caregivers in services has proven to be difficult, limiting caregiver engagement in activities that are expected to foster capacity-building outcomes (Dunst et al., 2014). Since caregiver involvement is a critical component of early intervention services, this leaves questions as to how to best provide evidence-based FCEI when going into the families' homes is not possible.

Models of Intervention

Young children who experience developmental delays or disabilities can benefit from early intervention services, which aim to support their growth and development (IDEA, 2004). Models of intervention in early intervention refer to the various approaches and strategies used by early intervention providers to promote a child's development and well-being. The wide range of service delivery frameworks and intervention methods used in early intervention reflect the diversity of families that states serve (Guralnick, 2011). In LLE, research has been conducted on the use of direct intervention (where an SLP administers the intervention), indirect intervention (where caregivers are the intervention agent), and a hybrid approach incorporating components of the two models (Carson et al., 2022). Research has found similar outcomes in direct and indirect services for LLE (Carson et al., 2022), allowing for early intervention providers to choose methods based on the unique needs of the families they serve. According to Part C of the

IDEA (2004), services should be grounded in evidence-based practices and provide individualized interventions that effectively address the unique needs of children and their families.

Caregiver-Implemented Intervention

One intervention model that aligns with the premise of family-centered services is caregiver-implemented interventions. Early intervention providers teach and coach caregivers in this indirect service model to deliver interventions or specific strategies to support their child's development (Carson et al., 2022). The benefits of caregiver-implemented interventions include that they occur in naturalistic settings (Tomeny et al., 2020), increase the dose of intervention (Sone et al., 2021), result in improved generalization and maintenance (Sone et al., 2021), increase caregivers' efficacy and empowerment (Tomeny et al., 2020), and are generally cost-efficient (Pickard et al., 2022; Trembath et al., 2019). Unfortunately, low levels of empirical studies report on caregiver-implementation fidelity, limiting the strength of the benefits noted in the studies (Lieberman-Betz, 2015).

Enhanced Milieu Training

There has been growing interest in caregiver-implemented services for LLE for several decades, and research has examined caregivers' use of several intervention approaches. Enhanced milieu training (EMT) (Hancock & Kaiser, 2006) is a naturalistic language intervention approach that aims to promote language development in children with language delays. It focuses on creating a language-rich environment through play-based activities that encourage children to communicate with others. The approach is based on operant conditioning principles, specifically using positive reinforcement to increase the likelihood of desirable behaviors (Hancock & Kaiser, 2006). Enhanced milieu training involves components such as environmental

arrangement, modeling, mand-model, and time delay prompting to promote language development in a natural and responsive manner. When using EMT, early intervention providers arrange the child's environment to encourage communication, such as positioning toys or materials that require the child to communicate to operate them. The early intervention provider models the desired communication behaviors and requests a response from the child, such as requesting a toy or action, then models the appropriate response for the child. Time delay prompting involves increasing the time between the provider's request and the child's response, encouraging the child to initiate communication and build independence.

Several studies have been conducted on training caregivers to use EMT in natural settings. Moore et al. (2014) conducted a study where SLPs trained caregivers to develop and implement a program called *Language and Play Everyday* that utilized components of EMT. Caregivers participated in group and individual training sessions and home practice to learn the strategies. At the end of the intervention program, the participants (n = 8) demonstrated increased expressive vocabulary skills and showed continued growth in expressive vocabulary at the 3-month follow-up (Moore et al., 2014).

Roberts and Kaiser (2012) explored teaching parents to implement EMT in a Teach-Model-Coach-Review format. Caregivers participated in 28 individual training sessions learning to use EMT strategies such as matched turns, time delay, and prompting. Children (n = 62) in the treatment group demonstrated statistically significant improvements in the total number of words used post-intervention. Additionally, the growth rates of children with language delay at the end of the intervention were comparable to the typically developing language group. Similarly, Roberts et al. (2014), using a hybrid EMT approach of direct and indirect treatment, trained caregivers to implement EMT in a Teach-Model-Coach-Review format using a hybrid direct and

indirect treatment approach. Using a single-case design, the researchers trained and coached caregivers of children with language impairments to use four EMT strategies (matched turns, expansions, time delays, and milieu prompting). The caregivers demonstrated fidelity after the training and coaching, and three of the four caregivers generalized the strategies to play sessions at home with their child. At the end of the intervention, the children (n = 4) demonstrated increased scores on a standardized receptive and expressive language measure and increased the total number of words used in language samples.

In a second study, Roberts and Kaiser (2015) again examined teaching caregivers to implement EMT in a Teach-Model-Coach-Review format with their language-delayed children (n = 97). This time, however, they required caregivers to participate in home practice during the week. There were variable results in expressive vocabulary amongst the children who participated (n = 97), but the treatment group showed statistically significant improvements in the number of different words used compared to the control group. However, no significant differences were observed between the treatment and control groups on standardized language measures.

Generalized Language Stimulation

Generalized language stimulation is an approach to language intervention that aims to promote language development in children by creating a language-rich environment (Delaney & Kaiser, 2001). This approach emphasizes using naturally occurring communication opportunities to expose children to a wide range of language structures, vocabulary, and social communication skills. Generalized language stimulation focuses on creating a positive and interactive environment that encourages children to communicate with others.

Several studies offer insight into caregivers' ability to implement generalized language stimulation techniques. Delaney and Kaiser (2001) successfully taught caregivers of two children with language delays strategies to use at home designed to support their child's language and behavioral development. The language strategies included increased parental verbal responsiveness, balanced turn-taking between the adults and child, and encouraging the child to initiate communication with others. At the end of the intervention, the children improved their vocabulary in context; however, no changes were noted in the standardized vocabulary measures (Delaney & Kaiser, 2001). Similarly, other research has shown that caregivers reported an improvement in their child's expressive vocabulary after being trained in general language stimulation techniques. Ciccone et al. (2012) trained caregivers and their children (18 participant dyads) during six weekly group training sessions where they learned language stimulation strategies for use in natural contexts. For half of the training session, the caregivers learned about the new strategies (while the children played with students) and then practiced the strategies in play for the remainder of the time. The language strategies taught included following the child's lead, encouraging engagement, language modeling, and using music and books. At the end of the intervention, the children demonstrated statistically significant increases in vocabulary size and communicative behaviors (e.g., turn-taking and initiations). In addition, the caregivers demonstrated increased use of communicative behaviors (e.g., turn-taking, responsive labeling, and expansions).

Interestingly, a study by McDonald et al. (2019) found different outcomes for children with solely expressive language delays compared to children with both receptive and expressive language delays. In this study, therapy assistants with qualifications and experience in child development supervised by SLPs trained caregivers in using generalized language stimulation

techniques (e.g., language-modeling strategies, providing supportive environments, and identifying language-rich activities). The researchers found that children with an expressive language delay showed significant improvements only in their expressive vocabulary. However, the children with mixed receptive and expressive language delay did not show improvements in expressive vocabulary. While the study did not report on caregiver fidelity to their use of the language strategies, this study did indicate differences in the language learning abilities of children with mixed receptive and expressive language delays compared to those with only expressive language delays.

The Hanen Centre (n.d.) has developed several programs for caregivers of language-delayed children. In each of these programs, caregivers are trained by professionals in using a variety of language-enhancing strategies to support their child's language acquisition. In a randomized controlled trial, Wake et al. (2011) trained caregivers to provide a modified version of The Hanen Centre's *You Make the Difference Program* (Manolson et al., 1995), which uses generalized language stimulation techniques. While no immediate post-intervention language measures were obtained, follow-up measures at 2 and 3 years old showed no statistically significant differences in the language skills in the intervention group compared to the control group (Wake et al., 2011).

Similarly, The Hanen Centre's *It Takes Two to Talk* program (Manolson, 1992), which also uses generalized language stimulation techniques, has demonstrated positive child outcomes at the end of the intervention. Fong et al. (2012) examined the child outcomes of training caregivers in Singapore to use *It Takes Two to Talk*. The caregivers of four toddlers with language impairments participated in the caregiver training over eight individual training sessions and three home visit sessions. All of the children's expressive vocabulary improved

over the course of the intervention compared to baseline, and children whose receptive language vocabulary was assessed also demonstrated improvements in that area (Fong et al., 2012). Senent-Capuz et al. (2021) conducted a quasi-experimental study in Spain comparing caregiver-implemented *It Takes Two to Talk* and a traditional clinician-implemented intervention with late talking toddlers. The researchers assigned 17 caregiver-child dyads with similar characteristics to either the *It Takes Two to Talk* or clinician-implemented intervention groups. Caregivers in the *It Takes Two to Talk* intervention group (n = 10) participated in group training on the program by trained SLPs. The caregivers learned about general communication development and specific generalized language stimulation strategies such as waiting for the child to initiate, following the child's lead, matching their turns with their child's turns, asking questions, and modeling language at their child's developmental level. In the traditional clinician-implemented intervention group (n = 7), the therapist interacted directly with the child using primarily modeling and imitation strategies to encourage verbal language. While the researchers found no significant differences between the groups in expressive language development, they did report that the children in the *It Takes Two to Talk* group demonstrated increased turn-taking skills and longer communication exchanges than the clinician-implemented intervention group. They also found that caregivers in the *It Takes Two to Talk* intervention group reported a more positive perception of their child's communication skills than the clinician-implemented intervention group. The caregivers in the clinician-implemented intervention indicated they had difficulties finding time to carryover language strategies from the clinician's sessions with their child. The differences in outcomes in these two groups indicate that while language measures may be the same, including caregivers in intervention can have a positive effect on the child's social

communication skills as well as improvements in the caregiver's ability to support their child (Senent-Capuz et al., 2021).

Focused Language Stimulation

Focused stimulation is an evidence-based approach to language intervention that aims to promote language development in young children with delays. When using focused stimulation, the interventionist models the target language structure multiple times in a variety of different contexts, such as during play activities or daily routines. The child is encouraged, but not required, to produce the target language structure verbally. The goal is to provide a high frequency of exposure to the target language structure in a supportive and interactive environment to help the child acquire the structure more quickly and effectively (Girolametto et al., 1996b).

Several programs have been developed using principles of focused stimulation that are targeted to caregivers of late talkers. *The Hanen Program for Parents*, an early caregiver training produced by The Hanen Cenre (Girolametto et al., 1986), trained caregivers to implement focused stimulation techniques with late talking toddlers. In one of the first studies (Girolametto et al., 1996b), SLPs trained in *The Hanen Program for Parents* taught the program's strategies to caregivers over seven sessions. They provided three individual feedback sessions where the caregiver was recorded while playing with their child and using the strategies. The strategies included generalized language strategies (e.g., following the child's lead and encouraging turn-taking) and focused stimulation. Children participants (n = 16) used significantly more target words than the control group at the end of the intervention. However, there was no difference between groups in their overall expressive vocabulary.

In another study using *The Hanen Program for Parents*, researchers modified the program by instructing caregivers to identify 10 target words to model using focused stimulation techniques during their daily routines (Girolametto et al., 1996a). Twenty-five caregiver-child dyads were randomly assigned to the treatment and delayed-treatment conditions. Caregivers in the treatment group participated in training similar to the Girolametto et al. (1996b) study, with the inclusion of the 10 target words to be used with focused stimulation techniques. Caregivers were instructed to use the target word during a natural routine and model the word at least five times during the interaction. If the child began to say the word, caregivers were trained to select a new target word to use in natural routines. During the intervention, the caregivers reduced the length of their sentences during interactions with their child while simultaneously increasing their verbal models of the target words. The children in the intervention group used a significantly greater variety of words and more of the target words than the control group by the end of the program. In addition, the children in the intervention group were observed to use more untrained words.

Another Hanen Centre intervention, the *Target Word Program* (Earle, 2015), combines focused stimulation with generalized language stimulation techniques. In a recent study, caregivers of children with LLE participated in four to five group training sessions and three individual sessions on the *Target Word Program* (Kwok et al., 2020). After the training, caregivers used the strategies for 12–18 weeks without support from the SLP. The researchers administered language assessments before and after the intervention and found positive child outcomes associated with the program in both the receptive and expressive language skills of late talking toddlers.

Virtual Interventions

Teletherapy, which involves delivering therapy services remotely through videoconferencing or other virtual platforms, has become increasingly popular as a means of providing services (Cason et al., 2012). In the context of early intervention for children with disabilities, teletherapy has shown promise as a way to overcome barriers to service delivery, such as limited resources in rural communities, limited transportation, or difficulty scheduling (Regina Molini-Avejonas et al., 2015). Additionally, a growing body of research has explored the benefits and effectiveness of teletherapy in improving developmental outcomes for young children with disabilities.

The use of teletherapy in early intervention for children with disabilities has several potential benefits. One of the primary advantages of teletherapy is that it can increase access to services for families who may face barriers to traditional in-person care. For example, families living in rural, underserviced areas may have limited access to early intervention services, and teletherapy can provide a means of receiving services they may not have received otherwise (Regina Molini-Avejonas et al., 2015). Additionally, teletherapy allows individuals to receive services in their own homes, which may benefit those with busy schedules or difficulty with transportation to appointments (Olsen et al., 2012). Another potential benefit of teletherapy in early intervention is that it allows services to continue when they might have otherwise been paused or stopped in cases of illness, weather, or pandemic (Tohidast et al., 2020). This continuity of care allows for continued access to services and eliminates the need for families to locate other providers. Teletherapy also has the potential to reduce costs associated with early intervention services. In some cases, teletherapy may be less expensive than traditional in-person

services, as it eliminates the need for travel and other associated costs (Olsen et al., 2012; Quinn et al., 2021).

Research suggests that teletherapy can be successful in training caregivers to implement interventions and can produce outcomes that are similar to in-person sessions. In a systematic review of 12 studies on the use of teletherapy in caregiver-implemented language interventions for autistic children, researchers found that all of the studies found improvements in the caregivers' fidelity in the use of the intervention and positive child outcomes (Akamoglu et al., 2020). For example, Meadan et al. (2016) successfully trained and coached caregivers to implement the Internet-Based Parent-Based Communication Strategies (i-PiCS) intervention with their autistic children. They found that caregivers were able to use naturalistic teaching strategies in natural environments with fidelity and noted positive changes in the children's communication skills (Meadan et al., 2016).

There is only one known study on the use of teletherapy in caregiver-implemented intervention for late talking toddlers. Quinn et al. (2021) examined caregiver training and outcomes for four children, one of whom was diagnosed as a late talker. The researchers used the Teach-Model-Coach-Review approach to train caregivers to use enhanced milieu training. At the end of the intervention, all of the caregivers improved in their fidelity to using the strategies during intervention sessions (Quinn et al., 2021).

Performance-Based Feedback

The research to practice gap in early childhood has been well documented. Research has indicated that despite intentions for FCEI practices, caregivers are not always involved in early intervention services as much as desired (Dunst et al., 2014). Thus, in an effort to improve the

implementation of family-centered practices, early intervention professionals must consider multiple means of training, coaching, and support for families to increase caregiver involvement.

Implementation science suggests that performance-based feedback is one way to support individuals in developing new skills. This feedback method is often used to help individuals improve their performance on a task and achieve a goal. It is generally based on objective criteria such as metrics, goals, or standards. This type of feedback can be used to identify areas of strength and weakness and provide specific guidance for improvement (Hemmeter et al., 2011).

Prior research has suggested that performance-based feedback as a means of ongoing support can be helpful to individuals implementing new techniques or strategies (Casey & McWilliam, 2008). In addition, performance-based feedback can help prevent the decline in intervention fidelity that naturally occurs after training (Solomon et al., 2012), indicating that individuals are more likely to continue using the strategies for longer durations when provided with consistent feedback. Initial training alone is often insufficient to enact meaningful change in practices (Casey & McWilliam, 2011), so early childhood professionals must prioritize methods to continue supporting families' use of strategies and intervention techniques.

Research has supported using email as a means of performance-based feedback that can be more efficient and feasible for families of young children (Barton et al., 2016). Notably, several studies have focused on delivering email messages with performance-based feedback to early childhood or early childhood special educators. In 2011, Hemmeter et al. supported preschool teachers' use of descriptive praise with their students by conducting training and providing feedback via email. The researchers found that the training combined with performance-based feedback was associated with an increase in the preschool teachers' use of descriptive praise.

More recently, Barton et al. (2020) replicated prior studies (Barton et al., 2013, 2016; Barton & Wolery, 2007) by examining performance-based feedback delivered via email to support inclusive early childhood educators' use of specific strategies such as play expansions, language expansions, and promoting social interactions. The researchers found that the teachers increased their use of the given strategies but noted variability between the targeted skills. These results were similar to the previous studies (e.g., Barton et al., 2016), identifying a functional relation between email performance-based feedback and targeted skills. Notably, the researchers reported that preparing and sending the email took 10-20 minutes, suggesting email feedback may be an efficient tool for those providing the support (Barton et al., 2020).

Vocabulary Acquisition and Usage for Late Talkers

Vocabulary Acquisition and Usage in Late Talkers (Alt et al., 2014) is a language intervention that uses high-frequency modeling in highly variable contexts with the goal of increasing the expressive vocabulary of a child with LLE. It is based on principles of statistical learning, where children identify the structure and learn information about language without conscious effort (Alt et al., 2012; Plante & Gómez, 2018). Mettler et al. (2022) identified six critical components of VAULT that set it apart from other expressive language interventions: (a) focused stimulation, (b) low-pressure interactions, (c) grammatical utterances, (d) engagement, (e) varied sentences, and (f) varied contexts. The six components, as well as a definition for each, are presented in Table 1.

Table 1

Six Components and Definitions of VAULT

Component	Definition
Focused stimulation	Dose rate of 9 targets per minute, for 7-8 consecutive minutes per target word (total of 68 doses)
Low-pressure interactions	No expectations or pressure on the child to verbalize. In VAULT, questions that require the child to respond are typically avoided.
Grammatical utterances	The verbal input used by the caregiver needs to be grammatically correct and avoid the use of telegraphic utterances.
Engagement	The target words are relevant to the activity the child is doing. This may include following the child's lead and reducing other distractions.
Varied sentences	The target word is used in multiple positions of sentences that contain a variety of other words. In other words, the target word should not be used in the same sentence repeatedly.
Varied contexts	The activities the child and caregiver participate in to target the desired word should be varied.

Note. Definitions from "Vocabulary Acquisition and Usage for Late Talkers: The Feasibility of a Caregiver-implemented Telehealth Model," by H. M. Mettler, S. L. Neiling, C. R. Figueroa, N. Evans-Reitz, and M. Alt, 2022, *Journal of Speech, Language, and Hearing Research*, pp. 1–19 (https://doi.org/10.1044/2022_JSLHR-22-00285).

Several studies have been conducted examining the use of VAULT with late talkers. In an initial feasibility study, Alt et al. (2014) provided the VAULT intervention twice a week to four toddlers with LLE for 7-10 weeks. On average, the clinicians modeled the target words 9.66 times per minute--a much higher rate than typical language modeling. At the end of the intervention, the children used more target words than control words, suggesting that VAULT is effective in teaching targeted words. In addition, the children showed an overall increase in expressive vocabulary, which may demonstrate an increase in their ability to learn new vocabulary words (Alt et al., 2014).

Additional studies on VAULT examined the specific parameters that lead to change or outcomes in child development. Alt et al. (2020) compared child outcomes when the number of words targeted per session (dose) changed. Both conditions, three target words/90 doses per word and six target words/45 doses per word per session, led to improvements in the expressive vocabulary of young children with LLE, with no difference found between the doses. Similarly, no significant differences were found when researchers varied the clinician's sentence length that contained the target words (Alt et al., 2021). Another VAULT study examined the effect of the intervention on the expressive vocabulary and phonology of toddlers with LLE. Munro et al. (2021) reported an increase in the expressive vocabulary as well as the phonetic inventory of the participants. In addition, the parents of the children enrolled in the intervention described a positive experience participating in VAULT (Munro et al., 2021). Finally, Ng et al. (2020) replicated the intervention in a single-case design with three Cantonese-speaking toddlers with LLE and found similar improvements in the children's expressive vocabulary.

When implemented by SLPs in a clinic-based setting, VAULT has successfully increased the number of target words produced by children with LLE (Alt et al., 2014, 2020, 2021; Munro et al., 2021; Ng et al., 2020). Only one study has attempted to replicate the results with caregivers delivering the intervention. Mettler et al. (2022) trained and coached the caregivers of five toddlers with LLE in implementing the VAULT intervention with their children. First, caregivers participated in a self-paced virtual training to learn about the six components of VAULT. Then, caregivers met with the researchers for a virtual live 30-minute coaching session once per week for eight weeks. The researchers originally planned to deliver two 30–minute live coaching sessions per week with the caregiver performing home practice for 30–minutes per week. However, this was reduced to one 30–minute live coaching session with 15 minutes of

home practice due to scheduling and caregivers not needing as much support as anticipated. The caregivers typically addressed two target words per week, changing target words when the child received 270 doses of each word or produced the target word across three days. During the live sessions, the coach reviewed the VAULT component practiced during the week, discussed the caregiver's experience during their home practice, and reviewed their plan for the session. Then, the caregivers administered the VAULT intervention with their child with a coach, scorekeeper, and reliability tracker observing the session. The researchers watching were muted, with the exception of the coach when they provided feedback. For the remainder of the live coached session, the coach and caregiver discussed what went well during the session and ways to improve their implementation of VAULT. The caregivers were then instructed to address two target words using the VAULT components for short sessions twice weekly (7–8 minutes per target word) at home. Caregivers were told to use the same dose rate achieved during the live coaching session. They were not required to record their sessions nor count their dose rate, but all reported they completed all home practice sessions. The caregivers achieved fidelity to the VAULT components, and similar to previous studies, the children learned more target words than control words. However, it is important to note that caregivers implemented VAULT with high fidelity during the first week of the intervention. Hence, the researchers reported that they did not observe improvements over time (Mettler et al., 2022).

The VAULT intervention has shown significant promise in improving the expressive vocabulary skills of toddlers with LLE. Each study has demonstrated how using principles of statistical learning can improve children's ability to learn language. Given the success in both the clinical and home environments, future research should continue to examine how caregivers can implement the strategies in order to align with IDEA's (2004) requirements for FCEI services.

Theoretical Framework

Two theoretical frameworks guide the work and support this dissertation. Because this study differs from other research in using caregivers as the intervention agent, it is important to consider both child language development and adult learning. First, statistical learning is explored as a means to describe how children learn language without effort or awareness. Then, Knowle's Theory of Andragogy will be discussed to explain how training caregivers to implement interventions is successful in early intervention.

Statistical Learning

Statistical learning is a theory of language acquisition that suggests that children learn language by using statistical patterns present in the input they hear to make predictions about the structure and meaning of language (Arciuli, 2017; Plante & Gómez, 2018). According to this theory, children extract regularities in the language they hear, such as the probability of certain sounds or words occurring together, and then use these regularities to learn about grammar and vocabulary (Saffran, 2020). By doing so, infants and toddlers are able to segment individual words and syllables from fluent speech (Saffran et al., 1996). This process allows children to learn and generalize the structure and rules of language quickly and efficiently without needing explicit instruction or conscious effort.

Statistical learning can be leveraged in implementing expressive language interventions by consistently targeting the same word, using variability in the nontarget words accompanying the target word, limiting the use of counterexamples, and providing ample opportunity to practice the target words (Alt, 2018; Alt et al., 2012). In general, focused stimulation uses principles of statistical learning by emphasizing specific words more intensely than what is used in natural conversation. The VAULT intervention relies on statistical learning theory to explain

how high-frequency input improves language learning in children with LLE. The varied grammatical sentences and contexts are used to increase how the target word is modeled with other non-target words. Additionally, the intervention agent focuses on language input rather than the child's language output (Alt et al., 2020). By providing children with frequent and meaningful exposure to a specific language structure or vocabulary, VAULT may enhance the child's ability to detect the statistical regularities in the language relevant to that structure or word. This, in turn, may make it easier for the child to learn the word and use it appropriately in their language production. It is important for SLPs using VAULT directly with children or with caregivers to understand how statistical learning explains language development and how to use that information to support the implementation of VAULT.

Knowles' Theory of Andragogy

Knowles' Theory of Andragogy, also known as Adult Learning Theory, is a theoretical model that describes how adults learn and was proposed by Malcolm Knowles in the 1970s. The theory has six main principles (Knowles et al., 2005):

1. Adult learners need to know why they need to learn something before they learn it. The benefits of learning the information and the consequences of not learning the information need to be clear.
2. Adult learners are self-directed and responsible for their own decisions. In this way, adult learners seek information they find valuable.
3. Adults approach learning with a wide array of previous knowledge and experiences that can be used as resources for learning.

4. Adult learners are motivated to learn when the knowledge or information is relevant to their lives. In other words, adult learners are ready for the information when the material to be learned can be directly applied to their lives.
5. Adults are motivated to learn new information or skills when they can identify a need for it in their lives. They learn new information when it directly applies to a problem they are facing or can help them in a real-life situation.
6. Adults are most motivated by internal drives, such as improved quality of life or self-esteem.

Each of these principles can be applied to the use of caregiver training in early intervention and emphasizes the importance of using family-centered practices in several ways. First, it is likely that the caregivers have self-identified a need to learn how to support their child with LLE because they have been referred to early intervention, so caregivers can be encouraged to determine their goals, needs, and interests. It is important for early intervention providers to prioritize the family's goals for their child to align with family-centered practices (DEC, 2014). Second, the early intervention providers can support the caregiver in identifying their knowledge gaps, identifying skills they would like to improve upon, and reflecting on their prior experience and knowledge that can be directly applied to their new skills. It is inherently essential for caregivers to want to learn the information in caregiver training sessions in order for them to use it at later times. Finally, early interventionists can provide caregivers with the tools, resources, and supports they need to achieve their learning goals (Cheng & Hackworth, 2021).

Conclusion

This dissertation focused on training and providing performance-based feedback to caregivers in implementing the VAULT intervention with their children with LLE. The purposes

of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers.

In this chapter, the researcher examined the literature on FCEI, primarily providing support for its use in early intervention to align with the IDEA (2004) and DEC *Recommended Practices* (2004). One method of providing FCEI is caregiver-implemented interventions. Research on caregiver-implemented interventions has shown its ability to improve family and child outcomes. This chapter also described the research on virtual interventions and best practices for performance-based feedback and the VAULT intervention. Finally, the chapter concluded with a discussion on how statistical learning and Knowle's Theory of Andragogy support investigating caregiver-implemented interventions for LLE.

CHAPTER III

METHODOLOGY

The VAULT is an intervention designed to improve the expressive vocabulary of children with LLE. Using principles of statistical learning, VAULT provides high-frequency focused stimulation of target vocabulary words in varied grammatical sentences and contexts (Alt et al., 2020). Several studies exist on using VAULT in a clinical setting, where trained clinicians provide the intervention directly to late talking children (Alt et al., 2014, 2020, 2021; Munro et al., 2021; Ng et al., 2020). In this setting, VAULT has been successful in increasing late talking toddlers' expressive language skills.

To align with best practices, interventions for toddlers should be family-centered and provided in natural settings (DEC, 2014). One study has examined the effectiveness of training and coaching caregivers to implement VAULT with their late talking children. Mettler et al. (2022) found that caregivers were effective in implementing the principles of VAULT and that they found the intervention to be meaningful. So far, this is the only study that has examined the ability of caregivers to implement VAULT successfully. The body of evidence on VAULT makes a strong case that implementation of VAULT can be successful in increasing expressive vocabulary skills. However, more is needed on its ability to be used by caregivers.

The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers.

Research Questions

Four research questions guided this dissertation:

Q1 Is there a functional relation between training and feedback on the increased level of caregivers' use of the VAULT focused stimulation dose rate at home with children who are late talkers?

Q2 To what extent do caregivers achieve fidelity to the other five components of VAULT during the course of the intervention?

Q3 To what extent do the late talking children learn the target words during the course of the intervention?

Q4 To what extent did the caregivers find the VAULT intervention to be valuable and practical?

This study replicated and extended current research by examining the effectiveness of training caregivers to use the VAULT intervention with their children with LLE. Mettler et al. (2022) completed a feasibility study on training and coaching caregivers to implement the VAULT intervention with five late talking toddlers. In their study, the caregivers participated in a self-paced virtual training on the VAULT components. The training videos instructed caregivers on the six VAULT components, showed demonstration videos, and allowed for independent worksheet practice. The caregivers then met with the research team for a live-coached session once weekly for eight weeks. During the coaching sessions, the caregiver practiced using the VAULT components, and the coach provided feedback as necessary. Then, the caregivers completed independent practice at home twice per week. The Mettler et al. (2022) study "did not follow a conventional research design with regard to caregiver-level outcomes" (p. 7) and did not employ the use of caregiver-level controls. In addition, the study included "elements of single-case design" (p. 7) for the child outcomes, such as three baseline data points at the beginning of the study and a delay phase for four participants.

Mettler et al. (2022) identified six critical components of VAULT. These components set VAULT apart from other focused stimulation interventions and must be explicitly taught to caregivers in order to maintain fidelity to the intervention. The six components and their definitions, previously included in the literature review, were presented in Table 1.

This replication systematically varied the following components:

1. This study used a multiple-probe multiple-baseline design. Because of the design, the participants served as their own control. Therefore, the use of control words, as seen in Mettler et al. (2022), was eliminated. This use of a multiple-probe multiple-baseline design improved the methodological rigor from Mettler et al. (2022).
2. In the study by Mettler et al. (2022), caregivers participated in self-paced virtual training modules to learn about the components of VAULT. In this study, caregiver training was held during live virtual meetings. The researcher used the training materials provided by Mettler et al. (2022). This was chosen to shorten the time required for training, so there was less of a delay between the baseline and treatment conditions.
3. This study omitted the live coaching sessions used in the study by Mettler et al. (2022) and, instead, provided emailed performance-based feedback weekly or after every two sessions. The emailed performance-based feedback contained information about the parent's dose rate and other VAULT components, a visual of their progress in increasing the dose rate, and suggestions for the following week. The researcher chose to eliminate live coaching sessions and weekly meetings to ease the requirements for longer sessions that require "on-the-spot" performance from the caregiver and child and time restrictions on the caregivers.

4. In the study by Mettler et al. (2022), caregivers declined to video record their practice sessions at home. Therefore, data were exclusive to the live coached sessions. In this study, caregivers were required to video record their play sessions for data analysis. This increased the opportunity for the caregivers to choose to play with their child when it fit into their daily schedule and gave the flexibility to work around the child's preferences.
5. Mettler et al. (2022) provided a qualitative score on a scale from 1 to 5 for five of the six VAULT components (see Table 1 for a definition of the components). This study measured the dose rate in the same way as previous VAULT studies, but rated the other five components on a rubric developed by the researcher. This change did not interfere with the research questions and was chosen to eliminate the subjective nature of scoring the caregivers' interactions.

Methodology

After receiving the University of Northern Colorado Institutional Review Board's approval (see Appendix A), the researcher recruited caregiver-child dyads to participate in the study. An electronic flyer was disseminated on social media groups for parents of young children, parents of late talkers, and early childhood professionals (see Appendix B). In addition, the flyer was posted at the University's Speech-Language Pathology and Audiology Clinic. Interested participants contacted the researcher via email, text, or social media message, and the potential participants were directed to complete initial screening questions to determine suitability for the study (see Appendix C). The inclusion criteria for this study were: (1) children between the ages of 24-30 months with an expressive language delay below the 10th percentile on the MacArthur-Bates Communication Development Inventories (CDI) (Fenson et al., 2007a);

(2) the child had no other formal diagnoses or other developmental concerns (e.g., Down syndrome, genetic or neurological disease, or other primary disorders); (3) the child scored within the low-risk range on the Modified Checklist for Autism in Toddlers (MCHAT) to reduce the influence of autism spectrum disorder on outcomes (Robins et al., 2009); (4) the child had normal hearing and vision, per recent screening or parent report; (5) the caregiver uses English as their primary mode of communication; (6) caregivers are adults with a consistent caregiving role; (7) the caregivers must have been willing to participate in the study for 10-12 weeks; (8) the caregivers must have been willing to participate in the training, video their play sessions with their child twice per week, and confirm receipt of the weekly email feedback; and (9) caregivers have a computer, laptop, smartphone, or electronic device and high speech internet connection in which they can record and send/upload videos. After determining if the caregiver-child dyads qualified based on the screening questionnaire, the caregiver met with the researcher via Zoom for the researcher to briefly explain the study, to answer questions, and to ask them to sign the consent to participate form (see Appendix D). Then, the caregivers were asked to complete the CDI: Words and Sentences and MCHAT. If they continued to meet the inclusion criteria based on the CDI: Words and Sentences and the MCHAT, they completed a demographics form that collected information about their background (e.g., age, race/ethnicity, education, location, etc.) and received instructions for identifying target words and completing the baseline condition.

Participants

A total of 29 caregivers contacted the researcher via email, text, or social media messages to learn more about the study. Twelve caregivers completed the initial screening questions, and 1 was disqualified based on the exclusionary criteria in the initial screening. The researcher contacted 11 caregivers, and 6 responded to meet with the researcher to learn more about the

study, give consent to participate, and complete initial assessments. Of those 6 caregivers, 1 was excluded after demonstrating characteristics of autism spectrum disorder on the MCHAT. Ultimately, 5 signed the consent to participate in the study. However, prior to beginning the study, 1 participant withdrew and 1 did not respond to repeated attempts to contact them via email and text messages. Therefore, 3 participants participated and completed all phases and requirements of the study. Pseudonyms were used to protect the identity of the caregivers and children.

Alice and Mario

Alice was 35 years old and her son, Mario, was 28 months old when they participated in this study. Alice is of Hispanic ethnicity and lives in the southwest of the United States. She had completed some college. Alice and her family use English and Spanish proficiently at home but participated in the study using solely English. Alice did not have concerns about Mario's hearing or vision, and Mario had not received a formal diagnosis. Before the study began, Alice completed the CDI: Words and Sentences and indicated that she had heard Mario use four verbal words. When he wanted something, she reported that he would cry and bring her to the item he wanted. Alice also completed the MCHAT, and Mario scored within the low-range risk for autism spectrum disorder. Alice and Mario had participated in their state's early intervention program for 3 months when the study began. They were meeting with a developmental specialist once a week at their home addressing early sounds and words.

Omar and Jackson

Omar was 40 years old and his son, Jackson, was 27 months old when they began the study. Omar is Black and lives in the upper midwestern region of the United States. Omar and his family use English at home. When asked about the highest level of education completed,

Omar selected “Other.” Omar did not have concerns about Jackson’s hearing or vision nor had Jackson received a formal diagnosis. Before the study began, Jackson’s family completed the CDI: Words and Sentences and indicated that Jackson used approximately 13 verbal words. Jackson scored within the low-risk range for autism spectrum disorder on the MCHAT. When the study began, Jackson and his family had participated in their state’s early intervention program for 9 months. He had been meeting with a developmental specialist once a week at home and then later at his daycare. His early intervention goals included the use of early words and gestures and making choices between two items.

Lily and Addison

Lily was 33 years old and her daughter, Addison, was 30 months old when they participated in the study. Lily is of Hispanic ethnicity and lives in the southern region of the United States. Lily completed a college degree and used English at home with her family. Lily did not have concerns about Addison’s hearing or vision, and Addison had not received a formal diagnosis. Lily completed the CDI: Words and Sentences and indicated that Addison used approximately 24 verbal words. Addison scored within the low-risk range for autism spectrum disorder on the MCHAT. Addison and her family had participated in their state’s early intervention program for 3 months when the study began. Her early intervention goals focused on imitating sounds and using early signs.

Setting

The study was conducted in the families’ homes, where they participated in the baseline condition, training via Zoom video conference (Yuan, 2020), the intervention condition, and the maintenance condition. The specific rooms within the families’ homes varied based on their preferences and schedules. However, all intervention sessions were provided in a naturalistic

environment to align with early intervention best practices (DEC, 2014). Each caregiver recorded themselves during a play session with their child. It was important that caregivers recorded themselves during a play session, as opposed to other daily routines such as dressing, diaper changes, or meals, to allow for consistency in measuring the VAULT components during similar activities as a change in routine may have inherently changed the caregivers' ability to use the components with fidelity.

Materials

Inclusion Determination

One inclusion criterion for the children participants was an expressive language delay below the 10th percentile on the CDI: Words and Sentences (Fenson et al., 2007a). The CDI: Words and Sentences is a normed parent report instrument designed for young children 16-30 months old. The CDI: Words and Sentences assessment gives scores for vocabulary, sentence complexity, and mean length of utterance (Fenson et al., 2007b). The first part of the CDI: Words and Sentences contains a checklist of 680 words in 22 semantic categories and, according to Fenson et al. (2007b), it takes approximately 20-40 minutes to administer, depending on the child's communication abilities. Only Part I of the CDI: Words and Sentences was administered by the caregivers; Part II measures sentence length grammatical markings, and it was expected that if a child was using less than 50 words at 2 years of age, they were not yet using grammatical markers (such as plural–*s,* present progressive–*ing*, etc.). The CDI: Words and Sentences reports a percentile rank based on the number of expressive words, and in order to be included in this study, children must have scored at or below the 10th percentile. If the caregiver-child dyad was eligible to participate, the same list of vocabulary words from the CDI: Words

and Sentences was presented as a receptive language list in order to aid in choosing target words for the intervention.

Another inclusion criterion was a low risk for autism spectrum disorder rating on the MCHAT (Robins et al., 2009). The MCHAT is a parent report screener for toddlers 16-30 months old. It consists of 23 items that evaluate the child's behavior consistent with autism spectrum disorder (in sensory, play, and early language development). A low-risk rating is obtained by scoring two or fewer positive responses (Robins et al., 2009). In order to be included in this study, a child must have demonstrated a low risk of autism spectrum disorder. The MCHAT does not contain a question regarding the child's expressive language, so an expressive language delay alone is not expected to impact the results.

Caregivers' Video Recording

All of the caregivers used their cell phones with a camera to record themselves playing with their child during the baseline, intervention, and maintenance conditions. For the purpose of this study, play was defined as engaging in age-appropriate activities of interest to the child (Lifter et al., 2011), and the materials used during play could include toys but could also include other age-appropriate materials. The recorded videos included audio of the caregiver and child. The caregivers uploaded the videos to Microsoft OneDrive, a password-protected online storage account, to share the videos with the researcher.

Initial Training Presentation

During the training, the researcher met with the caregivers to teach them the components of VAULT. The materials that were prepared for the training included Google Slides presentations, example videos of the VAULT components, practice exercises, and a summary handout. The initial training was conducted over two virtual meetings, lasting between 45

minutes to 1 hour each. The Google Slides presentation addressed each of the six components of VAULT. The teaching materials were obtained, recreated, and modified, if necessary, from the Mettler et al. (2022) supplemental materials (see modification descriptions below).

Video-Conferencing Program

The researcher used Zoom (Yuan, 2020) to meet with the caregivers virtually before the intervention to determine inclusion and to deliver and record the initial training. Security and privacy features offered by Zoom such as requiring a passcode to enter the meeting, the use of a waiting room to block entry for unwanted persons, and end-to-end encryption were employed. The researcher conducted the initial meetings and training in a private office with a locked door to maintain confidentiality. The recordings of the meetings were saved in Microsoft OneDrive using a secure password. Before the first meeting, the researcher instructed caregivers on accessing the Zoom invitation link. Zoom was also used to conduct the social validity interviews after the maintenance phase.

Dependent Variables

DV1

The first dependent variable was the caregivers' use of the VAULT components. There are six components of VAULT: (1) focused stimulation, (2) low-pressure interactions, (3) grammatical utterances, (4) engagement, (5) varied sentences, and (6) varied contexts. Each of the components was measured, but only focused stimulation produced a quantified measurement. The remainder of the components were measured on a rubric created by the researcher. The rubric included information on the operational definition of each component. Table 2 provides the operational definition and the rubric that was used to measure the caregivers' fidelity to the intervention. Operational definitions were adapted from the VAULT component definitions in

Mettler et al. (2022) so they could be measured on a rubric. Please see Appendix E for the data collection forms.

Table 2

Measuring VAULT Components Rubric

Component	Operational Definition	Met Criteria	Partially Met Criteria	Did Not Meet Criteria
Focused stimulation	Criteria: Dose rate of 9 targets per minute, for 7-8 consecutive minutes per target word (minimum of 64 doses per target word). The dose rate for each word will be average and reported for 7-8 minutes. Method of Measurement: Measured by recording the frequency of parent verbal models of each target word per minute. The observer will count the productions using a tally counter on a recording form divided by the minute. Because the frequency will be measured per minute, this allows the observations to be of variable length with a goal of 14–16-minute sessions. Parents will be asked to record 15-20 minutes, and the middle 14-16 minutes will be evaluated.	The dose rate for both target words during the session averages 9+ words/ minute, and a minimum of 64 doses per word was delivered.	The dose rate for one of the target words during the session averages 9+ words/minute, and a minimum of 64 doses was provided. However, the second target word's dose rate did not achieve the criteria.	The dose rate for the session averages less than 9 words/minute, and the minimum 64 doses per target word were not delivered.
Low-pressure interactions	Criteria: No expectations or pressure on the child to verbalize. In VAULT, questions that require the child to respond are typically avoided. Method of Measurement: The number of questions and commands directed toward the child will be recorded over the duration of one play session.	The caregiver directs three or fewer questions per session to the child, and if they do ask questions, the caregiver answers it themselves. AND If the caregiver gives directions, they follow the direction themselves.	The caregiver directs 4+ questions to the child, and if they do ask questions, the caregiver answers it themselves. OR The caregiver gives directions to the child but only follows the direction themselves sometimes	The caregiver directs any number of questions to the child and does not provide an answer themselves. AND/OR The caregiver gives directions to the child and does not follow the direction themselves.

Tabel 2 (continued)

Component	Operational Definition	Met Criteria	Partially Met Criteria	Did Not Meet Criteria
Grammatical utterances	Criteria: The verbal input used by the caregiver is grammatically correct, and the caregiver should avoid using telegraphic utterances. Method of Measurement: The number of telegraphic or non-grammatical phrases will be recorded over the duration of one play session.	The caregiver produced three or fewer telegraphic or non-grammatical phrases during the session.	The caregiver produced 4-6 telegraphic or non-grammatical phrases during the session.	The caregiver produced 6+ telegraphic or non-grammatical phrases during the session.
Engagement	Criteria: The target words are relevant to the child's activity. This may include following the child's lead and reducing other distractions. Method of Measurement: The tasks described are intended to be events that are under the control of the caregiver because no young child will be engaged 100% of the time. However, the caregiver can make efforts to maintain the child's attention. Engagement will be measured over one session.	The target words are clearly related to the activity the child is participating in. AND The caregiver follows the child's lead by engaging in play with items/toys the child is interested in. AND There are no background distractions (e.g., the television and radio are off.)	The target words are related to the activity the child is participating in, but either the caregiver is not following the child's lead, or there are multiple background distractions.	The target words are unrelated to the activity the child is doing. AND/OR There are multiple background distractions (e.g., home visitors, television, radio, etc.) during the play session.

Table 2 (continued)

Component	Operational Definition	Met Criteria	Partially Met Criteria	Did Not Meet Criteria
Varied sentences	Criteria: The target word is used in multiple positions of sentences containing various other words. In other words, the target word should not be used in the same sentence repeatedly. Method of Measurement: Varied sentences will be measured over one session.	The target words are used in three positions of sentences at least once (initial, medial, and final). For example, if the target word is *puppy*, the caregiver could say:"Puppy, where are you?," "I think the puppy looks hungry!" or "Come here, puppy!" AND The words in the sentences containing the target words are varied. For example: "Let's go, puppy!"; "I see the puppy,"; "I bet the puppy is hiding behind the chair,"; and "The puppy feels so soft."	The target words are used in two positions of sentences.	The target word is used in only one position of a sentence (initial, medial, or final). OR The same sentences are repeated throughout the session (limiting the variation of words paired with the target word).
Varied contexts	Criteria: The activities the child and caregiver participate in to target the desired word should be varied. Method of Measurement: Varied contexts will be measured over two sessions. The activities should be varied, but they may remain the same within one session if the child is actively engaged and the caregiver follows their lead. For example, if the target is *cup*, the caregiver could model the word while pretending to feed dolls in one session, and the next session, uses differently sized cups to scoop and pour.	The caregiver varied the activity for each target word between two sessions at minimum, and within the same session if the child's interest moves to the next activity. If the child remains engaged in the same activity for a longer time, the activity does not necessarily need to be changed within the same session.	The caregiver varied the activity for the target words between two sessions at a minimum. AND The caregiver did not vary the activity within the session if the child's interest changed.	The caregivers selected the same activity to repeat over two or more sessions

DV2

The second dependent variable was the children's production of the target words during the intervention sessions. This dependent variable was a product of advancing the treatment, meaning that new target words were introduced if a child started to produce a target word. The researcher was only looking at whether or not the child produced a target word in the session, as it is embedded in the progression of the intervention.

Independent Variable

The independent variable was the virtual VAULT training and weekly performance-based feedback. The virtual training was completed in two 45–60-minute sessions. The training included: (a) the logistics of the study, (b) the six VAULT components with video examples and collaborative worksheets, (c) time to address questions and concerns, and (d) a plan for the first week. The researcher developed the training on Google Slides with materials provided by Mettler et al. (2022). Some wording was changed from Mettler et al.'s (2022) training materials to reflect the current study and was combined into one document. For example, Mettler et al. (2022) began the training by describing the frequency with which they would conduct live coaching sessions. This section of the training was changed to describe the procedures used in the current study. In addition, the researcher developed new video examples of VAULT in use because the ones used by Mettler et al. (2022) are confidential and were not available to the researcher. The descriptions and details for each VAULT component remained the same as those used by Mettler et al. (2022). A script was used during the training (See Appendix F) and a one-page handout was provided at the end summarizing the VAULT components (Appendix G).

Performance-based feedback was provided via email to describe the caregivers' progress in using the VAULT components. Upon receipt of the videos from the caregivers, the researcher

graphed the caregivers' dose rate and sent the email to the caregivers after analyzing two video sessions. The caregivers were asked to upload the recordings of their play sessions to a shared password-protected Microsoft OneDrive folder. Caregivers received performance-based feedback via email after two sessions with: (a) the dose rate from the previous two sessions; (b) a graph of their progress showing the dose rate each session; (c) a description of two examples of when the caregivers used one of the VAULT components; (d) any information about the child's verbal productions and the need to change target words, if applicable; (e) suggestions on strategies/plans for the following sessions; and (f) a request for the caregiver to respond to the email to indicate they had received the information. Because the caregivers were asked to record two sessions per week, this feedback email was provided once per week. Please see Appendix H for an example of the weekly performance-based feedback email.

Experimental Design and Procedures

A multiple-probe, multiple-baseline design was used to investigate the effectiveness of training caregivers in implementing the VAULT intervention (Kennedy, 2005). This design was chosen because it would not be possible for the parents to unlearn the intervention once started, and the three participant dyads allowed for replication of experimental control. Additionally, the multiple-probe design was chosen to reduce the requirements for twice-weekly recordings for the caregivers while they were in the baseline phase. The participants followed the same experimental conditions, and the time that the intervention was introduced was staggered across dyads when the baseline data was stable. The experimental condition changes were based on the caregiver's use of focused stimulation. This study included three experimental conditions: baseline, intervention, and maintenance. Graphs of the multiple-baseline design are presented in Appendix I.

Threats to Internal Validity

Multiple baseline design in single case research methodology is susceptible to threats to internal validity (Kennedy, 2005), and researchers must consider methods to reduce the threats. First, to reduce the threat of maturation, the number of sessions rather than weeks was measured, and the introduction of the intervention was staggered across the multiple caregiver dyads. Five caregiver-child dyads were originally recruited to participate in the study to reduce the threat of attrition if some could not complete the full study. Prior to beginning the baseline condition, one participant withdrew from the study and another did not respond to repeated attempts to contact them. The researcher was able to collect data from three dyads to demonstrate three replications of the experimental effects (Kennedy, 2005). In addition, selection bias was reduced by randomizing the order in which participants began the intervention.

Pre-Baseline

Before beginning the baseline condition, the caregivers were presented with the vocabulary list from the CDI: Words and Sentences as a receptive vocabulary list to determine words the child understood (Fenson et al., 2007a). They were asked to identify 20 words they wanted their child to say. This list of receptive vocabulary words was compared with the expressive vocabulary words to confirm that they were words the child did not yet verbally produce. From the 20 identified words, the researcher selected 10 words so that some could be semantically paired to increase the ease of modeling during the intervention stage. Words were paired based on semantic categories if possible; however, words that the caregivers preferred were given a higher priority (see Appendix J for a list of the target words used by the caregivers in each condition). The researcher offered each dyad the opportunity to select other words

important to the family; however, all caregivers selected words from the receptive vocabulary list.

During this time, the caregivers were trained on accessing and uploading to a password-protected Microsoft OneDrive folder that served as a method to share information between the caregivers and researchers. The caregivers accessed the same folder for the baseline, intervention, and maintenance conditions. Only the caregivers, researcher, research advisor, and second observers had access to the data uploaded to the password-protected Microsoft OneDrive folder.

Baseline

During the baseline condition, the caregivers were instructed to use their smart device with a camera to record a play interaction with their child using either a device stand, propping it against a stable surface, or having another adult hold the device. The researcher identified two target words to model during the baseline condition from the list of target words. They were given the direction, “Please play with your child for 15-20 minutes with the goal of teaching them your target words.” Play was described as age-appropriate activities that are engaging to the child and could include toys or other household everyday objects. Examples of other household objects (such as containers, kitchen items, boxes, or rocks) were provided. The caregivers were intentionally told to teach their child to say the word to obtain an accurate baseline for their natural dose rate. It was anticipated that the caregivers would say the target words frequently, but not to the level of dose rate required in VAULT. If, by chance, a child produced a target word during the baseline session (whether or not it was targeted), that word was to be removed from the list of target words for the intervention. However, no child in the

study verbally produced a target word. The baseline condition continued until a stable data series was obtained (Kratochwill et al., 2013).

After each baseline session, the caregiver uploaded the video to the password-protected Microsoft OneDrive. The baseline condition consisted of a minimum of five sessions to demonstrate stability, and the intervention began after stability was established. After five baseline sessions established control, the first participant dyad began the intervention (Kennedy, 2005). The order in which participants entered the intervention phase was randomized. Data were collected on all VAULT components, but changes in the experimental conditions were based solely on the caregivers' use of focused stimulation. The second participant began the intervention after the first participant demonstrated the use of the dose rate required in VAULT (an average of 9 times per minute per target word) for at least three consecutive intervention sessions. The third participant began their intervention condition in the same manner.

Intervention

After baseline stability was established, the caregivers participated in individual virtual training with the researcher on the VAULT intervention, with explicit teaching on the six components required in VAULT. The training was developed with materials provided by Mettler et al. (2022) with adapted wording that described the current study (please see Appendix G for examples of training materials). The caregivers met with the researcher via Zoom for two training sessions that lasted 45-60 minutes each. The training sessions were held on consecutive days within the same week immediately after the baseline condition. The entirety of each training session was recorded to assess training fidelity. At the end of the training, caregivers asked questions and received information about the first intervention sessions and target words.

After completing the VAULT training, the caregivers were instructed to use the VAULT components to address two target words during a 15–20-minute play session two times per week. They were asked to video-record each of these play sessions and upload them to the same secure online drive in the same way as they did during the baseline condition. Email or text reminders, based on the caregivers' preferences, to complete a video-recorded session were provided to encourage caregiver participation. Caregivers' questions throughout the week were also addressed via text or email. After uploading the recordings of two play sessions, the researcher sent the caregiver the performance-based feedback email with information about their use of the VAULT components over the last two sessions.

In VAULT, the caregiver continues to use the same two target words until either one of two conditions occurs: (1) the child verbally produces the same target word at least once during a session over three consecutive sessions, or (2) after 270 doses are provided of the target word. In this study, the target words were changed after the caregivers provided 270 doses of each word because no child produced a target word during the intervention sessions. This is consistent with the implementation from Mettler et al. (2022) and previous VAULT studies. Changing the target words, regardless of whether the child has verbally produced the word, allowed for novelty in play for both the child and caregiver. In this manner, each participant dyad ended the intervention addressing a different number of target words, and no dyad addressed the same words for the duration of the intervention.

Maintenance

Two weeks after finishing the intervention, the caregivers participated in one 15–20-minute video-recorded play session at home with their child as a maintenance session. The caregivers were directed to use VAULT with two target words that were not used during the

intervention phase. The caregivers sent the video to the researcher in the same way they sent the baseline and intervention videos, and the researcher graphed the caregivers' dose rate.

Social Validity

The caregivers participated in a semi-structured interview after the maintenance session. The interview focused on the social validity of the intervention (see Appendix K) and lasted approximately 10 minutes. The interview was conducted by a second observer who had not worked with the family. The interviewer was an SLP with experience interviewing families and was trained on the VAULT intervention. Follow-up questions were asked if the caregiver's initial answers were too brief (such as a: yes" or "no"). For example, the interviewer asked the caregiver to provide more explanations or examples as needed. Each interview was conducted through Zoom (Yuan, 2020) at a time convenient for the caregivers and was recorded. Themes were identified from the caregivers' responses to the interview questions.

Procedural Fidelity

Procedural fidelity was measured for the researcher's training with the caregivers and the performance-based feedback emails. The procedural fidelity for the initial training was assessed by a trained observer using a checklist of the required caregiver training protocol (Kennedy, 2005). Fidelity was calculated by adding the number of tasks completed during the training divided by the number of total tasks on the checklist, then multiplying by 100 (see Appendix L for the fidelity checklists). The fidelity of all three participant trainings was 100%.

Similarly, a minimum of 25% of the performance-based feedback emails were viewed by an observer to assess for procedural fidelity. Feedback emails from each participant were randomly selected. Fidelity to the email protocol was calculated by adding the number of components within the email divided by the total items on the checklist for the performance-

based feedback emails, multiplied by 100 (Kennedy, 2005). The fidelity of implementation of the performance-based feedback emails was 100% for all of the participants.

Observation and Recording Procedure

The dependent variables were assessed on the video recordings provided by the caregivers during the baseline, intervention, and maintenance stages. The caregivers recorded their play sessions and then uploaded them to the password-protected Microsoft OneDrive for the researcher to view. The researcher counted the frequency of the caregivers' target word models to calculate the dose rate and measure the other VAULT components on the rubric. In addition, any target word productions the child made were noted.

Observation Training

Two reliability observers were recruited to participate in this study. Both were SLPs and Ph.D. students with experience delivering language interventions to young children and experience conducting research. Prior to the baseline phase, the second observers were trained on the coding procedures for the initial caregiver training, the performance-based feedback email, and the VAULT components used in the caregiver video recordings. The researcher and second observer reviewed the components required in the caregiver training and the performance-based feedback email during the training. They also reviewed the operational definitions of the VAULT components and practiced coding five sample videos of the intervention made by the researcher. The researcher and observer practiced measuring the dose rate and assessing the VAULT components using the rubric until they obtained at least 85% interobserver agreements (Horner et al., 2005; Kennedy, 2005; Kratochwill et al., 2013).

Interobserver Agreement

For the caregiver's implementation of the VAULT components, the researcher and observer coded at least 25% of the data in each experimental condition (Kratochwill et al., 2013). Interobserver agreement was calculated using point-by-point agreement for the dependent variables, where agreement was calculated by the number of agreements divided by the number of agreements plus disagreements, then multiplied by 100 (Kennedy, 2005). An agreement was counted for the caregiver's dose rate when both observers recorded a session average of nine or more target words per minute or less than nine target words per minute. An agreement was counted for the other five VAULT components when both observers recorded the same criteria (met, partially met, or not yet met).

For the first participant dyad, the reliability observer coded 40% of the baseline data, 40% of the intervention data, and 100% of the maintenance data. The interobserver agreement on Alice's use of VAULT averaged 87% (range = 67-100%). For the second participant dyad, the reliability observer coded 33% of the baseline data, 25% of the intervention data, and 100% of the maintenance data. The interobserver agreement on Omar's use of VAULT averaged 90% (range = 83%-100%). Finally, for the third participant dyad, the reliability observer coded 28% of the baseline data, 28% of the intervention data, and 100% of the maintenance data. The interobserver agreement on Lily's use of VAULT averaged 87% (range = 67%-100%).

Data Analysis

To answer the first research question, each caregiver's dose rates from all conditions were graphed using Microsoft Excel by the researcher for visual analysis. Visual analysis of the data according to single case research design was performed (Kennedy, 2005). A functional relation was determined if the change in caregivers' use of focused stimulation resulted from the

training and weekly performance-based feedback emails. The researcher determined if: (a) there was a predictable pattern of baseline data, (b) there were sufficient data points with consistency in each phase, and (c) there were at least three demonstrations of effect at three different points in time (Kratochwill et al., 2013).

To answer the second research question, the caregivers' use of the VAULT components was analyzed using a rubric developed by the researcher. Information on each VAULT component for each session was presented on a table and analyzed. The third research question was answered by noting child productions of the target word, and progress was described. The final research question was answered by transcribing the interviews, analyzing them, and grouping them by theme using content analysis (Kennedy, 2005).

Conclusion

The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers. The multiple probe multiple baseline across participants design was used to examine the functional relation between the virtual caregiver training with weekly performance-based feedback and caregivers' use of the VAULT components. Three caregiver-child dyads were selected according to the inclusion criteria for participation in the study. The study was conducted at caregivers' homes, where the caregivers recorded themselves playing with using the VAULT components. The training and interviews were conducted using Zoom video conferencing (Yuan, 2020). The data on focused stimulation were analyzed, graphed, and visually inspected according to single-case research design

standards. The data on the other five VAULT components were analyzed and described. Finally, a social validity interview was conducted to determine the value of the intervention.

CHAPTER IV

RESULTS

The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers. Data were collected to address four research questions:

Q1 Is there a functional relation between training and feedback on the increased level of caregivers' use of the VAULT focused stimulation dose rate at home with children who are late talkers?

Q2 To what extent do caregivers achieve fidelity to the other five components of VAULT during the course of the intervention?

Q3 To what extent do the late talking children learn the target words during the course of the intervention?

Q4 To what extent did the caregivers find the VAULT intervention to be valuable and practical?

A multiple-probe multiple baseline research design across three participants was implemented to answer the research questions. Data were collected on the caregivers' use of each VAULT component during the baseline, intervention, and maintenance conditions. However, changes in the experimental conditions were based on the caregivers' use of focused stimulation (also referred to as the dose rate). The dose rate for each session was graphed and visually inspected based on single-case research design standards (Horner et al., 2005; Kratochwill et al., 2013). When the intervention condition began for one participant, experimental control was visible in the baseline for the other caregivers.

To answer the first research question, data were collected on the participants' use of focused stimulation. Results demonstrated that all three participants reached fidelity to the VAULT focused stimulation target of nine productions per minute during the intervention condition. They also maintained the use of focused stimulation after ending the intervention, suggesting the sustainability of VAULT in play. The baselines for the second and third caregivers remained stable while the intervention was administered to the first caregiver. Likewise, the third caregiver's baseline remained stable while the intervention began with the second caregiver. Therefore, a functional relation between the training and performance-based feedback emails and caregivers' increased use of the VAULT focused stimulation was demonstrated (see Appendix I).

To answer the second research question, data were collected on the participant's use of the other five VAULT components (low-pressure interactions, grammatical utterances, engagement, varied sentences, and varied contexts). All caregivers demonstrated improvements in using the other five VAULT components from the baseline to the intervention condition. Data on the VAULT components for each caregiver-child dyad are presented in this chapter.

The third research question was answered by recording child productions of target words. An increase in the child's use of target words during the video-recorded intervention sessions was not a successful consequence of caregivers' use of the VAULT components. Some of the children demonstrated progress towards other pre-verbal or verbal goals, but only one child produced a target word, which was during the maintenance session. Finally, the fourth research question was answered by conducting a social validity interview after the maintenance condition with each participant.

Caregiver-Child Dyad #1--Alice and Mario

Caregiver Results

Focused Stimulation

During the baseline condition, Alice used an average of 3.46 target words per minute (range = 2.5-5.6 words per minute) while playing with Mario. This was lower than the VAULT focused stimulation rate of nine times per minute. Alice used the target word in a repetitive song during the third baseline session, which increased the dose rate naturally and led to a slightly accelerating trend. However, in subsequent baseline sessions, this decreased again to lower levels similar to those in the first and second sessions. The intervention condition was introduced after the fifth baseline session demonstrated overall stability.

After Alice received the training on the VAULT components, her dose rate dramatically increased to an average of 13.66 target words per minute (range = 11.3-15.8), which was higher than the target of nine times per minute. Additionally, the average dose rate for the last three baseline sessions was 3.6 words per minute, and the average dose rate for the first three intervention sessions was 15 words per minute, indicating an immediate and significant change in the use of focused stimulation. After two intervention sessions, the researcher provided the emailed performance feedback on Alice's use of the VAULT components. Using this information, Alice learned that her dose rate was higher than the expected target of nine times per minute. She was instructed she could decrease the rate and, therefore, slightly decreased the dose rate in the following sessions. She maintained a high-level dose rate of at least nine times per minute for all intervention sessions. The percentage of non-overlapping data was 100%. During maintenance, Alice continued to use focused stimulation at a high-level dose rate similar to the intervention condition of 12.9 target words per minute. Alice's data on the use of the

VAULT components including dose rate are presented in Table 3. A graph of Alice's use of focused stimulation is presented in Appendix I.

Table 3

Study Data for the First Caregiver-Child Dyad, Alice and Mario

		Vault Components					
Phase	Session	Dose Rate	Low Pressure Interaction	Grammatical Utterances	Engagement	Varied Sentences	Varied Contexts
Baseline	1	2.70	X	X	∆	✓	∆
	2	3.70	X	X	✓	∆	✓
	3	5.60	X	X	∆	∆	X
	4	2.80	X	X	✓	∆	X
	5	2.50	X	∆	✓	∆	X
Average		3.46					
Intervention	6	15.70	∆	✓	✓	✓	✓
	7	13.70	✓	✓	✓	✓	✓
	8	15.80	∆	∆	✓	✓	✓
	9	11.30	∆	∆	✓	✓	✓
	10	11.80	✓	✓	✓	✓	✓
Average		13.66					
Maintenance	11	12.90	∆	✓	✓	✓	✓

Note. The symbol ✓ indicates the participant met the criteria for the component, the ∆ indicates partially met, and the X indicates they did not meet the criteria. See Table 2 for a rubric on measuring the VAULT components.

Other Vault Components

During the baseline condition, Alice consistently used a high level of questions (greater than four during the sessions) and directions during the play sessions and, therefore, did not meet

the criteria for low-pressure interactions during the baseline condition. Alice used a high number of telegraphic utterances and did not meet the criteria for grammatical utterances in four out of five baseline sessions. She partially met the grammatical utterance criteria in one baseline session. Alice met the criteria for engagement in three baseline sessions and partially met the criteria for the other two baseline sessions. She partially met the criteria for varied sentences in four baseline sessions and met the criteria in one baseline session. Finally, Alice did not meet the criteria for three baseline sessions for varied contexts, partially met in one baseline session, and met the criteria in one baseline session.

During the intervention, Alice's use of the VAULT improved across all components. She fully met the criteria for the components of engagement, varied sentences, and varied contexts. Alice met the criteria for low-pressure interactions in two intervention sessions while partially meeting the criteria in the other three sessions. She met the criteria for grammatical utterances in three intervention sessions and partially met the criteria in the other two sessions. Alice partially met the criteria for low-pressure interactions in three intervention sessions and fully met the criteria for the remaining two intervention sessions. See Table 3 for Alice's data on the use of the VAULT components.

Child Results

Mario did not verbalize any target words for the duration of the study. However, he was observed imitating the target word with verbal approximations during two treatment sessions ("dʌ" for down). Alice responded to the verbalizations as if he were saying the target word and continued her use of VAULT.

Caregiver-Child Dyad #2--Omar and Jackson

Caregiver Results

Focused Stimulation

During the baseline condition, Omar used an average of 4.55 target words per minute (range = 2.1-7.2 words per minute) while playing with his son Jackson. In three of the six baseline sessions, Omar used the target words in a repetitive song, which naturally increased the dose rate and led to an accelerating trend line. However, this dose rate was lower than that required in VAULT, and the dose rate in the baseline sessions without songs remained at a low level. The researcher included a sixth baseline to ensure stability after the increases seen when Omar used the target words in a repetitive song. The intervention condition was introduced after the sixth baseline condition demonstrated overall stability.

After the intervention was introduced, an overall gradual accelerating slope demonstrated an increase in Omar's use of focused stimulation. His dose rate increased to an average of 10.85 target words per minute (range = 6-14.6). The average dose rate for the last three baseline sessions was 4.3 words per minute, and the average dose for the first three intervention sessions was 7.26 words per minute. Omar did not reach the minimum nine doses per minute until the fourth intervention session, indicating a slower and delayed rate of change from the intervention and emailed performance-based feedback on the use of focused stimulation. Additionally, Omar's dose rate declined slightly during the first three intervention sessions, as demonstrated by a slight decelerating trend line. However, Omar's dose rate increased to a level higher than VAULT's goal with an average for the final three intervention sessions of 14.23 words per minute. Omar maintained a high-level dose rate for the final five intervention sessions (average = 13, range =9.3-14.6 words per minute). The percentage of non-overlapping data was 87.5% due

to the decreased dose rate during session nine. During the maintenance condition, Omar demonstrated a very high level use of focused stimulation at 20.7 target words per minute. Omar's data on the use of the VAULT components including dose rate are presented in Table 4, and a graph of the use of focused stimulation is presented in Appendix I.

Table 4

Study Data for the Second Caregiver-Child Dyad, Omar and Jackson

		Vault Components					
Phase	Session	Dose Rate	Low Pressure Interaction	Grammatical Utterances	Engagement	Varied Sentences	Varied Contexts
Baseline	1	6.3	X	X	✓	X	X
	2	6.00	X	X	∆	X	X
	3	2.10	X	∆	∆	X	X
	4	7.20	X	X	✓	✓	X
	5	3.30	X	X	✓	✓	X
	6	2.40	X	X	∆	✓	X
Average		4.55					
Intervention	7	8.20	∆	✓	✓	∆	✓
	8	7.60	∆	∆	✓	✓	✓
	9	6.00	✓	✓	✓	✓	✓
	10	9.30	✓	✓	✓	∆	✓
	11	13.00	✓	✓	∆	✓	✓
	12	14.60	✓	✓	✓	✓	✓
	13	14.00	∆	✓	✓	✓	✓
	14	14.10	✓	✓	✓	✓	✓
Average		10.85					
Maintenance	15	20.70	∆	✓	∆	✓	✓

Note. The symbol ✓ indicates the participant met the criteria for the component, the ∆ indicates partially met, and the X indicates they did not meet the criteria. See Table 2 for a rubric on measuring the VAULT components.

Other Vault Components

During the baseline condition, Omar consistently used a high level of questions and directions, which created a high-pressure interaction situation with Jackson. Therefore, he did not meet the criteria for low-pressure interactions in any of the baseline sessions. Omar used many telegraphic utterances and did not meet the criteria for grammatical utterances in five out of six baseline sessions (he partially met the criteria in the sixth session). Omar met the criteria for engagement in three baseline sessions. He partially met the criteria in the other three sessions because he used screens during the session that were distracting for Jackson and unrelated to the target word. Omar did not meet the criteria for varied sentences in the first three baseline sessions and met the criteria in the last three sessions. Finally, Omar used the target words in the same scenarios with the same items in all baseline sessions. Therefore, he did not meet the criteria for varied contexts in any of the sessions.

During the intervention phase, Omar's use of VAULT improved across all components. He met the criteria for low-pressure interactions in five sessions and partially met the criteria in three sessions. Omar met the grammatical utterances and engagement criteria in seven of the eight intervention sessions. He met the criteria for varied sentences in six out of eight intervention sessions and partially met the criteria in the other two sessions. Omar met the criteria for varied contexts in all eight intervention sessions. Finally, Omar met the criteria for grammatical utterances, varied sentences, and varied contexts during the maintenance session while partially meeting the criteria for low-pressure interactions and engagement. See Table 4 for Omar's data on the use of the VAULT components.

Child Results

Jackson did not verbalize any target words for the duration of the study. In addition, Jackson was not observed to use any single words in the video recordings. He communicated with his father using solely non-word vocalizations such as grunts and yells in protest.

Caregiver-Child Dyad #3--Lily and Addison

Caregiver Results

Focused Stimulation

During the baseline condition, Lily used an average of 2.94 target words per minute (range = 1.5 to 4.4 words per minute) while playing with her daughter, Addison. Unlike the first two participants, Lily demonstrated low variability in focused stimulation during the baseline condition. The intervention condition was introduced after the seventh baseline session demonstrated overall stability.

After the intervention was introduced, Lily demonstrated a gradual accelerating slope in the use of focused stimulation. Her dose rate increased to an average of 10.15 target words per minute (range = 4.9-17.3) during the intervention condition. The average dose rate for the last three baseline sessions was 2.63 words per minute, and the average for the first three intervention sessions was 7.3 words per minute. Lily reached the target dose rate of nine words per minute during the third intervention session after receiving the emailed performance-based feedback on the first two sessions. Therefore, she demonstrated a slower and more gradual rate of change after the training and performance-based feedback email. The average dose rate for the last three intervention sessions was 13.1 target words per minute, higher than the target dose rate of nine times per minute. Lily maintained a dose rate higher than the VAULT target for five intervention sessions (average = 12.1, range = 9-17.3 words per minute). The percentage of non-overlapping

data was 100%, indicating that all intervention condition dose rates were higher than ones during the baseline condition. During the maintenance condition, Lily used a high level of focused stimulation at an average of 11.4 target words per minute. Lily's data on the use of the VAULT components are presented in Table 5, and a graph of the use of focused stimulation is presented in Appendix I.

Table 5

Study Data for the Third Caregiver-Child Dyad, Lily and Addison

		Vault Components					
Phase	Session	Dose Rate	Low Pressure Interaction	Grammatical Utterances	Engagement	Varied Sentences	Varied Contexts
Baseline	1	4.20	X	✓	✓	△	X
	2	2.50	X	✓	✓	△	X
	3	3.40	X	△	✓	X	X
	4	2.50	X	✓	✓	△	X
	5	4.40	X	✓	✓	X	X
	6	1.50	X	✓	✓	X	△
	7	2.00	X	✓	△	X	X
Average		2.94					
Intervention	8	4.90	△	✓	✓	X	✓
	9	5.70	✓	✓	✓	X	✓
	10	11.40	✓	✓	✓	✓	✓
	11	9.80	✓	✓	✓	✓	✓
	12	17.30	✓	✓	✓	✓	✓
	13	13.00	△	✓	✓	✓	✓
	14	9.00	X	✓	✓	✓	✓
Average		10.15					
Maintenance	15	11.40	X	✓	✓	✓	✓

Note. The symbol ✓ indicates the participant met the criteria for the component, the △ indicates partially met, and the X indicates they did not meet the criteria. See Table 2 for a rubric on measuring the VAULT components.

Other Vault Components

During the baseline condition, Lily used a high level of questions, creating high-pressure interactions with Addison. Therefore, she did not meet the criteria for low-pressure interaction in

any of the baseline sessions. Lily met the criteria for grammatical utterances in six of the seven baseline sessions and partially met the criteria in one session. Similarly, she met the criteria for engagement in six of the seven baseline sessions while partially meeting the criteria in one session. Lily partially met the criteria for varied sentences in three baseline sessions while not meeting the criteria in four baseline sessions. Finally, Lily did not meet the criteria for varied contexts in six baseline sessions, meaning she used the same activities for most sessions. She partially met the criteria in one baseline session.

Similar to the other participants, Lily's use of the VAULT components improved during the intervention condition. Lily met the criteria for low-pressure interactions in four intervention sessions, partially met the criteria in two sessions, and did not meet the criteria in one session. She met the criteria for grammatical utterances, engagement, and varied contexts in all of the intervention sessions. Lily met the criteria for varied sentences in five intervention sessions while not meeting the criteria in two sessions. Finally, Lily met the criteria for grammatical utterances, engagement, varied sentences, and varied contexts during the maintenance session. She did not meet the criteria for low-pressure interaction. See Table 5 for the data on Lily's use of the VAULT components.

Child Results

Addison verbally produced one target word during the maintenance session. This was the first and only time she used a target word during a session, and Lily reported that it was the first time she had ever used that specific word. Lily also noted that Addison used a different target word outside a video-recorded session.

Social Validity

To answer the final research question, the caregivers participated in an interview to assess the social validity of the intervention. All interview questions were semi-structured and open-ended (see Appendix K). The caregivers were interviewed by one of the second observers who had received training on the VAULT intervention and had experience conducting interviews in research. The interviews lasted 5-10 minutes and were conducted virtually after the caregivers sent the maintenance session. Each interview was audio-recorded, initially transcribed by Zoom video conferencing (Yuan, 2020), and then the transcription was checked by the researcher. The caregivers were asked questions regarding their thoughts and experiences with the VAULT intervention and changes they noticed in their interactions or their child's language.

All three caregivers expressed that they found the intervention successful, even though only one of the children used a target word during a video-recorded session. However, each caregiver stated that it was successful for different reasons. When Alice was asked how successful she found the intervention to be, she stated, "Very. I mean he hasn't said quite actual words consistently, but a lot more babbling. He repeats sounds more. His focus has been a lot better so I think it works very well." When asked the same question, Omar stated, "I found it pretty successful because, overall, it just, it gave us a different routine and just a different way of trying to help our son improve his overall speech and just development." Finally, Lily expressed similar satisfaction when she described how her daughter, Addison, used a target word during play that was not previously a part of her vocabulary. Lily said,

> I found it successful in the fact that she better positively connected jump with the action verb of it. If you tell her jump, she'll jump, jump, jump, and she'll say it while she's jumping Which jump was not a part of her vocabulary prior to the study.

Similarly, all caregivers stated they would be willing to continue the intervention, suggesting that they found the intervention to be practical and able to be used in their daily lives.

Next, the caregivers were asked what they found most helpful about the intervention. Two of the three caregivers described how receiving feedback and guidance from the researcher helped implement the VAULT components. The third caregiver described how the frequency of doing the video-record VAULT sessions, twice per week, was helpful to them and their ability to practice the VAULT components. The caregivers were then asked what could have been more helpful to them, and two reported that they would have liked the intervention to continue for a longer time. The third caregiver stated that she was interested in learning more about the background of VAULT and other studies conducted on the intervention.

All three caregivers reported that this intervention has changed how they interact with their child, each stating that they have increased their use of focused stimulation in other daily routines and activities. For example, Omar stated, “When I see him, basically paying attention to something or if we're out and he's looking around at things, I see myself saying the words a few times. Repeating, you know, the same word in different ways and sentences.” Similarly, all three caregivers noticed a change in their child’s language by describing their pre-verbal language or attention skills. For example, Lily and Alice both noted that their child’s ability to attend to an activity during play lengthened.

The caregivers were then asked if they would recommend the VAULT training to other caregivers. All three caregivers reported that they would recommend the training. Additionally, Alice reported that she has shared information about focused stimulation and VAULT with a friend of hers who is concerned about her child’s language development.

Finally, the caregivers were asked if there was anything else they'd like to share about their experiences. Each caregiver expressed a positive experience or how their participation helped them. For example, Omar stated, "I think it brought us closer together. It gave us some good one-on-one time." Alice stated,

> Honestly, I think it was a blessing. Just finding the ad on Facebook. It was huge for us because my son's in the early intervention, and I felt like I wasn't getting the help I wanted, like the one-on-one or show me how I can help him.

During this time, Lily said she would like to participate in future studies. Therefore, because of their descriptions of their positive experiences, it can be concluded that all caregivers found the intervention valuable and practical.

Conclusion

A multiple-probe multiple baseline research design across three participants was implemented to answer the research questions in this study. Data were collected on the caregiver's use of the VAULT components during all conditions, and the results demonstrated that each caregiver met the VAULT definition of focused stimulation with fidelity. The caregivers also showed improvements in their use of the other VAULT components during the course of the intervention. Additionally, the caregivers maintained their use of focused stimulation after the end of the intervention. One child used a target word during the maintenance session; however, her caregiver reported that she had used a different target word at other times. Each caregiver reported overall satisfaction with the intervention, indicating it was valuable and practical.

CHAPTER V

DISCUSSION

Late-language emergence occurs in approximately 10-15% of toddlers and is defined by having less than 50 single words and a lack of two-word phrases at 2 years old (Desmarais et al., 2008; Paul, 1993; Zubrick et al., 2007). The relative prevalence of LLE leads to a noteworthy number of late talking toddlers on early intervention SLPs' caseloads. Most interventions for LLE use a direct-service model, meaning the intervention is delivered by an SLP or other early intervention provider in a clinical setting. However, Part C of the IDEA (IDEA, 2004) and the DEC *Recommended Practices* (DEC, 2014) support caregiver-implemented interventions as a family-centered practice for infants and toddlers with disabilities. The shortage of evidence for caregiver-implemented interventions has left a research-to-practice gap in feasible ways to teach caregivers to implement interventions for this population.

The purposes of this study were to examine (a) how teaching and feedback affect caregivers' use of VAULT components with their late talking toddlers, (b) whether there is a subsequent change in the toddler's use of target vocabulary words, and (c) whether the intervention is valuable to the caregivers. The VAULT intervention uses high-frequency verbal modeling in variable contexts to increase a child's expressive vocabulary (Alt et al., 2014). Several studies exist in which VAULT positively impacts the expressive vocabulary of children with LLE; however, prior to this dissertation, only one study examined how caregivers could implement VAULT.

A multiple probe multiple baseline across three participants was used to determine if there was a functional relation between training and weekly performance-based feedback emails on caregivers' use of VAULT. The researcher virtually trained three caregivers to use the VAULT intervention during play with their late talking toddler and provided weekly emailed performance-based feedback on their use of the VAULT components. Four research questions guided this study:

Q1 Is there a functional relation between training and feedback on the increased level of caregivers' use of the VAULT focused stimulation dose rate at home with children who are late talkers?

Q2 To what extent do caregivers achieve fidelity to the other five components of VAULT during the course of the intervention?

Q3 To what extent do the late talking children learn the target words during the course of the intervention?

Q4 To what extent did the caregivers find the VAULT intervention to be valuable and practical?

Focused Stimulation

The first research question examined the caregivers' use of VAULT's focused stimulation component (also called dose rate). The caregivers' dose rates varied in their respective baseline conditions, and all caregivers used a rate that was lower than the target of nine times per minute in VAULT. One interesting finding was that the first and second participants' baseline dose rates naturally increased when they used the target words in repetitive songs. While it did not increase to the dose rate level required in VAULT, it demonstrates a potential method to increase caregivers' use of focused stimulation in natural environments and contexts. Music has long been a method for supporting child development (e.g., Hallam, 2010; Hooper, 2023; Knight & Rabon, 2017; Paquette & Rieg, 2008), and this study demonstrated that it may come naturally to some caregivers even without direct instruction.

The results showed that by the end of the intervention, all caregivers had achieved fidelity to the VAULT focused stimulation parameters. Therefore, a functional relation was found between the virtual training and performance-based feedback emails and caregivers' use of focused stimulation. Two of the three participants required the performance-based feedback email to increase their dose rate to the VAULT dose rate (Barton et al., 2020; Casey & McWilliam, 2011; Hester et al., 1996; Krick Oborn & Johnson, 2015; Pentimonti et al., 2022). Additionally, all caregivers sometimes exceeded the VAULT dose rate parameters, a similar finding to those in the study by Mettler et al. (2022), who also used higher doses than required. This finding supports the conclusion that caregivers can implement VAULT's focused stimulation component with fidelity.

The first caregiver, Alice, began using the increased dose rate immediately following the training and maintained a high rate for the remainder of the study. Alice was the only caregiver who did not require support from the performance-based feedback emails to increase her dose rate. This was similar to the findings of Mettler et al. (2022) where, after the caregivers completed the self-paced VAULT training, the researchers "did not observe improvement, per se, as caregivers' fidelity was high from the first week of treatment" (p. 13). Interestingly, upon receiving feedback that her dose rate was higher than required and that she could decrease it, her dose rate decreased but remained above the VAULT parameters of nine times per minute. The session-specific dose rates for all of the participants are detailed in Table 6.

The second caregiver, Omar, demonstrated a different trajectory when using focused stimulation than the first caregiver. In the first and second intervention sessions, Omar met the dose rate for only one of the target words. Upon analyzing the video recordings, it was found that he was verbally producing the words simultaneously instead of using only one target word at a

time. In other words, Omar used both target words for the full 15-20 minutes instead of using one target word for 7-9 minutes and then the second target word for the other 7-9 minutes of the play sessions. Because of this, he could not maintain the required dose rate to meet the criteria for the VAULT focused stimulation. He may have used both target words for the entire session because of a misunderstanding in the intervention directions given during the virtual training for using VAULT; however, during a feedback discussion about the sessions, Omar expressed difficulty in using one word without inadvertently saying the other, suggesting the words may have been too closely semantically related. The target words in these intervention sessions were "in" and "out," and Omar had consistently used them one after the other throughout the sessions. Following the study design, the researcher sent the performance-based feedback email weekly after the caregiver uploaded two videos. Therefore, Omar had conducted two play sessions before this error was discovered. In this circumstance, coaching caregivers to use VAULT in a live-coaching format might be better suited to catching errors early in the learning process. For example, the coach in the Mettler et al. (2022) study gave immediate feedback in the form of encouragement, suggestions, and information about their dose rate and remaining time in the session. The error was pointed out to Omar, who was instructed to use each word individually. In the next intervention session, the target words remained the same, and he used the words individually, but neither word was used to the required dose rate (as seen in the data from the third intervention session). Omar received additional feedback from the researcher mid-week that described a lower dose rate than needed in VAULT and to increase the dose rate, and he increased his dose rate to an average of 9.3 words per minute during the fourth intervention session. Then, once Omar produced each target word at least 270 times (following other VAULT studies), the target words were changed after the fourth intervention session and were no longer

that closely semantically related. It became significantly more manageable for Omar to use one word at a time, increasing his dose rate to 13 words per minute during the fifth intervention session. One strategy that worked well for Omar was having his partner record the videos and indicate when it was time for him to change target words. In this manner, he focused solely on one target word at a time. This supports the idea that caregivers may benefit from the support of a second adult (in the form of another caregiver or a coach) to use the VAULT components with fidelity (Krick Oborn & Johnson, 2015; Sone et al., 2021). However, it also implies that certain caregivers might encounter challenges in meeting the requirements of these components if they lack additional support. This highlights a consideration for early intervention professionals and suggests a potential area where they could provide valuable assistance and support.

The third participant, Lily, began meeting the target dose rate of nine times per minute during the third intervention session. Lily increased her dose rate after receiving feedback that the dose was under the target during the first two sessions, suggesting a successful use of the performance-based feedback. She demonstrated a higher rate of variability than the other caregivers within the intervention sessions, with a peak in the third session of 17.3 words per minute. The reason for this could have been a sense of saturation or fatigue, meaning Lily had difficulty maintaining the rate for target words in subsequent sessions because it was much higher than her natural average dose rate of 2.94 target words per minute during the baseline condition. This is a unique finding compared to Mettler et al's. (2022), where the researchers found that each caregiver sometimes exceeded, but varied little, from the desired rate for the duration of the intervention. Similar to the first participant, Lily also decreased her target rate after the feedback from the third and fourth sessions, during which she used a much higher dose rate than required.

The findings of this study also demonstrated that caregivers could maintain a high level of focused stimulation after the intervention ended. This finding is supported by other caregiver-implemented language interventions showing maintained use of language strategies over time (Akamoglu & Meadan, 2019; Kaiser & Roberts, 2013; Roberts et al., 2014; Woods et al., 2004). Each caregiver used a dose rate above the VAULT parameters of nine times per minute, ranging from 11.4 to 20.7 words per minute during the maintenance condition.

One interesting finding that contrasts with those of Mettler et al. (2022) is the high-level dose rate that each caregiver met either for the duration of the session, as in Alice's case, or periodically, as in Lily's case. Mettler et al. (2022) found the average dose rate across all caregivers in the intervention sessions ranged from a low of 8.1 words per minute to a high of 10.3 words per minute. In several cases, the high of 10.3 words per minute was significantly less than the average dose rates of this study's caregivers' intervention session. One explanation for this difference is the fact that the caregivers in Mettler et al's. (2022) study received live coaching during their sessions, and the researchers gave feedback on their dose rate, the remaining time in the session, and were asked to stop when they reached the minimum dosage for each target word. This prevented the caregivers from significantly exceeding the dose rate, as seen in this study. The dose rates for each intervention session are aggregated in Table 6.

Table 6

Dose Rate Averages per Session during the Intervention Condition

	Intervention Average Dose Rate								
	Session								
Caregiver	1	2	3	4	5	6	7	8	Avg.
Alice	15.7	13.7	15.8	11.3	11.8	–	–	–	13.66
Omar	8.2	7.6	6.0	9.3	13.0	14.6	14.0	14.1	10.85
Lily	4.9	5.7	11.4	9.8	17.3	13.0	9.0	–	10.15

The results of this study regarding the emailed performance-based feedback are consistent with other studies (e.g., Barton et al., 2013, 2016, 2020) demonstrating that participants can modify their behavior after receiving the feedback. In this study, the email-based performance feedback was delivered after two sessions. The first participant, Alice, did not need the feedback to reach nor maintain a high dose rate. However, more frequent feedback may have been beneficial for the other caregivers to reduce errors and support them in a more responsive manner than was inherent in this study's design. For example, Omar's error in using both target words simultaneously would have been limited to one session. Brief feedback via text message that informed him of his current dose rate, reminded him of the target dose rate, and offered suggestions on how to achieve it was provided mid-week (after the third intervention session), which resulted in improvements in Omar's use of the VAULT components. Further, Lily may have been able to increase her dose rate to a minimum of nine times per minute during the second intervention session had feedback been provided after the first session.

The findings of this study are similar to those of other studies that demonstrated caregivers' ability to learn and implement language-enhancing strategies to support their child's language (Akamoglu & Meadan, 2018; Ciccone et al., 2012; DeVeney et al., 2017; Kwok et al.,

2020; Roberts & Kaiser, 2015; Senent-Capuz et al., 2021). It is important to acknowledge that the caregivers received support prior to completing the individual sessions with their child in the form of preplanned activities with example sentences to use containing the target words. Similar to the caregivers in Mettler et al. (2022), the caregivers frequently incorporated suggested activities and sentences in the intervention sessions. While caregivers were not required to use those activities or sentences, this may have been an essential factor in their ability to meet fidelity to the VAULT components (Mettler et al., 2022). The high level of support provided is a necessary consideration for VAULT implementation by SLPs or other early intervention providers with significant caseload demands.

Other Vocabulary Acquisition and Usage in Late Talkers Components

The second research question addressed how the caregivers implemented the other five VAULT components: low-pressure interactions, grammatical utterances, engagement, varied sentences, and varied contexts. During the baseline conditions, all caregivers asked their children many questions, which resulted in none meeting the criteria for low-pressure interaction. A recent study by King et al. (2023) found that parents of young children frequently used what they called “intrusive caregiver behaviors” (behaviors that were adult-centered or adult-led such as limiting the child’s ability to take a turn or respond, reducing their ability to explore items, or taking over the play) when asked to teach their child a skill. While King et al. (2023) didn’t directly address the frequency of questions during the interactions, the caregivers in this study demonstrated similar behaviors when they were observed to ask a high number of questions that attempted to direct their child’s attention to a specific item and created a high-pressure environment. On the contrary, all the caregivers in this study either met or partially met the criteria for engagement by following their child’s lead and reducing outside distractions during

the baseline condition. This is an interesting finding because previous studies have shown that caregivers often struggle to follow their child's lead, particularly when directed to teach them something as was the case in this study (Dotterer et al., 2012; King et al., 2023). There may be several explanations for this. First, all of the caregivers and their children were enrolled in early intervention, and they may have already learned how to follow their child's lead during play. It is also possible that requiring the caregivers to set aside the time to record the videos naturally encourages them to follow their child's lead.

Research indicates that high-quality caregiver linguistic input in the form of complex grammatical utterances supports child development (Anderson et al., 2021; Rowe, 2012; Rowe & Snow, 2020). In this study caregivers exhibited variation in their use of grammatical utterances during the baseline condition. The third participant, Lily, rarely used telegraphic utterances. However, both Alice and Omar used them more frequently. However, all of the caregivers were able to meet the criteria for grammatical utterances quickly during the intervention. Similarly, the caregivers primarily used the same or very similar activities during the baseline condition and did not meet the criteria for varied contexts. However, they all met the criteria for varied contexts by the first intervention session and continued to do so for the duration of the intervention. Lastly, the caregivers displayed differences in their use of varied sentences. During some baseline sessions, the caregivers met the criteria, and then, in others, they did not, indicating that this component is highly variable during play. After the training, Alice met the criteria for varied sentences during the first session, Omar by the second session, and Lily by the third. It is important to note that examples of varied sentences containing the target words were provided each week throughout the intervention.

Interestingly, none of the participants fully met the criteria for low-pressure interactions during the maintenance session. Alice and Omar partially met the criteria, while Lily did not meet the criteria, indicating that each caregiver used a higher number of questions with their child than they were generally using during the intervention. Mettler et al. (2022) also reported that the low-pressure interaction component was the most difficult to implement. However, the caregivers in Mettler et al's. (2022) study achieved fidelity to the component by the second week of the intervention. This difference in reaching and maintaining fidelity could be due to how the components were measured; Mettler et al. (2022) used subjective real-time ratings, while this study used a rubric that may have had a narrower definition of low-pressure interactions.

Changes in Child Language

The third research question evaluated changes in the children's expressive vocabulary. Only one child, Addison, was observed to independently and spontaneously verbally produce a target word during a video-recorded session. However, Addison's caregiver, Lily, reported that Addison used the target word "jump" independently while playing at the park with her grandmother during the timeframe of the intervention, although it didn't occur during an intervention session. During the social validity interview, Lily also stated that Addison had continued to independently say "jump" in appropriate contexts during play. This finding demonstrates that novel word learning is possible in this intervention; however, it may not occur in the short duration of treatment and may not be able to be measured during the video-recorded sessions. All of the studies on VAULT thus far have demonstrated improvements in the children's vocabularies; however, the interventions have all lasted between 8 to 10 weeks (Alt et al., 2014, 2020, 2021; Munro et al., 2021; Ng et al., 2020). In each clinician-implemented study, the children received the intervention twice weekly, meaning 16 to 20 intervention studies. In the

study by Mettler et al. (2022), where the caregivers were trained to implement VAULT, the caregivers practiced the VAULT components twice per week individually and then participated in a once-weekly live coached session for 8 weeks for a total of 24 intervention sessions. In this study, the number of intervention sessions ranged from five to eight, considerably fewer than the number of sessions in the previous VAULT studies. Therefore, it is unknown if the children in this study would have demonstrated more progress toward verbally producing the target words if the number of intervention sessions matched those of the previous VAULT studies. Addison's results, which showed that she began to use two target words towards the end of the study, may indicate that additional intervention sessions would support continued progress.

This study's results differed from those of Mettler et al. (2022) in the changes in child language. All five children in Mettler et al's. (2022) study produced target words during the intervention condition, starting between the first and fourth week of the intervention. One explanation may be the difference in how target word productions were counted and measured. In the study by Mettler et al. (2022), one target word was required to be produced during the live coached session; however, other productions could be from the caregiver report. Another explanation for the differences in findings could be that the participants in this study required more time to achieve fidelity to the focused stimulation criteria. The participants in Mettler et al.'s (2022) study met the criteria for focused stimulation within the first week of intervention; this may be because of inherent differences in the participants, but is more likely because they received immediate feedback on their dose and support to increase the dose rate during live coached sessions. They also received immediate feedback on their use of the other five VAULT components. This significant difference in study design may contribute to the difference in word learning between the child participants.

It is important to note that both Alice and Omar reported progress in their child's language development during the social validity interview despite their children not producing a target word verbally during the video-recorded sessions. Alice noted that Mario used more babbling, imitated sounds more frequently, and that his attention improved during play. Omar reported similar changes, stating that Jackson was imitating more often than before. Additionally, each caregiver reported that participating in the training and intervention has changed how they interact with their child.

Social Validity

The final research question aimed to determine whether the caregivers found the intervention valuable and practical. The caregivers participated in a semi-structured interview following the maintenance session to answer this question. All caregivers expressed satisfaction with the intervention and noted a noticeable improvement in their child's language, indicating its perceived value. All of the participants also stated that they would continue the intervention, suggesting they believed the intervention to be practical and something they could embed in their lives. Furthermore, when asked what would have been helpful to them, two of the three caregivers stated that they wished the intervention would have been more extended, further demonstrating that they found it valuable and practical. These findings were consistent with the literature on social validity, which states that families generally find family-centered early intervention services meet their needs (Epley et al., 2011; Kuhlthau et al., 2011).

While questions specific to the family-centeredness of the intervention were not included in the interview, it is important for future SLPs and other early intervention providers to consider how VAULT can be implemented as a FCEI. The caregivers were asked what they found most helpful about the intervention, and two of the three caregivers highlighted the importance of

receiving feedback and guidance when implementing VAULT in their play routine. Therefore, the support provided by the researcher was a significant component of the success of the intervention. The caregivers and researchers collaborated in the learning process, and the caregivers were responsible for implementing the intervention in their natural environments. This aspect of the study aligned with principles of FCEI advocated by the IDEA (IDEA, 2004) and the DEC's *Recommended Practices* (DEC, 2014).

Limitations

This study focused on three caregivers' implementation of VAULT with their late talking toddler. All caregivers volunteered to participate in the study and were highly motivated to learn how to support their child's language development. Additionally, all the children were enrolled in early intervention services, indicating the caregivers were already seeking outside support for their child's development. While one family spoke two languages at home, all caregivers participated in English. Therefore, the findings from this study cannot be generalized nor representative of other caregivers of late talking toddlers.

The second limitation of the study was the duration of the intervention condition. As previously discussed, in other studies on VAULT, the intervention lasted for 8 or more weeks (Alt et al., 2014, 2020, 2021; Mettler et al., 2022; Munro et al., 2021; Ng et al., 2020). Therefore, the participants received considerably more treatment sessions, and changes to the child's expressive language were observed. While some changes in the children's language skills were seen in this study, continuing the intervention condition for longer may result in additional benefits and improvements in the children's vocabulary. Two of the three participants supported this by stating that they wished the intervention continued for a longer period of time.

One of the caregivers in this study, Lily, reported that her child said one of the target words during the intervention condition, but outside of the video-recorded sessions. This addresses another limitation of this study: measuring the production of target words or language changes was limited to words the child said during the video-recorded sessions. The criteria for producing a target word was that the child would say it independently, meaning they were not imitating their caregiver. Because the caregiver is inherently talking a lot while using the VAULT components, children do not have much time to independently or spontaneously say a target word. Changes in vocabulary may be better measured in other sessions or at other times when the caregivers reduce the amount of time they are talking or in other informal ways.

A fourth limitation of the study was using the MCHAT as a screening tool for autism spectrum disorder. The MCHAT is well-studied, designed to be implemented widely, and is one of the most commonly used screeners for autism spectrum disorder (Petrocchi et al., 2020). However, due to the nature of broad screenings, the MCHAT produces a significant number of false positives, and up to half of the children who screened at-risk for autism spectrum disorder will later receive either no diagnosis or a different diagnosis (Aishworiya et al., 2023). One child was excluded from participating in this study due to an increased risk for autism spectrum disorder as indicated by the MCHAT and researchers should take into account the potential implications of such exclusions on study participation. Therefore, the MCHAT may be too limiting in determining inclusion criteria for future participants.

Implications for Future Research

Several suggestions can be made to future researchers wishing to expand or replicate this study. While not an intended research question, this study includes caregivers of color and linguistic and cultural diversity that expands the literature on diverse populations in early

intervention. It is important to continue this trend in future studies. Researchers could replicate this study with other participants from other regions, demographics, and child ages to support the findings and generalization. For example, the study could be conducted with children and families who have different demographic backgrounds, who have not participated in early intervention, who use other home languages, or who have other disabilities such as autism spectrum disorder. Many caregivers of late talking toddlers reached out to the researcher for information about the study, indicating a high need for this area of research.

Another important consideration for future researchers is determining the best way to measure the children's expressive language during the intervention. This study used the CDI: Words & Sentences (Fenson et al., 2007a) to gather baseline expressive vocabulary information, and the children's target word productions were tallied during the video-recorded intervention session. Only one child produced a target word during the video-recorded sessions, but her caregiver reported that she had used another word outside of the video. Therefore, researchers should consider other ways of measuring realized changes in the children's vocabularies. For example, researchers could include a caregiver report of words produced outside the sessions throughout the week or re-administer a standardized language measure at the end of the study.

Future researchers could also consider changes to measuring the risk for autism spectrum disorder in children participants. As previously stated, the MCHAT may be too limiting to use to determine study inclusion. Future researchers could consider other ways of assessing the influence of autism spectrum disorder on children's language. For example, caregivers could complete other or additional screeners such as the Quantitative Checklist for Autism in Toddlers, in which caregivers rate the frequency of behaviors (rather than the presence or absence) or the Toddler Autism Symptom Inventory, which is a semi-structured interview that could be used

alongside other assessments. Both of these screening tools are free and widely available to caregivers, early intervention providers, and researchers.

As previously discussed, the caregivers in this study and Mettler et al's. (2022) benefitted from frequent feedback and significant support in generating ideas for relevant activities and varied sentences. This may be difficult for SLPs and early interventionists with high caseload demands to support. Additionally, caregivers should eventually be able to independently implement the VAULT components throughout their daily routines in order to maintain the benefits of the intervention. Therefore, future researchers could examine how changes in the frequency of feedback affect the outcomes and could consider fading the level of support to determine how caregivers can maintain fidelity or what level of continued support may be needed.

Finally, future studies should continue the intervention sessions for a longer duration of time after training the caregivers to determine the child's ability to learn new words when receiving VAULT from a caregiver. The only time a child produced a target word during a video-recorded session was during the maintenance session. Other VAULT studies conducted the intervention for 8 or more weeks and observed changes in the children's vocabularies. Therefore, future researchers should consider conducting the intervention for longer periods of time to allow the children more time to learn new words.

Conclusion

This study demonstrated a functional relation between the online caregiver training on VAULT and performance-based feedback email on the caregiver's use of focused stimulation. All three participants met fidelity to VAULT's focused stimulation and demonstrated progress toward fidelity to the other VAULT components. Additionally, the caregivers found the

intervention to be feasible and valuable. While only one child produced a target word during the intervention, all caregivers reported changes in their child's language. This study supported previous literature on the effectiveness of caregiver training on the caregiver's efficacy in supporting their child's language development. This study's limitations include generalizability, intervention duration, and dependent variable measurement. Future researchers should consider using other demographic populations of LLE, lengthening the intervention condition, and alternative expressive language measurements.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

UNIVERSITY OF
NORTHERN COLORADO

Institutional Review Board

Date:	08/05/2023
Principal Investigator:	Kelly Meadows
Committee Action:	**Expedited Approval - New Protocol**
Action Date:	08/05/2023
Protocol Number:	2304049181
Protocol Title:	Facilitating Language Development in Late-Talking Toddlers: A Study of Caregiver Training and Intervention Effectiveness
Expiration Date:	08/05/2024

The University of Northern Colorado Institutional Review Board has granted approval for the above referenced protocol. Your protocol was approved under expedited category (6) (7) as outlined below:

Category 6: Collection of data from voice, video, digital, or image recordings made for research purposes.

Category 7: Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

All research must be conducted in accordance with the procedures outlined in your approved protocol.

If continuing review is required for your research, your project is approved until the expiration date listed above. The investigator will need to submit a request for Continuing Review at least 30 days prior to the expiration date. If the study's approval expires, investigators must stop all research activities immediately (including data analysis) and contact the Office of Research and Sponsored Programs for guidance.

If your study has not been assigned an expiration date, continuing review is not required for your research.

For the duration of the research, the investigator(s) must:

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Institutional Review Board

- Submit any change in the research design, investigators, and any new or revised study documents (including consent forms, questionnaires, advertisements, etc.) to the UNC IRB and receive approval before implementing the changes.
- Use only a copy of the UNC IRB approved consent and/or assent forms. The investigator bears the responsibility for obtaining informed consent from all subjects prior to the start of the study procedures.
- Inform the UNC IRB immediately of an Unanticipated Problems involving risks to subjects or others and serious and unexpected adverse events.
- Report all Non-Compliance issues or complaints regarding the project promptly to the UNC IRB.

As principal investigator of this research project, you are responsible to:

- Conduct the research in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Obtain informed consent and research privacy authorizations using the currently approved forms and retain all original, signed forms, if applicable.
- Request approval from the IRB prior to implementing any/all modifications.
- Promptly report to the IRB any unanticipated problems involving risks to subjects or others and serious and unexpected adverse events.
- Maintain accurate and complete study records.
- Report all Non-Compliance issues or complaints regarding the project promptly to the IRB.

Please note that all research records must be retained for a minimum of three (3) years after the conclusion of the project. Once your project is complete, please submit the Closing Report Form.

If you have any questions, please contact Chris Saxton, Interim IRB Administrator, at 970-702-5427 or chris.saxton@unco.edu. Please include your Protocol Number in all future correspondence. Best of luck with your research!

Sincerely,

Michael D. Aldridge

Michael Aldridge
IRB Co-Chair, University of Northern Colorado: FWA00000784

Carter Hall 2008 | Campus Box 143 | Greeley, CO 80639 | Office 970-702-5427

UNIVERSITY OF
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APPENDIX B

RECRUITMENT FLYER

Is your child a late-talker?

Participants needed for a research study on training caregivers to improve the language skills of their late-talking toddler.

Criteria for Participation

The Child:

- Between 24-30 months
- Uses less than 50 words
- English speaker
- Has not been diagnosed with disabilities

The Caregiver:

- Have an electronic device with a camera
- Have access to high-speed internet
- Be willing to record videos of you playing with your child for the researcher to review

Contact:

Kelly Meadows
kelly.meadows@proton.me
970-716-0165

If you are interested or want more information, please contact Kelly Meadows at kelly.meadows@proton.me

This study is part of a doctoral dissertation. There will be compensation for completing the study.

APPENDIX C

INITIAL SCREENING QUESTIONS

Name: _____ Date: _____

Screening Questions	Yes	No
1. What is your child's date of birth? (Are they between 24-30 months old?)		
2. Has your child been diagnosed with a disability or do you have concerns about a developmental disability (e.g., Down syndrome or genetic diseases)?		
3. Do you have concerns about your child's hearing or vision?		
4. Do you or your child regularly speak a language other than English?		
5. Are you one of the child's primary caregivers?		
6. Are you willing to participate in the study for 10-12 weeks?		
7. Do you have a computer, laptop, smartphone, or electronic device with a camera attached and a high-speed internet connection?		
8. Are you able and willing to record play sessions with your child twice per week and upload them to a password-protected online drive?		

APPENDIX D

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH

UNIVERSITY OF NORTHERN COLORADO

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH

UNIVERSITY OF NORTHERN COLORADO

Project Title: Facilitating language development in late-talking toddlers: A study of caregiver training and intervention effectiveness

Researcher: Kelly Meadows M.S. CCC-SLP
Email: mead5638@bears.unco.edu

Research Advisor: Sandy Bowen, PhD., Professor, School of Special Education
Email: sandy.bowen@unco.edu

You and your child are invited to participate in a research study. The following information is provided to help you decide whether or not to participate.

The purpose of this study is to examine caregivers' use of an expressive language intervention with their late-talking toddler. The study will require you to participate approximately twice per week for three months. In order to participate, you and your child must meet the following criteria: (1) the child is between the ages of 24-30 months with an expressive language delay below the 10th percentile on the MacArthur-Bates Communication Development Inventories (CDI) (2) no other diagnoses or other developmental concerns (Down syndrome, genetic or neurological disease, or other primary disorders), (3) low-risk range on the Modified Checklist for Autism in Toddlers (MCHAT), (4) normal hearing and vision, (5) the caregiver uses English as their primary mode of communication, (6) the caregivers is an adult with a consistent caregiving role, (7) the caregiver is willing to participate in the study for 10-12 weeks, (8) the caregiver is willing to participate in the training, video their play sessions with their child twice per week, and confirm receipt of the weekly email feedback, and (9) the caregiver has a computer, laptop, smartphone, or electronic device and high speech internet connection in which they can record and send/upload videos.

The researcher will request your email to create a secure online One Drive storage account for exchanging and storing videos between you and the researcher. As a participant in this research, you will be asked to:

1. Complete assessment information about your child;
2. Record 15–20-minute videos of you playing with your child at home, twice per week;
3. Participate in a virtual training on the language intervention, estimated to take two hours (split into one-hour meetings);
4. Continue to video-record yourself playing with your child for 15-20 minutes twice per week, but this time using the language intervention strategies learned in the virtual training;
5. Upload the recorded videos of you playing with your child to the secure One Drive folder. Weekly feedback on your use of the strategies will be provided via email;
6. Record an additional 15–20-minute play session using the language intervention strategies two weeks after the end of the intervention;

Participant initial _____

7. Participate in an interview by a research assistant to reflect on how you feel about the intervention and your child's progress. The interview is expected to last 15-20 minutes and will be recorded for transcription and analysis.

The videos of you and your child that you upload to One Drive will be accessed and viewed for data analysis by the researcher, a second observer, and the research advisor. Researchers cannot guarantee confidentiality but will attempt to maximize confidentiality to the best of our ability. Your personal information, such as your name, child's name, and child's date of birth, will be altered to a case number. Only the researcher will know the case number associated with you and your child. Data collected and analyzed for this study will be kept in a password-protected One Drive folder and will be permanently deleted after three years from the conclusion of the study. However, some of the data will be sent to you weekly via email for your review, which is not inherently private. Foreseeable risks include discomfort in learning a new caregiver-child interaction, discomfort associated with performance-based feedback on new skills, or discomfort reflecting on their previous interactions with their child.

The cost associated with this study is your time participating in the initial virtual training and twice weekly video recordings. If you participate and complete the study, you will be compensated with a $75 gift card to Amazon, Walmart, or Target. The risks associated with this study are no greater than everyday life.

Participation in the study is voluntary. You may decide not to participate in this study, and if you begin participation, you may still decide to stop and withdraw at any time. Please take your time to read and thoroughly review this document and decide whether you would like to participate in this research study.

Having read the above and had the opportunity to ask questions, please sign below if you would like to participate in the study. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Research & Sponsored Programs, University of Northern Colorado at irb@unco.edu or 970-351-1910.

Caregiver Participant's Signature: _____ Date:_____

Your child's participation in the study is voluntary. You may decide for your child to not participate in this study, and if you begin participation, you may still decide to stop and withdraw at any time. Having read the above and had the opportunity to ask questions, please sign below if you would like your child to participate in the study.

Child's Name: _____ Date:_____

Caregiver's Signature: _____ Date:_____

Researcher's Signature: _____ Date:_____

APPENDIX E

DATA COLLECTION FORMS

Data Collection Forms

Identifier: _____Initials:_____ Date: _____

Dose Rate

Target Word #1 _____		**Target Word #2 _____**	
Minute	**Number of Models**	**Minute**	**Number of Models**
1		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8		17	
9		18	

Note: The dose rate for each word should be provided over 7-9 minutes, so you may not need all rows for each target word.

Identifier: _____Initials:_____ Date: _____

VAULT Components

Component	Met Criteria	Partially Met Criteria	Did Not Meet Criteria	Comments
Dose Rate Session Average: _____	Dose rate for both target words averages 9+ words/minute and a minimum of 64 doses was delivered.	Dose rate for only one of the target words averages 9+ words/minute and a minimum of 64 doses was delivered.	Dose rate averages less than 9 words/minute and the minimum of 64 doses per target word was not delivered.	
Low-pressure interactions	Three or fewer questions (if questions are asked, they answer it themselves) AND If directions are given, they answer it themselves.	4+ questions are observed and the caregiver answers it themselves OR Directions are given but the caregiver only follows the direction sometimes.	Any number of questions and the caregiver does not provide an answer themselves. AND/OR The caregiver gives directions to the child and does not follow the direction themselves.	

Grammatical utterances	The caregiver produced three or fewer telegraphic or non-grammatical phrases during the session.	The caregiver produced 4-6 telegraphic or non-grammatical phrases during the session.	The caregiver produced 6+ telegraphic or nongrammatical phrases during the session.	
Engagement	The target words are clearly related to the activity AND Caregiver follows the child's lead AND There are no background distractions	The target words are related to the activity, but either the caregiver is not following the child's lead, or there are multiple background distractions.	The target words are unrelated to the activity AND/OR There are multiple background distractions during the play session.	
Varied Sentences	The target words are used in three positions of sentences at least once (initial, medial, and final). AND The words in the sentences containing the target words are varied.	The target words are used in two positions of sentences.	The target word is used in only one position of a sentence (initial, medial, or final). OR The same sentences are repeated throughout the session.	

Varied Contexts	The caregiver varied the activity for each target word.	The caregiver varied the activity for the target words between two sessions AND The caregiver did not vary the activity within the session if the child's interest changed.	The caregivers selected the same activity to repeat over two or more sessions.	

APPENDIX F

VOCABULARY ACQUISITION AND USAGE IN LATE TALKERS TRAINING SCRIPT AND EXAMPLE PRESENTATION SLIDES

VAULT TRAINING SCRIPT

Slide 1: (Title page)

Slide 2:

Before we dive into VAULT, I'd like to welcome you to the study and thank you for your participation. I am excited to work with you.

My name is Kelly Meadows and I am a doctoral student at University of Northern Colorado studying early childhood special education. I am also a speech-language pathologist working with young children between birth and three years old. I am excited to start this project with you to learn more about how we can support language development in late-talking toddlers.

As a reminder, this meeting is being video-recorded to make sure I am providing accurate information. Would you like to continue?

Slide 3:

In the Vocabulary Acquisition and Usage for Late Talkers (or VAULT) treatment, the goal is to improve your child's vocabulary. We do this through a scientifically-based procedure based on Statistical Learning—a type of learning all people do without even realizing it.

What it looks like is you talking a lot and your child playing and listening. By listening, they should learn to pick up on the patterns of words and learn how to use them. There is a list of target words (words we are trying to teach your child) used over the course of the treatment. These words are meant to be common and useful in your child's daily life. For example, we may target toy words, such as plane, or body parts, such as foot. You have already chosen those words.

Slide 4:

You will be the one providing your child with the VAULT treatment, but I will guide you along the way.

Slide 5:

A major part of the treatment is for you to say the target word many, many times in just a short period of time (9 times per minute for 7-8 minutes, to be exact).

Although you will be doing a lot of talking, your child doesn't have to say anything. We find that children can learn just from hearing words a lot.

After you complete this training, you will be asked to record yourself using the VAULT components during a play session with your child twice per week. The play sessions and video recordings should last 15-20 minutes each. When you've finished the recording, please upload it to a designated Google Drive account that will allow us to share materials and videos. As a reminder, the only people that have access to the videos are you, me, a second observer who will check my data collection, and my research advisor.

After you have sent two video recordings, I will send you an email that contains feedback on your use of the VAULT components, any updates to the intervention, and suggestions for ways to use target words the following week.

Slide 6:

Please watch this short clip to get a feel for what it will be like to give the VAULT treatment.

Hopefully that made a bit more sense now that you've seen the VAULT treatment in action.

Slide 7:

Now, we're going to talk about each of the six components of VAULT: 1) Focused Stimulation, 2) Low-Pressure Interactions, 3) Grammatical Utterances, 4) Engagement, 5) Varied Sentences, and 6) Varied Contexts.

While participating in this training, you may be asked to respond to some questions. This is designed to help practice the components along the way.

Slide 8: (Focused Stimulation Title Page)

Slide 9:

In VAULT, you'll speak to your child differently than the way you typically talk with them. You will use a technique called Focused Stimulation. This is where you use a target word in sentences many, many times—about 9 times per minute over the course of 7-8 minutes.

This means you'll say the target word nearly 70 times in less than 10 minutes! This pace will probably feel very fast at first because it isn't how we usually talk!

Slide 10:

The target word needs to be the word that you say the most often in these 7–8 minutes. This will make it "pop" and stand out from other words your child hears you say. You'll start by focusing on using the target word as many times as you can in sentences.

Slide 11:

You could use the target word to talk about:
a) what your child is doing,
b) what you and your child are seeing,
c) a toy your child is holding or playing with— or any number of things!

Slide 12:

When you say a target word lots of times, like you'll be doing in VAULT, you help your child's brain pick up on the target word more easily. In the following clip, watch how I use target words more often than any other word. See if you can tell what the target word is. This clip will give you an idea of what Focused Stimulation is like.

Slide 13: (Video of Focused Stimulation)

Slide 14:

Hopefully you were able to pick up on the target words from each session just by watching. The target words pop! This is what we hope will happen for your child.

Remember, saying a target word about 9 times per minute is the most important part of VAULT. For each target word, you will maintain the rate of saying the target word 9 times per minute over a 7–8- minute period. (You won't have to keep this pace up all day long!)

Because you will be talking most of the time, it might seem like your child doesn't have much time to talk, but don't worry. The theory behind this technique is about giving the child more exposures to certain words than they would usually have. So, it is okay if your child does not say much during the VAULT sessions.

Slide 15:

One other thing to keep in mind with Focused Stimulation: for certain words, it is okay to use different versions of the target word.

Here's what we mean: for the word "run," you can say "running" or "runs" because your child still hears the word "run" in those words.

For the word "run," what we don't want you to say is "ran" because "ran" sounds different from "run". We want your child to learn the sound of the word "run."

Slide 16:

Another example is "eat."

If the target word is "eat," you can say "eats," "eating," or "eaten" because they all have the word "eat" in them. Your child will still hear the word "eat."

But if you say the word "ate," that is different from the word "eat," so it wouldn't "count" for eat.

After your child's target words are selected, we're more than happy to discuss with you which versions "count" or "don't count".

Slide 17:

Let's see Worksheet 1 to practice this VAULT technique.

Slide 18: (Low Pressure Interactions Title Page)

Slide 19:

The next VAULT component is called Low-Pressure Interactions. In VAULT, there is no pressure on your child to talk. This means that they won't be required to repeat anything you say or respond to questions like, "What animal is this?"

We're going to teach you techniques to create a low-pressure interaction with your child.

Slide 20:

One technique is narration. Narration is just like it sounds— you narrate or describe what's happening, sort of like a sports broadcaster.

Although it may feel unnatural at first, this is one of the best ways to provide language stimulation for your child. Why? Because narration takes all the pressure off the child, so they can focus on what you're saying and doing together. It lets the child continue their play as they receive quality language input from you.

You may wonder, “How is my child going to learn to say new words if they don’t have to practice saying them?” That’s the beauty of narration. When your child isn't being asked, “What’s this?” or told to “say train,” their brain can focus on their play and your words without the pressure of having to respond.

Slide 21:

Narration takes practice. At first, you might find yourself asking your child a lot of questions or giving them lots of directions.

Questions and directions may put more pressure on a child to respond.

For the VAULT treatment approach, it is important to lower the pressure on your child. However, there are ways to use questions and directions without putting pressure on your child.

Slide 22:

We call these situations low-pressure interactions. If you do ask questions, keep it low pressure by not expecting a response from your child. You may even answer your own question.

For example, “What does the elephant want to do? This elephant wants to jump.”

You could also rephrase your questions so that they’re not really questions anymore. Do this by saying, “I wonder,” or “Let’s see.” in front of a question.

For example, instead of saying, “Where is the dog going?” you could say, “I wonder where the dog is going,” or “Let’s see where the dog is going.” If you give your child a direction to follow—for example, “Make the dog run”—you can reduce the pressure on them by following through with the direction yourself—for example, by grabbing the dog toy and pretending to make it run.

Slide 23:

You could also add phrases like “We can” or “Let’s” to the beginning of a direction. For example, instead of telling your child, “Stack the blocks,” you could say, “We can stack the blocks,” or “Let’s stack the blocks.”

Slide 24:

When you ask a question or give a direction, one final strategy is to make sure you say it only once. For example, rather than repeating, “Let’s stack the blocks. Stack the blocks. Let’s stack now,” try instead to say that one time and then move on, saying something like, “Let’s stack these blocks. My block is red. Oh no, the blocks are falling!”

Slide 25:

In VAULT, by narrating what is happening, answering your own questions, and following through with directions you give your child, you will reduce pressure on your child to respond. A child who is less pressured to respond has more brain power to learn new words.

In VAULT, by narrating what is happening, answering your own questions, and following through with directions you give your child, you will reduce pressure on your child to respond.

A child who is less pressured to respond has more brain power to learn new words. In the following clip, watch how I describe or narrate what each child is doing, and how there is no pressure on the child to respond. Science shows us that children can learn a lot just from listening.

Slide 26: (video of Low Pressure Interaction)

Slide 27:

To recap, one of the keys with VAULT is to not put any pressure on your child to respond. As you learned, narration is a useful technique to describe what is happening in the moment. If you ask your child questions, it's okay if they don't respond. Remember, you could even answer the question yourself. If you give your child a direction to follow, remember that you can reduce the pressure on them by showing them what you want them to do.

These techniques will create a low-pressure way of communicating that will help your child learn more words.

Keeping pressure low keeps frustration low, which will allow you to continue giving the VAULT treatment.

This is the end of the training video for creating Low-Pressure Interactions.

Remember, it's fine to ask your child to respond to a question or follow a direction when you are not doing the VAULT treatment. These techniques are part of what makes the VAULT time special.

Slide 28:

Let's see Worksheet 2 to practice this VAULT technique.

Slide 29: (Grammatical Utterances Title Page)

Slide 30:

Children learn from what they hear. So, quality language input is important for children's language development. It includes describing or narrating your child's actions, as you saw in the training on low pressure interactions.

Slide 31:

Another important aspect of language quality is the type of sentence your child hears. When giving the VAULT treatment to your child, make sure to use grammatical sentences, such as, "Your chair is brown," or "They eat at the table." Avoid leaving out words, as in "chair brown" or "eat at table."

In other words, don't use sentences that you'd feel awkward using with other adults. Instead, say, "The chair is brown," or "Let's eat at the table." Little words like "the" and "is" act like clues to help your child learn the meaning of nearby words, so don't leave them out!

Slide 32:

Grammatical sentences can be very short (for example "Daddy laughed") or very long.

How long should your sentences be? In general, aim for that just-right balance between too little and too much information.

I'll help you if you need some advice finding the right balance for your child.

Slide 33:

One final thing—it's okay to use a few words rather than a full sentence in response to a question, as long as it makes sense.

For example, if you ask and answer your own question, you don't have to say, "What is the dog doing? The dog is barking!" You could instead say, "What is the dog doing? Barking!"

Although "barking" isn't a full sentence by itself, it is grammatically correct and makes sense in response to the question.

In the following clip, watch how I speak grammatically with the children.

Slide 34: (Video of Grammatical Utterances)

Slide 35:

In VAULT, speaking in grammatical sentences with your child is important because it will help them learn new words. Think of your words like a puzzle.

If you just give your child one piece, it's hard to see the whole picture. Think of the target word as one piece, but the whole sentence as the puzzle. Your child needs the full context to understand best.

They need the full, grammatical sentence. If you leave out words like "a" or "the" from your sentences, part of the picture is missing.

Don't worry if your child can't say the whole sentence yet...this will help them get there.

Slide 36:

Let's see worksheet 3 to practice this VAULT technique. Using grammatical sentences IS one thing you should do when talking with your child whether you are doing VAULT or not.

Slide 37: (Engagement Title Page)

Slide 38:

Doing VAULT should be engaging for both you and your child. You'll want to set aside focused time for VAULT. The good news is it only takes 7–8 minutes to focus on one target word.

Slide 39:

Ideally, you and your toddler are both looking at the same thing while you're working on a target word.

This is called Joint Attention.

Saying your child's name or pointing to the item or action you're talking about also gets them looking at you and what you're talking about.

You may have to continue getting their attention throughout the session. Getting your child's attention for everything you say to them is not required, but it may help. What is important is that you are using the target words to talk about an activity or routine that your child is currently engaged in.

Slide 40:

It's also okay to switch activities or follow your child as they switch to a different activity if your child is not interested in the current one.

Whenever you switch activities, the key is to keep using the target word.

Even with a different activity, it is important to keep the rate of saying target words in sentences 9 times per minute for those 7-8 minutes.

Slide 41:

For example, for the target word "wash," let's say your child starts by washing dishes with you but then walks away and starts to play with a toy car.

First, you'd talk about washing dishes, such as, "You're washing so well. Let's wash the cup too. Washing makes the sink wet!" then after they switch to playing with the toy car, you could bring a sponge and start washing the car, saying, "Let's wash this dirty car! The wheels need to be washed. Should we wash the windows too?"

Even though you were playing with dishes and then cars, your child is still hearing the word "wash" and is paying attention to that word.

Slide 42:

Here are some tips to help keep you both interested.

Minimize distractions. Turn off devices and put them out of reach.

Offer choices of pre-selected activities, objects, or toys to give your child some control. Being able to choose is very motivating!

For example, if your child is eating a snack, you can give choices of foods to eat or utensils to use or even where to sit, if you are comfortable doing so. If you're excited, they'll be excited.

You'll know your child is engaged if they're looking at you or at the item you're talking about.

Slide 43: (Video of Engagement)

Slide 44:

No toddler is engaged 100% of the time. That's okay!

Do your best to use the target word in whichever activity you and your child are engaged in together.

You probably already do many of these things naturally, so keep it up!

Slide 45:

Now that we're done with the training for Engagement, let's see Worksheet 4 to practice some more.

Slide 46: (Varied Sentences Title Page)

Slide 47:

Another VAULT technique is using target words in Varied Sentences. Hearing a target word in different sentences will help your child learn the new word better than hearing it in the same sentence over and over (as in "There's your dog," "There's your dog," "There's your dog").

Remember how you learned in the Focused Stimulation training video that saying a target word a lot of times helps the word "pop"? Using a target word in a variety of different sentences helps it "pop," too.

We want to teach you two strategies that will help you come up with different sentences when doing VAULT with your child.

Slide 48:

The first strategy is to say the target word in different spots within sentences. What we mean is that you could say the target word at the beginning, middle, or end of a sentence, as in the following examples with the target word "dog": "Dogs wag their tails," "Watch the dog play fetch," and "I pet my dog."

Notice how dog was said at the beginning of the first sentence, in the middle of the second sentence, and at the end of the third sentence.

Slide 49:

A second strategy for changing up your sentences is to add describing words. If you say, "They have a dog," your next sentence could be, "They have a furry dog."

If you say, "That dog barked," your next sentence could be, "That dog barked loudly."

When you use a bunch of different words around the target word, not only may your child learn some new words (like "loudly" or "furry"), but it also makes the target word stand out even more!

In the following video clip, listen to the different kinds of sentences used to say the target words.

Slide 50:

Saying target words in different sentences is an important part of VAULT. It may be challenging at first, but keep in mind that the main goal is to avoid saying the target words in the same sentences over and over again.

It's okay if you repeat a sentence every now and then, but if you're stuck and can't think of a different sentence, use the strategies you learned in this training.

Think of how you might use the target word at the end of the sentence instead of the beginning, or try adding new describing words to your sentence. Before doing a VAULT activity, you might want to write out a bunch of sentences using the target word so that you don't have to think up new ones on the spot. Once you've done this a few times, it will get easier.

Don't forget that I'm here to help! Also remember, we're only asking you to use these varied sentences when you are giving VAULT. For the rest of your day, you can speak normally!

Slide 51: (Video of Varied Sentences)

Slide 52:

You've now completed the Varied Sentences training. To practice this skill, let's try out worksheet 5.

Slide 53: (Varied Contexts Title Page)

Slide 54:

You've learned about using target words in different sentences to help your child learn. In VAULT, it is also important for you to use different objects and activities when teaching your child a new word, rather than using the same activity again and again.

Slide 55:

We call this Varied Contexts. The idea here is that different contexts give children more information about the words they are learning.

For example, if a child's only experience with an apple is the apple slices you serve them on their highchair tray, they might not recognize a green apple in a tree or a whole red apple in the grocery store. Also, using different activities keeps things from getting boring!

Slide 56:

Varying contexts involves using varied objects, varied actions, and varied activities. If you are working on the target word "apple," in order to vary the activity, you could talk about apples while eating them at snack time, and you could also read a book about apples, and you could also show your child how you prepare the apple for snack time (for example, by washing, drying, and cutting it).

Slide 57:

Whatever activities you choose, make sure there are opportunities to use the target words in them. If you are at the park but there are no apples around, it's probably not the best time to work on the word "apple."

Slide 58:

In "apple" activities, you could use real apples, toyapples, red apples, green apples, whole apples and sliced apples!

Slide 59:

Finally, to vary your actions, if you're preparing apples for snack time, for example, you could wash the apple, dry the apple, cut the apple, and smell the apple.

I can help you be creative about easy and low or no-cost ways to have different examples of items.

Slide 60:

Here are three great ways to vary the activity:

1. Play! If you have different types of the same toy (like 3 different cars), play with all of them. You can also play with the cars in different ways— maybe pretend to wash the cars with water and a cloth or have the cars drive through a paper towel tube "tunnel." This is what we are going to focus on in this study.

2. Daily routines. If you want your child to work on the word "wet," for example, you can talk about wetness during bath time or during cooking.

3. Books. At this age, you don't need to read the words if they don't hold your toddler's interest. Flip through the
pictures and talk about what you see. In the following videos, watch how each child hears target
words in several different contexts through different activities, different actions, and different objects all for the same target word.

Slide 61:

In the next video, watch how the child hears the target word in different contexts through different activities, different actions, and different objects - all for the same target word.

Slide 62: (Video of Varied Contexts)

Slide 63:

When providing VAULT to your child, remember to change the context when you're working on a target word. This includes changing the toys that you're using, the activity or daily routine it's in, and the actions you do with them. When practicing on your own, you can even switch up the place (your home or the park) and the people (just you or adding siblings and other family members).

Having different activities and examples of the target word helps your child use it in different contexts. It may be challenging to come up with new activity ideas during this process, but I am here to help.

Slide 64:

This is the end of the training for Varied Contexts, which means you've completed training on all six VAULT components!

For additional practice with this final skill, see Worksheet 6.

EXAMPLE VAULT TRAINING SLIDES

6 Components of VAULT

1. Focused stimulation
2. Low-pressure interactions
3. Grammatical Utterances
4. Engagement
5. Varied sentences
6. Varied contexts

VAULT Component #1 Focused Stimulation

Focused Stimulation

- Use a target word in sentences **many many times**
- About 9 times per minute for 7-8 minutes

Target word = word you say <u>most often</u> in those 7-8 minutes

This will make the word 

Use the target word to talk about:

- What your child is doing
- What you and your child are seeing
- A toy your child is playing with

or any number of things!

When you say a target word lots of times, you help your child's brain pick up on the target word more easily.

Target words **POP**!

Saying the target word 9 times per minute over a 7-8 minute period

One other thing...

Okay to use **different versions** of the target word

For the word "run," you can say...

"running" "runs"

...but don't say  **"ran"**

Another example:

If the target words is “eat,” you can say...

“eats” “eating” “eaten”

...not 

Let’s Practice!

VAULT Worksheet 1: Focused Stimulation

VAULT Component #2
Low Pressure Interaction

Low Pressure Interactions

In VAULT, there is no pressure on your child to talk.

Techniques to create a low-pressure interaction:

Narration

↓

Describe what is happening, like a sports broadcaster

Narration takes practice!

Might find yourself:

- asking your child a lot of questions
- or giving them lots of directions

For VAULT, it is important to **lower the pressure**

Low-Pressure Interactions

If you give your child a *direction to follow*, you can reduce pressure by:

- Following through with the direction yourself
- Add phrases like “We can” or “Let’s”

Low-Pressure Interactions

If you *ask questions*, keep it low pressure by:

- Not expecting a response
- Answer your own question
- Rephrase your questions

“I wonder…”

“Let’s see…”

- Narrating what is happening
- Answering your own questions
- Following through with directions you give your child

Reduce Pressure

Final Strategy:

Ask a question or give a direction

only once!

One of the keys with VAULT is to not put any pressure on your child to respond.

- Narration
- If you ask questions...
  - It's okay if your child doesn't respond
  - Answer the question yourself
- If you give a direction...
  - Show your child what you want them to do

Keeps frustration low

Let's Practice!

VAULT Worksheet 2: Low-Pressure Interactions

APPENDIX G

VOCABULARY ACQUISITION AND USAGE IN LATE TALKERS HANDOUT

VAULT

VOCABULARY ACQUISITION AND USAGE FOR LATE-TALKERS

Target words are spoken 9x/minute for 7-8 minutes (or 67x within 7-8 minutes)

VAULT PRINCIPLES

Focused Stimulation
Say the target word many, many times in 7-8 minutes to make it POP!

Low-Pressure Interactions
Your child does NOT need to speak during VAULT. Use narration, answering your own questions, and following through with your directions to reduce pressure on your child to respond.

Grammatical Utterances
Use short or long grammatically correct sentences when speaking with your child.

Engagement
Use a variety of engaging activities to hold your child's interest in the target word.

Varied Sentences
Use a range of sentence types when speaking with the target word.

Varied Contexts
Vary the objects used, actions, and activities pertaining to each target word

APPENDIX H

PERFORMANCE-BASED FEEDBACK EMAIL EXAMPLE

Hi <redacted>!

I loved watching you and <redacted> play this week!

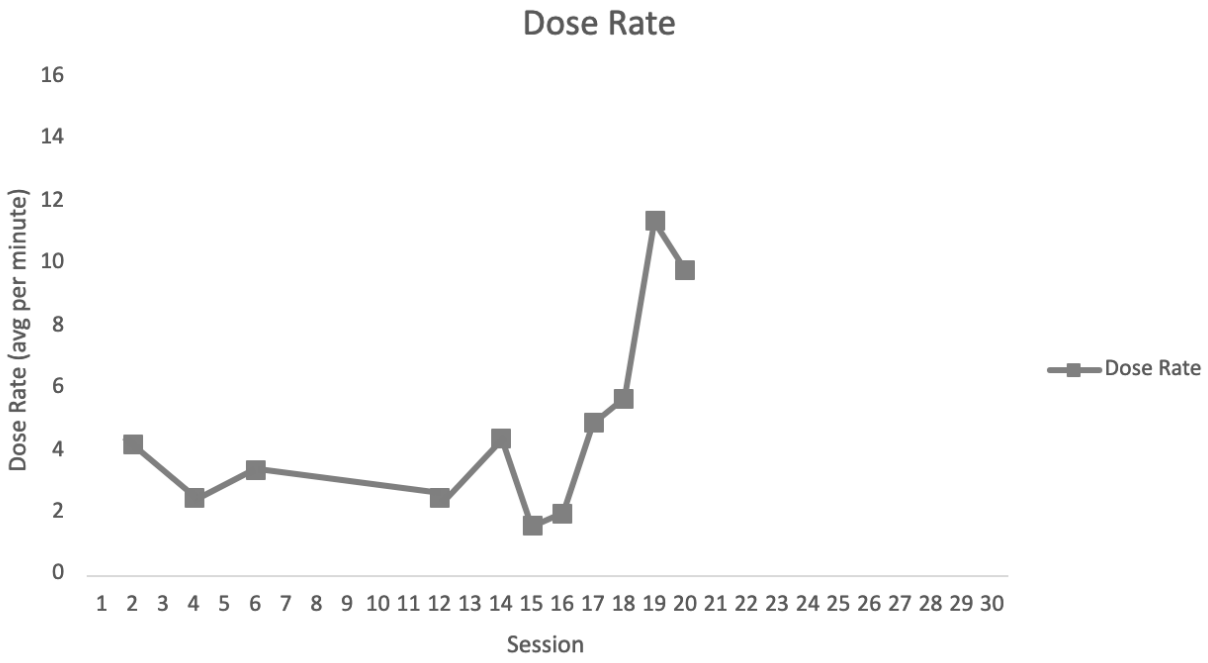
This week, please record 2 videos (15-20 minutes) of you playing with <redacted> using the VAULT components.

Here is your information on the VAULT components from the last week:

Target words: KICK and JUMP

Session	Date	Average Dose Rate
10	02/11/2024	11.4 words per minute
11	02/12/2023	9.8 words per minute

Here is your progress in the intervention so far:



VAULT Components

During the first video, you used an average of 11.4 target words per minute. This is great! You also did well using the target word in a variety of sentences (and at the beginning, middle, and end of sentences). During the second video, you averaged 9.8 target words per minute. There were several minutes that were lower than the goal of 9 words per minute but other minutes were above. I noticed the words that you used fewer target words were while you were reading the books. You did a great job following her lead by reading books, so keep working on ways to incorporate the target words!

You continue to do a great job following <redacted> lead! For example, when you were playing with the baby and she wanted to play with the van, you quickly changed your plan and continued to use the target word "jump" while playing with the van. You also did this when she wanted to read books. She was also very engaged with you throughout both videos.

Changes to the Study

There are no changes to the study this week. Continue to use "KICK" and "JUMP" in play.

Suggestions for Next Week

Here are some ideas for how to use the target words KICK and JUMP in play. You do not have to use these ideas, so please feel free to include your own! Because you are using the same words this week as you did last week, I encourage you to think about new ways or activities you could use for the target words. This can help you provide the Varied Contexts needed in VAULT.

KICK	JUMP
Inflate a balloon and encourage your child to kick it with their foot. Phrases you could use include, "Kick the balloon!", "I wonder how high you can kick the balloon", "Ready, set, kick!", "Oh no! We kicked the balloon way over there!"	Place pillows on the floor and encourage your child to jump from one to another. Phrases you could use include, "Ready, set, jump!", "I'm going to jump really high!" "Let's see if you can jump really high too", "Jump, jump!"
Kick a soft ball towards a small tower of blocks or row of plastic cups to knock over. Phrases you could use include, "Let's kick the ball", "I'm going to kick the ball and knock over the blocks!" "Kick!", "Oh no! I missed the kick!", "I wonder if you want to kick the ball too".	Set up small items in an obstacle course for you and your child to jump over. You can include other stuffed animals/toys in the activity too. Phrases you could use include: "I'm going to jump over the yellow block!", "It's your turn to jump", "I wonder if you can jump really high!", "Jump up high!" "Let's jump together!"
Gather several balls of different sizes and textures. Kick them to each other or a goal, talking about the attributes of each ball while you kick. Phrases you could use include, "I'm going to kick the small, red ball", "Oh no! I kicked the ball too hard", "Your turn to kick!" , "Kick [name], kick!" "I bet you can kick the ball now".	Place colored pieces of paper on the floor. Call out colors, and encourage or help your child to jump onto the corresponding color. Phrases you could use include, "Let's jump to the red square", "I wonder if you can jump up really high", "I want to jump to the blue square", "Woah! You jumped so high!", "Oh no! I jumped and fell over!"

Please send me a quick email/message back to let me know that you have received this message. Also, please let me know if you have any questions!

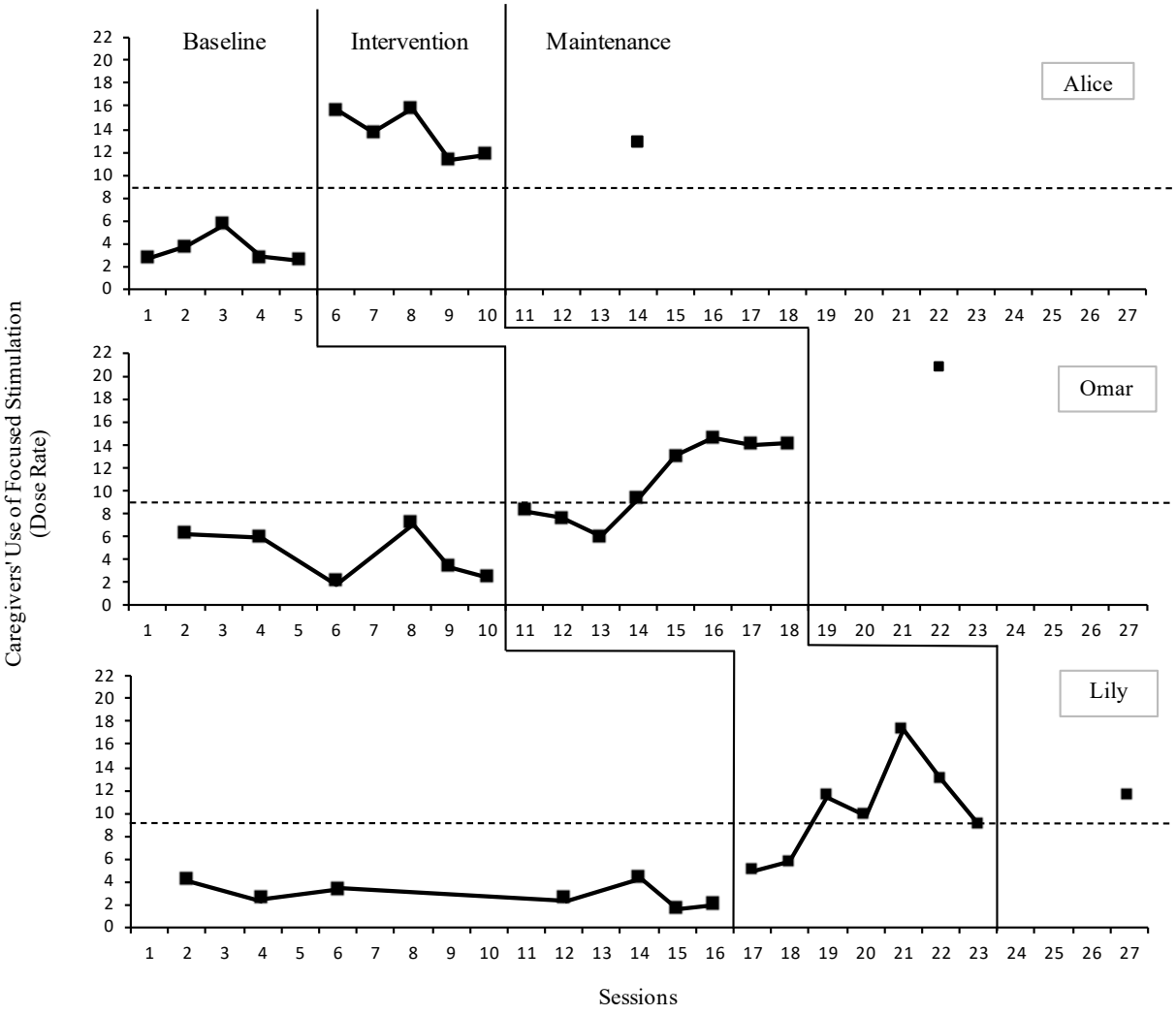
I look forward to observing again!

Talk to you soon,

Kelly

APPENDIX I

RESULTS GRAPH


Baseline
Intervention
Maintenance
Alice
Omar
Lily
Caregivers' Use of Focused Stimulation (Dose Rate)
Sessions

APPENDIX J

TARGET WORDS USED IN EACH CAREGIVER CONDITION

Target Words Used in Each Participant Condition

Caregiver		Target Word #1	Target Word #2
Alice	Baseline	Banana	Cookie
	Intervention	Up Down	Down Stop
	Maintenance	Eat	Shoe
Omar	Baseline	Clap	Hat
	Intervention	In Open	Out Stop
	Maintenance	Go	Jump
Lily	Baseline	Kiss	Bed
	Intervention	Kick Open	Jump Throw
	Maintenance	Wipe	Blanket

APPENDIX K

SOCIAL VALIDITY INTERVIEW QUESTIONS

Social Validity Semi-Structured Interview Questions

1. How successful did you find this intervention?
2. How willing would you be to continue this intervention?
3. What did you find most helpful about the intervention?
4. What could have been more helpful?
5. Has VAULT changed the way you interact with your child?
    a. If yes, can you tell me more about that? What has changed? How has it changed?
6. Have you noticed a change in your child's language after the intervention?
7. Would you recommend the VAULT training to other caregivers?
8. Is there anything else you'd like to share about your family's experience with the intervention?

APPENDIX L

FIDELITY CHECKLISTS

Procedural Fidelity Checklists

Fidelity checklist for initial training on VAULT components:

Identifier _____Initials:_____ Date: _____

VAULT Component	Step	Task	Occurred (time stamp)	Not Occurred	Comment
Focused Stimulation	1	Present training slides			
	2	Show a video demonstrating the component			
	3	Complete practice exercises			
	4	Offer opportunity for caregiver questions			
Low-Pressure Interactions	5	Present training slides			
	6	Show a video demonstrating the component			
	7	Complete practice exercises			
	8	Offer opportunity for caregiver questions			
Grammatical Utterances	9	Present training slides			
	10	Show a video demonstrating the component			
	11	Complete practice exercises			
	12	Offer opportunity for caregiver questions			
Engagement	13	Present training slides			
	14	Show a video demonstrating the component			
	15	Complete practice exercises			
	16	Offer opportunity for caregiver questions			

Varied Sentences	17	Present training slides			
	18	Show a video demonstrating the component			
	19	Complete practice exercises			
	20	Offer opportunity for caregiver questions			
Varied Contexts	21	Present training slides			
	22	Show a video demonstrating the component			
	23	Complete practice exercises			
	24	Offer opportunity for caregiver questions			

Fidelity checklist for performance-based feedback emails

Identifier _____**Initials:**_____ **Date:** _____

	Description	**Present**	**Not Present**	**Comments**
1	Dose rate from the previous two sessions is listed.			
2	Graph of the caregivers' progress showing the dose rate each session.			
3	Description of two examples of when the caregivers used one of the VAULT components.			
4	Any information about the child's verbal productions and the need to change target words if applicable.			
5	Suggestions on strategies/plans for the following sessions.			
6	Request for the caregiver to respond to the email to indicate they've received the information.			