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BIRTH TO THREE LANGUAGE ACQUISITION:  
INFLUENCES OF AMBIENT LANGUAGE  
IN THE MONTESSORI SETTING

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DISSERTATION

Submitted in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Education in Interdisciplinary Studies  
College of Education, Information, and Technology

NEW YORK

2021

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## **DEDICATION**

I dedicate this work to my family. My family's enthusiasm, love and support provided inspiration and energy to persevere.

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**ABSTRACT**

BIRTH TO THREE LANGUAGE ACQUISITION:  
INFLUENCES OF AMBIENT LANGUAGE  
IN THE MONTESSORI SETTING

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Long Island University, New York, 2021

Dissertation Chair:

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There is an expanse of literature looking at various topics supporting Montessori education, especially in preschool; however, there is a lack of research in infant and toddler Montessori classrooms. Most of the empirical data regarding language acquisition has focused on the child's acquisition of vocabulary through direct instruction, rather than the learning capability from overhearing a third party in a naturalistic setting. The purpose of this intervention study was to add to the limited empirical research on language acquisition in infant and toddler Montessori environments. More specifically, the intervention assessed if infants and toddlers could indirectly acquire new vocabulary through the Absorbent Mind from teachers and peers' ambient dialogue during the Montessori three-period lesson. The research utilized a descriptive, correlational pre-and-post quasi-experimental design to assess and analyze vocabulary and ambient language. Data collection occurred in three Association Montessori Internationale (AMI) and American Montessori Society (AMS) infant and toddler mixed-aged environments throughout New York State and Maryland. The Language Environmental Analysis (LENA) system was used to analyze audio recordings. Transcriptions of audio recordings quantified vocabulary acquisition and ambient language. Paired t-tests and ANCOVA were used to analyze children's acquired vocabulary. A fidelity scale analyzed the

extent to which Montessori trained teachers adhered to the three-period lesson intervention. The findings provide opportunities to improve infant and toddler teachers' classroom practice related to language acquisition. Suggestions were offered for early childhood teacher preparation programs.

*Keywords:* Absorbent Mind, Ambient Language, infant-toddlers, language acquisition, LENA System, mixed-age classroom, Montessori, vocabulary

## CHAPTER I

### BACKGROUND & CONTENT

*"The studies which have been made of early infancy leave no room for doubt: the first two years are important forever, because in that period, one passes from being nothing into being something" (Montessori, 1949/1997).*

In the 114-year history of Montessori education, there has been continuous research evaluating the method's effectiveness. There is an expanse of literature looking at various topics supporting Montessori education, especially in preschool; however, there is a lack of research in infant and toddler Montessori environments. In this dissertation, a closer evaluation of the two key foundational theories of the Montessori pedagogy and its impact on the infant and toddler environments were examined. The two concepts, mixed-age classrooms and absorbent mind theory were measured and observed by analyzing infants' and toddlers' language acquisition in authentic infant and toddler Montessori environments.

The research focused on infant and toddler language acquisition in Montessori environments is needed to enable Montessori Guides, teachers, teacher trainers, and administrators to improve their practice. While the primary participants for this study were in Montessori environments, this research supports all teachers in both traditional and non-traditional early childhood settings. Quantitative data support the advocacy of mixed-age environments and the absorbent mind theory, emphasizing the importance of the teacher's indirect contributions to the language-learning environment.

In 1917, Dr. Maria Montessori published *The Advanced Montessori Method* (Montessori, 1918/2007a), which emphasized the importance of the optimal development of the youngest children, infants, and toddlers for the first time. In all subsequent publications, Dr. Montessori stressed the importance of demonstrating respect for the infants and toddlers by educating them.



In *Education for a New World* (Montessori, 1946/2007b), first published in 1946, Montessori specifically wrote about the importance of the first two years of life. Dr. Montessori's *The Absorbent Mind* (1949/1997), first published in 1949, and *Discovery of the Child* (1948/1967), first published in 1948, concentrate on acquiring language in the early stages of life. Transcribed lecture notes as early as 1946 also indicate that Maria Montessori spoke extensively about the infant and toddler's absorbent mind and language development (Kripalani, 2002).

Research on infant toddler language acquisition suggests that young children acquire language from their environment (Akhtar et al., 1991; Christ & Wang, 2011; Clarke, 2003; Fernald & Weisleder, 2015; Harris et al., 2010; Hoff & Shatz, 2007; Pruden et al., 2006; Weisleder & Fernald, 2013). There is, however, a lack of research that examines the language acquisition of infants and toddlers in naturalistic learning environments or infant and toddler Montessori classrooms. This dissertation provides historical context to the development of the infant and toddler Montessori environment and literature and research measuring ambient language in mixed-aged classrooms. An ancillary purpose was to understand the correlation between infant and toddlers' vocabulary acquisition in the Montessori setting. The acquisition was assessed by using the Montessori three-period language lesson.

The Montessori method is the largest and oldest pedagogy globally, with over 22,000 schools in various academic settings, including public, private, parochial, and charter schools (Lillard & Else-Quest, 2006; Lillard, 2005; Whitescarver & Cossentino, 2008). The Montessori pedagogy is more often found at the preschool level; however, it is practiced at all education levels, including the infant and toddler age group (Lillard, P. P. 1996; Lillard, P. & Jessen, 2003; Lillard & Else-Quest, 2006).

## **Authentic Environments in the Montessori Setting**

Dr. Montessori did not trademark her name, method, or materials (Lillard, 2013; Lillard & McHugh, 2019a). Any school can call themselves a Montessori school, with or without trained staff or signature Montessori materials presented and practiced appropriately. Authentic Montessori environments begin with trained Montessori staff (Lillard & McHugh, 2019b). Two leading organizations oversee the practice and training of Montessori teachers. The Association Montessori Internationale (AMI) and the American Montessori Society (AMS) offer training and credentialing courses for teachers that work with infants and toddlers. There are 72 schools recognized and affiliated with AMI/USA that offer infant/toddler environments, with a total estimate of 127 classrooms in the United States. There are 1149 AMI Assistant to Infancy (A-I) trained Guides and eight AMI recognized A-I consultants, and another 15 AMI Consultant-in-training in the United States indicated by Kozicki, the AMI/USA secretary (S. Kozicki of AMI/USA, personal communication, June 6, 2021). Currently, there are 21 AMI A-I trainer of trainers and four auxiliary trainers in the world. Verheul, lead publisher at AMI, could not provide the number of AMI infant/toddler environments globally (J. Verheul of AMI, personal communication, June 6, 2021). Six hundred and nine AMS schools offer infant and toddler environments in the United States. An additional 69 schools internationally recognized by AMS offer infant/toddler environments. Kelly, former director of teacher education, affiliation, and services at AMS indicated AMS has credentialed 2,487 infant and toddler teachers since 1980 (A. Kelly of AMS, personal communication, May 4, 2016).

The adult's role in the authentic Montessori setting is to serve as a model for language and to prepare the environment with stimulating linguistic input (Honegger Fresco, 2019; Lillard, 2005; Lillard & McHugh, 2019a; Lillard & McHugh, 2019b; Montessori, 1946/2007b; Packard,

1972). Authentic Montessori environments exhibit several required characteristics that comply with the original, fundamental beliefs assumed to support optimal development. One of the foundational elements of this practice is the requirement of mixed-age groupings of children (Daoust, 2004; Lillard, 2005; Lillard, 2013; Lillard & McHugh, 2019a). The use of mixed-age groupings or multiage groupings potentially allows for a large and diverse amount of ambient language. Ambient language is the language surrounding a child (Forrester, 1993; Vihman, 1996; Vihman & Boysson-Bardies, 1994). In academic literature, ambient language is also identified as overheard speech (Akhtar, 2005b; Martinez-Sussmann et al., 2011; Schneidman et al., 2013). Ambient language comes from adults, group language lessons, and the language from older verbal children in the environment that other children can overhear (Akhtar et al., 2001; Floor & Akhtar, 2006; Fox Tree & Mayer, 2008; Gampe et al., 2012; Oshima-Takane et al., 1996).

### **Statement of Problem**

New research in fields such as brain development and neuroscience, positive psychology, intrinsic motivation and optimal experience theory (Rathunde, 2003; Rathunde & Csikszentmihalyi, 2005), school readiness (Kayili & Ari, 2011; Peng & Md-Yunus, 2014), self-regulation, social behaviors (Erwin et al., 2010; Lillard, & Else-Quest, 2006), creativity (Besançon & Lubart, 2008; Besançon et al., 2013; Rose et al., 2012), executive and cognitive functions (Bhatia et al. 2015; Diamond, 2012; Lillard, & Else-Quest, 2006), and mixed-age groupings (Gerard, 2005; Schweitzer, 2015) have been substantiated to the Montessori philosophy of education with sound research. However, neurocognitive research shows that vocabulary acquisition is grounded in perception and action (Hald et al., 2015) but has not been studied in Montessori environments. Another critical gap in the literature is the consideration of

the historical and practical documentation of the Montessori infant and toddler curriculum development. Montessori teacher training is grounded in Montessori pedagogy and current research. The lack of research to support the Montessori training curriculum is a detriment to the training and development of infant and toddler Montessori Guides.

Language ability and vocabulary size are the best predictors for school readiness and school success (Golinkoff & Hirsh-Pasek, 1999; Harris et al., 2010; Hart & Risley, 1995; Hoff, 2013; Morgan et al., 2015). The current research for school readiness focuses on preschool children's vocabulary outcomes (Golinkoff & Hirsh-Pasek, 1999; Harris et al. 2010; Hart & Risley, 1995; Hoff, 2013; Morgan et al. 2015). However, vocabulary acquisition begins and is greatly affected by experiences during the first 3 years of life (Anisfeld, 1984; Fernald, et al., 2013; Hoff & Shatz, 2007; Montessori, 1949/1997; Parish-Morris et al., 2013). Montessori (1949/1997) asserted:

The only language men ever speak perfectly is the one they learn in babyhood when no one can teach them anything! Not only this but if at a later age the child has to learn another language, no expert help will enable him to speak it with the same perfection as he does his first. (p. 6)

Morgan et al. (2015) investigated the oral vocabulary of 24-month-olds and the relationship to kindergarten readiness. After controlling for all other variables, Morgan et al. determined that children with smaller oral vocabularies at 24-months can be at risk for lower academic achievements in kindergarten. The extant literature has investigated young children in a lab or home setting with the mother as primary caregiver. This fact contributes to the research's low ecological validity (Erickson & Thiessen, 2015). Nearly 50% of children under the age of three are cared for by (a) individuals in licensed childcare, (b) family home daycare or

(c) other education facilities (e.g. nursery schools) (Cui & Natzke, 2021). On average, these infants and toddlers spend approximately 30 hours a week in regulated childcare settings (De Brey et al., 2021). Soderstrom and Wittebolle (2013) suggest that high-quality childcare settings play an important role in early language development. The findings suggest the need for further investigation of language acquisition in childcare settings.

An important role in early word learning for young children is intersubjectivity teacher engagement (Akhtar, 2005b; Carpenter et al., 1998). *Intersubjectivity awareness* (also known as *joint attention*) occurs when both teacher and child attend to a shared target or task (Akhtar et al., 2001; Trevarthen & Aitken, 2001). Montessori presentations, including the teacher's behavior in Montessori environments, rely on the theory of intersubjectivity to engage the child through the work both directly and indirectly.

This current study focuses on expanding the research of indirect learning and its relationship to vocabulary acquisition. Most of the empirical data regarding language acquisition has focused on the child being directly addressed, rather than the learning capability from overhearing a third-party interaction in a naturalistic setting (Foushee et al., 2021; Martinez-Sussman et al., 2011). The current research on ambient language suggests that the absence of intersubjectivity does not prevent successful word learning (Scofield & Behrend, 2011). This current study offered a closer look at ambient language and how it can be measured in a Montessori classroom setting. The study specifically examined how language acquisition relates to Maria Montessori's theory of the absorbent mind. The use of ambient language has also been studied in static environments with parents (Schneidman et al., 2013). Observing language development over time and within naturalist environments will provide a better understanding of how the foundation of language, specifically ambient language and the absorbent mind at work supports language learners (Hirsh-Pasek et al, 2015).

Research from neurolinguistics, neural multifunctionality, and language acquisition provides further insight into vocabulary acquisition. Neural multifunctionality is the acquisition process using working memory, attention, and cognition (Leikin, 2016). Leikin (2016) pointed out that, besides the natural condition of genetic and physical requirements to acquire speech, the most critical factor is external language stimuli in the environment. Leikin (2016) validated the studies of Gogate and Hollich (2013), Palmer et al. (2012), and Kuhl et al. (2006), suggesting that language has a critical period for acquisition. In Montessori environments, this is called the *sensitive periods* (Lillard & McHugh, 2019b; Montessori, 1918/2007a).

Theories of environmental influences on language acquisition have been based on studies of the “*mother-infant dyad*” (Lieven, 1994). Very few studies have examined the effect of ambient language experienced in childcare settings related to vocabulary acquisition (Akhtar, 2005a; Christ & Wang, 2011; Soderstrom & Wittebolle, 2013) or with infants and toddlers (Fitch et al., 2020). Additionally, there is no known research examining language acquisition in infant and toddler Montessori classrooms or the influence of peer ambient language on language acquisition. Research conducted in a lab or static setting has established that ambient language affects language acquisition when infants and toddlers overhear ambient vocabulary spoken to their parental caregivers. The current study's focus was to determine if this predictor is as impactful in mixed-age infant and toddler classrooms as it is in the latter.

### **Definitions of Terms**

**Association Montessori Internationale (AMI):** Founded by Maria Montessori in 1929 and located in the Netherlands. The AMI is the custodian of the Montessori movement's history and maintains the integrity of Maria Montessori's legacy. The AMI offers teacher training programs around the world.

**American Montessori Society (AMS):** Founded in 1960 by Nancy Rambusch, AMS modified the original Montessori Method to align with American culture. AMS offers teacher training programs, conferences, and maintains affiliate schools (Daoust, 2004; Povell, 2010).

**Authentic Montessori.** Montessori environments that have not compromised or altered the original intent of theories, pedagogy, philosophy, and practice them in their entirety. Classrooms must be guided by certified Montessori teachers (Lillard, 2013; Lillard & McHugh, 2019a; Lillard & McHugh, 2019b; Monson, 2006).

**Absorbent Mind.** Montessori describes the absorbent mind as the first three years of development in a child's unconscious mind where all stimuli are absorbed to create the individual (Montessori, 1949/1997).

**Ambient Language.** The language is indirectly overheard in an environment (Clarke, 2003).

**Assistant to Infancy (A-I):** The AMI curriculum developed by Adele Costa Gnocchi. These curriculums are intended teachers or Guides of infants and toddlers from birth to age three in AMI Montessori environments (De Serio, 2016; S. Brady, personal communication, April 11, 2016).

**Birth to Three (0-3):** Dr. Montessori's early writings use the descriptive zero to three or 0-3 when discussing the collective age group and is evident on aspects of development during a sensitive period or the collective development that takes place during the first Plane of Development (a range of ages for development). In more contemporary writing, the phrase "*Birth to Three*" is often used (Edwards, 2002; Lillard, P. P. & Jessen, 2003).

**Guide:** The Montessori term to identify teachers of infants and toddlers (Honegger Fresco, 2001). Notation: Guide is capitalized because it signifies the individual with specific training.

**Infants:** National Association for the Education of Young Children [NAEYC] (2011) defined infants as children under the age of 15-months.

**Infant Communities (Young Children's, Children's, or Toddler Community):** This space is prepared for children to enter once they are comfortably walking, typically between 14 to 18-months, depending on licensing regulations and will transition out to the Casa age group (Mixed-age preschool) between 34 – 36 months (Campanelli, 2000; North American Montessori Teachers Association, n.d.; S. Brady; personal communication, April 16, 2016).

**Intervention:** The intervention was target nonsense vocabulary words. New vocabulary words were the stimuli to the environment.

**LENA™ System:** Language Environment Analysis is a voice recorder and software system. LENA™ was created in response to the Hart and Risley (1995) study to find an easier way to transcribe and measure data culled from language assessments. The LENA tool is a wearable three-ounce device that can record all noise and language in the environment. The LENA tool has many measurement capabilities, including distinguishing child versus adult language, conversational turn-taking counts, measuring the amount of television noise in the environment, count words providing utterance and Mean Length Utterance (MLU) counts, and many more. The LENA tool can record up to 16 hours. The data is then downloaded to a computer where the LENA software creates data for further evaluation and study (LENA Foundation, 2016).



**Mean Length Utterance (MLU):** A sample of oral language measured in average length of oral expression (Nicolosi et al., 1989).

**Mixed-age Classrooms:** Also known as multi-aged or multigrade classrooms, these are classrooms that teach children in the same environment with various ages, grades, and abilities in the same environment (Berry & Little, 2006).

**Montessori Albums:** Individuals participating in Montessori Training create Montessori Albums (textbook). The albums consist of theoretical explanations of the pedagogy to interpret and implement into the classroom setting. The album also includes detailed diagrams of materials and furniture, step by step guide to the sequence of presentations, including the purpose and points of interest of every Montessori material and lesson. The albums cannot be purchased, as they are created by the Montessorian during training, demonstrating expert understanding of content. Under ethical guidelines, Montessori teachers may not reproduce the album without prior permission from the training agency (Honegger Fresco 2017, 2019). Note: Citations to Campanelli, 2000 and Brady, 2015 are personal Montessori Albums.

**Montessori Training:** Teacher preparation courses consisting of theoretical and practical lectures. Lectures also include demonstrations on presenting the Montessori didactic materials to young children (Cossentino, 2009). Credible teacher preparation courses also include required observations in qualified Montessori schools, internships, or field placements, and written, oral and practical exams.

**Natural Environment:** The everyday environment such as home, school, and community.

**Nido (Infant Environment):** The direct translation from Italian to English means “the nest”. It has synonymously been used as the name for infant care or daycare in Italy (Corsaro &

Emiliani, 1992) and Montessori infant classrooms (Campanelli, 2000; North American Montessori Teachers Association [NAMTA], n.d.).

**Recall:** Term used to identify the student's cognition or use of receptive language to demonstrate the use of a newly acquired vocabulary word when using the Montessori's three-period lesson (Montessori, 1949/1997).

**Recognition:** Term used to identify the child's ability to articulate or use expressive language to demonstrate the use of a newly acquired vocabulary word when using the Montessori three-period lesson (Montessori, 1949/1997; Standing, 1957/1998).

**Sensitive Period:** Developmental milestones that are a result of complex biological and environmental interactions. Sensitive periods can be described as periods of heightened interaction between organism and environment (Gogate & Hollich, 2013; Lillard & McHugh, 2019b).

**Teacher/ Directress/Guide:** The title of the Montessori trained adult in infant and toddler environments (S. Brady, personal communication, April 16, 2016).

**Toddlers.** NAEYC (2011) describes toddlers as children 12 to 36-months.

**Utterances:** The smallest unit of expression with complete communicative intention (Bavin, 2009).

**Word Count:** The frequency which certain words occur in spoken or written language (Nicolosi et al., 1989).

### **Theoretical Background**

Experimental psychologists, medical doctors, and philosophers were powerful influences on Dr. Montessori's view of the child, education, and the adult's role in the child's life, ultimately shaping the Montessori method (Kramer, 1976/1988; Standing, 1957/1998). Dr.

Montessori was always learning, open to new theories, and, most importantly, implemented, and shared new information through her lectures and writing (Kramer, 1976/1988; Povell, 2010; Standing, 1957/1998; Trabalzini, 2011).

## **Background**

Maria Montessori was born in Italy in 1870. Her biographers, Kramer (1976/1988), Povell (2010), and Standing (1957/1998), wrote about Dr. Montessori's early beginnings and her tireless work to become a medical doctor. From 1895 to 1896, Dr. Montessori worked at the Ambulatorio Infantile Children's Hospital and the Woman's Hospital of San Salvatore al Laterano. These positions supplied her extensive experience in pediatrics and maternal health. In 1896 Montessori was awarded the degree of doctor from the University of Rome. Povell (2010) and Trabalzini (2011) countered the many biographies and documents that state that Montessori was the first female physician in Italy or the first female physician to graduate from the University of Rome. Both authors indicated at least eight other women had graduated from different universities in Italy as physicians, including two the same year as Dr. Montessori. However, the academic work and challenges experienced by Dr. Montessori are not diminished.

Physicians at the time were trained to use observational skills to determine a diagnosis and suggest treatments. The method for physicians was to continue observations and alter treatment until the individual had been remedied. In *The Advanced Montessori Method: Spontaneous Action in Education* (2007a), Dr. Montessori wrote about the beginning of observation and experimentation, which was first pioneered by Gustav Fechner and, later, Wilhelm Wundt, the founding figure of psychology. This observation practice is how Dr. Montessori came to understand the needs of young children and remains the cornerstone of the Montessori philosophy and teacher preparation (Packard, 1972; Povell, 2010; Trabalzini, 2011).

Her original work is well documented with children and young adults at Rome's First State Orthophrenic School, where Montessori worked with children with deficiencies. Montessori then opened her first school for children in 1907 in Via dei Marsi in Rome (Babini, 2000; Packard, 1972; Kramer, 1976/1988; Standing, 1957/1998).

The works conducted by Weber, Fechner and Wundt in experimental psychology were important to Dr. Montessori's development of the materials and theory around sensorial impressions and the art of observation (Foschi, 2008; Povell, 2010; Tralbalzini, 2011). Montessori's theory of children's sensitivity to sensory input is inspired by Weber's work (Foschi, 2008; Kramer, 1976/1998). Fechner developed ways to scientifically measure the relationship between mind and body (Foschi, 2008). Wundt is credited with creating experimental psychology, providing inspiration and direction to Dr. Montessori's work with young children (Foschi, 2008; Kramer, 1976/1988).

Giuseppe Sergi, Achille de Giovanni, and Cesare Lombroso inspired Dr. Montessori's interest in measuring the child's physicality (Tralbalzini, 2011). Sergi emphasized anthropology and experimental psychology in education (Povell, 2010; Tralbalzini, 2011). Giovanni and Lombroso created the anthropometer to measure the physical attributes of the human body and emphasized anthropometry in psychology. Eventually, their work created three distinct sciences: (1) criminal anthropology, (2) medical anthropology, and (3) pedagogical anthropology. Dr. Montessori determined there was a use for this science in the education of young children, ultimately adapting the anthropometer to measure the child's size (Kramer, 1976/1988). Dr. Montessori's research in this field determines that children cannot do what adults do because of their body proportions and differences in strength and equilibrium (Feez, 2013). The tool

developed by Dr. Montessori is used in paleontology, forensic science, epidemiology, and the study of ergonomics.

Giovani and Lombroso's impact on Dr. Montessori's work is evident in Dr. Montessori's emphasis in lectures discussing the importance of observations of children. Giovani and Lombroso's also influenced how Montessori educated others about the role of adults in children's development. Montessori gave credit to Sergi for turning her attention to the school environment (Kramer, 1976/1988). Other philosophers and educators that Montessori studied with great interest were Itard and Séguin (Jackson, 2011; Povell, 2010; Trabalzini, 2011). Montessori implemented their ideas and replicated lessons while working with young children both in the Orthophrenic School and later in the first Casa dei Bambini (Children's House).

From 1900 to 1916, Montessori became an anthropology and hygiene lecturer and teacher at the Royal Woman Teacher Training College in Rome (Feez, 2013). Dr. Montessori taught teacher trainee coursework in general psychology, physiology, anatomy, and the psychology of children with mental deficiencies before developing the Montessori method. Montessori later included recording measurements, using the adapted anthropometer, and the importance of close observation of children's behaviors in later writings (Kramer, 1976/1988). Montessori continued to practice medicine and lectured widely about social reform, women, and children with disabilities (Povell, 2010).

It is important to mention that Montessori did not create the Montessori pedagogy within an egotistical bubble. Montessori became interested in the research and writings of Séguin in the last year of study (Povell, 2010; Trabalzini, 2011). Montessori audited a university course in pedagogy. Montessori read most of the past 200 years' major education works and began creating her thoughts about education and the young child (Kramer, 1976/1988; Standing,

1957/1998). Itard, Locke, Froebel, Pestalozzi, Rousseau, and Séguin influenced her work (Kramer, 1976/1988; Feez, 2013; & Standing, 1957/1998).

Montessori had a keen interest in the development of the senses. Séguin focused on the work of Pestalozzi and the idea of training the senses and using this training in general education. Montessori continued this idea of training by implementing sensory work as part of curriculum development. Rousseau focused on the process of learning, which Montessori extrapolated, emphasizing that the child learns from concrete experiences rather than from abstract ones, which have become the keystones of the Montessori practice (Guttek, 2004). Rousseau's research informed Montessori's thoughts regarding freedom of choice (Guttek, 2004).

Early educational theorists, including Pestalozzi, Froebel, and Dr. Montessori were influenced by Rousseau's work (Irish National Teacher's Organization [INTO], 1995; Kramer, 1976/1988; Povell, 2010). Pestalozzi like Rousseau did not agree with rote learning skills for young children. Pestalozzi's (INTO, 1995; Povell, 2010; Standing, 1922/1965) philosophy and perspective also included physical activity, learning through the child's senses, and groupings by ability. Dr. Montessori went on to refine Pestalozzi's ideas (Kramer, 1976/1988; Standing, 1957/1965). Montessori created environments similar to Pestalozzi's vision, which were more like home settings and less structured classrooms (Guttek, 2004). Like Pestalozzi, Froebel agreed that learning and growth were dependent on self-activity (INTO, 1995). Froebel created the Kindergarten curriculum, which included activities for the child to master control of their hands and movement and care for the plants in the indoor and outdoor environment (INTO, 1995). Froebel's didactic Kindergarten materials and curriculum influenced Montessori. This influence can be observed daily in the manipulative and practical life activities in the Montessori classrooms (INTO, 1995; Lillard, 2013).

Dr. Montessori wrote many books and articles, and lectures discussing the theories that support optimal development for the young child. Montessori developed a full curriculum for 3- to 6-year-old children. Montessori inspired the Assistant to Infancy Curriculum (curriculum for infants and toddlers), developed by Adele Costa Gnocchi, a Montessori student and supporter, (De Serio, 2016), and the elementary curriculum, developed by Montessori's son Mario Montessori (Schnepf, 2010; Trudeau, 1984). Both Gnocchi and Mario Montessori looked to the foundation of Montessori's original theories for inspiration, support, and guidance.

## **Historical**

There are limited reliable works dedicated to documenting Montessori's life work given her numerous contributions (Giovetti, 2014; Kramer, 1976/1988; Standing, 1957/1998). Recent dissertations and publications have expanded and corrected some inaccuracies (Babini, 2000; Jackson, 2011; Povell, 2010; Schnepf, 2010; Trabalzini, 2011; Van Aken, 2006). Trabalzini's (2011) book utilizes a historical lens to analyze Montessori's literature. Kramer's (1976/1988) book remains the leading document of Montessori's life. Babini (2000) found that Kramer's (1976/1988) biography had several inaccuracies and is outdated due to more recent publications, including Dr. Montessori's diary journaling migration to the United States in 1913 (Montessori, 2013). Both Kramer (1976/1998) and Standing's (1957/1998) biographies provide a brief discussion of the work and implementation of the Montessori programs for children under three. There is currently some literature in print in Italian discussing the Birth to Three Montessori movements (Belotti & Honegger Fresco, 1983; Giovetti, 2014; Honegger Fresco, 2001, 2017, 2019).

Additional information about Montessori's life and work can be found at the AMI and AMS archives, and an annotated timeline is attached (Appendix A). Arcane literature such as

dissertations (Appelbaum, 1971; Murray, 2008; Schnepf, 2010; Trudeau, 1984), privately published books, pamphlets (AMI, 2013), and books that are out of circulation (Standing, 1922/1965) or only in Italian (Belotti & Honegger Fresco, 1983; Giovetti, 2014; Honegger Fresco, 2001, 2017) contain forgotten details of her life and work.

In academic literature, there is a great focus on pedagogy and her didactic materials. Additionally, Povell (2010) recounted the stories of Dr. Montessori's advocacy for children and her support of women in leadership roles. Dr. Montessori was nominated three times for the Nobel Peace Prize to promote and educate peace (Honegger Fresco, 2001; Kramer 1976/1988; Povell, 2010; Standing, 1957/1998). Montessori also received the French Legion of Honor in 1949 and the Dutch Order of Orange-Nassau (Honegger Fresco, 2001; Trabalzini, 2011). Montessori advocated tirelessly for children's rights, freedom, and equal pay for equal work performed by women (Povell, 2010). Dr. Montessori was devoutly religious. Montessori wrote about the education of religion and spirituality in the Roman Catholic faith as well as the religious instruction of children. At the request of Montessori, Anna Maccheroni worked with Father Casulleras in Spain to combine Montessori theory and religious instruction. In 1915, they opened the first Montessori school to focus on religious education (Montessori, 1922/1965b; Standing, 1922/1965). Later, Adele Costa Gnocchi and Sophia Cavaletti would extend Montessori's work to create the Catechesis of the Good Shephard and expand the Montessori pedagogy into religious teachings for young children (Cavaletti et al., 1995; Honegger Fresco, 2017; Lillig, 1999). Montessori published *The Mass Explained to Children* in 1932 (Montessori, 1932/2015).



## History of the Montessori Assistant to Infancy Curriculum

The Montessori training for the infant and toddler Montessori curriculum is called Assistants to Infancy. The curriculum defined the role of the trained adult to be both an assistant to the child and parent, as well as guide them both through the child's first years of life (Brady, 2015; Campanelli, 2000; De Serio, 2016). Dr. Montessori wrote extensively about the infant in *The Absorbent Mind* (1949/1997). She focused on the development of what she called the "unconscious mind of child". Montessori (1949/1997) believed that education was a "help to life" (p. 13), and therefore education should begin at birth or even conception. She felt the education in the first period of life was the most important due to a child's development of his whole-self or *psychic powers*.

Babini's (2000) research on the history of Dr. Montessori concludes that there are many inaccuracies, oversights, and scarcity of details published. The history of the Assistant to Infancy, the Montessori method, and training for adults to work with children under 3-years is scarce and often an afterthought or completely neglected. A review of the Montessori literature shows limited references to the infant and toddler curriculum before 1917. *The Advanced Montessori Method* (1917/2007a) emphasized the elementary child with a brief discussion of the development of the infant. Dr. Montessori's observations and research about the infant's development had such an impact on her views of the child that Montessori included the infant in almost every book published after writing *The Advanced Montessori Method* (1917/2007a).

Dr. Montessori first wrote about the work of teachers' training as Assistants to Infancy in *The Absorbent Mind* (1949/1997). She wrote about "helpers in the home" (Montessori, 1949/1997, p.112), a training program for specialists to work with children under the age of two. The specialists were being trained at the Scuola Assistenti Infanzia Montessoriane in Rome. In

*The Formation of Man* (1949/2007c) Dr. Montessori cites that Montessori schools admitted children as young as 1.5-years of age. She also stated that Montessori Crèches were in operation in New York and England. *The Secret of Childhood* (1936/1966) and *The Child in the Family* (1923/1989), both written before *The Absorbent Mind* (1949/1997), indicate her growing interest and thoughts on birth and the family.

Trabalzini (2011) wrote about Montessori's time in India from 1942 - 1944. Trabalzini (2011) stated that Dr. Montessori and her son focused on studying the educational approach from birth to three years. The first known lecture to focus on the first three years of life was presented at the National Education Association of the United States' International Congress on Education held in Oakland, California, in 1915. The lecture was entitled "The Mother and the Child" by Dr. Montessori and focused mainly on the Mother-infant bond (Matheson & Zimmerman, 1986). In 1921, Dr. Montessori presented workshops to parents in Belgium and Austria about newborns. Dr. Montessori's first course featuring the infant and toddler was in 1944 in Ahmedabad, India. Montessori presented 30 lectures on the first 3 years of life and repeated these lectures while in Ceylon, India: now Sri Lanka. In 1946, Montessori presented another course in Karachi, India, now Pakistan. Atmaram Makhijani transcribed the course and provided a copy of the transcription to Mario Montessori. The child during from birth to three and the absorbent mind the early years of life were the focus of these lectures and later published by Lakshmi Kripalani (2002).

Kramer (1976/1988) and Standing (1957/1998) failed to mention any details of these early lectures about infants and toddlers. Neither biographer mentioned that notes from the Ceylon course were interpreted by Prakasam (2007) and compiled into the book, *What you Should Know about Your Child* in 1948. This oversight from both major authors of Montessori's

work demonstrates a disregard for Dr. Montessori's impact on the development of her methodology for infants and toddlers. The lack of information also created an opportunity for further investigation of the development of the Assistant to Infancy courses and infant and toddler Montessori programs.

### **Political Influence on Pedagogy**

In 1925, fascist Italy passed a national law for the "Protection and Assistance of Infancy" (Gandini and Edwards, 2001). The political landscape may have shaped the original purpose for the content of the first infant and toddler environments in Italy, as well as the infant and toddler Montessori movement. The name of the law itself leads to speculation about how much the law influenced the creation of the Montessori Assistants to Infancy Program. This law created a new government structure, the Opera Nazionale Maternita e Infanzia (ONMI) or National Organization for Maternity and Infancy. The program was to organize centers to assist and instruct mothers on infants' care and train caregivers on the care for infants while mothers worked (Corsaro & Emiliani, 1992). The program also had strong guidelines for staff qualifications. The program was to educate expectant mothers about prenatal care, good hygiene, proper feeding practices, and creating schedules.

Some similarities immediately emerge between the Assistants to Infancy Montessori programs and OMNI such as: (1) the importance of qualifications and training of staff, (2) education of mothers, and (3) hygiene and health of the mother and child. There were also numerous differences between the ONMI program and the Montessori practice. The OMNI program cared for children as a group (ratio was 20:1) and followed on a strict schedule. Playpens were used to control children. The OMNI program also lacked the holistic view of the

whole mother and child. Additionally, the OMNI program believed that “spoiling” the child was unnecessary (Corsaro & Emiliani, 1992; Gandini & Edwards, 2001).

Law No. 1044 was passed in 1971 (Gandini & Edwards, 2001; Pistillo, 1989) and was implemented in December 1975. This law provided maternity, parental leave for working mothers and established asili nido or daycare centers (Corsaro & Emiliani, 1992). The national government had teacher training requirements for asili nido. There are three options available to teachers: (1) diploma di assistant d'infanzia (Assistants to Infancy diploma), (2) training as a health nurse and vocational training for 3 to 4 years, and (3) training as a preschool teacher to care for infants and toddlers, even without specialized training for the age group. To care for infants in the 1980's, the Italian government transferred infant and toddler services from health and social welfare departments to the departments of education, creating continuity with preschool services (Gandini & Edwards, 2001).

### **Inspiration for the Assistants to Infancy**

Dr. Montessori (1949/1997) wrote extensively in *The Absorbent Mind* about the development of infants and toddlers. Her observations of infants in India and more intimately, the birth of one of her colleague's newborn infant in 1936. Montessori was inspired by Dr. Alexis Carrel's (1939) who believed the period of infancy is the richest time to cultivate the young child's development. Dr. Carrel (1939) discussed human nature in *Man, the Unknown*. His mention of infants in his book underscores that scientists were beginning to acknowledge and understand the importance of infant development.

Montessori was also inspired by Rousseau's philosophy of child rearing practices the included: (1) the removal of artificial restraints, (2) the need for children to touch materials, and (3) allowing children to be free to learn from their own experiences (Kramer, 1976/1988). The

suggestions to allow children space and freedom of movement in a classroom had a significant impact on the training of adults in the Assistants to Infancy program. Specific pedagogical methods include the removal of all containers, such as playpens, or items that would harm the natural physical, cognitive, and emotional development of the child (Campanelli, 2000).

Dr. Montessori's writings for the birth to three environments provide the foundational theory (Greenwald, 2000). Adele Costa Gnocchi (1883 – 1967), a student of Dr. Montessori is credited with developing curriculum for infants and toddlers. Adele Costa Gnocchi was a pupil of Dr. Montessori at her first course in Città di Castello in 1909 at the age of 26 (AMI, 2013; Honegger Fresco, 2001; Maccheroni, 1947, Montanaro, 2002). Costa Gnocchi attended many more Montessori training courses throughout her life, as Dr. Montessori's lectures consistently expanded due to her continued observations and research (Honegger Fresco, 2001). Costa Gnocchi went on to receive a degree in philosophy in 1909. Varga (1997) states the degree was a Ph.D., while other documents state a degree in psychology, from the Regia Scuola Normale Femminile, or the Royal Female Normal School. Costa Gnocchi continued her studies and graduated in 1913 with a degree in Moral Pedagogy from the Regio Istituto Superiore di Magistero, or the Royal Institute of Education (Honegger Fresco, 2001). Costa Gnocchi opened her first school, La Scuoletta, at Palazzo Taverna in 1927 and began enrolling toddlers as early as 1939 (Slabaugh, 2013).

In 1949, the Eighth International Montessori Congress emphasized the protection of the infant and toddler and the training of the individuals caring and educating them. The theme of the conference was entitled *The Formation of Man in World Reconstruction*. Montessori presented four conferences entitled: (1) *The Creative Capacity of Early Infancy*, (2) *Human Solidarity in Time and Space*, (3) *The Absorbent Mind*, and (4) *World Unity through the Child*.

During the Congress, a classroom of young toddlers was set up for viewing. The classroom was under the direction of Giana Gobbi. The children began months earlier at Costa Gnocchi's school (Trabalzini, 2011).

Montessori had the resources and ideas to conduct research using the Montessori method for children in the period of life known as unconscious learning during the first three years of life. Although Dr. Montessori had the resources and ideas, she never guided an infant or toddler classroom (Slabaugh, 2013). Dr. Montessori helped Costa Gnocchi conceptualize the idea and provided guidance through correspondence (K. Slabaugh, personal communication, April 10, 2016). Mario Montessori recalls that Dr. Montessori met with Costa Gnocchi upon his mother's return from India in 1949. Dr. Montessori had followed Costa Gnocchi's work with infants and toddlers closely. Montessori believed that "we start education far too late!" (Montanaro, 2002, p 215). Costa Gnocchi had learned of the recent publication of *The Absorbent Mind* published in India and ordered the book. *The Absorbent Mind* is part of the foundation of the original programs Costa Gnocchi would operate (Montessori, M. M., 1998). Costa Gnocchi founded the School for Assistants to Infancy in Palazzo Vidoni in Rome (La Scuola Assistenti all'Infanzia) in January 1949. Some documents state that the school opened as early as 1947 (Centro Nascita Montessori, 2016; Honegger Fresco, 1990; Slabaugh, 2013). The first Assistance to Infancy diploma was issued to thirteen students in 1951 (Honegger Fresco, 2001).

Costa Gnocchi shared credit for opening the school with Dr. Giuseppe Vitetti, a professor at the pediatric clinic of the University of Rome, who held the title of president of the school, and Dr. Cesare Pignocco, a pediatrics specialist (Montessori, M. M., 1960). This school became the future model for Assistants to Infancy training courses (AMI, 2013). Dr. Vitetti and Dr.

Pignocco combined the psycho-pedagogical sciences with medicine for a more holistic observation of the child in childcare settings. They also provided special training for adults that cared for young children in these settings (De Serio, 2016). The same year, Costa Gnocchi opened the Palazzo Taverna, serving children aged 12-months to three-years. Assistants to Infancy teacher trainees completed their internships and observations at Palazzo Taverna under Gnocchi's guidance.

In 1955, Silvana Quattrocchi Montanaro, a pediatrician, was asked to present the Montessori Training School's hygiene lectures for Assistants to Infancy (Montanaro, 2002). Montanaro continued to train on topics such as child neuropsychiatry and nutrition. Dr. Montanaro wrote *Understanding the Human Being* in 1987, which is a required reading assignment for AMI teachers in the Assistants to Infancy training program (S. Brady, AMI A-I Trainer, personal communication, April 11, 2016; Montanaro, 1991). Later, Dr. Montanaro became the founding trainer for Assistants to Infancy training for AMI (Stephenson, 2013).

In 1957, Costa Gnocchi established the Centro Nascita Montessori or Montessori Birth Center (AMI, 2013; Centro Nascita Montessori, 2016; De Serio, 2016; Franceschini & Honegger Fresco, 2010). The birth center's purpose was to reduce the medicalization of the birthing process and remove the fear of childbirth. Psycho-prophylactic obstetric care such as Lamaze and Respiratory Autogenic Training (RAT) was introduced (Honegger Fresco, 2001). Findings from research conducted at the Montessori Birth Center were reported at Montessori Congresses. The findings supported the Assistant training agenda for the infancy curriculum.

The first birth to three environments in the United States opened in Dayton, Ohio in 1966 by Rita Brandimarte Messineo, who received her training from Costa Gnocchi in 1963 (Honegger Fresco, 2001; Varga, 1997). The first AMI Assistants to Infancy diploma course was

conducted in Rome in 1980. Dr. Montanaro, Gianna Gobbi, Lidia Celli, and Gabriela Bartoli instructed the course (The Montessori Institute, n.d.). The first Montessori birth to three teacher training was held in 1981 in the United States at the Center for Montessori Teacher Education (CMTE), an AMS accredited training center in New York. All instructors worked with Costa Gnocchi and the original Assistants to Infancy training center or the Montessori Birth Center in Italy (Honegger Fresco, 2001). In 1983, the first AMI Assistants to Infancy course in the United States was held in Houston, Texas (The Montessori Institute, n.d.). Judi Orion, Gianna Gobbi, and Dr. Montanaro were the instructors (Lillard & Jessen, 2003). In 2003, Paula Polk Lillard and Lynn Lillard Jessen published *Montessori from the Start: The Child at Home, from Birth to Age Three*. Susan Mayclin Stephenson published *The Joyful Child* in 2013. The books highlighted the Montessori Method and practice working with infants and toddlers in home and classroom settings. The furniture for infant-toddler spaces was not mass produced in the early 1980's. Schools and teachers followed the Montessori albums guidelines to create infant toddler furniture, working closely with private carpenters and cabinetmakers (Honegger Fresco, 2019). Michael Olaf began creating furniture and activities found in the 0-3 Montessori albums in 1982. The specific infant and toddler Montessori material catalog was entitled *The Joyful Child* (S. Stephenson, personal communication, June 20, 2016). Neinhuis Montessori, the largest Montessori material manufacturer globally, added infant and toddler materials to their catalog in 1995. Kenison, a branch manager at Neinhuis Montessori confirmed that they collaborated with Judi Orion, an AMI A-I Trainer and Trainer of Trainers, to develop and produce the infant and toddler materials (S. Kenison, personal communication, June 24, 2016). Community Playthings began making Montessori specific infant and toddler furniture in 2005 (J. Maendel of Community Plaything, personal communication, April 12, 2016).



### **Montessori Philosophy**

Dr. Montessori's writings demonstrate a philosophy that the adult should be both physically and spiritually present for the child during the adult-child interactions. The concept of *being present* is found repeatedly in Montessori's writings (Montessori, 1914/1965a, 1948/1967, 1949/1997; 1919/2007a). The Montessori pedagogy and practice are based on several theories, including the theory of the *absorbent mind*, *sensitive periods*, *four planes of development*, *human tendencies*, *mixed-age groupings*, and *the prepared environment* (Lillard & McHugh, 2019a, Lillard & McHugh, 2019b, Montessori, 1949/1997, Montessori, M. M, 1971).

### **Absorbent Mind**

Maria Montessori wrote *The Absorbent Mind* in 1948 in India, and the book was published in 1949. Regarding the historical timeline, there are several contradictions. The original manuscript has been cited as a transcription from the first training course in Ahmedabad in 1944 (De Serio, 2016; Schnepf, 2010), also noted as transcriptions from the second course held in Ahmadabad, India in 1948 (Grazzini, 1996). Haines (1993) stated it was from a course Montessori held in 1949. Regardless, *The Absorbent Mind* is universally accepted to be about infant and toddler education. It was written during her time in India and is, by far, one of the most impactful literature pieces to propagate her legacy. Dr. Montessori believed that the term absorbent mind reflected her idea that children absorbed knowledge and information through their senses from the environment around them (Montessori, 1949/1997). Children acquire this through self-development, and the environment provides the learning opportunities (Guterk, 2004, Montessori, 1949/1997).

Dr. Montessori stressed the theory of the absorbent mind and mixed-age groupings. Montessori drew attention to the prepared environment and teacher preparation (Appelbaum, 1971). Montessori believed that individuals had three developmental phases. The first stage of the absorbent mind manifested from birth through age six. Montessori continued to further subdivide this state into two phases, birth to three and 3-6-year-olds. The first phase entered their group's culture through environmental exploration, absorbing information, constructing concepts through exposure to reality, and beginning to use language (Gutek, 2004). The infant and toddler children are unconscious learners.

Montessori (1949/1997) emphasized that the infant will absorb spoken language sounds. She understood and communicated that infant would unconsciously absorb the cultural attributes of the language that is heard. Montessori stated, "the child does not inherit a pre-established model for his language, but he inherits the power of constructing a language by an unconscious activity of absorption" (p 73). She continued to talk about language and the ability to converse with others, and the importance of young children's independence.

#### **Four Planes of Development and Sensitive Periods**

In *The Four Planes of Education* Mario Montessori (1971) explained that children grow and learn along a plane and do not learn at the same rate. Montessori applied the phrase *sensitive periods* to describe when the experience of a given behavior is significant. The idea that there is a sensitive period for developmental milestones is no longer a novel notion. There are critical periods for certain linguistic aptitudes (Boysson-Bardies, 1999; Gogate & Hollich, 2010; Kuhl, 2010; Kuhl et al., 1997; Kuhl et al., 2006). The period for weaning, toilet learning, reading, writing, mathematical concepts, interest in grace and courtesy are examples of sensitive periods.

Gogate and Hollich (2010) suggested that not only is language acquired during a sensitive period, but also that language develops in a specific sequence of sensitive periods based on the interactions and the environment. Montessori stated the same ideas in *The Absorbent Mind* (1949/1997) before Gogate and Hollich (2010). Cases of children deprived of language support this theory, including Genie, who was found at the age of 13 and had been severely neglected by her parents (Curtis, 1977; Rymer, 1994). Despite considerable efforts with therapists, Genie was never able to speak normally (Curtis, 1977). Kuhl et al. (1997) reported similar findings with children who are deaf and were deprived of oral or manual language. The case of Genie and Victor, the wild boy of Aveyron, and several others over the last 2 centuries confirm a limited period for language acquisition (Curtiss, 1977; Rymer, 1994). Emotional trauma and the isolation these children experienced could have also affected their later learning, which then supports the idea that children require exposure to language in normal settings (Clarke, 2016; Curtiss, 1977; Kuhl et al., 1997; Rymer, 1994).

### **Human Tendencies**

Mario Montessori (1956) wrote about his mother's thoughts on human tendencies in *The Human Tendencies and Montessori Education*. There are twelve human tendencies and Mario Montessori (1956) lists communication as one of them. Mario Montessori explains the human tendency of communication as: (a) process of learning to talk, (b) having the desire to talk, and (c) the need to express oneself. The Montessori teacher prepares the environment to aid the development of language and communication.

### **Montessori Prepared Environments**

A Montessori classroom environment must be prepared with the child in mind that included space arrangement and the size of tools, materials, and furniture (Lillard, 1996;

Honegger Fresco 2019; Lillard & McHugh, 2019a). Publications about the prepared environment relate to the teacher's relationship to the materials. The A-I Guide is the adult teacher in a Montessori birth to three environments. With birth to three environments, the A-I Guide is a factor to entice and motivate students beyond the materials (Honegger Fresco, 2019). The Guide in the environment is viewed as an instructional tool or material. The A-I Guide helps with the construction of intellect and personality, character, and temperament (Montessori, 1919/2007a).

Mooney (2000) discusses the importance including the Guide and children when preparing the environment. Elkind (2007) wrote that the Montessori teacher certification courses by AMI and AMS are the most extensive training today in teacher preparation programs, especially in the use of the Montessori materials and their role in developing the child. Teacher preparation creates a normalized Montessori environment and ideally focuses on understanding the environment's importance and the Guide/teacher's impact on that environment. The Guide's role is to practice Montessori theories and act as the ultimate language material. Once the Guide is trained and understands their role in developing the child's environment, interconnectedness and space will support the child's success.

### **Mixed-age Groupings**

The mixed-age classroom is an important theme in the prepared environment. Mixed-age classrooms provide children with opportunities to learn from others and teach peers (Gerard, 2005). The adults in the mixed-aged environments provided a greater variety of experiences for the older children introducing younger children to more complex themes and activities promoting greater skill acquisition in the younger child.

Baily et al. (1993) concluded that mixed-age classrooms appeared to affect the rate of development in younger children's communication skills. Bailey et al.'s (1993) results indicated older children modeling competent behaviors for younger children increased engagement and created a stimulating environment. The older child's behavior was like that of a teacher, reinforcing appropriate behaviors. Gerard (2005) similarly explained that children in multiage environments provided younger children with more complex language opportunities.

### **Research and the Assistants to Infancy**

There is a paucity of research conducted in infant and toddler Montessori classrooms. Literature providing historical context to the development of the Assistant to Infancy training and development of the infant and toddler Montessori curriculum is scarce. The Montessori Birth Center's work provided much of the documented literature and research regarding the Montessori birth to three movement. As previously mentioned, research related to early contributions of the Assistants to Infancy programs was reported in 1948. Costa Gnocchi and Dr. Giuseppe Vitetti reported their work at the AIM (Assistenti all' Infanzia Montessori) school at the International Congress held in San Remo in 1949 (Honegger Fresco, 2001). Additionally, Dr. Pignocco reported on the work with infants and toddlers at the Congress of Nepiology in 1952 in Italy (Honegger, 2001). Dr. Pignocco elaborated that work with infants needed to begin at birth. Pignocco indicated the adult must aid the young child through natural physiological development and the psychic self or what is now called the social/emotional development of the child (Montessori, M. M., 1960). Dr. Pignocco asserted that the adult must respect the infants and provide them with environments that support learning and development. Belotti and Honegger Fresco (1983) compared Montessori infant and toddler classrooms to traditional infant and

toddler classrooms. The Belotti and Henegger (1983) and much of the Montessori birth to three information is only available in Italian.

### **Infant-Toddler Curriculum**

Honegger Fresco (1990) wrote that the Montessori Assistant to Infancy program is still not well known. Honegger Fresco (1990) expressed the importance of understanding that the Assistant to Infancy is not a social worker or a daycare provider. The difference lies in the training in observing the psychological development of the young child under three-years as a whole child, the study of the developing infant within utero, and the care of the mother at the time of most infant-toddler credentialing programs. The Assistant to Infancy is prepared to care for the infant upon birth, as well as care and educate the new mother. Mario Montessori (1960) shared the school's translated prospectus *Aims and Characteristics*, including the outline for the Assistants to Infancy teacher training. The course was originally 2-years and later changed to 3-years (De Serio, 2016). The training program included the study of child psychology, nutrition, anatomy and physiology of development, physical, mental, psychic hygiene, psychoanalysis, obstetrics, and general care of the child. The trainees were provided a placement to obtain practical experience.

The Ministerial Consortium recognized the Montessori Assistant Training College for Technical Training (De Serio, 2016). In Italy, the graduates received a certificate recognized by the Italian government titled “Assistant to Infants.” This certificate is recognized in nurseries, maternity clinics, home settings, and any organization caring for infants. The original training required practical experience in the nurseries, home settings, maternity clinics, and the Provincial Institute of Assistance to Infancy of Rome, which accepted orphans. The Assistants to Infancy student was required to observe and participate in the birth of newborns for 30 nights in the

maternity clinic. The AMI continues to hold the requirement of observing at least one birth; however, the observation method is up to the student. The observation method can be a home birth, hospital birth, birthing center, or even a video (S. Brady, personal communication, April 11, 2016). The prospectus outlines the requirements of the Teacher Trainer. They are required to hold a bachelor's degree, have studied and researched the work of Dr. Montessori, and knowledgeable about infants and toddler curricular (Montessori, M. M., 1960).

The AMI Infant Montessori classrooms are typically called the *Nido*. Nido's Italian translation, "the nest", pays respect to the national origin of the philosophy and the idea of what Costa Gnocchi felt the infant environment should feel like; a safe, comfortable place to grow. As stated before, Nido is also synonymous with daycare or nursery in Italian early childhood literature. The toddler environment has several universal identifiers. In the AMI training albums, they are called Infant Communities (IC). However, schools labeling these environments have included Children's Community (CC), Young Children's Community, and Toddler Communities (Campanelli, 2000; Brady, 2015). Some programs have deviated from the original name of "IC" due to the Montessori belief that toddlers are different from infants because toddlers are able to manage responsibility. In training, teachers are taught to speak to toddlers and infants with full language and extensive vocabulary and not babytalk. The toddler should no longer wear a bib, which is a symbol of infancy and acknowledge the sensitive period to begin weaning is before the child transitions to the "IC". The label "Infant Community" has created confusion for families searching for a toddler environment and the teacher who has been instructed to respect the next phase of their life, toddlerhood.

Originally, the Nido environment was created to be mother-infant classes. As societal shifts occurred, the need to provide care for infants while the mother worked increased. Nido

environments are now available to care for infants during the week's working hours to support and educate the working families looking to follow the Montessori method from birth (Campanelli, 2000; Lillard, 1996).

Dr. Montessori wanted to deemphasize the teacher's role, typically called a directress, in Montessori environments (Appelbaum, 1971). Costa Gnocchi did not feel that title fit the adult that worked with infants and toddlers. They did not direct the child but rather guided them. Teachers in infant and toddler classrooms are typically referred to as Guides or Montessorians (Honegger Fresco, 2001). To provide sound teaching practices, extensive research and preparation is offered in the training of Guides. An example of the extensive research and preparation for the infant learning spaces is evident in the curriculum for the visual senses in the Nido. In the AMI albums, there is a complete curriculum of mobiles for the young infant. These mobiles were based on Costa Gnocchi and Gobbi's research, specifically their research of Alexander Calder and Munari. One of the first mobiles in the AMI album is called the Munari and was created with the focus that the contrast of black and white in the first few weeks of life aids in eye-tracking development. Another mobile is named after Gianni Gobbi, which was developed to recognize gradation of color in mind (S. Brady, personal communication, April 11, 2016; Campanelli, 2000).

Honegger Fresco (2001) noted that Costa Gnocchi remained faithful to the Montessori principles, including the requirement to look to other research and great philosophers. Costa Gnocchi acknowledged attachment theory, while also studying research on embryology and psychoanalysis (Honegger Fresco, 2001). Costa Gnocchi's original practices, which included making the most natural light and being aware and conscientious about the words spoken to both the child and the mother, are still taught today. Costa Gnocchi also taught that the adult in the



teaching environment should wear a smock or uniform, remove obstacles to learning, and the materials in the space are for the child and not for the adult's convenience (Campanelli, 2000; Honegger Fresco, 2001).

### **Montessori Language Environments**

Montanaro (1991) wrote that the adult must understand that all communication forms will provide information to the child about their external world, people, and objects. Montanaro stated “language is absorbed and then reproduced” (p. 141). In her handbook, Montessori (1914/1965a) explained that it is the teacher’s responsibility to be the role model of proper language. The teacher must accurately articulate the sounds and teach children how to recognize and discriminate the sounds of their language environment.

The infant classroom typically ranges in age from 6-weeks-to-18-months. The toddler classrooms range in age from 18-months-to-3-years. Dr. Montessori believed the language experiences in the environment should be more natural than remedial. Packard (1972) agreed with Montessori, stating that language is to be modeled slowly with clear articulation. Children absorb the patterns and tonalities of language from birth.

The adult is considered the most important language “material” in the Montessori infant toddler environment. The adult models demonstrate the best representation of the community the child resides in (Packard, 1972). Packard (1972) believed that dignity and love are conveyed through the media of tone rather than words. Therefore, infants will understand messages from the beginning of their life. Dignity and love are important because Montessori did not want the environment to be overly rigid with instruction or lessons, as these only correct the child (Packard, 1972; Honegger Fresco, 2019)

Physical materials in the environment are arranged into language areas that the children access, including the language shelves and a reading area. The language shelves are set up to have enough space to represent several objects from the three language categories presented within the three-period lesson. At least one shelf will have real or replicated objects, another shelf with real or replicated objects with exact or similar picture cards, and another shelf with language cards. The classroom Guide is responsible for providing and rotating these materials based on their interest and observations. The pedagogy focuses on reality, and that young children learn a great amount of detail through their senses (Montessori, 1949/1997). The intention is to provide as many real objects as possible. When the real item is not available or is unrealistic to add to the environment, then a replicated object is used.

The objects are placed in containers that entice the children to choose the work which may include: (a) colorful baskets, (b) complicated boxes that need to be opened, or (3) coordinated decorations on a box, folder, or tray. Another requirement is the containers are categorized into teaching language and vocabulary. For example, a container may hold replicated farm animals, while others may hold animals found in the desert or miniature cooking utensils. A rule of thumb is to limit the number of objects, with only five to eight in number (Campanelli, 2000). The next shelf would include the objects with exact cards (Brady, 2015). Container categorization helps the young child learn that a three-dimensional object can be represented in two dimensions. The objects can also be represented with similar cards that allow the child to learn that the object may appear in a book and look different due to color, size, or representation, but it is the same object with the same name (Brady, 2015). The third set of shelves would have language cards. These sets would be placed in interesting trays, baskets, and folders. The language cards allow the Guide to introduce items that may not be available as

realistic presentations or replicas in the classroom, allowing them to extend the lesson through conversations and games (Campanelli, 2000).

### **Significance of the Study**

Research in infant and toddler Montessori environments is almost non-existent (Schnepf, 2010) and is required to move the field forward. The historical component added above will begin the dialog for other researchers beginning this journey. Vance (2003) compared the Montessori pedagogy and other preschool forms with a measure of language, specifically literacy. Children attending Montessori schools significantly scored higher than children attending the other preschool programs (Vance, 2003). These results suggest that Montessori language lessons are more instructive than other forms of language experiences in traditional classrooms. The research of language in infant and toddler Montessori environments will allow the Assistant to Infancy community to join the conversations around language acquisition research. Gogate and Hollich (2013) expressed that the literature has focused on the child's current state or factors in the environment, but not both. There is a need to combine the methods to test for multi-causality through observation and experimentation. This study assessed if infants and toddlers could indirectly acquire new vocabulary in a classroom setting from teachers and peers' ambient dialogue. A tool used to capture and analyze language was implemented, along with observation and experimentation, during the Montessori three-period lesson. This study honors what Dr. Montessori expressed at the First International Course in 1913 "Let us do only what we did when studying all other living organisms, let us study humans in their natural state" (Feez, 2013 p 8).

## **Chapter Synthesis**

Chapter 1 included the research foundation and the need to investigate ambient language in mixed-age infant-toddler classrooms. Key terms were defined with significance to the present study. A historical context and review of the Montessori philosophy were provided to offer a biographical overview of the extent of Dr. Montessori's research. Finally, an in-depth review of the theories of the infant and toddler Montessori curriculum development were synthesized.

## CHAPTER II

### LITERATURE REVIEW

This chapter explores the Montessori theories related to language acquisition of infants and toddlers in Montessori mixed-age classrooms. The review of literature focused on three components: (a) the Montessori theories including the absorbent mind, sensitive periods, mixed-age classrooms, and the three-period lesson as related to language; (b) infant and toddler language development and (c) ambient language. This review covers a broad range of relevant literature from education, neurodevelopment, and language acquisition.

#### **Montessori Pedagogy**

Several theories contribute to the foundation of the Montessori pedagogy. Literature documenting Montessori preschool education is well documented, but there is a paucity of research in birth to three Montessori environments. There are several theories that contribute to the Montessori pedagogy and practice. Much of the background was shared in chapter 1 and current literature was further explored in this chapter to provide a deeper understanding of Montessori environments and its requirements.

As established in chapter 1, Montessori emphasized that children learn through concrete experiences. They can abstract from those experiences to create their own ideas and relations, moving systematically from simple to complex themes, and are free to choose their activities (Feez, 2007). The evaluation and analysis of Montessori practice have relied largely on research conducted in preschool and elementary classrooms (Cossentino, 2005; Haines, 2010; Lillard, 2012; Pate et al., 2014; Patel, 2012; Peng & Md-Yunus, 2014; Vance, 2003).

One of the earliest comparative studies in the Montessori preschool setting in the United States was conducted by Fleege et al. (1967), with many others that followed (Bagby et al, 2012;

Kayili & Ari, 2011; Lillard, 2008; Lopata et al, 2005; Peng & Md-Yunus 2014). Studies have also been conducted comparing the Montessori philosophy to other non-traditional programs (Currie & Breadmore, 1983; Edwards, 2002). Montessori pedagogy has influenced research academic domains including positive psychology, intrinsic motivation and optimal experience theory (Rathunde, 2003; Rathunde & Csikszentmihalyi, 2005); school readiness (Kayili & Ari, 2011; Peng & Md-Yunus, 2014), self- regulation, social behaviors (Erwin et al. 2010; Lillard & Else-Quest, 2006), creativity (Besançon, & Lubart, 2008; Besançon et al., 2013; Rose et al., 2012), executive and cognitive functions (Bhatia et al., 2015; Diamond, 2012; Henry, 2014; Lillard & Else-Quest, 2006; Yen, & Ispa, 2000), literacy (Patel, 2012), and mixed-age groupings (Gerard, 2005; Schweitzer, 2015).

### **Absorbent Mind**

The term *absorbent mind* was coined by Dr. Maria Montessori in her early lectures and later was the title of a publication that to this day differentiates her philosophy from other theorists. Dr. Maria Montessori defined the absorbent mind as the unconscious learning of a child under the age of three (Montessori, 1949/1997). Contemporary researchers and authors have studied unconscious learning and used terms such as *implicit memory*, *implicit cognition*, and *automatic bottoms-up process* to represent that same idea (Gaillard et al, 2014; Schilhab, 2015). McLaughlin (1990) reviewed multiple studies that compared the theory of conscious versus unconscious learning specific to the area of language. McLaughlin's (1990) review did not consider Montessori's theory or studies on language in Montessori environments; however, the concepts and language are similar. McLaughlin (1990) examined several debates of theories of unconscious learning and unconscious acquisition in psycholinguistics. -The theories included defining levels of awareness, attention, and memory. The debates were grounded in determining if either process can falsify the theory of unconscious learning. Dr. Montessori (1949/1997) also

wrote about children's awareness, their attention to the world, and use of memory in the acquisition of language and knowledge during the first three years. McLaughlin (1990) discussed the theory of implicit learning (as cited in Reber, 1976; Reber & Allen, 1978), and the process of acquiring complex and abstract knowledge using novel items similar to Montessori concepts of language acquisition (Montessori 1949/1997; 1914/1965a).

### **Unconscious Language and Vocabulary Acquisition**

The quality and quantity of language input has been investigated in a variety of studies (Huttenlocher et al., 1991; Rowe, 2012), including language instruction (Tomlinson, 2012) as well as the impact of working memory on vocabulary acquisition (Hofmeister, 2015; Kuhl & Meltzoff, 1995). For clarification, this study was a language acquisition study, not a language learning study, and more specifically a vocabulary acquisition study, not a word learning study. Acquisition of language is defined as an unconscious process, whereas language or word learning is a conscious process (Chomsky, 2006; Moreen & Soneni, 2015; Pinker, 2007; Rezaee & Farahian, 2015) associated with direct instruction. Montessori (1949/1997) theorized language was acquired through the unconscious absorbent mind. The terms language learning and language acquisition are not used interchangeably (Montessori, 1949/1997; Moreen & Soneni, 2015; Rezaee & Fahahian, 2015).

Consciousness linked to cognition is typically measured and linked to assessment. The measurement for implicit or unconscious learning is still debatable. Ellis (2006) extensively studied language acquisition and the role the unconscious mind has on the acquisition process. One formal measurement of unconscious learning is to assess grammar acquisition (McLaughlin, 1990). In more recent years, the use of brain imaging, sequence studies, dissociation studies, and forced task studies have also been used (Destrebecqz & Peigneuz, 2005). There is, however, still

a debate about the most accurate way to determine knowledge development through unconscious learning. The development, deployment, and assessment of these methods and measures substantiates Montessori's early theory of the absorbent mind.

The idea of incidental learning or unconscious acquisition of knowledge has been studied and debated (Ellis, 2015, McLaughlin, 1990; Rezaee & Farahian, 2015). Ellis (2015) believes acquiring language does not just fit within the idea of implicit and explicit learning, but within a larger complex system including statistical abstraction across language usage. Montessori (1949/1997) defined unconscious learning as the ability to absorb information without effort. A contemporary perspective and definition of unconscious learning is that it is unintentional and even accidental. Learning occurs through acquisition methods while attending to other activities (Rezaee & Farahian, 2015; Smith 1999). Lane and Allen's (2010) study of kindergarten children determined that incidental learning in the classroom could contribute to the breadth of sophisticated vocabulary acquired in the classroom. Language acquisition is largely incidental, instinctive, and effortless (Montessori, 1949/1997; Pinker, 2007; Saffran et al., 1997; Oshima-Takane, 1988). Contradictory to the belief that young children's primary means of acquiring language occurs through direct oral presentation (Akhtar et al., 1991; Christ, 2007), studies have demonstrated that incidental word learning within context has been identified as a contributor to vocabulary acquisition (Akhtar et al., 2001; Fox Tree & Mayers, 2008; Gampe et al., 2012; Lane & Allen, 2010; Oshima-Takane, 1988). Harris et al., (2010) stated that infants and toddlers acquire vocabulary through everyday observations and interactions and not implicit instruction. Infants can recognize words heard in fluent speech that are later presented to them in isolation (Jusczyk & Anslin, 1995) by segmenting sounds using statistical learning (Saffran et al., 1996; Stahl et al., 2014). Statistical learning is an unconscious learning event that has been noted to be



one of the contributing factors to how young children learn grammar without direct instruction (Saffran, et al., 1996; Stahl et al., 2014). Very little research has been conducted to investigate the different characteristics of incidental learning, such as ambient language (Saffran et al., 1997).

### **Sensitive and Critical Periods of Vocabulary Acquisition**

Montessori (1936/1966) asserted that children have sensitive periods for learning and acquiring particular skills. Montessori believed that children can easily absorb new information during this time of sensitivity. Montessori developed this theory with consideration of Itard's writings about Victor, the "wild boy of Aveyron" (Feez, 2007; Itard, 1802/1962) as well as readings of Jacques Loeb, a 19<sup>th</sup>-century biologist, and Hugo de Vries, a 19<sup>th</sup>-century botanist (Ramani, 2015). The term *sensitive period* was first coined by Hugo de Vries in his 1905 botany research (de Vries, 1906/2007), maintaining that sensitive periods occur over a span of time. Montessori began using the term to describe the weeks, months or even years around the traditional milestones of early childhood development (Montessori, 1936/1966; 1949/1997).

The sensitive period for language begins prenatally and continues to develop after birth in this sensitive or heightened state until around six-years-old (Gogate & Hollich 2010; Montanaro, 2001). Contemporary researchers support the theory of sensitive periods of development as well as the idea that language develops through a sequence of interactions with others and the environment (Gogate & Hollich, 2010). This theory was again highlighted and substantiated with the study of Genie, a child neglected of language, who was discovered in the early 1970's (Rymer, 1993).

Sensitive periods are not interchangeable with critical periods. Critical periods are known to be of shorter duration and depending on the domain or learning area could have a

definitive and finite timeline (Hubel & Wiesel, 1970; Kuhl, 2010). The theory of critical periods for language acquisition has been the focus of several research studies in recent years, especially in the field of second language acquisition (Doupe & Kuhl, 1999; Hurford, 1991; Newport et al., 2001). An example of a critical period for language is the critical period for the acquisition to differentiate phoneme sounds. Kuhl et al. (2006) indicated that a child loses the ability to differentiate phoneme sounds not found in their native language after 8 months of age. Kuhl, (2010) focused on the development of the brain to begin understanding how the structure and mechanics of the brain support language acquisition.

### **Physical and Neurological Development**

Birnholz and Benacerraf (1983) and Northern and Downs' (2002) research supports the idea that the physical development of the child's oral and hearing apparatus must be intact for language acquisition. The child's oral and hearing apparatus plays two roles in the reception of auditory stimuli. First to receive stimuli, and second, to differentiate the auditory signals (Ruben, 1999). Research has shown that fetuses can respond, discriminate, and show preferences of language while developing within utero (Birnholz & Benacerraf, 1983; DeCasper & Prescott, 1984; Querleu et al., 1988).

Pujol et al. (2006) studied 100 children's three-dimensional magnetic resonance imaging (MRI) to create a timeline of myelination in the brain and map the correlation to language acquisition. Vocabulary acquisition accelerated after the age of 18 months. The behavioral indicator of vocabulary acquisition coincided with the rapid myelination phase in the language region of the brain. Pujol et al.'s (2006) findings are reflected in Dr. Montessori's language development chart first published in 1949 (Appendix B) which features the timeline of the myelination process and rapid language development. Pujol et al.'s (2006) study was an

extension of earlier studies conducted by Neville et al. (1992) that looked to measure and identify the critical periods within the sensitive periods of language development.

Aitchison (1998), Kuhl et al. (2006) and Kuhl (2010) also supported Dr. Montessori's theory of a sensitive period for language beginning at birth and continuing until the child is six-years-old. Kuhl et al. (2006) and Kuhl (2010) went on to explain critical periods within the sensitive period of language. Infants, up to the age of eight months, perceived and responded to all phonetic sounds in their native language as well as non-native languages, also known as *phonemic perception* (Kuhl et al., 2006). If infants were not exposed to phonemic sounds not found in their native language by ten months of age, they would lose the ability to discriminate those sounds. The research indicates that the ability for phonemic discrimination for sounds not heard in their native language is lost in the ninth and tenth month of life. The result is a decline of phonemic perception by the child (Kuhl et al, 2006; Werker et al., 1981).

### **Mixed-aged Classrooms**

Mixed-age classrooms in Montessori environments rely on peer learning (Lillard & McHugh, 2019a). The older children act as models for younger children in the classroom (Bettmann, 2003). Wood and Frid (2005) support the multiage classrooms and state that children cannot learn thoroughly without interactions with more knowledgeable peers. Social learning theorists (Bandura, 1986; Vygotsky, 1978) support the premise that younger children learn from older peers.

Research on the effect of peer learning in infant and toddler classroom settings, especially in language, is limited. One study conducted by Hanna and Meltzoff (1993) indicated that young toddlers could learn from older toddlers. The experiment focused on behaviors that could be imitated and less on language. The literature focused on preschool settings is conflicting and

even controversial, demonstrating both positive effects and negative or null effects on the group (Ansari et al., 2016; Bell et al., 2013; Gerard, 2005; Rouse, 2015).

Ansari et al. (2016) and Bell et al. 2013) conducted research in Head Start mixed-age classrooms. Ansari et al. (2016) found that when examining language outcomes in a mixed-age preschool classroom, 3-year old's "demonstrated greater gains" (p. 61) when enrolled with fewer older children. The 4-year-olds also demonstrated negative implications of the mixed classroom. Ansari et al. (2016) noted that the study did not consider classroom management skills, the mechanisms for teacher instruction, or the classroom interactions between the peers. Contrary to Ansari et al. (2016), Bell et al.'s (2013) study concluded that mixed-age classrooms are not negatively associated with school readiness, and that there is actually "no significant association with school readiness at all" (p. 9). The study suggests that further exploration of the composition and dynamics of the mixed-age classroom is in need. Guo et al. (2014) extended Bell et al.'s (2013) study and determined that the younger child in the mixed classroom had greater gains in vocabulary development than the older peers. Peer to peer conversations in mixed-age settings in preschool classrooms increase academic readiness and academic skills such as vocabulary acquisition (Ansari et al., 2016; Guo et al., 2014; Mashburn et al., 2009; Wood & Frid, 2005).

Mashburn et al. (2009) emphasized the importance of well-managed classrooms. Proper classroom management provides opportunities for the child to engage with adults and peers within the environment. Lloyd (2002) discussed the same sentiment stressing that multi-age classroom instructors must consider classroom organization as well as classroom management.

### ***Montessori Language Materials and Interventions***

Montessori materials are based on (a) natural products, (b) design, (c) use and (d) aim. Montessori materials should be made of natural materials (Honegger Fresco, 2019). The design of the materials provides concrete and realistic or near to realistic replicability. The real or exactness of the replicated object provides the child the most information in the sensorial and lingual exploration of the objects by the child (Campanelli, 2000). Infants and toddlers should be able to hold the language objects. The objects should be dimensionally appropriate when compared to similar themed items (Campanelli, 2000). Language objects and cards lessons should be categorized to have five to eight themed items. Ideally, language objects and cards should be in a container that is attractive and entices the child to the work (S. Brady, personal communication, April 11, 2016). Feez (2007) emphasized that a child in a Montessori environment learns through their sensorial experience of Montessori objects. Language acquisition through the senses is emphasized in Montessori settings by using classification and learning the exact names of items and subjects through taxonomy and concrete materials (Feez, 2007).

The infant and toddler language shelves hold real objects, replicated objects, objects with exact cards, objects with similar cards and language card sets (Campanelli, 2000; Brady, 2015; S. Brady, personal communication, April 11, 2016). The real and replicated objects are presented with the traditional three-period lesson (TPL). The objects and cards are also presented, using the 3-dimensional object to demonstrate the 2-dimensional form in the card, first laying an object directly on the exact card and later next to the similar card. The language cards can also be presented using the TPL. It is best to begin with real and replicated objects with the youngest children and then move to the exact, similar cards and language card sets as the children mature

through language development (Campanelli, 2000; S. Brady, personal communication, April 11, 2016).

### **Three-Period Lesson**

Édouard Séguin (1866/1971) first introduced the three-period lesson as an intervention for teaching deaf children and has since been used in Montessori classrooms around the world (Feez, 2007; Jackson, 2011; Nichols, 1984; Standing, 1957/1998). Séguin was Itard's protégé and further developed interventions used for children with deficiencies using didactic materials (Feez, 2007; Jackson, 2011; Séguin, 1866/1971). The lessons support children in the associations between objects and concepts and their corresponding names in a concrete way (Feez, 2007; Richardson, 1997). Dr. Montessori created the Montessori three-period lesson by adapting the writings of Itard (1802/1962) and Séguin (1866/1971).

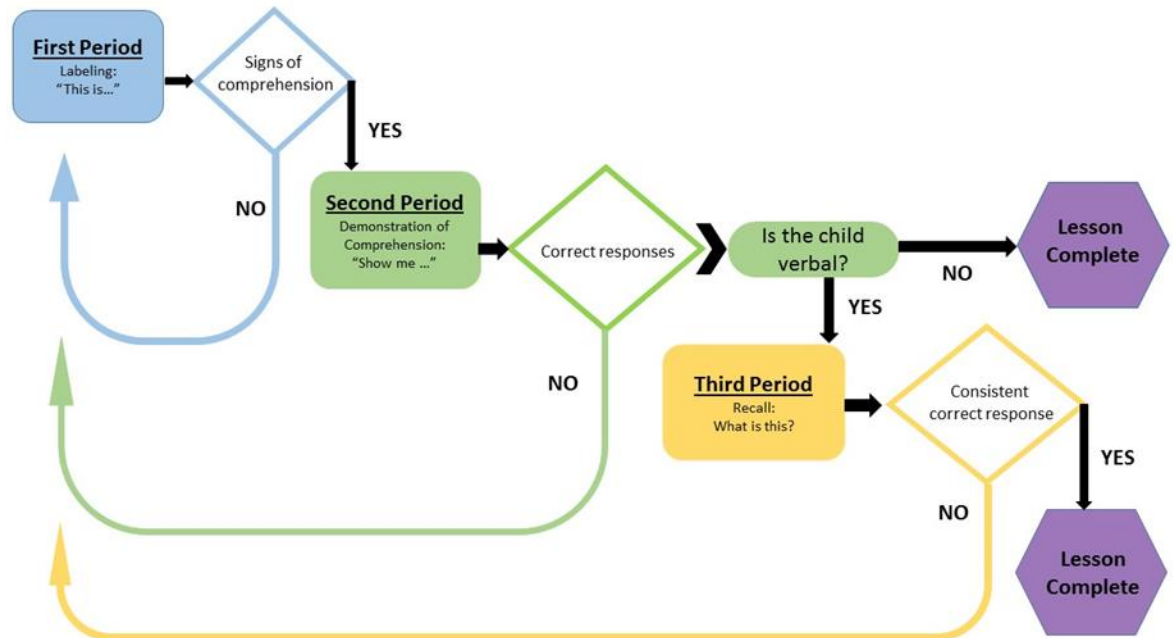
Itard (1802/1962) began the process of teaching the child through: (a) means of repetition (b) the use of memory and (c) the use of three-dimensional objects. The three-dimensional objects were compared to two-dimensional images with systematic differentiating activities. These activities were developed during Itard's (1802/1962) work with Victor. The activities were specific to Victor's needs, wants, and environment. Feez (2007) outlined Itard's (1802/1962) practice with Victor. The practice included the child's desire to have his personal items orderly and hung on hooks in a specific way. Montessori later listed the sense of *Order* as a *Human Tendency* (Montessori, M. M., 1956). Itard (1802/1962) used the exactness and desire to continue preparing Victor for extensions in learning. Itard (1802/1962) extended more items hung sequentially on hooks. When the number exceeded Victor's memory skill, images and outlines were placed next to the hooks as memory aids. Itard (1802/1962) replaced the three – dimensional objects with two-dimensional objects to match with the memory aids on the hooks.

These lessons scaffold the teaching labels to identify the whole and parts of an object known as nomenclature.

Dr. Montessori extrapolated from this information and created the three-period lesson. Initially, the focus is on the objects, then transition away from the object to memory aids by using language cards (pictorial images of the objects) and lastly, nomenclature sets (learning the parts of a whole). Montessori further developed the practice by categorizing the subjects and themes. Language acquisition was supported by sorting objects into categories (Gopnik & Meltzoff, 1987; Montessori, 1948/1967). Montessori adapted Séguin's (1866/1971) lessons into the foundational language presentation (Montessori, 1948/1967; Van Aken, 2006) in Montessori environments. The three-period lesson (TPL) is the method for integrating the introduction and assessment of vocabulary in Montessori environments (Jackson, 2011; Lillard, 2005; Richardson, 1997). While Séguin's (1866/1971) ideas on teaching language included (a) focusing on tactile experiences with objects and (b) scaffolding from simple to complex, Dr. Montessori's language lesson is divided into three stages as shown in Figure 1.

**Figure 1**

*Montessori Birth -Three, three-period lesson Flow Chart. Adapted from Jackson, 2011)*



Dr. Montessori (1948/1967) describes the script for the TPL in *Discovery of the Child* (Jackson, 2011; Montessori, 1948/1967; Van Aken, 2006). The first period, naming, is the association of an object with a name. For example, the child is shown an object and the teacher simply states, “This is...” The Guide continues for the predetermined number of objects presented in the lesson. The second period, recognition, involves recognition or comprehension of the object when the name is given. For example, the Guide will state “show me...” or “point to ...” or “give me ...” If the child cannot show the Guide the association, the Guide will go back to the first lesson. The third period, recall, involves expressing the name of the object. The Guide will ask, “What is this?” The third period is asked when the Guide knows the child has



expressive language. The Guide does not want to defeat the child by asking for a skill the child is not developmentally capable of exhibiting (Campanelli, 2000). If the child does not express or articulate the correct word, the Guide goes back to the first period (Campanelli, 2000), as outlined in the Birth-Three Three-period lesson Flow Chart (Figure 1).

The traditional TPL is modified when conducted in the environments for children under three years of age. Lessons are however, presented in sequence and upon mastery. Children may not complete the full sequence of lessons. Only if the child can verbalize the answer can the third lesson occur (Campanelli, 2000). The flexibility and adaptability that is required in presenting the TPL in the birth to three environment demonstrates respect and understanding of a child's language development in the first three years. The prompts vary so that the Guide can elicit the most out of the child.

This is the methodology of introducing vocabulary words and meaning during the TPL. The TPL supports acquisition through repetition, ostensive naming, multiple opportunities for demonstration and exposure, and simultaneous multi-word acquisition (Axelsson & Horst, 2013; Gurteen et al., 2011; McMurray, 2007; Pinkham et al., 2011). This method of vocabulary introduction allows the assessment component to be more valid compared to other methods (Axelsson & Horst, 2013).

### **Language Acquisition**

The ability to acquire vocabulary relies on four sequential conditions. The first conditions is proper development of physical structures, including neural development, oral-facial structures and auditory structures (Kuhl, 2010; Pujol, et al., 2006). Second, exposure to new vocabulary (Geoffroy et al., 2010; Harris et al., 2010). Third, motivation to engage in the language environment (Gleitman & Newport, 1995; Harris et al., 2010) and fourth, multiple and repetitive

exposures to new words (Brown, P. 2000; Leung & Pikulski, 1990; Montessori, 1936/1966). A child's experience with their environment in the first three years of life creates 85% of all neuronal connections that are formed, including those involved in language learning (National Research Council, 2000). Hart and Risley (1995) demonstrated the importance of vocabulary and language-rich environments for young children. The Hart and Risley (1995) study evaluated language in the home environment. The study highlighted the academic impact and school readiness and potential deficits a child could face if they did not acquire adequate vocabulary. Many others have used this study to catapult learning strategies and introduce interventions for children with vocabulary gaps or for children with the potential to have vocabulary gaps based on their socio-economic status (Christ & Wang, 2011). Using the LENA<sup>TM</sup> recording and software tool, researchers were able to quantify and substantiate the amount of language overheard in the child's home environment. When factoring language that is overheard, a child could hear up to 29,000 adult words in a 10-hour period (Weisleder & Fernald, 2013).

Much of the research on school readiness focuses on preschool children's vocabulary outcomes (Golinkoff & Hirsh-Pasek, 1999; Harris et al., 2010; Hart & Risley, 1995; Hoff, 2013; Morgan et al., 2015). Language ability and vocabulary size are the best predictors for school readiness and school success (Golinkoff & Hirsh-Pasek, 1999; Harris et al., 2010; Hoff, 2013; Morgan et al., 2015). Language and vocabulary acquisition influences later cognitive and academic outcomes (Brown & Lenneberg, 1954; Geoffroy et al., 2010; Hart & Risley, 1995; Hirsh-Pasek et al., 2015; Morgan, et al., 2015). Vocabulary knowledge is essential for enhanced reading development (Dickinson et al., 2010) and comprehension competency of oral communication (Bradfield et al., 2014).

Quality childcare environments may have a positive impact on early language development (Geoffroy et al., 2010; Soderstrom & Wittebolle, 2013). Soderstrom & Bhaskaran (2010) and Soderstrom et al. (2013) reported that the quantity of adult speech does not differ across home and various childcare settings. However, there is evidence that there are differences in the quality of input. Childcare programs have more ambient language than homes and home childcare programs. The input from peers in childcare settings was not measured for mixed-age groups. Morgan et al.'s (2015) study concluded that the quality of parent language contributed to an increase in vocabulary acquisition, but it also proved that attendance in childcare also contributed to a child's acquisition of language. Soderstrom and Wittebolle (2013) acknowledged several studies that determined the advantage of childcare centers compared to care provided by a nanny or other home providers.

### **Language Acquisition in the Montessori Environment**

Language is a major curricular area in the Montessori environment associated with many didactic language materials (Soundy, 2003). However, the Montessori Guide is the dynamic material for language development in the Montessori prepared environment (Bettmann, 2016). The use of language objects and cards cannot elicit the language acquisition needed without the spoken word that comes from the Montessori Guide first. The language lessons are typically spontaneous and allow the child to consolidate their experiences (Bettmann, 2016).

#### ***Language Acquisition in the Preschool Montessori Environment***

Research focusing on the Montessori language lessons and Montessori language practices in birth to three settings is limited (Van Aken, 2006). Several studies, however, have assessed the Montessori method as it relates to language acquisition in the Montessori preschool setting (Bettmann, 2016; Franc & Subotić, 2015; Hojnoski et al., 2008; Gobbo, 2013; Richardson, 1997; Patel, 2012). Zebron et al. (2015) provided a brief overview of the challenges a teacher of a

Montessori classroom or a teacher of a child-centered approach would encounter if presented with a student demonstrating signs of a communication delay or disorder. Zebron et al. (2015) provided recommendations on how to support a child with speech and language challenges in the Montessori setting which included: (a) the encouragement of one-on-one conversations based on the child's interests, (b) allowing time for students to respond to questions, and (c) modeling with clear and pronounced articulation.

Recent studies investigated Montessori's psychogrammar and phonological linguistic awareness and the effect on the development and improvement of metalinguistic and phonological awareness in primary classrooms (Franc & Subotić, 2015; Gobbo, 2013). It was determined that preschool children who attended a Montessori preschool program had greater metalinguistic and phonological awareness compared to children attending a regular preschool program. The Montessori pedagogy has been studied (Hojnoski et al., 2008; Richardson, 1997; Patel, 2012; Vance, 2003) and compared to other preschool philosophies measuring language, specifically literacy. The children attending Montessori schools scored higher on language exams than children attending the other preschool programs (Franc & Subotić, 2015; Gobbo, 2013; Hojnoski et al., 2008; Patel, 2012; Vance, 2003). The results suggest that Montessori language lessons are more instructive than traditional forms of language exposure in preschool classrooms (Franc & Subotić, 2015; Gobbo, 2013; Hojnoski et al., 2008; Patel, 2012; Vance, 2003).

Hojnoski et al. (2008) measured and compared peer verbal interactions in Montessori settings and traditional settings for preschool. Hojnoski et al. (2008) concluded that verbal interactions were above the base level for peers in small groups when the adult was not present and below the base level during solitary work. The solitary work and small group work is

common in the pre-academic Montessori settings. Traditional classrooms were higher than the base level for small group work and lower than the base level for large group work. The small and large group work were the common play interactions in the traditional setting. The findings support that small group work in both Montessori settings and traditional settings are the most ideal for peer verbal interactions.

### ***Language Acquisition in Birth to Three Montessori Environments***

Pouzar-Kozak (2008) compared Montessori's writings to contemporary research on first language acquisition within the first three years of early childhood (Aitchison 1998, 2012; Chomsky, 1986, 1988, 2006; Lenneberg, 1969; Vygotsky, 1978, 1986). A comprehensive comparison study by Pouzar-Kozak (2008) evaluated *process versus content* approach and *biological versus nurture*. Montessori and Chomsky believed that language was innate. However, Montessori believed young children absorb the language around them instead of inheriting language as Chomsky postulates (Pouzar-Kozak, 2008; Haines 2010).

Two studies (Korfmacher & Spicer, 2002; Soundy, 2003) focused on the birth to three Montessori settings. Only Soundy (2003) focused on the development of language. Soundy (2003) used a naturalistic evaluation of Montessori materials in an American Montessori Society (AMS) Montessori birth to three environments. Soundy (2003) assessed the language materials and practices. The vignettes and interpretations of observations captured actions by the Guides and children. Soundy's (2003) observations included acknowledging the organization of language materials on shelves in the classroom and the three-period lesson. Soundy (2003) also observed and reported the classroom teachers, typically called Guides, verbal interactions and responses to the children. Soundy's (2003) findings provide evidence that Montessori birth to three programs provide appropriate language and literacy skills to young children.

### ***Vocabulary Acquisition in Infants and toddler Montessori Environments***

The study of infant and toddler vocabulary acquisition is vast and dense. Literature ranges from the influence of television and technology, such as smart phones and tablets (Alloway et al., 2014; Krcmar et al., 2007; Roseberry et al., 2014; Zimmerman et al., 2007), to classroom literacy and intervention strategies (Christ & Wang, 2010, 2011; Duff et al., 2015; Fernald & Weisleder, 2015; Zosh et al., 2014), statistical learning of language and vocabulary (Ellis, 2006; Erickson & Thiessen, 2015; Saffran et al., 1996; Stahl et al., 2014), vocabulary spurts or explosions (McMurray, 2007). Evidence demonstrates that language rich environments and interactions foster optimal language development (Zauche et al., 2016). Acquiring vocabulary in infants and toddlers requires the development of linguistic subdomains including semantics, phonology, and grammar. Semantics is to learn the meaning of the word, phonology is the focus of the sounds of the word, and grammar is the use of the words within the rules of the preordained rules of the user community (Clarke, 2016; Gogate & Hollich, 2010). Infants and toddlers unconsciously use statistics and sequencing to support the full acquisition of language (Cunilera et al., 2010; Ellis, 2006; Stahl et al., 2014).

The seminal language research by Hart and Risley (1995) and later studies (Akhtar, 2005b; Akhtar, et al., 2001; Driscoll et al., 2003; Fernald et al., 2013; Gampe, et al., 2012; Warren, S., 2001; Weisleder & Fernald, 2013) measuring vocabulary acquisition investigated young children in lab or home settings with the primary caregiver, the parents. Erickson and Thiessen (2015) believe these studies conducted in very controlled settings contribute to the low ecological validity of the results because they are not generalizable to classroom settings. Soderstrom and Wittebolle (2013) suggest that high-quality childcare settings play an important

role in early language development. This suggestion supports the need for further investigation of language acquisition through incidental learning in childcare settings. There is a lack of research regarding language acquisition in naturalist infant and toddler classroom settings (Akhtar, 2005a, 2005b). This gap in research negatively affects the current vocabulary and Montessori language programs as well as curricula that aim to influence the word and knowledge gap.

In early childhood settings, direct instruction is the primary mode of lesson and information sharing. In the Montessori classroom, there is direct instruction with presentations. Specifically with infants and toddlers, it has been argued that communication is largely implicit and related to intersubjectivity. Beebe et al. (2003) provided the link between dialogic discourse and intersubjectivity. An analysis of three infant theorists' definitions of intersubjectivity provides a unique contribution to the understanding of intersubjectivity. Intersubjectivity's foundation is initially in experiences, preverbal and dialogic (Beebe et al., 2003). The theorists agreed that experiences between the adult and child, or peer-to-peer relationships, such as correspondence, matching, and similarities are fundamental to preverbal communication.

Joint attention is when both child and adult are focused on the same object and word, allowing for improvement in vocabulary acquisition and word learning (Kristen et al., 2011; Tomasello, 1995). Aschermann (2001) asserted that older siblings, through intersubjectivity, influence their younger sibling's language learning. Aschermann (2001) described intersubjectivity between peers as "created between children when they are able to come to a shared understanding of the process and goals of the activity" (p.13).

### **Ambient Language**

Three forms of overhearing include: (a) overhearing as happenstance, chance, or opportunity; (b) overhearing as attention focusing; and (c) overhearing as conversation monitoring or tracking (Forrester, 1993; Messer & Turner, 1993). In a social cognitive approach, each can have a benefit to overall language acquisition, such as the learning through overhearing the rules of conversation by monitoring adult conversation. This perspective suggests that by observing activities, including language lessons and general conversations, acquisition of language can be mastered without direct learning or overt practice (Akhtar, 2005a, Akhtar, 2005b; Akhtar, 2014; Akhtar, et al., 2001; Driscoll et al., 2003; Gampe et al., 2012).

### **Overhearing as happenstance**

Overhearing by chance or opportunity is the random ambient language a child hears throughout any environment. This is the overhearing of conversation and learning code-switching and social cues, as well as dialects or accents. The opportunities that are overheard can occur between child to child, child-to-adult or adult-to-adult conversations and intentions (Messer & Turner, 1993).

There is limited research on the effect of ambient language in infant and toddler language development in the classroom (Akhtar, 2005a; Akhtar, 2005b; Forrester, 1988; Knightly et al., 2003). Overhearing has been associated with the acquisition of grammar and syntax and general communication rules such as turn-taking (Pinker, 2007). Akhtar (2005b) determined that young children have the ability to learn novel words through overhearing third-party conversations in a lab setting. Akhtar (2005b) continued to conclude that children acquire some vocabulary through ambient language experiences. Knightly et al. (2003) concluded that childhood overhearing might improve speech perception for children. The improved perception allows better production of speech. Production and the quality of the production is typically one form



of assessment of comprehension of vocabulary. Younger siblings who overhear language provided to the older sibling experience more complex and mature language than younger children without an older sibling do (Oshima-Taken et al., 1996).

Gogate and Hollich (2010) state that children develop comprehension-using perception and select attention to ambient language. Ambient language is a socially grounded phenomenon. Just as the social theory of Bandura (1986, 2001) and Vygotsky (1978, 1986) supported the mixed-age environments, Bakhtin, a Russian philologist, supports the social theory of learning through peers. Bakhtin believes that learning occurs within the social language or *dialogic discourse* (Bakhtin, 1981; Hoff, 2006; Koschmann, 1999) which includes overheard language.

### **Overhearing as attention focusing**

An example of overhearing as attention focusing is when a child or individual is within hearing distance of a conversation and can have their attention diverted from an activity or conversation when their name has been used in the conversation. This act typically will stop a child or individual from their activity attention and reroute their attention to the overheard conversation (Messer & Turner, 1993).

### **Overhearing as conversation monitoring**

Overhearing as conversation monitoring as a bystander allows situational awareness and monitoring the progress of conversations (Forrester, 1993; Gutnik & Kaminka, 2006).

Monitoring or tracking supports vocabulary development because vocabulary is not just learned in isolated direct instruction but from the overhearing the vocabulary within a dialogue. The dialogue, including the style, intonation, and tone are just as crucial to understanding the concept of the word as the true comprehension of the word (Bakhtin, 1981; 2004). The term *dialogic* is defined within the Bakhtin perspective as conversation and inquiry providing the meaning of an

utterance by its location within the dialogue (Wegerif, 2008). Bakhtin (1981) described the context of communication as having history. He stated that we do not learn words from the dictionary, but from speakers who carry voices of those who used the words before them. Bakhtin (1981) continued to point out that meaning given to words is essentially dialogic. For the youngest child, the infant, the earliest sign of communication, the eye gaze and pointing demonstrates the dialogic relationship (Wegerif, 2008). Koschmann (1999) emphasized why dialogic discourse is so important to understand in the context of learning. The dialogic view decentralizes learning and makes learning a social interaction rather than at the hand of one instructor or even within one learner (Koschmann, 1999).

Boysson-Bardies (1999) posited that there is no need for direct instruction for the acquisition of language and vocabulary. Akhtar et al. (2001) conducted a study of 24 toddlers in a lab setting. Researchers provided the children with target names with associated target objects. Some children were provided direct instruction and others overheard the target names. The results indicated children in a lab setting could learn words equally as well when they overhear the word as when they are directly addressed. Akhtar (2005b) extended the Akhtar et al. (2001) study. In a lab setting, 30 toddlers were assessed to see if they could acquire target words associated with target objects under different conditions including a toy as a distraction. Akhtar et al. (2001) concluded that children could learn new words through third party monitoring or overhearing. Children learn language from what they overhear in the environment, or from ambient language (Akhtar, 2005; Akhtar, et al., 2001; Akhtar et al., 1991; Driscoll et al., 2003; Gampe, et al., 2012; Warren, 2001).

Infants learn about the phonology of language from ambient language by overhearing it (Knightly et al., 2003). Nakamura and Robb's (2000) study supported that infants learn syllabic

structures and their vocalizations through ambient language opportunities. Although their study was not conducted in a natural setting, it still demonstrates the importance of ambient language. This was also evident across cultures. Saffran et al. (1997) assessed both children and adults, evaluating their word knowledge based on what words they had overheard during a twenty-minute computer exercise. After this incidental exposure to artificial language, children and adults demonstrated that they had learned words during this twenty-minute computer experience. Saffran et al. (1997) concluded that incidental learning could be important in natural language and vocabulary acquisition.

Most of the empirical data regarding language acquisition has focused on a parent or teacher directly addressing a child, not the child overhearing a third-party interaction in a naturalist setting (Akhtar, 2005a; Akhtar, 2005b; Martinez-Sussman et al., 2011). Additionally, ambient language has been studied in static environments; often with parents present (Akhtar, 2005a; Akhtar, 2005b; Shneidman et al., 2013). Onnis's (2014) review of the nature of ambient language and its influence on learning in recent research indicated that the amount and nature of ambient language may play a more important role in language development than previously acknowledged. Hirsh-Pasek et al. (2015) believed there is a need to look at the foundations of language acquisition across a broader period, across cultures, and within naturally occurring activities to allow those who work with young children a full perspective to better support the children during their language acquisition stage. The literature on ambient language that young children overhear and its impact on vocabulary acquisition does not investigate the impact of classroom environments.

Xu et al. (2012) examined the environment and variables within the environment such as ambient noise, overlapping sound, and peer talk. Using the Language Environment Analysis

(LENA) recording device and software, Xu et al. (2012) evaluated the correlation between environmental variables and child language development. The LENA natural language corpus used in this study consisted of 106 typically developing children, 49 children with language delays, and 71 children with autism, all in home settings. The analysis demonstrated that TV exposure, both foreground, and background, showed significant and negative correlations with child language development for all groups. The study also demonstrated that foreground peer talk had significant and positive correlation for language development in children with language delays and autism, while there was negative correlation of peer talk that was distant for all groups. Xu et al. (2012) suggested the need for further studies in ambient language and the correlation language development for specific groups of children, such as children with hearing loss. Additionally, the Xu et al. (2012) study demonstrated that background noise had a significant and negative correlation on language development in children with language delays and autism, but not all groups were affected by foreground noise. The final measure of the study was the measure of the background adult word count. The study used the LENA Corpus, a set of over 300 recordings using the LENA tool in the home setting. Noteworthy, that there was no correlation of the background adult word count and the language scores of the children developing typically. There was a significant positive correlation of distant word count and language scores for children with language delays and autism. Lehet et al. (2021) continued to examine the reliability of LENA for the adult word count measure. Lehet et al. (2021) conducted an extensive review of literature. The most noteworthy was the determination of the detection cost function (DCF). The DCF determines the probability of false alarms and assists in the development of benchmarking the quantified performance results. Lehet et al.'s (2021) study reported the DCF value for naturalistic recordings of student interaction in peer-led team

learning to outperform the baseline. The study does not highlight strengths of the tool and areas for further research to strengthen the accuracy of measured results.

Intersubjectivity, the joint attention or mutual engagement in ambient language, is not evident. The speaker may not know the listener is eavesdropping, and the listener may not even know they are receiving the input because the ambient language was received unconsciously. The assumption is ambient language has been overheard because the child was in a social setting of more than one listener and speaker (Schneidman et al., 2009). Akhtar (2005b) demonstrated that 2-year-olds could learn novel words in overhearing situations while engaged with toys or when overhearing the novel word within a directive rather than a single utterance. Schneidman et al. (2009) argued that this occurs due to joint focus or joint attention. Schneidman et al. (2009) indicated that children have the ability to learn novel words from overheard speech in a lab setting. Schneidman et al. (2009) stated that children surrounded by multiple speakers such as group childcare settings, develop active monitoring skills. Schneidman et al. (2009) replicated findings that children can learn words without joint attention and concluded that social attention and social learning provides children with everyday learning experiences, which includes overhearing.

Shin (2012) further investigated and discussed the theory of joint attention with infants. Shin (2012) found infants demonstrated engagement in effective communication and experienced joint attention during peer interactions without verbal language. Shin (2012) states “active observation can also mean active participation” (p. 315). The study also indicated that infants under the age of two were capable of producing and comprehending imperative and declarative pointing during peer interactions.

## Chapter Synthesis

Experiences during the first three years of life greatly influence language acquisition (Anisfeld, 1984; Geoffroy et al. 2010; Harris et al., 2010; Hoff & Shatz, 2007; Parish-Morris et al., 2013). Literature undoubtedly states that early acquisition of vocabulary supports later academic success (Brown & Lenneberg, 1954; Geoffroy et al., 2010; Hart & Risley, 1995; Hirsh-Pasek et al., 2015; Morgan et al., 2015). There is, however, a gap in literature in the area of vocabulary acquisition in the Montessori setting (Van Aken, 2006) in birth to three mixed-age classrooms and specifically ambient language's influence on language acquisition (Akhtar, 2005b).

The current literature of mixed-age classrooms (Ansari et al., 2016; Bell et al., 2013; Gerard, 2005; Rouse, 2015) and ambient language (Akhtar, 2005b; Akhtar et al., 2001; Akhtar et al., 1991; Driscoll et al., 2003; Gampe et al., 2012; Warren, 2001) provide little insight about the true nature of language acquisition in birth to three Montessori mixed-age environments. This literature gap has led to a lack of understanding of the impact of ambient language on the development of language. The lack of research in language development in birth to three Montessori classroom environments creates a new area of research. The literature that does exist lends itself to the hypothesis of the present study. Ambient language provided by peers and adults teaching in mixed-age classrooms is robust and can provide much linguistic input as direct instruction.

Chapter III presents the methodology and research design for the current study. Several research questions are addressed related to the acquisition of language in a mixed-age infant-

toddler Montessori classroom environment. Chapter III also discusses the use of the Montessori three-period lesson and the Language Environment Analysis (LENA) recording device and software as the assessment tools in Montessori mixed-age environments.

## **Chapter III**

### **METHOD**

This chapter described the methodology and methods implemented in this quantitative descriptive and correlational study to understand the relationship of ambient language in the birth to three Montessori setting. Data was collected through observation. Understanding ambient language and the benefits it has in the early childhood classroom could potentially influence (a) classroom design; (b) teacher preparation programs; (c) classroom interventions; and (d) language and vocabulary lesson development.

This chapter began with an introduction establishing the nature and purpose of the present study and the statement of the research questions. It then presents an overview of a descriptive correlational design and explains the selection of the general method for the current study. The chapter concluded with a detailed description of the design and measures of this study including: (a) implementation of the intervention; (b) selection of nonsense words; (c) data analysis methods; (d) quantitative data analysis methods; (e) review of the pilot study; (f) ethical concerns, and (g) limitations and strengths of the study.

#### **Nature of the Study, Research Approach and Research Questions**

The purpose of this quantitative descriptive correlation study was to determine the relationship or correlation of ambient language on language development in mixed-age birth to three Montessori classrooms. The study focused on the assessment of the intervention by measuring ambient language within the environment. The following research questions (RQ) guided this study:

**RQ1:** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?



**RQ2:** How much ambient language is provided by verbal toddlers in mixed-aged Montessori environments, as measured by the total child word count (CWC)?

**RQ3:** How much ambient language is provided by adults in mixed-aged Montessori environments as measured by the total adult word count (AWC)?

**RQ4:** What is the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child?

### **Research Design**

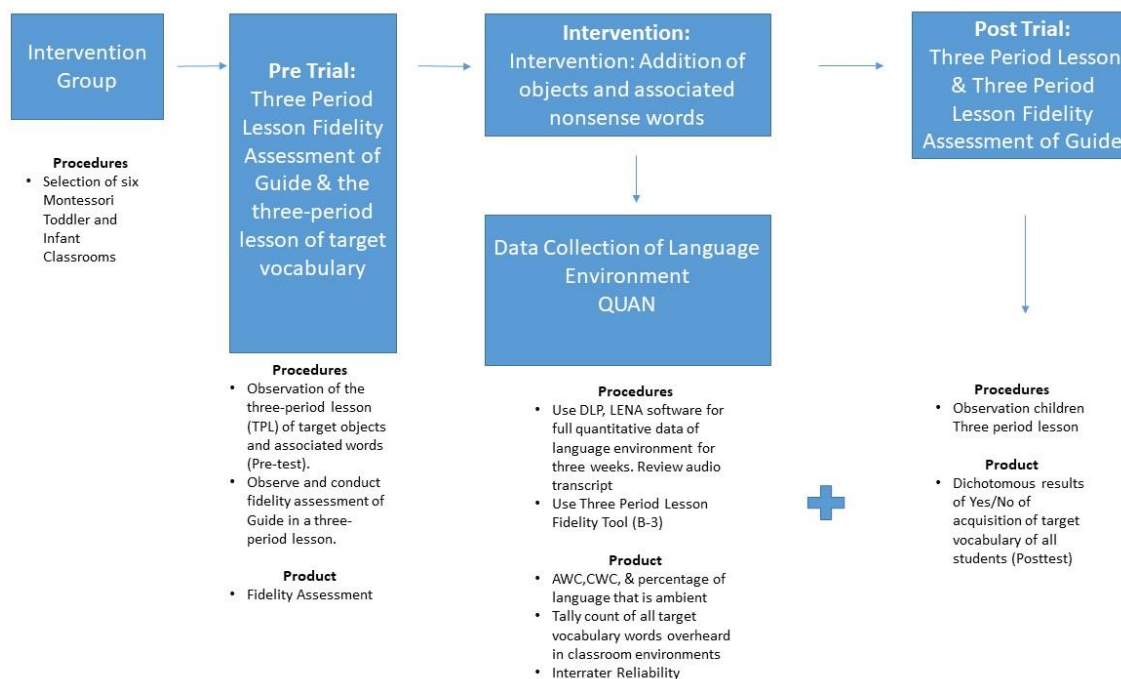
This quantitative descriptive and correlational study was used for the multiple methods of observations to determine if a relationship exists between ambient language and language acquisition in young toddlers in mixed-aged Montessori classrooms. A descriptive and correlational design was selected for this study as this design met the needs of research questions posed. Measuring multiple variables including the influence of the targeted nonsense words examines the relationship between variables but does not determine causality (Marczyk, et al., 2005). The descriptive design will identify who, what, why, when, and where will be studied (Casillas-Martin, et. al, 2020; Grimes & Schulz, 2002). Casillas-Martin, et al. (2020) recently used a quantitative descriptive correlation design to measure early childhood teacher educators' digital competence. Schappe (2015) used a descriptive correlational design to determine the relationships between performance on early childhood assessment and teacher's perception. Buson and Alieto (2019) used a quantitative descriptive correlational design to analyze the relationship between reading comprehension and prior knowledge of language (i.e., synonyms, appearance similarities, cues from title or illustrations). An examination of language acquisition influenced by ambient language in Montessori mixed-age classrooms is a new area of inquiry.

For this reason, a descriptive, correlational design using naturalistic, and observation is the best fit.

Descriptive design is a representative of an event to collect data using samples illustrative of a population. Observation of the demonstration of both vocabulary usage and comprehension of nonverbal toddlers was necessary to capture the true nature and benefit of the Montessori theory, the absorbent mind, qualitatively. Salkind (2010) also described descriptive statistics. Correlation describes a relationship between two or more variables but cannot infer cause and effect (Salkind, 2010). The Pearson correlation is the most common bivariate measure of correlation. A bivariate correlation determines the degree of relationship between two variables. The intended study includes a pre-post quasi-experimental design with an intervention of the target non-sense words. The correlation of the determined independent and dependent variables was determined by the results of the post-test. The independent variable is the ambient language (amlang). The dependent variable is the target vocabulary words acquired: sugs (nD1), meck (nD2), dusset (nD3), pame (nD4), bursa (nD5), kack (nD6).

**Figure 2**

*Descriptive, correlational study design for language acquisition*



## Participants

Using various Montessori networks, six Montessori birth to three environments were recruited for the study. The number of participants in this study was 56 children and 12 adults. Participants included infants and toddlers in Association Montessori Internationale (AMI) and American Montessori Society (AMS) classroom environments led by AMI or AMS trained staff. Due to state childcare licensing requirements, the infant/Nido classroom typically did not exceed eight infants, with an age range of 6-weeks-old to 15-months-old. The toddler environment typically had ten to twelve students in a classroom ranging in age from 15-months to 3-years-old. A description of the study and permission forms (Appendix C) provided to all participants and children's families/guardians allowed opportunities to opt in or out of the study. The permission

forms and opt in and out protocol met the LIU Institutional Review Board (IRB) requirements and approval (Appendix D).

## **Setting**

The settings selected for the study were AMI and AMS infant and toddler classroom environments. There were four different Montessori infant toddler classrooms participating in the study. There are many Montessori associations and organizations around the world and several Montessori training programs. The AMI is the original organization that Maria Montessori founded in 1929 to ensure that the philosophy and curriculum would not be corrupted or used inappropriately. The AMS was originally under the governing body of AMI and later separated becoming its own entity in 1960 (Povell, 2010). The AMI/USA is now the AMI affiliate in the United States. The AMI and AMS settings were selected because they both have rigorous training requirements for their diploma holders. The AMI and AMS both require teachers in training to have hands-on experience with materials, observations of children in Montessori settings under the guidance of trained staff, and an assessment phase of the training. These requirements ensure the Montessori trainee understands the writings of Maria Montessori, can apply her philosophy and pedagogy, and that trainees can implement the Montessori curriculum. The AMI and AMS also have assessment programs for the schools. The selection of only AMI or AMS trained staff provides reliability and validity to the setting itself.

## **Materials**

### ***Assessment Measures.***

There were several materials or tools used as assessment measures. To assess and measure ambient language audio recordings of all language provided by both the children and adults in the environment could provide results to the research questions. The Language

Environment Analyses (LENA™) System was determined to be the best audio recording process to provide measurable data. In addition to the LENA™ system, non-descript objects were created and provided as nonsense words used in the intervention of the three-period lesson.

***Language Environment Analysis (LENA™) System.***

To obtain quantitative data, the experiment used the Language Environment Analysis System (LENA™) and language materials, also known as replicated non-descript objects, with associated nonsense words to answer the research questions of the present study. LENA™ System is a software program and recording device that assists in the analysis of audio input in the environment (LENA™ Foundation, 2008). The recording device is the digital language processor (DLP) and can store up to 16 hours of recordings (see Figure 3). Twelve children wore the 3 oz. DLP in a cloth vest so that s/he could not see the device (see Figure 4). The DLP was plugged into the computer with a USB port; the recordings were downloaded/transferred and analyzed by LENA™ software. The software can analyze both the acoustic environment--using advanced speech identification algorithms--and files on language activity, from which it can produce reports.

**Figure 3**

*LENA™ digital language processor (DLP) weighing 3 oz.*





**Figure 4**

*Custom LENA™ vest.*



*Note: The DLP slides into the pocket fastened closed with Velcro. This pocket allows the DLP to be secured and not visible to the young child. Vests sized according to the child's age.*

The LENA<sup>TM</sup> Software analyzed the data and provided the following covariates for the study:

- adult word counts (AWC)
- child word counts (CWC).

The tool determined if the input was near or far and classified as “meaningful” or “distant language” (Xu et al., 2012). This distinction was beneficial to this study. The LENA tool analyzed the environment for meaningful language input versus silence, noise, and input from media such as the TV (LENA<sup>TM</sup> Foundation, 2008; Xu et al., 2009). The LENA<sup>TM</sup> system requirement for the laptop includes 8GB of memory and a fixed hard drive. The LENA<sup>TM</sup> agreement states that storage must be on the hard drive and not on a network. Intel Core i5 or AMD A1, 4 logical processors and Window 10 operating system were also required to operate the LENA<sup>TM</sup> Software. The display must meet 1024x 768 monitor specifications to view the output image. In addition to the specifications, the agreement indicated that the laptop’s sole purpose was to analyze the DLP output using the LENA<sup>TM</sup> software.

**Validity.** The validity of the LENA<sup>TM</sup> tool was investigated from 2006 to 2008. The algorithms used in the software were designed after extensive interpretation of the LENA<sup>TM</sup> audio files (Xu et al., 2009). The files were coded by both trained transcribers and computer software. The data sets were used to assess accuracy and reliability of the software output of the covariates. Ganek and Eriks-Brophy (2016) states that LENA<sup>TM</sup> was normed and demonstrated validity for use with children from 2 months-to- 48 months of age. Additional studies continued to demonstrate the validity of the LENA system (Yoder et al., 2013).

**Reliability.** The reliability range of the LENA<sup>TM</sup> digital audio recording system and software is between 70% and 85% (Xu, et al., 2009). Xu et al (2009) measured for mean length



utterance (MLU) in morphemes of the oldest child and youngest child. A morpheme is the minimal sound sequence that has a meaning (Clarke, 2016). An analysis of the recording provided a count of the target words heard in the recordings measuring the impact of the ambient language environment overheard by the oldest and youngest child in the learning environment. Ongoing training with the LENA<sup>TM</sup> Foundation created the interrater reliability needed for the LENA<sup>TM</sup> Tool. The researcher participated in online training and mentorship with the LENA<sup>TM</sup> organization in the proper use of the tool and use of the LENA<sup>TM</sup> Software and ADEX tools.

The reliability of the LENA<sup>TM</sup> system is reviewed in the technical report. The technical report compares the tool and software accuracy to human transcribers, with the LENA<sup>TM</sup> system having less than 5% error (Xu et al., 2009). The original intention of the tool was to assess home language and provide information to speech pathologists and caregivers in home settings. The LENA<sup>TM</sup> system has quickly become a tool used in multiple settings to assist in the evaluation of infant and toddler language environments. A recent study (Lehet et al., 2021) examined adult speech, which contributed to ambient language, and determined that the LENA tools was reliable to measure ambient language. Lehet et al. (2021) argued that there are potential errors in word counts depending on the gender assessed. The recommendation is to use human observers to verify word counts.

The LENA<sup>TM</sup> tool was selected because it was designed for use specifically with infant and toddlers in natural settings, not controlled environments. The LENA<sup>TM</sup> tool allows a snapshot of the child's acoustic environment without disruption to their typical day (Xu et al., 2009). The additional advantages to using the LENA<sup>TM</sup> system is that the assessment of the language input from a variety of sources can be captured (peers, multiple adults, etc.). The complex social scene of the child in a mixed-age classroom can easily be recorded and analyzed.

The LENA™ system allows extraction of statistical data to be analyzed in other statistical programs such as SPSS and STATA analysis software.

Another examined the reliability of the LENA™ for use in preschool classroom settings (McCauley et al., 2011). Five-minute segments from 30 recording sessions in preschool classrooms were coded by a human observer and compared with LENA™ counts. Total correlation between the human and LENA™ estimates was .81 ( $p < .01$ ) across the adult, child, and other variable categories. Inter-rater reliability was calculated on 12% of the recordings and kappa was reported at .90. This suggests the LENA™ is a reliable tool for measuring the natural language of adults in a preschool classroom environment. LENA has predominantly been used in correlational and comparative studies and to date has been used in at least seven studies with an experimental design to evaluate intervention effects (Greenwood et al., 2018). In the majority of studies LENA has been used and analyzed in home settings. Limited studies have used LENA in naturalist classroom settings (Dykstra et al., 2012).

### ***Targeted Objects and Words***

Three-period lessons (TPL) were presented using a basket of unknown non-descript target objects to obtain quantitative data (see Figure 5). Target non-sense words for the non-descript objects were created to align with the Montessori practice of learning new words in isolation. Each target object was assigned an associated nonsense word (see Figure 6).

**Figure 5**

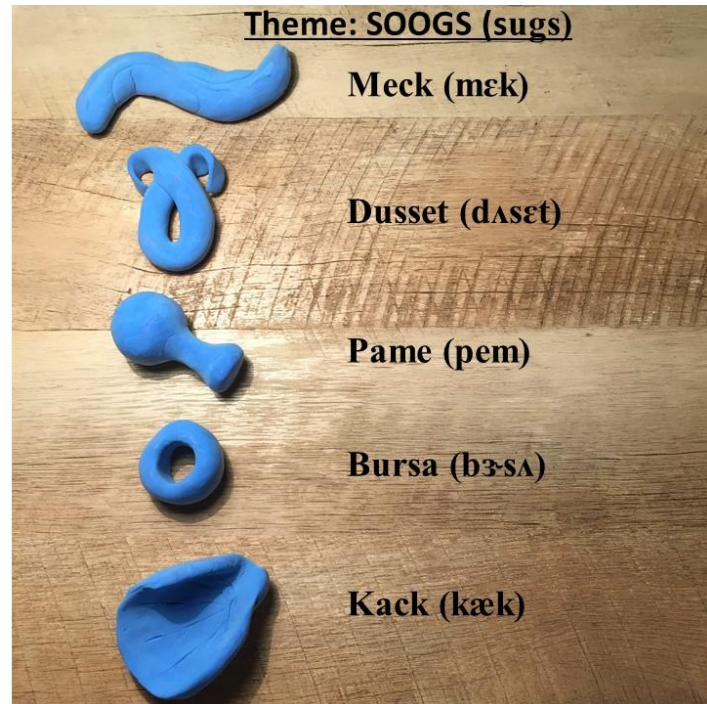
*Target objects created for the study.*



*Note: All Target objects created with non-toxic clay. The only distinguishing features of the objects are the shapes.*

**Figure 6**

*Target objects with assigned target nonsense words.*



**Validity of target word selection.** The decision to use nonsense words over a non-English word allowed the study to control a number of variables that could not be controlled otherwise (Kuhl et al., 2006; Kuhl, 2010). Most importantly, this study focused on monolingual vocabulary acquisition and not second language learning (L2) or bilingual learning. The use of a novel word allow for more clarity in the findings and model the Akhtar et al. (2001) research. Nonsense words used for the study ensured that participants had not had prior exposure to the words.

**Reliability.** Target words and the corresponding objects created for the TPL component follow several guidelines to comply with Montessori principles and provide reliability and validity to the words selected. The guidelines include (a) Montessori language material

guidelines that encourages the use of hands-on materials that isolate and refine the senses (Van Aken, 2006), (b) selecting words that contain high probability phonotactic sequences, and (c) selecting a variety of nonsense mono-syllabic and bi-syllabic words with a variety of phonemic sounds.

The Montessori philosophy encourages the learning of new skills and information in isolation. Teaching colors is an example of this isolated learning in a Montessori toddler environment. The only differentiating aspect of the tool used is the color. If the shapes are all different as well, then it is harder for the child to discern if we are providing the new word to the shape or the color. Consistent with this philosophy, five objects were created of hard clay for this study. All objects were made of the same clay color to isolate the learning objective: learning the word to match the shape of the object (see Figure 6).

The words selected for the study conform to English language rules, also called legal nonsense words. Vitevitch et al.'s (1997) language study demonstrated how to select legal nonsense words. Phonotactics is the configuration of speech sounds within syllables and words as well as the probability that a given segment will occur in a specific position within a syllable or word (Jusczyk & Anslin, 1995; Vitevitch, et al., 1997). Identifying the restrictions of English, Vitevitch et al. (1997) stated “only a subset of consonants may form syllable-initial clusters and the order of consonants with clusters is severely restricted” (p. 47). This is important for this study to take into consideration because a study conducted by Jusczyk et al. (1993) produced results determining that 9-month-old infants demonstrated sensitivity to phonotactic patterns to their native language.

Jusczyk et al. (1993) demonstrated that infants preferred to listen to mono-syllabic nonsense words containing high probability phonotactic sequences over words containing low

probability sequences. Auer (1993) determined that phonotactic probability directly affected processing time for consonant-vowel-consonant (CVC) words. High probability phonetic words were processed more rapidly than those with low probability. High probability and low probability are determined by positional probability of each segment.

The words chosen are phonotactically legal nonsense words. The decision to use legal nonsense words respects children's already learned segmental and sequential patterns of language. A selection of high probability occurring mono-syllabic and bi-syllabic nonsense words were chosen from the Jusczyk et al. (1994) and Jusczyk et al. (1993) studies. An effort was made not to repeat vowel and consonant sounds or clusters. The words chosen are listed in Table 1. For the purpose of this language study, the International Phonetic Alphabet (International Phonetic Association, 2005) was followed for the pronunciation of all words. Selection of the phonemes were also based on diversity of the consonant and vowel sound as well as the diversity of positioning within the oral structure (see Table 1).

**Table 1**

*Phonetic pronunciation of high probability nonsense words*

Nonsense Word	Phoneme Placement
mɛk	Nasal bilabial/Front vowel/ Plosive velar
dʌset	Plosive dental/Alveolar, central vowel/Fricative dental/Aveolar front vowel/Dental plosive
pem	Plosive bilabial/ Front vowel/Nasal bilabial
bɜːsʌ	Plosive bi-labial/Central vowel/Fricative dental/Alveolar central vowel
kæk	Plosive Velar/ Front vowel/ Plosive Velar
sug	Fricative dental/Aveolar/Back vowel/Plosive uvular

*Note.* Phonetic pronunciation of high probability nonsense words following the International Phonetic Alphabet (Appendix E), followed by a descriptive analysis of the diversity of the vowels and consonants articulated in each word.

### **Intervention**

The TPL was used as the intervention to gain data. The TPL was measured and provided quantitative results. Currently, no known instruments exist to assess the degree of fidelity to the Montessori TPL (Murray et al. 2019). The Three-Period Lesson Fidelity Tool (B-3) (Appendix F) was created to assess fidelity.

### ***Interrater Reliability of Fidelity Measure***

Judi Orion trained the researcher in a collaborative training event with The Montessori Institute (TMI) and Computer Associates (CA Inc.) Montessori Children's Centers. Judi Orion is one of the first A-I Montessori trainers for AMI in the United States. The researcher obtained the internationally recognized AMI Assistants to Infancy (0-3) Diploma in 1999 (see Figure 7). The program included 400 hours of lecture and practical experience in the classroom, as well as 350 hours of observations of children birth to three years of age.

**Figure 7**

*AMI diploma issued to researcher*



*Note:* AMI Diploma issued to the researcher in 1999. The diploma was signed by: Renilde Montessori, AMI Secretary; Virginia Buckley, AMI Examiner; and Judith Orion, AMI Trainer.

The researcher and another AMI or AMS trained individual used the Three-Period Lesson Fidelity Tool (B-3) (Appendix F) at each research site. Several factors can influence the fidelity of the TPL including: (a) ongoing professional development, (b) quality of language materials, (c) quality of teacher/child interactions, (d) experience in Montessori environments, (e) experience with infants and toddlers, and (f) overall qualifications.

Sara Brady (Sara Brady of AMI, personal communication, May 2016), an AMI birth to three teacher trainer reviewed and provided feedback regarding the Three-Period Lesson Fidelity Tool (B-3). The purpose of the tool was to assist the researcher when evaluating the TPL during the experiments. Assessors chosen for the study hold an AMI or AMS diploma to ensure understanding of the TPL within a Montessori environment. To determine fidelity to the TPL



scores between the assessors for each environment were documented. The TPL Fidelity Tool (B-3) explicitly developed for this study does not have available independent validity or reliability data. To determine the internal validity, Cronbach  $\alpha$  was computed.

### ***Fidelity of Implementation of Three-Period Lesson***

Typically, scales are developed and used to quantify fidelity to compare an intervention to the empirically tested model on which it is based. Several studies investigated fidelity of the Montessori practice. Yen and Ispa (2000) investigated the instructional fidelity, specifically focusing on collaboration. Blank (2009) investigated the adherence to the uninterrupted three-hour work cycle. Fidelity is the way in which delivery of an intervention adheres to the original model of intervention (Mowbray et al., 2003). Fidelity criteria was developed as a guide to implement a model (Bond et al., 1997) and monitor program quality (Bond et al., 1997; Bond et al., 2000). McGrew et al. (1994) indicated fidelity is to assess conformity to a set process, with and without a set of defined parameters, and to ensure internal and external validity.

A set of fidelity criteria was developed for this study to assess the validity of the TPL. The fidelity criteria were developed with consideration for both pedagogy and practice. The Likert-type scale measured:

- (a) The extent to which Montessori trained teachers or Guides adhered to the intention of the curriculum (Pence et al., 2008);
- (b) If poor outcomes reflected a failure to comply with the intended Montessori model (Mills & Ragan, 2000)
- (c) The level of quality in the delivery of the TPL in the Montessori model (Pence, et al., 2008).

Mills and Ragan (2000) stated that failed implementation and compliance with a model is the most common reason for failed outcomes. Using a fidelity tool also allows replication of the study. The Three-Period Lesson Fidelity Tool (B-3) allowed the TPL to be accurately standardized and researched with more consistency (Vartoli & Rohs, 2009). Teague et al. (1995) noted that a well-developed and valid measure of fidelity enhances statistical power in outcome studies, acting as a moderating variable to help explain variance in outcomes. Teague et al. (1995) indicated that the fidelity criteria provides support to exclude environments that deviate from the intended model. The fidelity tool allowed comparisons of the TPL and can document deviations to the lesson.

### ***Criteria for Three-Period Lesson Fidelity Tool (B-3)***

McGrew et al. (1994) and Teague et al. (1998) defined the steps in establishing fidelity criteria. First is to determine critical components of an expert consensus-based model or that the model has been described explicitly. Each indicator must have a source of data, operationally defined along with a rating scale so that it is objectively measured (Mowbray et al., 2003). Authentic Montessori practice requires that those who present the TPL be a lead Guide who is AMI or AMS trained or an assistant in an AMI or AMS environment guided by an AMI or AMS Guide. The Guide also must receive professional development on the TPL from an AMI or AMS trained individual. The child determines the duration of the presentation. Once the child disengages, the lesson is terminated or complete. The child's level of interest, gauged by the Guide and the assistant, typically determines the length of time language materials are available on a shelf. A reference of time is usually three weeks (S. Brady, Personal Communication, August 22, 2016).

The second step was the collection of data to measure the indicators (McGrew et al., 1994; Teague et al., 1998). An AMI Montessori trainer reviewed the selected criteria, which was supported by Montessori literature (Appendix G). The Three-Period Lesson Fidelity Tool (B-3) was created specifically for this study to capture the degree of compliance with the practice and implementation of the TPL as taught in Montessori training, but it also has many similarities with other fidelity assessment tools used for language curriculums in early childhood settings (Cohen, L. E. et al., 2012; Pence et al., 2008).

The third step was to review the criteria regarding the Guide's reliability and validity. (McGrew et al., 1994; Teague, et al., 1998). The TPL was observed two times over the three-week period using the Three-Period Lesson Fidelity Tool (B-3). A Fidelity Assessor used the tool to assess the Guide during the TPL using a Likert-type 5-point scale of 19 criteria. The scale ranged from *strongly agree* to *strongly disagree* (*strongly agree* = 1, *strongly disagree* = 5). Survey items 1- 5 were designed to assess the environment, survey items 6-9 were designed to assess teacher engagement, and survey items 10-19 were designed to assess pedagogical compliance.

## **Procedures**

### **Data Collection**

Data was collected using naturalist observation and standardized observations. Several steps were followed to achieve the results, these included (a) collection of permissions, (b) pre-test (c) quantitative procedures, (e) post-test, and (f) data analysis. Data were collected through direct and indirect observation. Direct observation of children and teaching staff in classrooms during the Montessori work cycle. The TPL was observed and student's ability to recall and or recognize the nonsense target words was documented as a dichotomous result. The indirect

observation was listening to the audio of every hour recorded in the classrooms. In addition to listening to the audio recording, a transcript was created from one classroom. This transcript was reviewed and used for further sample analysis.

### ***Permissions***

Upon completion of school selection and submission of Institutional Review Board (IRB) approved permission forms (Appendix C), an appointment was arranged with the school leadership team. Permissions were collected from families and classroom staff. Classroom staff included the lead teachers/Guides and assistant teachers. The meeting reviewed the purpose of the study, the responsibilities of the classroom Guides during the study, and scheduled staff training. The staff training included a discussion of the purpose of the study, training on the use of LENA<sup>TM</sup> DLP, and a review of classroom documentation including the Classroom Daily Activity Log and Classroom Survey (Appendix H and I).

### **Quantitative Analysis**

The quantitative data gained from LENA<sup>TM</sup> can be further explained by the observed narrative and verbal data gained from the TPL. To document the pre- and post-assessment using the TPL to measure the frequency count of expressive use and comprehension of the target words, event sampling was used (Cohen et al., 2007). The pre- and post-test Target Nonsense Word Acquisition Documentation form was used. The Target Nonsense Word Tally of Classroom Audio Recordings Form was used to measure the 136.56 hours of the language in the environment. The transcriber documented target words heard using hash marks and provided a total tally for each word at the end of the observation.

### *Descriptive, Correlational Study*

The Montessori pedagogy is a scientifically based philosophy of education that has early roots in observation and measurement of young children. Observation was used for data collection in the present intervention study. Observations allowed for the collection of data needed to determine the correlation ambient language had on language acquisition. The design included an intervention because the research questions are proposed within a Montessori theoretical framework. The use of empirical data obtained through observations best supports the curriculum and theories within the Montessori philosophy studied.

Korfmacher and Spicer's (2002) study, the first to be conducted in a birth to three Montessori setting, examining three Nido and three Infant Communities (IC) for toddlers within an AMI Montessori Early Head Start Program. The outcomes are based on teacher perceptions using a modified behavioral scale. Korfmacher and Spicer's (2002) observations consisted of family interviews, and observations in a home and Montessori environment.

Korfmacher and Spicer (2002) demonstrated the way different children experience high quality, theoretically driven childcare. Korfmacher and Spicer (2002) highlighted the Montessori model as an intervention with attention to orientation and the environment. They focused on independent and autonomous learning, as well as developmentally appropriate activities, and the effect it had on the regulation of behavior of young children.

**Pretest.** The third lesson of the TPL presented to the participating children is considered the assessment phase of the intervention. The Guide asked the students for the name of the nondescript objects. The audio recording on the DLP and tabulated Pre and Post Test Target Nonsense Words on the Acquisition Documentation (Appendix J) provided pre-test results.

**Quantitative procedures.** In each environment, two children, the youngest and oldest, wore a specialized vest holding the digital language processor (DLP). Typically, the oldest and youngest child were in the environment allowing consistency unless there was an unplanned absence of the oldest or youngest child. On any given day that this occurred, the next child fitting the characteristic of youngest nonverbal or oldest verbal child wore the vest. The Guide, the teacher in the room, and researcher determined the best practice to ensure the child did not see the DLP placement in the vest. Throughout three weeks of the present study, the eldest and youngest child wore the DLP during the morning Montessori work cycle. The DLP recorded all audio inputs from the environment.

Guides were instructed to provide a typical TPL to the oldest child using the target language objects and associated words during the morning work cycle over the course of three weeks. The Guides were also instructed to discuss the language objects with the adults in the room in normal conversation as they would with any other typical classroom material. The Guide's presentation of the TPL was assessed three times during the study using the Three-Period Lesson Fidelity Tool (B-3) created for this study. The teacher assessment occurred on the first day of the experiment, mid-experiment, and at the post-test, the last day of the experiment. The pre- and post-test observed and documented the comprehension and expressive scores of the TPL and the target words of each child.

At the culmination of three weeks of data collection, using both the DLP and observations, the data were analyzed and integrated. First, the DLP was downloaded, and recordings reviewed for target words using the Target Nonsense Word Tally of Classroom Audio Recordings Form (Appendix K). Then, the recordings were analyzed using LENA™ results.

The data were pulled from the recordings, LENA<sup>TM</sup> software, observations of the pre- and post-test and the Three-period Lesson Fidelity Tool (B-3) were computed and integrated.

A professional transcription company transcribed one set of recordings. The transcription was used to assess the validity of the LENA<sup>TM</sup> DLP and LENA<sup>TM</sup> Software. The transcript was coded and tallied to measure the target words, who spoke them, and if the spoken language was a distant or overheard language or if it was directed to the child wearing the DLP.

**Descriptive procedures.** The Guides were instructed to document anything noteworthy or atypical of the morning work cycle in the Classroom Daily Log. The Log measured fidelity. The Guides were also instructed to identify how many times the three-period lesson was conducted, introducing the target nonsense words and objects. The Classroom Survey was also completed to provide additional information. This information included but was not limited to: (a) the teacher's home language, (b) children's home language, (c) education of teaching staff, and (d) family structure of students.

**Data Analysis.** Two children wore the LENA<sup>TM</sup> recording device during the morning Montessori two-hour work cycle for three weeks, yielding approximately 15 hours of recordings for each child wearing the DLP in each environment. This resulted in approximately 136 hours of recorded classroom discourse. Data were analyzed by integrating both quantitative and qualitative data together. The researcher analyzed the data in terms of the four research questions listed again for the reader's convenience:

**RQ1:** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?

**RQ2:** How much ambient language is provided by verbal toddlers in mixed-aged Montessori environments, as measured by the total child word count (CWC)?

**RQ3:** How much ambient language is provided by adults in mixed-aged Montessori environments as measured by the total adult word count (AWC)?

**RQ4:** What is the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child in mixed age classrooms?

To answer RQ 1 the researcher used the LENA™ DLP to record the language within the mixed-age classroom environment. The researcher also added the nonsense words and associated non-descript objects using the three-period lesson (TPL) intervention. The TPL was recorded, measured and analyzed using the DLP. The TPL was also annotated using the Montessori Three-Period Lesson Fidelity Tool (B-3) (Appendix F), Classroom Daily Activity Log (Appendix H), the Pre and Posttest, (Appendix J), and Target Nonsense Word Tally of Classroom Audio Recordings (Appendix K). The researcher analyzed the pre and posttest results of the youngest children to determine if acquisition and or comprehension of the target words occurred. The independent variable is the ambient language (amlang). The dependent variable is the target vocabulary words acquired: *sugs* ( $n_{D1}$ ), *meck* ( $n_{D2}$ ), *dusset* ( $n_{D3}$ ), *pame* ( $n_{D4}$ ), *bursa* ( $n_{D5}$ ), *kack* ( $n_{D6}$ ). Pre and post-tests were conducted only using the second and third lesson (the assessment portion of the Three-Period Lesson). A dichotomous result of only “yes = 1” or “no = 0” was recorded for each lesson for each child in the classroom environment during the pre and post-test, with a potential  $n = 40$ . All other three-period lessons conducted in the environment throughout the study were presented per the Montessori pedagogical guidelines for the age group. A classroom log was created for staff to document the number of three-period lessons conducted using the target vocabulary words throughout the three weeks. The use of Factorial Analysis of variance (ANCOVA), comparing all environments and subjects, was used. The adequacy of the overall ANCOVA model, the main effects, and the interaction term were



assessed based on the statistical significance of the respective  $F$  statistics with an a priori acceptance criterion of  $(p(F)) \leq .05$ . ANCOVA assisted in measuring the dichotomous group, the children who acquired the target vocabulary words (chaq), and the children who did not acquire the target vocabulary words (chnoag).

The procedure for analysis used for RQ2 and RQ3 included extrapolating the adult word count (AWC) and child word count (CWC), from the DLP output and was then identified as the factor levels. The output of LENA<sup>TM</sup> Software and transcriptions provided counts. A focus was on the output labeled (a) Language Overheard in the Distance and (b) Meaningful Language or language directed to the individual.

To examine RQ4 using ANCOVA for the pre- and post-test, assuming the individual data collector had factor variable of ability (Yes or No). If the  $F$  statistic is larger than the mean between the groups than the mean within the group's variance, then ANCOVA indicates the factor variables (ambient language) affect the dependent variable (vocabulary acquired). If the variance explained is greater within groups than in between groups at statistical significance ( $p < .05$ ) then it indicates ambient language effects the vocabulary acquired.

During the pre- and post-tests, the TPL Fidelity Tool (B-3) was used to assess fidelity and interrater reliability. During the three-week period of the intervention, an AMI or AMS individual not associated with the study observed a three-period-lesson conducted in each environment. Scores were tabulated to determine fidelity to the intervention. The researcher and one additional Montessori-trained individual recruited for the study used the fidelity tool. Each statement achieved a score based on a Likert type scale between one and five.

A Classroom Survey was created to obtain descriptive classroom environment data about the children and teaching staff. Descriptive statistics for the classroom's characteristics were

calculated, and graphs were created using Stata/IC version 13.2. Microsoft Excel version 2013 was used in formatting the tabular data. Descriptive statistics calculated included a) total hours the DLP was worn, (b) gender, (c) mean age, (d) child race, and (e) home language. The LENA<sup>TM</sup> Tool provided a variety of units of measure used in the analysis. The purpose was to answer the four research questions posed in this study. A pilot study determined the LENA<sup>TM</sup> DLP, and Software could capture ambient language in a mixed-age setting.

### **Pilot Study**

A pilot study to field test the LENA<sup>TM</sup> DLP and software was conducted in a mixed-age Montessori Family Childcare environment. The field test included the use of nonsense words by the adults in conversation with other adults in the space. This allowed the researcher to identify the targeted words in the recording and determine the feasibility and ease of quantifying the nonsense words using the audio recordings. The nonsense words were not directed to the children. The Three-period lesson was not conducted in this setting and the nondescript objects were not included in this pilot student. The pilot study did not include the use of the fidelity measurement of the three-period lesson.

### **Participants**

An Association Montessori International (AMI) Montessori trained teacher and her assistant participated in the pilot study. Included in the study were six children ranging in age from 12-months of age to six-years-old. The oldest and youngest child wore the DLP. The children were all residents of Nassau County, New York living within the Haitian community. All children and families spoke English and some families spoke French. Permission to participate was obtained from families and staff.

**Setting**

A licensed family childcare setting that operated in Nassau County, New York was chosen for the pilot study. The Montessori philosophy is the pedagogy followed at the program. The home had three rooms that the children moved through on the first floor. The first room was the instructional room, the second room was for the children under the age of 18-months and the kitchen was where all meals and snacks were provided. The setting provided care and education for children five days a week from 8:00 AM – 6:00 PM. The program also offered before and afternoon care for school-age children.

**Materials**

The youngest and oldest child wore the LENA™ DLP. The infant wore the vest with the DLP. The six-year-old wore the DLP in the pocket of clothing worn on the day of the study. The DLP output downloaded to the Lenovo Laptop specifically procured for the study at the end of the day. The LENA™ system requirement for the Laptop includes 8GB of memory and a fixed hard drive. The LENA™ agreement states that storage must be on the hard drive and not on a network. Intel Core i5 or AMD A1, 4 logical processors and Windows 10 operating system were also required to operate the LENA™ Software. The display must meet 1024 x768 monitor specifications to view.

**Measures**

The measures for this pilot study were the analysis of the ambient language. The intent of the pilot study was to measure the adult word count (AWC), and child word count (CWC) overheard in the environment. The DLP captured both the AWC and CWC along with the count of language overheard in the distance as well as language labeled "meaningful" or directed to the child.

## **Procedure**

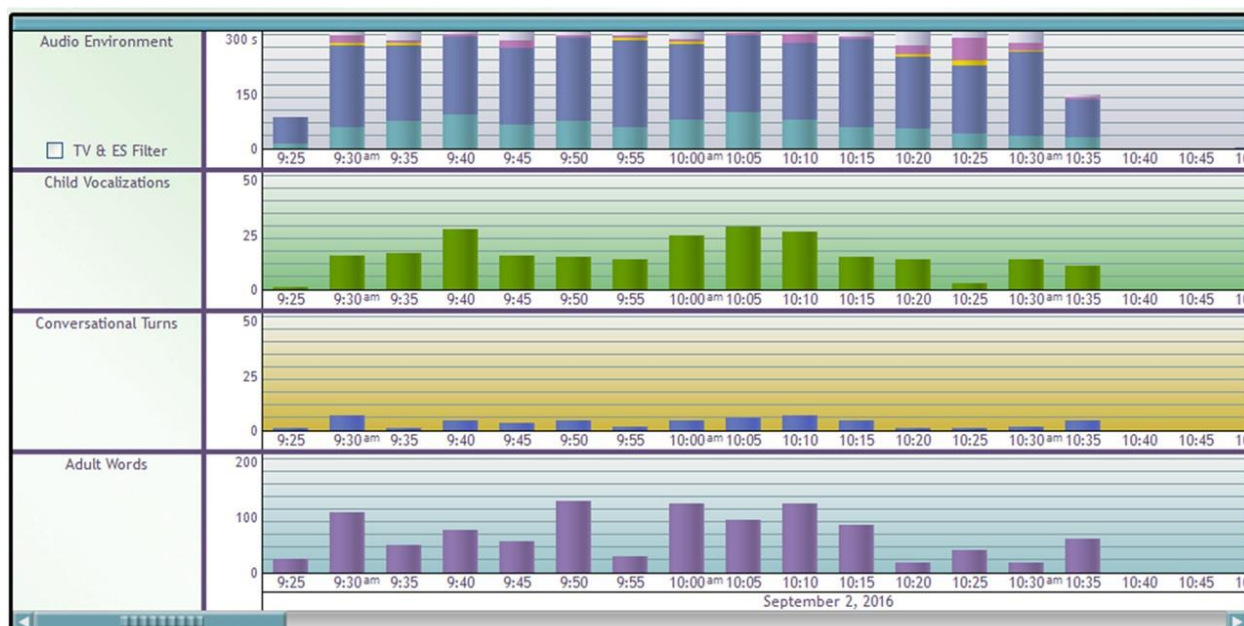
Permission forms provided to the families several weeks prior to the study were collected, reviewed, and stored. Upon arrival to the home setting, the researcher turned on the DLP and slipped one into the infant vest. The infant vest was placed on the youngest child in attendance. The second DLP was provided to the oldestchild in attendance. The DLP was placed in his pants pocket. The device recorded for one hour. The DLPs were then linked to the laptop computer and the recording downloaded for analysis.

## **Data Analysis**

The LENA<sup>TM</sup> Software provides numerical and graphic output (see Figure 8 and 9). The one-hour sample of a 12-month-old wearing the vest and DLP resulted in the following output: 1,061 adult word counts (AWC), and 57 Conversational Turn Counts (CTC). The one-hour recording can be broken down into the following percentages: (a) Television/Media, 1%, (b) Silence, 5%, (c) Noise, 5%, (d) Language overheard in the distance, 68%, (e) Meaningful language directed to child, 21%. The percentage of language overheard in the distance is consistent with Soderstrom and Bhaskaran's (2010) report.

**Figure 8.**

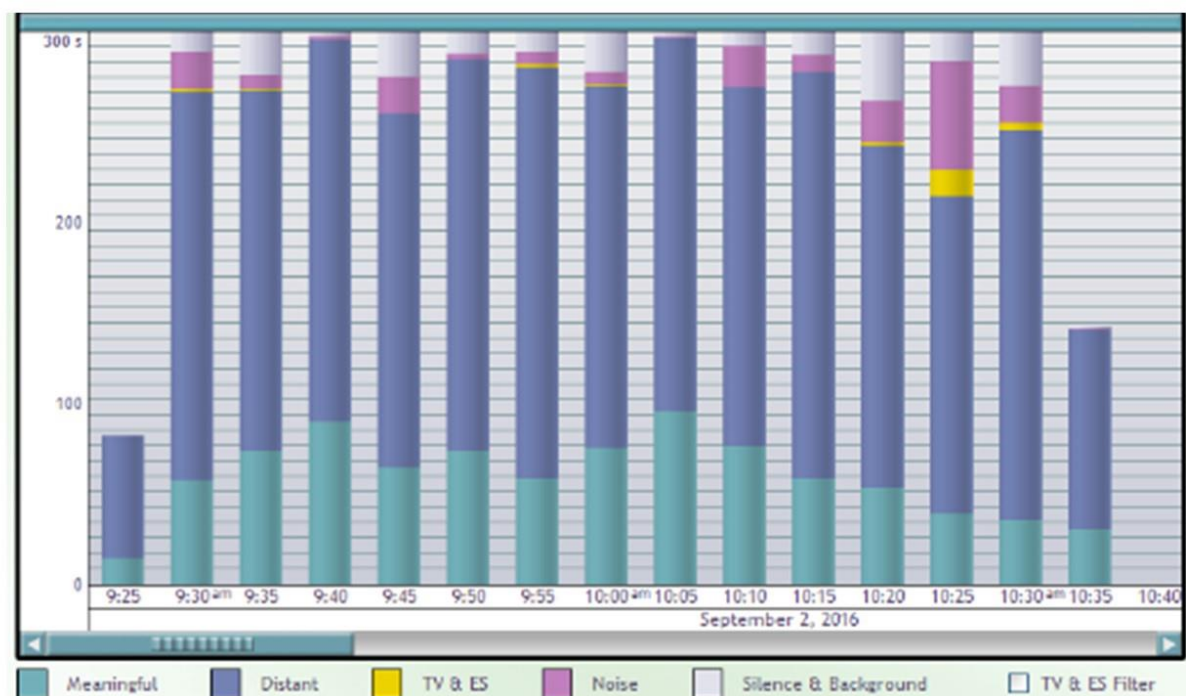
*Environmental recording sample of a mixed-age Montessori home-based childcare environment.*



*Note:* Measurement of overall audio environment = environmental noise and language, child vocalizations = child word count (CWC), conversational turns = conversational turn counts (CTC), and adult words = adult word count (AWC), across the horizontal axis denoting time in five-minute increments.

**Figure 9**

*Environmental recording sample of a mixed-age Montessori home-based childcare environment.*



### Summary of Pilot Study

The pilot provided results supporting the intervention study. The playback of the recordings provided insight to the clarity of the acoustic information. This was relevant as it determined the ease for later transcription and feasibility to quantify the targeted nonsense words that were part of the proposed intervention of the main study. The demonstration that 68% of language heard is in the distance, or ambient, demonstrated that there is a need to measure the impact of ambient language on language and vocabulary acquisition. The pilot also demonstrated that the DLP was able to capture data relevant to the research questions of the main study, which included the adult word count (AWC), and child word count (CWC). The results demonstrating data of the percentage of language overheard and the percentage of language that

was meaningful or directed to the child was not an intended output. However, this information supported the purpose of the main study.

### **Limitations and Weakness of the Pilot Study**

The output of the oldest child was limited and not used in the reported measures. The placement of the DLP in the pants pocket did not provide consistent recordings. The DLP did provide results for ambient noise such as movement of furniture, music, and sirens.

### **Ethical Considerations**

Long Island University's Post Institutional Review Board supervised and approved the current research. Participating staff, parents, teachers, and program directors provided written informed consent forms. Informed consent forms were provided to the parents both for themselves and on behalf of their children. Programs were selected based on the qualifications of the Guides leading the environment. All Guides were required to hold an AMI or AMS Birth to Three diploma. The diploma guarantees the Guides understand and implement the Three-Period-Lesson for the age group they are instructing. Programs were recruited nationally through word of mouth and direct contact via phone calls and e-mail communications. The programs participating in the study were located in New York and Maryland. No financial rewards or awards were promised to the programs for participation.

Current ethical standards for compliance regarding the use of recordings was adhered to (Mok et al. 2014). Technical threats including threats to confidentiality are addressed (Corti et al., 2000). All data collected from the LENA<sup>TM</sup> digital language processor (DLP) was stored on a password-protected computer owned by the researcher. The computer's sole use was only for the use of LENA<sup>TM</sup> software and its audio files as per contractual agreement with the LENA<sup>TM</sup> Foundation. Confidentiality of students was maintained by assigning ID codes instead of names

to output data. Pseudonyms or anonymization was prescribed for any names found in transcriptions. To minimize what was captured and what was only necessary the recordings were limited to the classroom work cycle.

### **Strengths and Limitations**

The use of the LENA software was the strength of the study, especially the feature identifying what language was heard near or far. Hand coding of the audio was also conducted. Soderstrom & Wittebolle (2013) determined that hand coding was an essential part of the analysis since loud ambient noise in settings similar to childcare settings could lead to the LENA<sup>TM</sup> analysis tool to underestimate the actual speech heard. Hand coding decreased the amount of error in measuring word count. The LENA<sup>TM</sup> tool does not transcribe the audio, so hand-coding was also essential to quantify the number of times the target words were spoken in the environment by both children and adults. As stated earlier, the use of LENA<sup>TM</sup> in classroom settings may yield some error in the data. The use of the tool and gaining the plethora of detail from the environment outweighs the limitations of LENA<sup>TM</sup>. The use of the Three-Period Lesson Fidelity Tool (B-3) was also a strength of the study because the three-period lesson has been practiced for over 100 years and this was potentially the first time the practice assessed for validity. The use of ANCOVA provides empirical evidence of any existing difference between the groups, especially because the groups were not randomly selected (Marczyk et al., 2005).

### **Summary**

This chapter has presented the research questions that guided the present study and provided a basic review of descriptive and correlational research design using naturalist observations. The chapter has presented a detailed description of quantitative approaches and the study design implemented in this research. The findings resulted from the design of this study are reported in Chapter IV.



Dr. Montessori (1949/1997) stated that the helpers for the child under two years of age, the role we now call Guides, must have scientific knowledge of the development of language. Dr. Montessori wrote and educated Guides and directresses about: (a) the intrauterine development of the hearing and speaking apparatus, (b) neurodevelopment and myelination, (c) sensitive periods, and (d) language development milestones. As Dr. Montessori continued learning and synthesized information gleaned from other philosophers and researchers, she incorporated the information into the Montessori training and lectures. Educators of infants and toddlers should be aware of the seminal and contemporary research that supports classroom practices for instructing vocabulary and language lessons. The findings of this study could potentially affect future Montessori teacher training, specifically the infant toddler language curriculum.

## CHAPTER IV

### Findings of the Study

#### Introduction

The purpose of this chapter is to discuss the findings of the study by revisiting and addressing the research questions. A descriptive and correlational method of analysis of multiple observation types was used. As discussed in the literature review, children acquire knowledge through incidental learning or unconscious acquisition as defined by the Montessori theory of the absorbent mind (Ellis, 2015; McLaughlin, 1990; Montessori, 1949/1997; Rezaee & Farahian, 2015). Ambient language and its influence on young children acquiring vocabulary in lab settings inspired the development of this current study, following research previously conducted by Akhtar (2005a), Akhtar (2005b), Forrester (1988), Knightly et al. (2003), and Messer and Turner (1993).

The purpose of this study was to determine the influence of ambient language on language development in mixed-age birth-to-three Montessori classrooms. This purpose was achieved by responding to the following research questions:

**RQ1:** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?

**RQ2:** How much ambient language is provided by verbal toddlers in mixed-aged Montessori environments, as measured by the total child word count (CWC)?

**RQ3:** How much ambient language is provided by adults in mixed-aged Montessori environments as measured by the total adult word count (AWC)?

**RQ4:** What is the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child in mixed age classrooms?

The process for data collection to respond to each of the above research questions is in Chapter 3. The specific details of data collection, analysis, and associated findings follow in the remainder of Chapter 4. Any deviations to planned procedures are also noted.

This chapter (a) identifies and discusses the participants, (b) describes and analyzes the pre-and post-test scores, (c) describes the Three-Period Lesson Fidelity Tool (B-3) used in this study, (d) presents data, and (e) summarizes the measurements collected using the LENA tool. This chapter concludes with a summary of findings regarding the influence ambient language has on language acquisition.

### **The Participants**

The study was conducted at six Montessori schools/classrooms located in New York City and Maryland. State or City childcare regulatory agencies licensed the participating schools. The New York City Department of Health, Bureau of Childcare licensed all New York City participating programs, and that complied with Health Code Article 47. Maryland is regulated and licensed by the Maryland Board of Education, Division of Early Childhood and complies with Title 13A Code of Maryland Regulations (COMAR). The New York City School affiliated with the American Montessori Society (AMS) is AMS accredited. The New York City school affiliated with Association Montessori Internationale (AMI) and the Maryland school affiliated with AMI school were both AMI recognized or affiliated. AMI and AMS schools were selected for the study for their documented adherence to authentic Montessori practice (Lillard, 2013; Lillard & McHugh, 2019a; Lillard & McHugh, 2019b; Monson, 2006) and the requirements of Montessori trained teachers in their respective age specialties (Appelbaum, 1971; Packard, 1972; Povell, 2010; Trbalzini, 2011). An AMI or AMS-trained Guide led each of the participating classrooms.

A request was sent to several AMI and AMS schools in New York, Massachusetts, Virginia, Maryland, Texas, and Connecticut to participate in an infant-toddler Montessori classroom study. Several schools inquired and began the process of information sharing with parents and staff and distributing consent forms. Seven classrooms began the study. One classroom ended the study upon the admission of a new student in week three. The family chose not to consent to the audio recording. The data collection for that classroom terminated immediately. The high drop-off of participation interest due to lack of consent for an audio recording is consistent with Greenwood et al. (2018) experience. Six mixed-aged infant and toddler classrooms participated in and completed the study.

The collection of participant data from AMI and AMS Montessori programs began at the start of the study. The participants included 56 infants and toddlers (30 males, 26 females) and 12 AMI and AMS trained teachers and assistant teachers. Class rosters and dates of birth found in Appendix L. At the time of the study, participants' ages ranged between 11-and-40-months ( $M = 25.8$  months). However, females were, on average older than male participants (Figure 10). Four Guides hold AMS Montessori 0-3 teaching diplomas, and two Guides hold AMI Montessori 0-3 teaching diplomas. Three Guides have their bachelor's degrees and three hold an associate degree. Teaching experience ranged from 5-years-to-17-years working with infants and toddlers. Two assistant teachers held the AMI Montessori 0-3 teaching diploma along with their Associates degree. Three assistants held their bachelor's degree, and one had an associate degree. Teaching experience for the assistant teachers ranged from three-years-to-26 years.

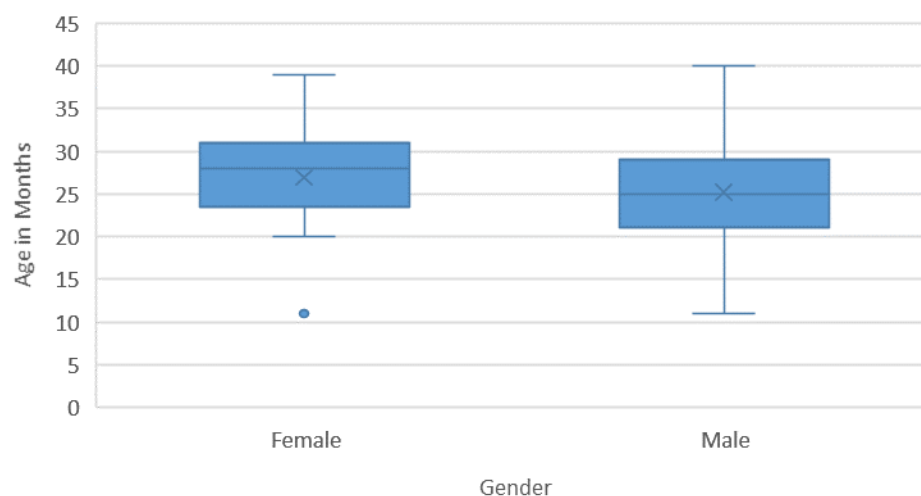
Each school followed the Montessori philosophy's basic tenants, as discussed in the first two chapters, including mixed-ages, Montessori language materials, and proper implementation of the three-period lesson as discussed and described at length in Chapters 2 and 3. The

intervention was originally introduced as an intervention for vocabulary introduction by Édouard Séguin (Feez, 2007; Jackson, 2011; Nichols, 1984; Séguin, 1866/1971) and Montessori refined and adapted the intervention (Montessori, 1967; Van Aken, 2006) with further study of Itard's work (Feez, 2007).

The literature review suggests children can learn through ambient language; however, little research exists measuring the correlation of peers' ambient language to language acquisition of younger peers in classroom settings, specifically mixed-age classrooms. Quantitative data collected from six Montessori classrooms using the LENA Digital Language Processor, a recording device that provided quantitative data. A total of 136.56 hours of recorded classroom audio provided quantitative data (Figure 11). The three-week intervention resulted in one complete recording for each DLP wearer. In addition to the recordings and the pre-post-test measuring the intervention, the researcher developed the Three-Period Lesson Fidelity Tool (B-3) to measure the teacher's fidelity to the intervention, the three-period lesson.

**Figure 10**

*Mean Ages of the Child Participants, by Gender*

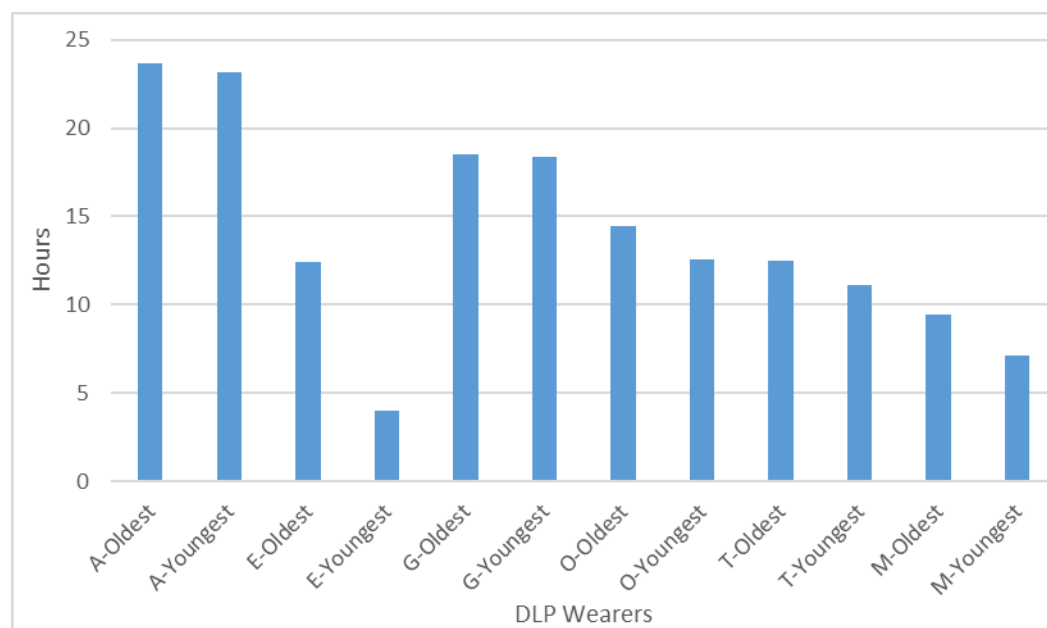


*Note: n=56*

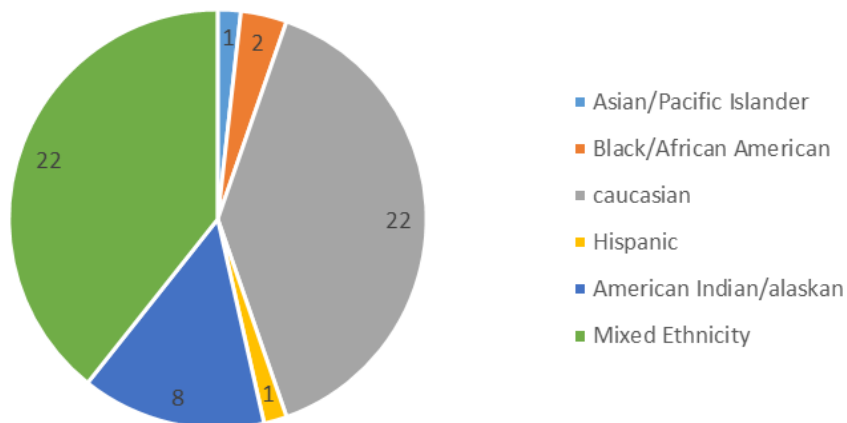
Most of the children, 94.6% or 53 participants, lived in a dual adult household, and the remainder in single-parent homes. Dual adult households included married, partnered, and blended family structures. The race/ethnicity of the children (Figure 12) demonstrates diversity among the sample.

**Figure 11**

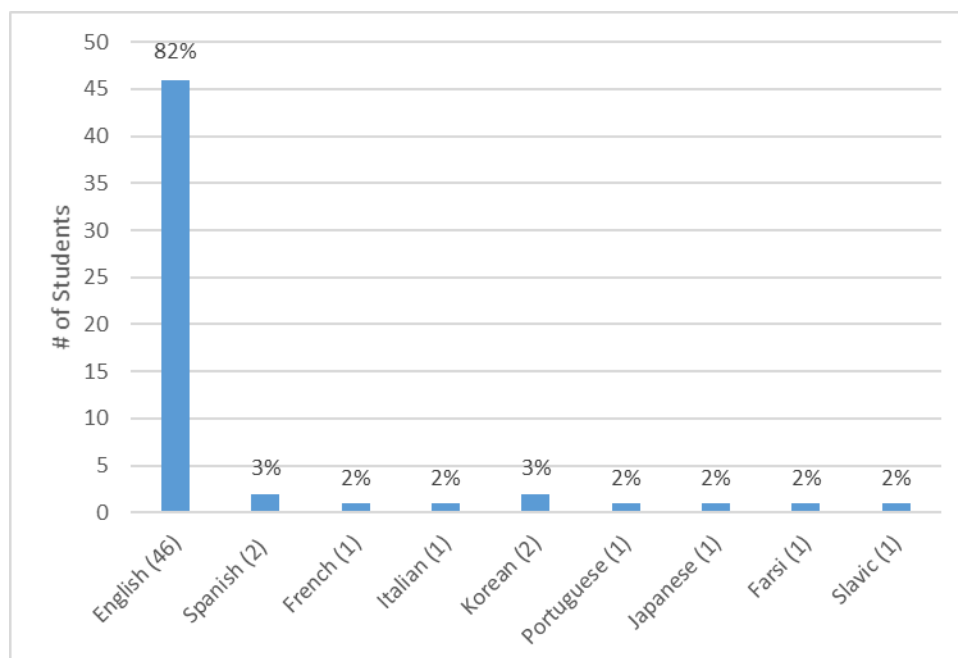
*Total Hours per LENA DLP Wearer*



*Note:* Participant E-Youngest is an outlier in the group. Each classroom pair should have similar measures of time. Further evaluation reveals both technical issues and lack of attendance of the youngest participant as contributing factors to the discrepancy.

**Figure 12***Ethnicity of the Child Participants*Note:  $n=56$ 

Most of the child participants, 46 children of 56 (82%), spoke English as their primary language. However, 10 of the participating (18%) were multilingual learners, with languages as diverse as Spanish, Korean, Farsi, and Slavic (Figure 13). English was the primary classroom language of the six classrooms assessed for the study. The researcher did not consider bilingual or multilingual classrooms for this monolingual study.

**Figure 13***Home Language Details of Classroom Participants***Data Analysis**

The purpose of this study was to measure ambient language in mixed-age classrooms, as well as determine the influence of peer and adult ambient language on the acquisition of targeted vocabulary words of the youngest children. This study utilized a pre-post-test design using an intervention model, introducing nonsense target objects and words. The intervention's delivery presented the target words and object using the Montessori three-period lesson (Jackson, 2011; Lillard, 2005; Richardson, 1997) to the oldest children in the classroom. Based on the pilot study discussed in Chapter 3, with 68% of the classroom language being ambient language, the developed research predicted younger children could acquire language through the ambient language of older peers and adults in the classroom. Formulated research questions provided



quantitative data about ambient language in mixed-aged classrooms and how ambient language influences vocabulary acquisition.

The LENA Digital Language Processor (DLP) was used to obtain the quantitative data. The LENA Software analyzed the data metrics, including child word count (CWC) and adult word count (AWC). Also collected were the number of minutes recorded per subject, percent of meaningful language provided to the subject, and percent of distant language or ambient language overheard by each subject. Paired t-tests and ANCOVA were used for further analysis of the research questions. Using STATA 16, full analyses were conducted (see examples in Appendix M). The observational design of the study included: (a) classroom observation while using the Three-Period Lesson Fidelity Tool (B-3), (b) the observation of the first and final TPL provided to the children, (c) hand tallying and coding of audio recordings and (d) coding of two three-week transcripts. One provided by the oldest child and one from the youngest child from the A-room. The researcher observed classrooms two mornings, once at the beginning of the three-week study and again at the end of the three-week study. The three-period lesson provided dichotomous results of “yes” or “no” for observations of recognition and or recall. The LENA DLP also provided a digital recording for each subject. All audio was listened to, and tallies of all target nonsense words were tabulated. One complete classroom recording, including a recording from the youngest and oldest subject for three-weeks, was transcribed. Target words were tallied from the transcription. Additional three-period lessons were documented and tallied. A tally of the target words and meaningful responses that demonstrated responses to ambient language was completed of all audio recordings.

Due to a lack of data, the target word “sugs” was removed from the dataset. As described in chapter 3, all target words had an associated object except for the categorical target word

“sugs”. During the classroom observations, many of the teachers used the word “that” interchangeably with the category “sugs”. The ambiguity in using “sugs” may explain why there were significant differences in the pre and post-test outcomes of recall and recognition of all target words except for “sugs”.

### **Analysis of the Three-Period Lesson Fidelity Tool (B-3)**

The adapted Montessori three-period lesson for infants and toddlers presented as the intervention introduced the classroom’s nonsense words. The development of the Three-Period Lesson Fidelity Tool (B-3) provided an assessment tool to measure fidelity because there was no other fidelity measure for the TPL within the time of the study in Montessori settings. Culclasure et al. (2019) indicated fidelity to the Montessori Method, and measuring fidelity to practices, such as the TPL, improves research data intended to demonstrate the influence and correlation of the Montessori Method on positive child outcomes. The TPL Fidelity Tool (B-3), a 5-item Likert-type scale, measured the fidelity of the Montessori teachers’ delivery of the Montessori three-period lesson. The researcher and an AMI or AMS trained staff member (co-assessor) at each site completed the fidelity tool on two occasions: the first day and last day of observation for each classroom. The researcher presented the tool to the co-assessors before the study for review and training. The scale used in this study was composed of 18 questions or criteria that were determined by three specific criteria categories: (a) language area of the classroom (Bettmann, 2003, Bettmann 2016; Brady, 2015; Campanelli, 2000), (b) engagement (Bettmann, 2003; Brady, 2015; Campanelli, 2000), (c) and pedagogical compliance of presentation (Campanelli, 2000; Cossentino, 2005; Jackson, 2011; Montessori, 1948/1967). The Likert-type scale measured the teacher’s adherence to the language curriculum and the level of quality in delivering the three-period lesson.

A total of 136.56 hours of audio from six classrooms provided the quantitative data for analysis. Additionally, each classroom was observed at the first and last week of the three-week study. Cronbach's alpha test was performed to test for the three-period lesson delivery consistency across the six classrooms and indicated high reliability ( $\alpha = .91$ , average inter-item covariance = 373). The classroom analysis was conducted as a whole, given the high reliability and the small sample size in individual classrooms. However, a summary of the fidelity results for each school is in Appendix N.

### **Descriptive and Correlational Observation**

The quantitative descriptive and correlational study design allowed for collecting and analyzing quantitative data attained through observation. The quantitative data was analyzed independently to answer the research questions. The use of the DLP and LENA software provided these results. Due to the small sample sizes a causal correlation could not be assumed in the analysis of each research question.

### **Research Question 1**

**RQ1:** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?

Reviewing the data of the independent variable (amlang) and the dependent variables, each of the nonsense words, a causal relationship using traditional chi squared was impossible to determine due to the small sample size. The controlled research design did however suggest a causal relationship using p-tests as the results showed a difference between the pre and posttests. This difference demonstrates that the presence of the independent variable, the ambient language, influenced the ability to acquire vocabulary words, the dependent variable.

**Quasi-experimental Design Observing Pre-Post tests**

Prior to the start of the study, all teachers attended an information and instructional session about the study, TPL, and LENA devices. For 3 weeks, the addition of five target nonsense words and objects previously described provided the intervention to assist in measuring ambient language. A pre-test conducted on the first day of the study confirmed that none of the children had previously been exposed to the nonsense target words or objects. The pre-test results determined that each child did not recognize or recall any target words or objects (see Tables 2 and 3 for a summary of observations). Each teacher used the nonsense words and objects as they would with any other language material in their environment, except they withheld the TPL for the nonsense words and corresponding objects with the youngest children in the room. The post-test results of recognition and recall for all children were assessed, excluding the oldest child. The second and third period lesson of the TLP during the post-test were assessed. The second-period assessed recognition and comprehension of receptive language. The third-period assessed recall and expressions through articulation. Results are found in Tables 2 and 3. The total tally of the target nonsense word from the audio recordings is in Appendix O.

**Table 2***Recognition of Words, Summary of Observations*

	Pre-test observation				Post-test observation			
	Recognized		Not Recognized		Recognized		Not Recognized	
<i>Mek</i>	0	0%	39	100%	14	35.89%	25	64%
<i>Dusset</i>	0	0%	39	100%	12	30.76%	27	69.23%
<i>Pame</i>	0	0%	39	100%	11	28.20%	28	71.79%
<i>Bursa</i>	0	0%	39	100%	10	25.64%	29	74.35%
<i>Kack</i>	0	0%	39	100%	12	30.76%	27	69.23%

*Note:* 56 children participated in this study, while 39 cooperated for both pre and post-test results.

**Table 3***Recall of Words, Summary of Observations*

	Pre-test observation				Post-test observation			
	Recalled		Not Recalled		Recalled		Not Recalled	
<i>Mek</i>	0	0%	39	100%	7	17.94%	32	82.05%
<i>Dusset</i>	0	0%	39	100%	5	12.80%	34	87.17%
<i>Pame</i>	0	0%	39	100%	4	12.25%	35	89.74%
<i>Bursa</i>	0	0%	39	100%	5	12.80%	34	87.17%
<i>Kack</i>	0	0%	39	100%	8	20.51%	31	79.48%

***Quantitative results***

Tables 2 and 3 summarize the observations for recognition and recall. Table 4 (recognition) and Table 5 (recall) summarize the results of paired t-tests across the pre and post-test conditions. The results indicate that target ambient language improves the acquisition of target nonsense words in a toddler mixed-age classroom. Recognition of all target words

increased significantly over the three-weeks (Table 4), as did the recall of all target words (Table 5).

**Table 4**

*Tests of Recognition, Paired t-tests*

	<i>Pre-test</i>	<i>Post-test</i>				
	<i>M (SD)</i>	<i>M (SD)</i>	<i>t(df)</i>	<i>r</i>	<i>Upper</i>	<i>Lower</i>
<i>Mek</i>	0(0)	.36(.49)	-4.61(38)***	-.28	1.52	.04
<i>Dusset</i>	0(0)	.31(.07)	-.16(38)***	-.15	-.43	.17
<i>Pame</i>	0(0)	.28(.07)	-.43(38)***	-.30	-.54	.02
<i>Bursa</i>	0(0)	.26(.44)	-.11(38)***	-.02	-.33	.29
<i>Kack</i>	0(0)	.31 (.47)	-4.46 (38)***	.02	-.29	.32

*Notes: n=39, listwise. Figures rounded to 2 decimal places. \*\*\* t-test significant at the  $p<.0001$*

*level, \*\*  $p<.0.001$ , \* $p<.05$*

**Table 5***Tests of Recall, Paired t-tests*

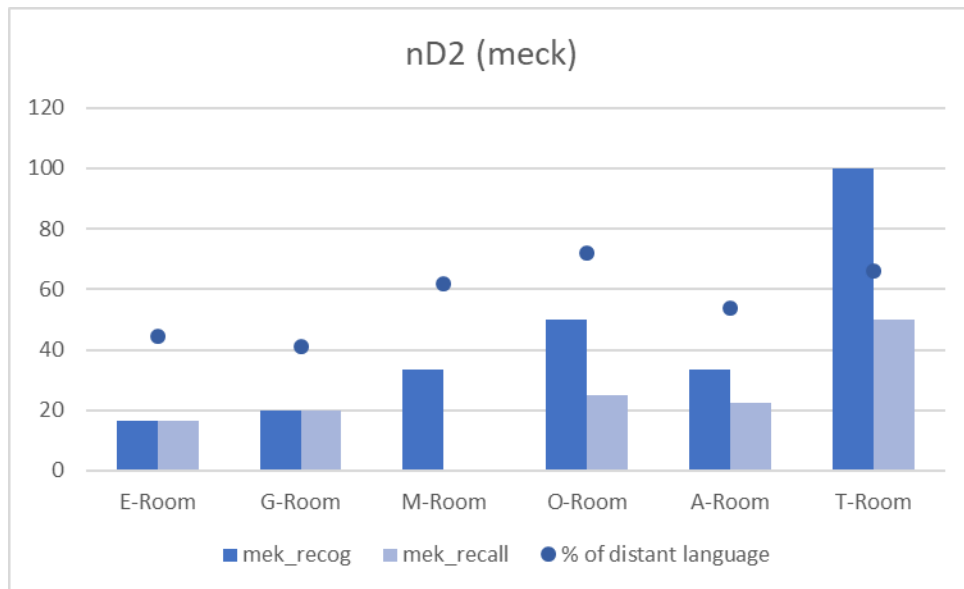
	<i>Pre-test</i>	<i>Post-test</i>				
	<i>M (SD)</i>	<i>M (SD)</i>	<i>t(df)</i>	<i>r</i>	<i>Upper</i>	<i>Lower</i>
<i>Mek</i>	0(0)	.18(.39)	-2.88(38)*	-.04	-.34	.27
<i>Dusset</i>	0(0)	.13(.05)	-2.36(38)*	-.33	-.56	-.02
<i>Pame</i>	0(0)	.10(.05)	-2.08(38)*	-.26	-.51	.06
<i>Bursa</i>	0(0)	.13(.34)	-2.37(38)*	-.23	-.51	.06
<i>Kack</i>	0(0)	.10(.31)	-2.08(3)*	.08	-.38	.23

*Notes: n=39, listwise. Figures rounded to 2 decimal places. \*\*\* t-test significant at the  $p<.0001$  level, \*\*  $p<.0001$ , \* $p<.05$*

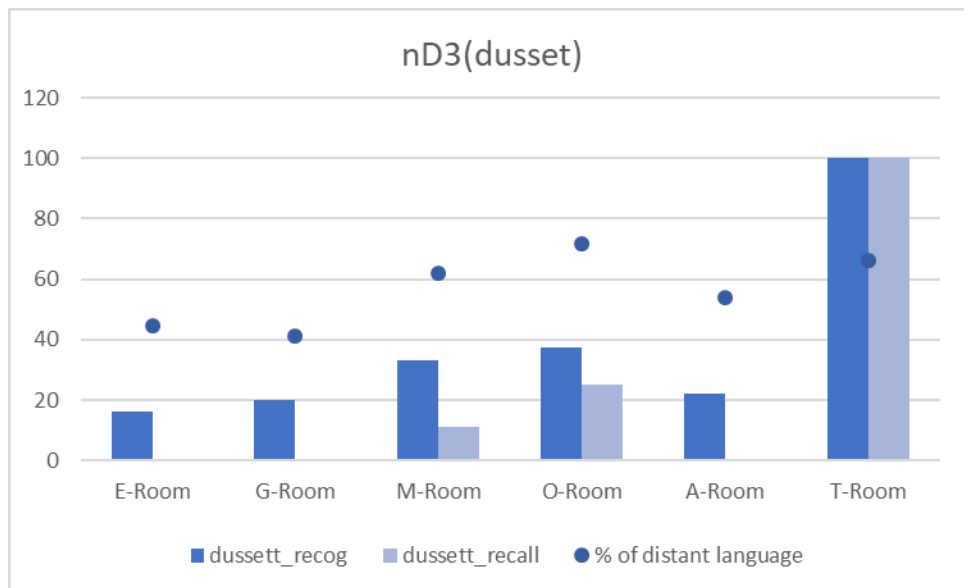
**Descriptive Statistics.** Although the sample sizes of individual classrooms were too small to perform meaningful analysis, descriptive data enables a better understanding of how exposure to ambient language affects vocabulary acquisition. As ambient language increases, the ability to acquire a new vocabulary word also increases. The acquisition was demonstrated via either recognition assessment or recall assessment (Figures 14-18). The results demonstrated in Figures 14-18 support the TPL process that children are expected to recognize vocabulary words before they can recall (express or articulate) the word. Guides would not move to the third-lesson if the child could not recognize the word. The results are consistent with expectations for this assessment. The O-room does demonstrate one outlier for the target word “bursa”. An explanation for this anomaly is that the O-room has the greatest percent of distant language recorded. See Appendix P for the full analysis.

**Figure 14**

*Percentage of Distant Language, Recognition, and Recall of “mek”, by Classroom*

**Figure 15**

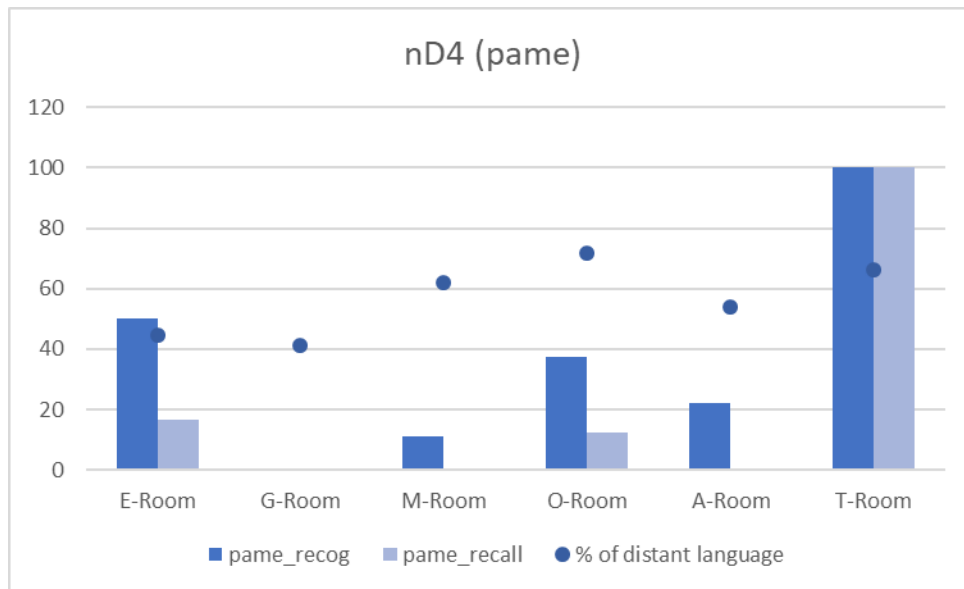
*Percentage of Distant Language, Recognition, and Recall of “dusset”, by Classroom*



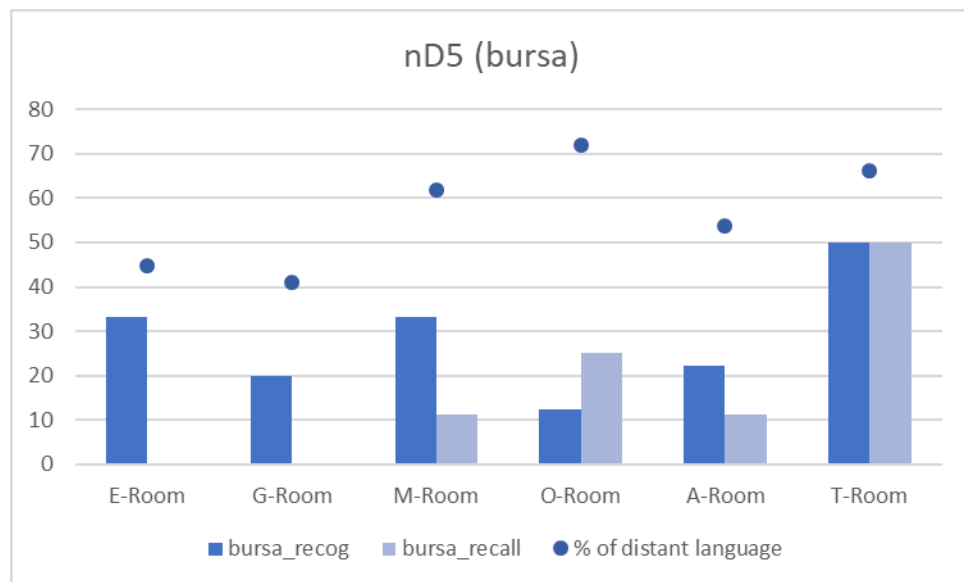


**Figure 16**

*Percentage of Distant Language, Recognition, and Recall of “pame”, by Classroom*

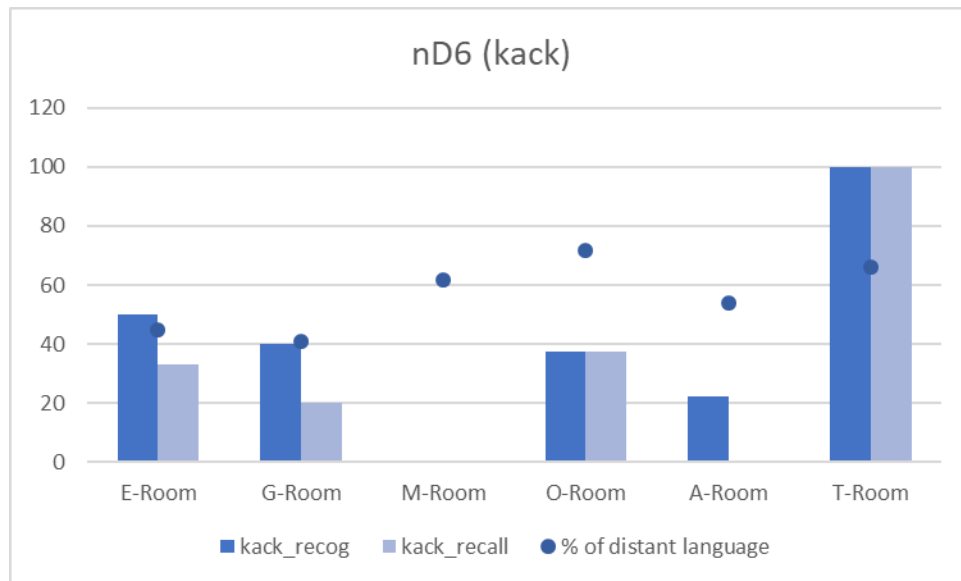
**Figure 17**

*Percentage of distant language, Recognition, and Recall of “bursa”, by classroom*



**Figure 18**

*Percentage of Distant Language, Recognition, and Recall of “kack”, by Classroom*



Given the earlier observation that female participants’ mean age was higher than the mean age of males, in a follow-up analysis, the recognition and recall scores compared across the pre- and post-test conditions by gender provided interesting data. In the interest of brevity, only  $p$  values are provided in Table 6. Full tables are provided in Appendix Q. These results provide evidence of a difference between girls and boys regarding distant language exposure and recall of new language. While both girls and boys significantly increased their recognition of all target words in the post-test condition, girls were less likely than boys to recall the new words.

**Table 6***Tests of Recall and Recognition, Paired t-tests, Comparing Pre and Post-tests, by Gender*

Recognition	mek	dusset	pame	bursa	kack
Girls	0.0043**	0.009**	0.0018**	0.04*	0.009**
Boys	0.0013**	0.002**	0.02*	0.002**	0.002**
Recall					
Girls	0.08	0.08	0.08	0.167	0.08
Boys	0.01*	0.04*	0.08	0.02*	0.0055**

*Notes: n=39, listwise. Figures rounded to 2 decimal places. \*\*\* t-test significant at the  $p<.0001$  level, \*\*  $p<.001$ , \* $p<.05$*

The sample distribution (Figure 10) revealed that boys tend to be younger than girls, follow-up analyses were performed to determine whether there was an interaction between age and gender on recognition and recall. Surprisingly, there was an insignificant correlation between age and recognition of mek after controlling for gender,  $F(1, 41) = .86, p = .36$ , but age had a significant independent effect  $F(1, 41) = 6.91, p < .05$ . Similarly, age did not significantly impact recall of dusset after controlling for gender,  $F(1, 41) = 0.36, p = .5$ , but there was an independent effect of age  $F(1, 41) = 1.04, p < .05$ . For pame, no interaction effect was found on recognition, although age did have an independent effect,  $F(1, 41) = 3.87, p < .05$ . However, there was a significant effect of age on recall of pame after controlling for gender,  $F(1, 41) = .46, p < .05$ , with both age and gender also having independent effects. A similar observation was found for recall of kack,  $F(1, 41) = 4.48, p < .05$ . This finding suggests that girls are more likely to recall pame and kack as they get older. All other ANCOVAs produced models of poor fit and

thus unreliable results. Each target word selected demonstrates a variety of phonemic sounds and oral placement. The difference may be that the children were not developmentally ready to express these sounds in the post-test assessing recognition orally. This explanation, however, does not explain the post-test assessing recall. An additional theory is that children were not interested in the target word or object and did not find enough novelty to capture their attention.

### ***Research Question 2***

**RQ2:** How much ambient language did verbal toddlers produce as measured by the total child word count (CWC)?

The data was attained through the Digital Language Processor (DLP) described in detail in the quantitative analysis review. The purpose for descriptive information is to determine causal relation between the ambient language provided by the oldest toddler and the dependent variable, the acquisition of the nonsense words. Causality could not be proved using chi-squared or regression analysis due to the small sample size. The *p-tests* shared in RQ1, demonstrate that the youngest child acquired the target words. The only exposure the youngest child heard of the target word, was the target words as ambient language in the environment provided by oldest children and adults in the classroom.

The observations that were documented included the first and last day of the three-period lesson, audio files and transcripts. The following are examples of how children responded to ambient language that were documented in anecdotal recordings: (a) a child responding to questions not directed to the child, (b) a child adding to a conversation that the child was not included in (self-talk), (c) children singing along to songs that were sung in another part of the room, and (d) children responding to circle time prompts, when not participating in circle time.

The analysis of observations indicated that the ambient language in the space influenced the children sampled.

The measure is the total tally of overheard target nonsense words by the youngest child in the classroom, as recorded by the DLP and tallied by the researcher during analysis of the audio files is provided in Table 7. The analysis of the audio files and converting children's and teacher's conversations and creating quantitative data is part of the convergent design.

**Table 7**

*Total Tally of Ambient Target Nonsense Words Heard by the Youngest Child in Each Classroom*

		mek		dussett		pame		bursa		kack	
		Total tally	Total %	Total Tally	Total %	Total Tally	Total %	Total Tally	Total %	Total Tally	Total %
<b>A-Room</b>											
<b>Youngest</b>	Adult Language	43	81.13%	46	85.18%	46	79.31%	27	90%	21	77.77%
	Other child(ren)	10	18.86%	8	14.80%	12	20.68%	3	10%	6	22.22%
<b>G-Room</b>											
<b>Youngest</b>	Adult Language	12	85.71%	14	77.77%	9	69.23%	9	69.23%	18	85.71%
	Other child(ren)	2	14.28%	4	22.20%	4	30.76%	4	30.76%	3	12.28%
<b>E-Room</b>											
<b>Youngest</b>	Adult Language	3	100%	8	100%	8	100%	3	100%	6	100%
	Other child(ren)	0	0%	0	0%	0	0%	0	0%	0	0%
<b>T-Room</b>											
<b>Youngest</b>	Adult Language	23	100%	25	100%	21	100%	30	100%	18	100%
	Other Child(ren)	0	0%	0	0%	0	0%	0	0%	0	0%
<b>O-Room</b>											
<b>Youngest</b>	Adult Language	32	72.72%	42	75%	23	71.87%	32	71.11%	29	61.70%
	Other child(ren)	12	27.27%	14	25%	9	28.12%	13	28.88%	18	38.29%
<b>M-Room</b>											
<b>Youngest</b>	Adult Language	40	81.63%	39	88.63%	47	92.10%	48	94.11%	44	78.57%
	Other child(ren)	9	18.36%	5	11.36%	4	7.84%	3	5.88%	12	21.42%

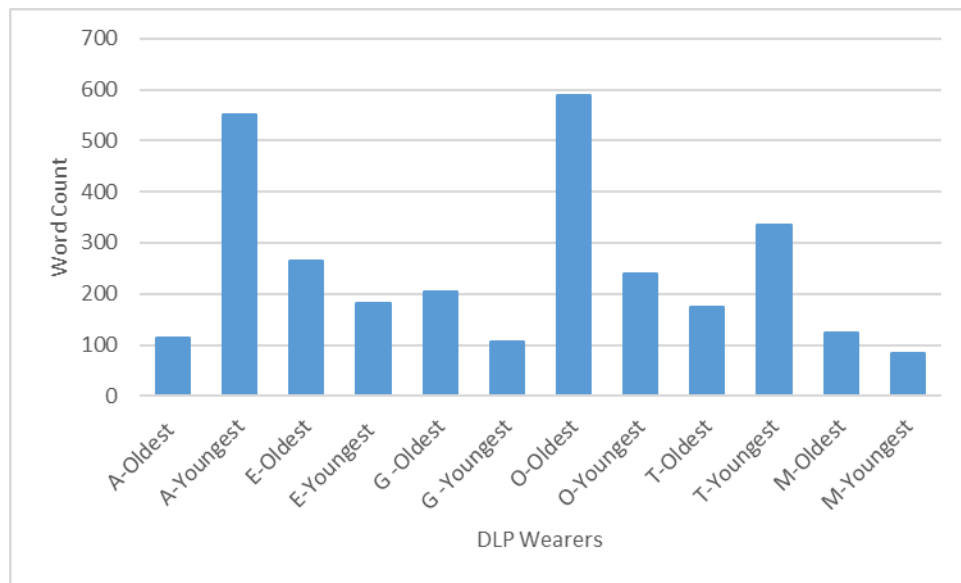
## Descriptive Statistics

The Digital Language Processor (DLP) and LENA software provided the child word counts (CWC) for each child who wore the LENA DLP. The LENA DLP and LENA software calculated the exact word count for each child. Figure 19 shows the mean CWC across all classrooms, and Figure 20, the total counts. The least number of words spoken on a given day

was 27 words by the youngest child in the O-Room. The greatest number of words spoken on a given day was 589 by the oldest child, also in the O-Room.

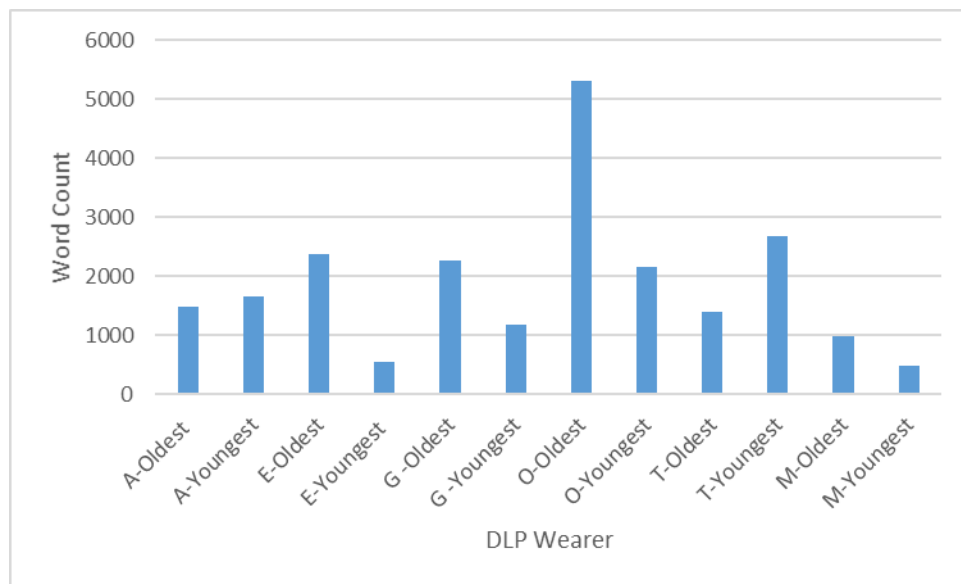
**Figure 19**

*Mean Daily Child Word Count, all Classrooms*



**Figure 20**

*Total Daily Child Word Count, all Classrooms*



The DLP with the LENA software is designed to show how audio recordings are distributed between meaningful language, ambient language, silence, and noise (Xu et al., 2012). Table 8 merges the observations and DLP data. Each room's data averaged independently of each other over 3 weeks. Each measure of meaningful language, ambient language, silence, and noise averaged independently over 3 weeks. For this current study, defining meaningful language is the direct language spoken to the child. The three-week average percentage of time devoted to meaningful language ranged between 12.8% in the G-classroom and 44.55% in the O-room. The three-week average time devoted to ambient language ranged between 55.63% in the G-room and 72.11% in the O-room. The classroom in which meaningful language was lowest (E-room) also had the lowest average proportion of ambient language, while the classroom in which meaningful language was highest (O-Room) also had the highest proportion of ambient language. This observation indicates a relationship between ambient and meaningful language. Pearson's correlation analysis was performed to check this finding. The results for the oldest ( $r = .304$ ,  $p = .558$ ) and youngest ( $r = .730$ ,  $p = .099$ ) child indicated a correlation, but neither was statistically significant. The total tallies from Table 7 indicated the total percentage of added target nonsense words as the ambient language by the older children ranged from 5.8% - 38.29%, dependent on the target word and classroom. The O-room demonstrates that of the 100% ambient target nonsense words recorded by the DLP, the oldest children provided 38.29%. The adult provided the remaining percent of ambient target nonsense words. The O-room provided the most child language output, resulting in children's ambient language compared to the other classrooms.

An analysis of the youngest peers' recorded audio also indicated that, on average, the youngest child in the classroom heard an additional 14.81% of target words from other children

in the room. This number increased to 17.77% when removing the G-room from the analysis, which had nonverbal children. The analysis of the recording audio of the oldest children indicated they contributed on average 35.5% of the target nonsense words to the environment. Previous research demonstrated a similar discrepancy when LENA DLP and measuring ambient language (Ford et al., 2008; Gilkerson et al., 2016).

**Table 8**

*Distribution of Observed Audio Hours, by Classroom*

Daily average in %						
measure	A-Room	E-Room	G-Room	O-Room	T-Room	M-Room
	M	M	M	M	M	M
Oldest Child						
Meaningful Language	20.61	24.11	15	24.2	16	19.25
Distant (Ambient) Language	56.61	62.88	55.63	72.11	70.25	65.5
Silence	19.38	9	21.27	12.3	11	10.87
Noise	3.9	2.9	5	1.44	1.5	3.87
Youngest Child						
Meaningful Language	20.46	19.33	12.8	44.55	19	21.3
Distant (Ambient) Language	53.84	44.66	41	71.88	66.12	61.8
Silence	21.69	7.3	21.54	4.7	10.37	12.83
Noise	2.5	2.9	5.27	2	2.6	3

**Research Question 3**

**RQ3:** How much ambient language did adults produce in mixed-aged Montessori environments, as measured by the total adult word count (AWC)?

The data was attained through the Digital Language Processor (DLP) described in detail in the quantitative analysis review. The purpose and need for such information is to determine causal relation between the ambient language provided by the adults and the dependent variable, the acquisition of the nonsense words. Causality was not proven using chi-squared or regression analysis due to the small sample size. The *p-tests* shared in RQ1, demonstrate that the youngest child acquired the target words. The only exposure the youngest child heard of the target word,



was the target words as ambient language in the environment provided by oldest children and adults in the classroom.

The Digital Language Processor (DLP) transcripts captured repetition in Montessori early childhood language lessons, specifically the TPL. In two independent morning lessons directed to one child, a teacher repeated the word “goggles” 37 times in labeling and conversation (Table 9). The child repeated the vocabulary word 11 times, both in an echo and in conversation. The first language lesson category was a “summer” theme. The second category was “marine life”. Comparing the target nonsense words and other language lessons indicates a consistent pattern of vocabulary presentation using the TPL. The review of the audio and transcripts showed that most of the language overheard was intentional classroom teaching; however, some language overheard by the children included: a) language spoken in another language, typically Spanish, b) conversations with parents at drop off, and c) conversations between teaching peers.

**Table 9***Sample Known Words Tally, A-Room*

Target word	Teacher Tally	Child Tally
Goggles	37	13
Sunscreen	49	13
Swimming Trunks	21	7
Towel	31	7
Sunglasses	13	4
Sandals	1	1
Sunhat	20	4
Jellyfish	17	11
Seahorse	24	18
Orca	29	20
Octopus	27	15
Dolphin	21	15
Stingray	15	3

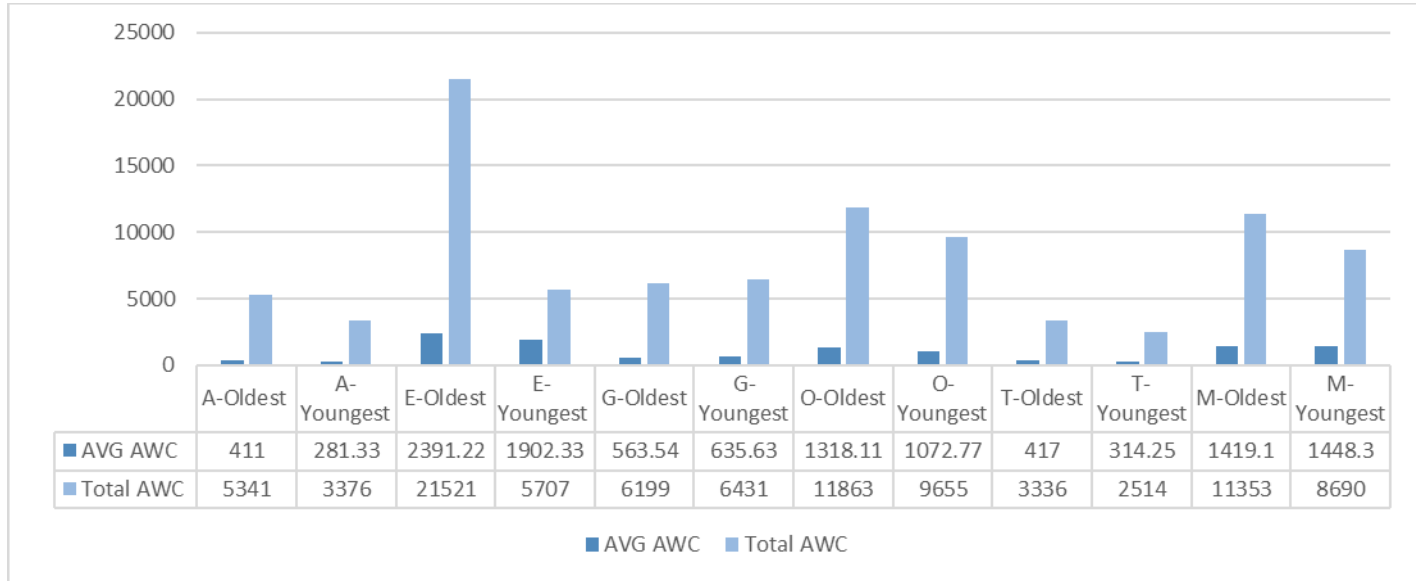
*Notes:*  $r=0.5783$ ,  $p<.05$

**Descriptive Statistics.** The LENA software calculated the total adult word count for each listener. The summaries of adult word count, child turn count, and child vocalizations are in Table 10. Figure 21 shows the total daily adult word count for all classrooms, while the average word count is in Figure 20. The average word count was calculated by adults' words and words overheard by the child (Foushee et al., 2021; Gilkerson et al., 2016; Gilkerson & Richards 2008). Aggregate data showed higher AWC for the oldest child in the classroom compared to the youngest child. The average AWC over 3 weeks during the recording window was 1460.3 (Table 11). Similar measurements for both the oldest and youngest in the classroom met expectations. There was a substantial difference in adult language between the oldest and youngest child in the E-room. In this instance, the youngest child did not wear the LENA device for one day during the intervention. Thus, the average word count is an adequate representation

of the overall study in the E-room. Additionally, measuring ambient target nonsense words as recorded by the youngest DLP wearer tallied by the researcher and documented in Table 12. The total percentage of adult ambient target nonsense words range from 61.70% - 100%.

**Figure 21**

*Total Adult Word Count and Average Adult Word Count, all Classrooms*



**Table 10**

*Measures of Adult Word Count, Child Turn Count, and Child Vocalizations, by Classroom*

Measure	All	A-Room	E-Room	G-Room	O-Room	T-Room	M-Room
		<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
<b>Oldest Child</b>							
Recorded Length (hours)	91	23.65	12.44	18.48	14.47	12.51	9.45
Mean Adult Word Count	6520	411	2391.22	563.54	1318.11	417	1419.1
Mean Child Turn Count	212.27	12	73	18.45	65.33	10.87	32.62
Mean Child Vocalizations	1472.7	114.92	265	205.45	589.66	174.12	123.5
<b>Youngest Child</b>							
Recorded Length (hours)	76.36	23.14		18.38	12.58	11.1	7.15
Mean Adult Word Count	130.65	281.33	1902.33	635.63	1072.77	314.25	1448.3
Mean Child Turn Count	130.65	5	49	12.9	29	11.25	23.5
Mean Child Vocalizations	1499.5	551.66	181.33	107.54	240.33	336.12	82.5

*Notes:* Mean scores are rounded to 2 decimal places. Days of observation ranged from 6-13.

The observation notes and review of the transcripts were merged. The descriptive data is found in Table 10. The oldest child in the six classrooms was consistently presented with the adult's nonsense words with direct instruction. The six children were observed and had a pre and post-test. Table 11 represents that the oldest children's recognition and recall were assessed and demonstrated a significant change from the pre-test to the post-test. The *P-values* indicate that the difference between pre-test and post-test (or learning outcome) is statistically significant. Posttest results can be found in Appendix R. This result was expected and why the study intended to measure the oldest child's verbal contribution of the newly acquired vocabulary word to the classroom's ambient language.

The audio transcripts were reviewed. The youngest and oldest children's DLPs recorded adult and child ambient language. Tally shown in Table 7 of the recordings demonstrated the

total number of nonsense words overheard through ambient language. The O-room's adult ambient language measurement was the greatest in this room (see Table 7).

**Table 11**

*Tests of Recall and Recognition, Paired t-tests, Comparing Pre and Post-tests*

	mek	dusset	pame	bursa	kack
Recognition	0.008*	.	0.09	0.002*	0.008*
Recall	0.002*	0.03*	0.03*	0.03*	0.09

*Notes: n=6, listwise. Figures rounded to 2 decimal places. \*\*\* t-test significant at the  $p<.0001$  level, \*\*  $p<.001$ , \* $p<.05$*

#### **Research Question 4**

**RQ4:** What is the relationship between ambient language and toddler vocabulary acquisition in mixed-age classrooms?

The post-test using the TLP determined which children acquired the target nonsense words. A full tally sheet is in Appendix O. The observation and documentation of the dichotomous tally of the TPL assessment determined that 17 children recognized “mek”, while 11 children could recall “mek”. Of all five-target nonsense words, “mek” had the overall highest tally results. In total, at least six or more of the younger children recognized and or recalled the nonsense words.

#### **Correlational Analysis**

Finally, TPL assessed the relationship between the oldest toddler's ambient language and overheard by the youngest toddler's vocabulary acquisition. Table 9 shows the tally of known words expressed by children and teachers after listening to the audio recordings. Table 12 shows the tally of expressed nonsense words. Pearson's correlation tests indicated a moderate positive relationship between the tally of known words by children and teachers,  $r=0.5783$ ,  $p<.05$ , and a

very strong, positive relationship between the tally of nonsense words expressed by children and teachers,  $r=0.9587$ ,  $p<.05$ .

**Table 12**

*Nonsense Words Tally, A- Room*

Target word	Teacher Tally	Child Tally
mek	79	13
dusset	59	10
pame	64	10
bursa	48	6
kak	35	6
sug	17	4

*Notes:  $r=0.9587$ ,  $p<.05$*

The oldest children contributed on average 35.5% of the ambient nonsense words to the classroom environment. The youngest children's post-test TPL assessment was observed, and results were tabulated (Table 2 and 3). Evidence indicates some children acquired nonsense words without direct instruction. Transcripts were reviewed and tallied; observations were converted into numerical data for Table 9 and Table 12. The DLP recordings and observations confirm that the youngest's children's exposure to the nonsense words was only through ambient language.

### **Summary**

Can the amount of ambient language provided by adults or children correlate to the younger children's ability to acquire target vocabulary words in a Montessori classroom? True

correlation cannot be determined due to the small sample size. However, the *p*-test did suggest there is a difference in the pre and posttest indicating language acquisition.

### **Chapter Conclusion**

This chapter documents the results of the quantitative data collected using a descriptive, correlational approach that was integrated for a full analysis. Observed and documented vocabulary usage and comprehension of nonverbal toddlers captured the true nature and benefit of the absorbent mind concept, as expressed by Maria Montessori. Altogether, these results provide evidence that ambient language positively correlates to language acquisition when infants and toddlers overhear ambient vocabulary spoken within their classrooms. The data indicates high recognition and recall of vocabulary introduced by ambient language. Ambient language in classrooms can increase vocabulary acquisition among even the youngest children. The final chapter discusses the results and implications of these findings.

## **CHAPTER V**

### **Conclusions and implications for research, theory, policy, and practice**

The purpose of this quantitative descriptive and correlation study was to address the empirical gaps in measuring ambient language in infant-toddler mixed-age Montessori classrooms. The chapter presents an overview of the study, including purpose, participants, collection procedures, and analysis. Next, an overview of the findings of the study is provided. The chapter elaborates on the study's findings with a comparison of the findings to similar studies related to ambient language, Montessori mixed-age classrooms, and language acquisition. The chapter describes implications for early childhood educators, makes recommendations for further research, and discusses the study's limitations.

### **Summary**

#### **Purpose of the Study**

The primary research purpose was to address the theoretical and empirical gaps in measuring ambient language in infant-toddler mixed-age Montessori classrooms. The ancillary purpose was to understand the correlation of ambient language and its use to predict language acquisition, specifically target nonsense words. There was evidence that children can learn language from their environment, specifically through indirect learning. Harris et al. (2010) echoed the seminal literature of researchers (Hart & Risley; 1995, Kuhl & Meltoff; 1995, Rowe, 2012; Soderstrom et al., 2013) who stressed the quantity of language in the child's environment is important and a key to language acquisition. Early studies focused on parental language input, quantity, and quality in the home setting (Hart & Risley, 1995). Murray et al. (2006) measured and compared the quantity of home language to center-based care settings. Soderstrom et al. (2013) compared adult speech within the home and childcare centers.



Hart and Risley (1995) compared children from low socio-economic status (SES) households and working families. Language acquisition was measured in children's homes. Much of the language research conducted in the following years followed this comparative demographic methodology. Greenwood et al. (2011) replicated many measures of the Hart and Risley (1995) study using LENA, specifically measuring the amount of adult language provided to young children in the home. Greenwood et al. (2011) did not differentiate if the adult word count (AWC) only used direct and meaningful language or if distant or overheard language was also included in the AWC. Early studies, including Weisleder and Fernald (2013), indicated that young children did not learn language from the overheard speech in the home setting, consistent with Schneidman et al. (2012). The inability to acquire language from the ambient language in the home setting contradicts the research in lab settings. Bergelson et al. (2018) measured adult-directed speech, essentially, overheard speech. Bergelson et al. (2018) stated previous research did not consider the influence multiple adults and siblings have on ambient language. Additionally, Lehet et al. (2021) indicated ambient language could be measured in the context of home environments.

Soderstrom et al. (2013) found that children in high-quality childcare programs experienced the same quality of language found in a high SES home. The same study found children in childcare programs heard significantly more words and questions from adults when comparing children in low SES homes. Soderstrom et al. (2013) did not report meaningful language (direct language) or included distant language (ambient language) in the study's findings. In a different study in lab settings demonstrated that toddlers accompanied by their parents could learn novel words through overhearing (Gampe et al., 2012). Gampe et al.'s (2012) findings are in line with the additional studies conducted by Floor and Akhtar (2006) and Akhtar

(2005b). There is, however, a lack of literature examining infant-toddler language acquisition and ambient language in mixed-age Montessori settings. This chapter will synthesize the data collected in six infant-toddler mixed-age Montessori classrooms.

The much-needed research inspired this study's development to quantify the absorbent mind Montessori theory (Montessori, 1949/1997) and later Gutek (2004). Much of the previous literature was with anecdotal experiences and observations and lacked empirically sound data (Haines, 1993; Montessori, 1949/1997). This chapter provides interpretations and implications of empirical findings for research, policy, and practice. The primary investigator has examined empirical data related to ambient language in Montessori settings. Data were collected to answer four research questions.

**RQ1:** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?

**RQ2:** How much ambient language is provided by verbal toddlers in mixed-aged Montessori environments, as measured by the total child word count (CWC)?

**RQ3:** How much ambient language is provided by adults in mixed-aged Montessori environments as measured by the total adult word count (AWC)?

**RQ4:** What is the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child in mixed-age classrooms?

### **Design and Procedures of the Study**

A quantitative descriptive and correlational design using observation to collect data were used to fulfill the goals of this study. Infant-toddler mixed-age Montessori classrooms served as the setting for observations and data collection of ambient language. The Montessori three-period lesson (TPL) served as an intervention assessing target nonsense vocabulary words and

associated objects. Jackson (2011) outlined in detail the format of the TPL presentation, and it was later adapted for infants and toddlers (S. Brady, personal communication, April 11, 2016).

As described in Chapter 2, mixed-age groupings are an important characteristic of Montessori classrooms (Bailey et al., 1993; Gerard, 2005; Lillard, 2005). The absorbent mind theory can be best explained and demonstrated by children's language acquisition under three years (Lillard, 2005; Montessori, 1949/1997). Montessori (1949/1997) stated, "...the child...does not inherit a pre-established model for his language, but he inherits the power of constructing a language by an unconscious activity of absorption" (p73).

Participant selection of infants and toddlers in authentic mixed-aged Montessori settings was important to the study. The participants and settings chosen provided the purest space to quantify the theory of the absorbent mind. Additionally, the absorbent mind theory is rooted in infant and toddler language acquisition (Montessori, 1949/1997). Measuring unconscious learning was important to determine the relationship that older peers in an authentic mixed-aged Montessori classroom have on younger peers' language acquisition.

This design involved multiple observation methods to attain quantitative data for three weeks. A pre-posttest was administered to participants to assess their recognition and recall of target nonsense words. The youngest and oldest child in all classrooms wore a LENA recording device, which included a digital learning processor (DLP). The data collection included: (a) a classroom survey collecting student and staff information, (b) conducting pre-and-post tests using the TPL, (c) 3 weeks of audio recordings for a total of 12 subjects, and (d) a three-week transcript of one classroom's audio file. Data were collected for the fidelity measure using the Three-Period Lesson Fidelity Tool (B-3). Chapter 4 provided detailed findings of the data analysis.

The DLP and LENA software processed the audio recordings for analysis. The data indicated that the DLP and LENA software could discriminate between direct and ambient language in a classroom setting. Analysis using the LENA software categorized "distant language" as the ambient language for the present study. Using the playback of recordings, sample transcriptions, and target word tally sheets, it was evident that the LENA classification of "distant language" was a reliable measure of ambient language.

### **Interpretation of Findings**

#### **Quantitative Research Findings**

Montessori (1949/1997) stated, "The child grows up speaking his parents' tongue, yet to grown-ups, the learning of a language is a very great intellectual achievement. No one teaches the child, yet he comes to use nouns, verbs, and adjectives to perfection" (p.5). Montessori believed language acquisition was through the unconscious learning or absorption of information and knowledge from the environment around them. Montessori specifically referenced language development in the first 3 years as an example of the absorbent mind theory (Montessori, 1949/1997 and later Gutek, 2004). Researchers Cossentino (2009), Isaacs (2018), Lillard (2005), and Lillard and McHugh (2019b) cited Montessori's original writings from 1949.

The investigator's goal was to determine if the absorbent mind theory could be quantified by measuring ambient language. Research questions were developed to determine if ambient language could influence vocabulary acquisition. Montessori classrooms typically introduce new vocabulary using the TPL. The TPL vocabulary lesson was used as an intervention for the present study to measure vocabulary recognition and recall of receptive and expressive language. The TPL was used to introduce the nonsense target words. The TPL was used with the oldest children, but the youngest children overheard the TPL. The TPL was later used to assess the

youngest child's acquisition of the target nonsense words. The full TPL using the target nonsense words was not conducted with the younger children. The only way the younger children could acquire the nonsense target words is through the ambient language in the classroom. The TPL assessment confirmed the acquisition in lesson two (recognition/reception) and lesson three (recall/expression).

### ***Descriptive Statistics***

The TPL's structure allows for a uniform presentation. In addition to attaining specific data for the research questions, this study provided descriptive statistics demonstrating the influence of classroom ambient language on young children. On average, the oldest children in the classroom experienced ambient language 63.83% of the instructional day and direct language 19.87%. The youngest children in the study experienced ambient language 56.55% of the instructional day and direct language 22.90% of the instructional day. The data were consistent with the original pilot, where 68% of the language was ambient language during the recorded period. More importantly, the study measured the amount of peer ambient language in addition to adult ambient language. The results indicated that older children contributed an additional 39.5% of the target nonsense words overheard in the classroom. The data were also consistent with recent research using LENA to measure overheard and ambient language in naturalist settings (Foushee et al., 2021). Foushee et al.'s (2021) research with preschool children investigated the use of novel words and word learning influenced by three different exposures to the ambient language. Foushee et al.'s (2021) research supported the need for more research related to ambient language in naturalistic classroom settings.

## Research Questions.

**RQ1.** In what way does ambient language affect vocabulary acquisition, specifically target nonsense words, in a toddler mixed-age classroom?

The first research inquiry was to determine the relationship ambient language had on vocabulary acquisition. More specifically, the ability for the youngest child to acquire language from the older children in the classroom. The findings suggest that exposure to ambient language improved language acquisition for toddlers. Recognition of target words increased after 3 weeks. More importantly, verbal classroom peers contributed to the addition of the quality and quantity of vocabulary. As Fernald and Weisleder (2015) eluded, increased language quality in real-world interactions increases vocabulary acquisition. Similar to Foushee's (2021) research, ambient language and ambient target nonsense words increased in the current investigation.

Wang et al. (2017) provided a systematic review of 35 existing studies using LENA. The purpose of Wang et al.'s (2017) analyses was to confirm reliability in different settings (e.g., classroom settings, lab, home settings) and different age populations. Wang et al. (2017) and Cristia et al. (2020b) identified the DLP's inability to measure a child's vocalization in environments where overlapping speech occurs. This gap of data collected by the DLP is substantiated with the Lehet et al. (2021) study. Classroom settings typically demonstrate overlapping speech. For this reason, the daily total child word count (CWC) and average CWC could be greater.

Additionally, research needs to be conducted to measure the reliability of LENA in classroom settings. Measuring CWC in a mixed-aged Montessori classroom demonstrated the understanding of the relationship older peers' ambient language had on the increase of ambient

target vocabulary. Peer learning is dependent on the mixed-age groupings (Lillard & McHugh, 2019a; Wood & Frid, 2005).

**RQ2.** How much ambient language is provided by verbal toddlers in mixed-aged Montessori environments, as measured by the total child word count (CWC)?

The second research question examined CWC's of verbal toddlers' ambient language. The average CWC for each subject ranged from 82 words to 589 words a day during the two-hour work cycle. The average child word count for a given recorded work cycle overheard by the youngest or oldest child was 247.67 words. Older peers increased the target word exposure by 39.5%, as determined by the target word tally. Warren et al. (2010) examined the reliability of CWC and concluded that the audio needs to be within a six-to-ten-foot radius of the DLP. This study measured all ambient language in the classroom. Some of the language overheard was from a range greater than ten feet, and for this reason, the overall and average CWC could be greater.

The intervention of six vocabulary words allowed for greater analysis of differentiated words based on phonetic properties of the word. More students recalled the words "*pame*" and "*kack*" than other target words. An unexpected result of the study was the difference in recognition and recall by gender. Girls recalled fewer nonsense words than boys in the study did. Gender differences in recognizing and recalling target words was not a goal of the present research. A future study may consider gender as a variable.

The mixed-age Montessori classroom design is noteworthy. Older peers increased the target word exposure by 39.5%, as determined by the target word tally. The mixed-age classroom is an integral part of the Montessori classroom, specifically because younger children learn from older peers (Bailey et al., 1993; Gerard, 2005). The DLP output, classroom

recordings, and target word tallies demonstrated the importance of older children in the present investigation. Younger children absorbed the additional language of older peers. Replication in non-Montessori settings or same-age classrooms may not produce similar outcomes. Future research might examine the influence of ambient language on vocabulary with different settings. One could compare two different classroom settings or compare mixed-age settings with single-age settings.

**RQ3.** How much ambient language is provided by adults in mixed-aged Montessori environments as measured by the total adult word count (AWC)?

The third research question examined adult ambient language in mixed-aged Montessori classrooms. The average adult word count for a given recorded work cycle overheard by the youngest or oldest child was 1014.54. During any given days' work cycle, a child participant heard from 82 words up to 4,000 words a day spoken by the adult. As cited above, Warren et al. (2010) determined that for the best reliability of AWC, the audio needs to be within a six to a 10-foot radius of the DLP. Some of the language overheard was from a range greater than ten feet, and for this reason, the overall and average adult count could be greater. A recent meta-analysis of LENA studies and analyzing the accuracy of LENA to measure AWC supports the opinion of Cristia et al. (2020b). Cristia et al. (2020b) indicated that additional studies using LENA in a naturalistic setting and with toddlers older than 2-years of age are needed to strengthen the reliability of research currently available. An interesting finding was differences between the AWC and CWC measured in this study. The lower the AWC during the work cycle, the higher the CWC, as overheard by the youngest and oldest children. This result requires additional research and review of the data with a larger sample to determine the influence of AWC on CWC in the classroom.



**RQ4.** What is the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child in mixed-age classrooms?

The fourth research question specifically analyzed the correlation between ambient language provided by the oldest child and the acquisition of vocabulary by the youngest child in the Montessori mixed-age classroom. The results demonstrated a positive correlation between the oldest child's ambient language and the youngest child's ability to acquire target nonsense words. The acquisition of target vocabulary by the youngest child indicated that ambient language influenced language acquisition.

Before the current study, there was little evidence that the absorbent mind could be measured empirically (Montessori, 1949/1997; and later Gutek, 2004). There was limited evidence about the influence of mixed-age classrooms on infants and toddlers' development, specifically in the area of language. There was also limited research or evidence regarding the Montessori TLP as a language intervention (Feez, 2007; Jackson, 2011; Lillard, 2005).

### **Three-Period Lesson Fidelity Tool (B-3)**

Chapter 3 and 4 provided details of the newly developed Three-Period Lesson Fidelity Tool (B-3). Culclasure et al. (2019) described and further discussed by Murray et al. (2019), no widely accepted tool exists to assess Montessori environments or Montessori practices. The researcher developed and used the Three-Period Lesson Fidelity Tool (B-3) in the current study. Mowbray et al. (2003) outlined a fidelity assessment framework that: (a) identified fidelity criteria (Appendix G), (b) measuring fidelity, (c) assessed the reliability and validity of the fidelity criteria, and (d) developed an instrument. The criteria included an interview with an AMI Assistant to Infancy trainer, a review of both student and trainer Montessori albums, and Montessori literature. The information ensured that criteria included qualifications, classroom

environment, language materials, delivery, and dosage of vocabulary. Montessori trained individuals understand the criteria and validity. To ensure inter-rater reliability, only individuals trained as an AMI or AMS Guide/directress could use the Three-Period Lesson Fidelity Tool (B-3) to assess the intervention and classroom. The researcher and an assessor reviewed the tool before starting the study and used the tool during the classroom's initial and final observation.

The AMI and AMS qualifications were the indicator of *expert* for this tool. The Three-Period Lesson Fidelity Tool (B-3), a Likert-type scale, assessed for fidelity to the intervention. Inter-rater reliability was determined by using internal consistency reliability (Cronbach's coefficient alpha). The Three-Period Lesson Fidelity Tool (B-3) determined that all rooms and teachers had fidelity to the Montessori TPL. There were a range of scores on the final scoring. Comparatively, the difference in AMI and AMS training potentially influenced the rate of fidelity and the range of scores. Future language interventions in Montessori settings may replicate and measure teacher fidelity during TPL lessons. Due to the small sample size, the recommendation is to continue to explore the use and development of the Three-Period Lesson Fidelity tool (B-3).

### **Implications**

The lesser-known infant and toddler Montessori pedagogy and curriculum, known as an *assistant to infancy* (Brady, 2015; Campanelli, 2000; DeSerio, 2016; Greenwald, 2000; Honneger Fresco, 2019) was discussed in chapter 1. The Montessori theoretical framework, specifically the absorbent mind and mixed-aged classrooms, was used to understand infant and toddler language acquisition. Ambient language or distant language was identified as the independent variable. The dependent variables were the nonsense words measured both as a tally of known ambient language and to measure language acquisition from ambient language.

This study contributed empirical findings to support Maria Montessori's theory of the absorbent mind.

This investigation determined that ambient language was measurable in a mixed-age Montessori classroom. Additionally, there was a correlation that older peers' ambient language influenced language acquisition of younger classroom peers. The findings are supported by Foushee et al. (2021) and Hanna and Meltzoff (1993). Foushee et al. (2021) determined ambient language influenced novel word learning and word meaning. Hanna and Meltzoff (1993) had strong evidence that learning occurs through peer observation. Experiments conducted by Hanna and Meltzoff (1993) found infants' ability to socially learn was supported by peer observation and imitation of other infants. This study demonstrates the social nature of language acquisition in infant and toddler mixed-aged classrooms.

### **Implications for Educators**

Infant-toddler Montessori teachers and assistant teachers have extensive training in the absorbent mind, infant-toddler child development, and creating the child's environment and materials. Montessori teachers reflect on their teaching approach through the Montessori pedagogical lens. This specialized training and grounding in pedagogy is an excellent example for others working with infants and toddlers. Five areas that can influence educators and classroom practice is: (a) infant-toddler mixed-age classrooms, (b) an adapted Montessori three-period lesson, (c) ambient language, (d) specialized training in infant and toddler development, and (e) infant and toddler Montessori pedagogy in classroom practice.

Mixed-age classroom literature has predominately focused on 3-to-6-year-old children or older populations. The literature on the Montessori perspective of mixed-age classrooms was discussed (Bailey et al., 1993; Gerard, 2005) as well as non-Montessori theories and research of

mixed-aged environments. The present study provided evidence that mixed-age groupings in infant and toddler settings positively influence language acquisition.

The Montessori three-period lesson adapted for infant-toddler Montessori settings as presented and instructed in AMI and AMS trainings was used. The slight variation in presentation for infants and toddlers respects the development of a younger child. The adaptation of the TPL for infant and toddlers did not detract from the intentions of the original TPL intended for older children. The TPL in this study demonstrates a language intervention tool that measured recognition (comprehension) and recall (expression) with infants and toddlers. Additionally, study results demonstrated the successful development and use of the TPL Fidelity Tool (B-3) to ensure fidelity to the TPL.

There is limited research related to ambient language and its influence on infant and toddler's language acquisition in early childhood settings (Akhtar, 2005b; Akhtar et al., 2001; Foushee et al., 2019; Gogate & Hollich, 2010; Shneidman et al., 2013). This study is the first to report the importance of ambient language in infant-toddler Montessori settings. The lack of formal acknowledgment leaves a gap in both literature and the potential influences ambient language can have on educator preparation, speech-language pathologists, and parent educators. The predominant focus for language development with children, especially infants and toddlers, has been direct instruction and parent communication. These findings emphasized that children learn and absorb new language unconsciously in classrooms from adults and peers.

Lillard and McHugh (2019a, 2019b) emphasized the quality of teacher training and Montessori teachers' preparation. Lillard and McHugh (2019a, 2019b) stated authentic Montessori training ensures quality and adherence to Montessori pedagogy and curricular practices. Elkind (2007) wrote, "Montessori teachers receive extensive training...Such hands-on

training is unmatched in most of our college and university teacher-training programs" (p 205). The intervention's success was due to the high quality and specialized training of the Montessori infant and toddlers' teachers. In traditional infant-toddler classrooms, the level of experience and training is minimal compared to infant-toddler Montessori classrooms. The National Survey of Early Care and Education (NSECE) (2016) documented the educational qualifications of infant and toddler caregivers. The NSECE (2016) indicated that 17% of infant and toddler teachers hold their associate degrees, and 19% hold their bachelor's degrees or higher. Whitebook et al. (2012, 2018) have slightly higher numbers, with 35% of infant-toddler teachers holding a bachelor's degree nationwide. These studies indicate that approximately 48%-64% of the infant-toddler workforce do not have formalized education specific to the education and care of infants and toddlers.

Of the lead teachers in the study, 50% hold an associate degree, 50% hold a bachelor's degree, and all hold the additional Montessori diploma specific to their age specialization. As Lillard and McHugh (2019a) and Honegger Fresco (2017) detailed, the attention to the development of the prepared environment, adherence to pedagogy, and creating one's album or text, and personal transformation is unmatched to the experience of traditional infant and toddler teachers.

The highly trained infant-toddler Montessori teacher is the one that knows how to implement a mixed-age classroom for infants and toddlers and ensure both a safe and appropriate learning environment (Honegger Fresco, 2017). The highly trained infant-toddler Montessori teacher knows how to present the TPL with intent, clarity, and enticement for all children. The Three-Period Lesson Fidelity Tool (B-3) results demonstrated consistent use of the Montessori TPL throughout six classrooms from a variety of Montessori trained Guides. The Guides knew

what themes intrigued children and how to extend or scaffold the lessons. They understood when to end the lesson and when to revisit the lesson another day.

The Montessori teacher also understands that their actions, language, and the actions and language of others influence children at all times. The Montessori Guides learn the absorbent mind theory and understand that all their positive and negative attributes will influence each child's development in their care. The training includes the teachers' understanding that language, tone, dialect, accent, body movements, clutter, and extraneous noise will influence the child (Brady, 2015; Campanelli, 2000; Fresco, 2017). The Montessori training is about understanding the child and the Montessori pedagogy and about the adult themselves, as they are the most important learning material in the classroom. Whitebook et al. (2009) indicated that traditional early childhood teacher preparatory programs have a greater focus on preschool through elementary school development and may not provide adequate course work that focuses on birth to age three. The lack of adequate course preparation may influence the teacher's success with the youngest age groups. Montessori schools require infant-toddler teachers to hold age-specific teaching diplomas (S. Brady, Personal communication, August 22, 2016). Traditional childcare programs have low requirements for teacher training and education when working with infants and toddlers. The limited requirements include not requiring a high school diploma, General Education Development Test (GED), or bachelor's degree. Nineteen to thirty-five percent of infant-toddler practitioners' nationwide hold a bachelor's degree (NSECE, 2016; Whitebook et al., 2012; Whitebook et al., 2018). However, the degrees they hold may not have evidence of age-specific training. In one study, only 2.5% of higher education programs surveyed had coursework specific to infant-toddler development and care (Ritblatt et al., 2013).

In New York State, less than 1% of four-year higher education institution's coursework specializes in infants and toddlers (Gilken et al., 2020).

### **Future research**

The participating programs were predominantly in urban settings and focused on monolingual classrooms. A recommendation is to conduct future research to analyze ambient language in infant-toddler settings in rural and suburban communities. An additional recommendation is to include bilingual settings and multilingual learners. For example, one of the children in the T-Room was trilingual. The child was the only one to recognize and recall all target words by the end of the first week. This finding suggests recommendations for additional research in settings with multilingual learners.

The data suggested that “*pame*”, and “*kack*” was easier to acquire than the other nonsense target words. Future research can explore the variables that contributed to this ease of acquisition. The purpose of this investigation was not to compare genders and vocabulary acquisition. However, the data provided interesting results that warrant a closer look at both the influence of the TPL and ambient language on language acquisition in boys and girls comparatively. Lehet et al. (2021) measured LENA's reliability to measure adult ambient language for one day in a home setting. A recommendation would be to incorporate Lehet et al.'s (2021) methodology to measure child/peer ambient language in a classroom setting for several days.

### **Limitations**

There are several limitations to this study. First, the sample size was small, with only 6 participating Montessori classrooms, 12 teaching staff, and 56 children. The settings took place primarily in New York City, with one classroom in Maryland. Future studies could expand the

participation to additional urban environments, as well as rural and suburban programs. Original invitations to participate in the current study included Montessori programs in suburban and urban locations of New York, Texas, Virginia, Connecticut, and Massachusetts. Due to certain school boards, school leaders, Guides, assistant teachers, or parental concerns with the audio recordings, many programs opted not to participate. Some research sites were excluded from the study because 100% participant consensus (e.g., staff, students, families) was not obtained. Given the small sample size, the data analysis had limited power. Future research with a larger sample size would be more generalizable.

A second limitation was the use of the TLP. Teachers used the TLP throughout the day for other themes. It was evident from the audio transcripts that some classrooms had more robust language lessons and the frequency of a variety of language themes presented throughout the work cycle. The increased frequency throughout the day of the TPL for any theme could be a variable that influenced acquisition. Different Montessori training might have been a factor in the study's results.

Third, infant-toddler classrooms posed an additional limitation. Unlike lab settings cited in the literature (Akhtar, 2005a; Akhtar, 2005b), the present investigation took place in a naturalistic infant-toddler classroom. Future researchers could conduct an experimental study with randomized control and experimental groups. The inherent behavior of infants and toddlers also posed challenges during the pre-post-tests and the TPL. If a child refused to participate or walked away, data collection terminated as per the IRB agreements. The lack of data is less about the children's ability to acquire language in classrooms and more about needing better methods to collect data in classroom settings with infants and toddlers. Methods for improvement would include randomized control and experimental groups as well as adding more



than one day for data collection. The addition of collection days would reduce the number of participants without final data of the three-period lesson.

### **Conclusion**

The much-needed research inspired this investigation to quantify Montessori theory of the absorbent mind (Montessori, 1949/1997; and later Gutek, 2004). The primary research purpose was to address the theoretical and empirical gaps in measuring ambient language in infant-toddler mixed-age Montessori classrooms. The research questions guided the study design. This study provides initial insight into infant-toddler mixed-age Montessori classrooms focusing on the Montessori TLP and the use of the LENA tool as previously studied (Foushee et al., 2021; Gilkerson et al., 2016; Wang et al., 2017) to measure and analyze ambient language.

Throughout the researcher's investigation, the most important finding is that the youngest children could acquire new vocabulary words through ambient language. The acquisition of new vocabulary through ambient language demonstrates the absorbent mind at work and the correlation between ambient language and language acquisition in peers. Another indirect finding was that recognition and recall rates differ based on gender in young children. Last, the researcher found a correlation between the amount of language the adults used, and the amount of language classroom children expressed.

The researcher used infant-toddler mixed-age Montessori classrooms and the Montessori TPL as an assessment tool to quantify the absorbent mind. The results may bring awareness to the need to measure both ambient language and quantify the absorbent mind. The measurement of ambient language and word count between adult and child may have been the initial questions; however, LENA DLP and software data strengthened the study results. Results led to the inference that ambient language and its influence on language acquisition are an acceptable

way to provide quantitative data to the Montessori theory of the absorbent mind. The study's success was largely due to the infant-toddler Montessori teachers' extensive training and their fidelity to authentic Montessori practice and the Montessori TPL. The newly devised Three-Period Lesson Fidelity Tool (B-3) substantiated the teachers' fidelity to the TPL. The findings, implications, and limitations provide new opportunities for future research in infant-toddler language acquisition.

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## Appendix A

### Maria Montessori and Adele Costa Gnocchi: A historical timeline including the development of the Assistant to Infancy Curriculum

#### **1870**

Maria Montessori born August 31<sup>st</sup> in Chiaravalle (Ancona) Italy to Alessandro Montessori and Renilde Stoppani.

#### **1883**

January 21: Adele Costa Gnocchi is born in Montefalco; Perugia, Italy (Montanaro, 2002).

Enrolled at Reale Scuola Tecnica Michelangelo Buonarroti for technical school (Babini, 2000; Gutek & Gutek, 2016). Montessori's enrollment is cited as 1884 by Trabalzini (2011).

#### **1886**

Montessori graduates from Scuola Tecnica and enters Regio Istituto Tecnico Leonardo da Vinci and graduates in 1890 (Gutek & Gutek, 2016; Povell, 2010; Trabalzini, 2011).

#### **1890**

Montessori enrolls at the University of Rome to study natural sciences (Schnepf, 2010). At this time approximately five other women had graduated in the field of medicine from various universities in Italy but is the first at the University of Rome (Foschi, 2008; Honegger Fresco, 2017; Povell, 2007; Trabalzini, 2011).

#### **1892**

Montessori passes natural science exams, earns a diploma di licenza (Gutek and Gutek, 2016) and continues onto a degree course in medicine (Babini, 2000; Gutek & Gutek, 2016).

#### **1896**

July 10: Montessori graduates from medical school joining a small group of accomplished women in Italy. Dr. Montessori was not the first woman to earn a medical degree in Italy or even from the University of Rome as previously documented (Povell, 2010; Trabalzini, 2011).

September: Dr. Montessori becomes member of the Italian delegation to the International Congress on Women's Rights held in Berlin, addressing the congress about women's rights, including equal pay for equal work, a woman's presence in university settings and professions (Povell, 2010; Trabalzini, 2011).

September: Dr. Montessori publishes *Sul significato dei cristalli del Leyden nell'as, a bronchiale*, translated as *On the maning of leyden crystals in bronchial asthma* (Povell, 2010; Trabalzini, 2011).

#### **1896 – 1898**

Dr. Montessori takes appointment to work in Rome's Clinica Psichiatrica (Gutek & Gutek, 2016).

### **1897**

Dr. Montessori audits courses in pedagogy and psychology at the University of Rome.

Dr. Montessori publishes her thesis under the title *Sulle cosiddette allucinazioni antagonistiche* in The Journal *Policlinico* (Povell, 2010; Trabalzini, 2011).

Dr. Montessori publishes a scientific piece with Dr. Giuseppe Ferruccio Montesano entitled *Ricerche batteriologiche sul liquido cefalo rachidiano dei dementi paralitici*, translated as Bacteriological researches on the rachidian cephalic fluid of paralytic demented subjects (Trabalzini, 2011).

### **1898**

March 31: Mario, Dr. Montessori's only son, is born (Montessori, 2013).

September 8-15: Dr. Montessori participates in the First Pedagogical Conference of Turin for elementary teachers. In her speech Montessori declares that the problem of "defective" children is an educational, not medical, problem. Dr. Montessori later publishes articles based on her speeches (Van Aken, 2006, Trabalzini, 2011).

Dr. Montessori visited Bourneville Institute in Paris to study the methods of Itard and Séguin for sensorial reeducation.

Dr. Montessori joins the National League for the Education of Retarded Children.

Dr. Montessori with Dr. Montesano (father of Mario Montessori) founds *Per a Donna* society in Rome translated as *For the Woman*, to promote men and women to collaborate in scientific and social fields and to publish and present research together (Povell, 2010).

### **1899**

Dr. Montessori represent the Italian government at the International Council of Women in London, speaking on women's rights, work conditions for women, and against child labor (Schnepf, 2010; Trabalzini, 2011).

February: Dr. Montessori spoke at The New Woman conference in Milan addressing the theme of woman inferiority. Montessori later published an article entitled *The female question and the congress of London* (Trabalzini, 2011).

The National League for the Protection of Retarded Children is found, and Dr. Montessori is a counselor with Dr. Montesano. The league's aim was to open a school to train teachers to educate phrenasthenic children and is finally achieved in 1900 (Trabalzini, 2011).

Dr. Montessori joins the Theosophical Society. The Theosophical Society later invites Dr. Montessori to India in 1939 (Trabalzini, 2011).

### **1900**

April: Dr. Montessori and Dr. Montesano are announced as co-directors of the new education institution the Scuola Magistrale Ortofrenica, translated as *The Orthophrenic School* (Gutek & Gutek, 2016). This is where Montessori works with children and pilots' activities created by Séguin (Honegger Fresco, 2017).

December 27<sup>th</sup>, L'Instituto Medico-Pedagogico della lega, translated as the *Lega's Medical-Pedagogical Institute* was opened in response to the impressive results of the Orthophrenic School.

### **1901**

Children at the Scuola Magistrale Ortofrenica in Rome pass the state education test designed for normal children. This event creates international interest in Dr. Montessori's work (Lillard, 2005).

Dr. Montessori leaves the Scuola Magistrale Ortofrenico and begins her second degree in education, experimental psychology, and anthropology at the University of Rome (Pendleton, n.d.). Dr. Montessori focuses on physiological anthropology under the tutelage of Cesare Lombroso and Giuseppe Sergi (Gutek & Gutek, 2016).

Dr. Montessori joins the faculty of Magistero Femminile, one of two universities for women (Schnepf, 2010).

Dr. Montessori presents in Naples, at the National Pedagogical Congress. Montessori presents Séguin's ideas and methods, which Montessori has extended with her work with children (Honegger Fresco, 2017).

### **1904**

Dr. Montessori is appointed to the Chair of Anthropology at the University of Rome Pedagogic School. Montessori lectures on the application of anthropology and biology to education (Gutek & Gutek, 2016).

### **1906**

Dr. Montessori joins the Association for Women in Rome and petitions for Women's right to vote. Women do not receive this right in Italy until 1946 while this right was achieved in the United States in 1920 (Povell, 2010; Trabalzini, 2011).

Dr. Montessori is approached by Edouardo Talamo, director of the Istituto Romano di Beni Stabili, a real estate association translated as Roman Good Building Association, to establish a school in The San Lorenzo district (Gutek & Gutek, 2016; Povell, 2010; Trabalzini, 2011).

### **1907**

January 6: In Via dei Marsi 58, the first Casa dei Bambini is opened. Legally, it could not be called a school so Dr. Montessori's supporter and fellow woman's advocate, Olga Lodi

suggested the name Casa dei Bambini. Dr. Montessori is assisted by Candida Nuccitelli (Gutek & Gutek, 2016) and Ms. Talamo (Trabalzini, 2011). On April 7, several months later, another Casa Dei Bambini is opened in San Lorenzo district and then at the villa of the British ambassador to Italy (Gutek & Gutek, 2016).

### **1908**

April 24 - 30: Dr. Montessori participates in the First National Congress of Italian Women in Rome. Dr. Montessori presents a topic on sexual morality in education (Trabalzini, 2011).

May: Dr. Montessori presents on sexual morality in education at a conference to benefit *Asilo Mariuccia*, a rehabilitative institution for exploited and prostituted girls (Trabalzini, 2011).

October 18: The Societa Umanitaria, translated as The Humanitarian Society of Italy, opens a Montessori school (Gutek & Gutek, 2016; Trabalzini, 2011).

The Society House of Labor is commissioned to manufacture Montessori didactic materials (Gutek & Gutek, 2016).

### **1909**

June: Adele Costa Gnocchi graduates with a degree from the Royal Female Normal School with honors (Honegger Fresco, 2001). Various documents indicate that this was either in psychology or philosophy, some indicating that a Ph.D. was awarded (Varga, 1997).

August 1: First course of the Montessori pedagogy is given in Citta di Castello under the invitation of Baroness Alice Hallgarten and Baron Leopoldo Franchetti (Trabalzini, 2011). Adele Costa Gnocchi is one of the seventy participants (Honegger Fresco, 2001; Montanaro, 1990, Trabalzini, 2011).

Second Casa dei Bambini opens in Milan directed by Anna Fedeli (Montessori, 2013). Anna Marchese's memoir notes this information differently, stating that the school opened in 1908 and Marchese was the directress. The program was a full day program running from 8:00 AM – 6:00 PM to correspond with the working shifts of the families in the neighborhood (Maccheroni, 1947).

Dr. Montessori Publishes *Metodo della Padagogia Scientifica applicato all'educazione infantile nelle case dei bambini*, later titled in the English edition as *The Montessori method*. *The Montessori method* is translated in 1912 by her student Anne George, the first American to be trained by Montessori (Schnepf, 2010).

Kindergarten Primary Magazine introduces Maria Montessori and the Montessori philosophy in the United States. (Appelbaum, 1971; Povell, 2010).

### **1910**

*Antropologica Pedagogica* is published based on her lectures at the University of Rome from 1904-1908. This is translated into English in 1913 (Trabalzini, 2011).

A Montessori school is established at the Convent of the Franciscan Missionary Sisters of Mary on Via Giusti. This is the school that is featured and photographed for the 1910 McClure article. This is the site that Dr. Montessori would later host her International course (Gutek & Gutek, 2016).

*McClure Magazine* publishes their first article about the Montessori method. This relationship continues for five years (Gutek & Gutek, 2016).

Dr. Montessori holds two Montessori teacher training courses in Rome (Trabalzini, 2011).

## **1911**

Carl R. Byior participates in private training in Italy under Dr. Montessori regarding the use of the didactic materials. He owns 80% of the Montessori Franchise at this time and patents in the United States, becoming the president of the House of Childhood in New York, NY. He manufactures and sells the Montessori didactic materials (Gutek & Gutek, 2016).

May: Josephine Tozier writes an article about Dr. Montessori's work at the Ortofrenica School entitled "An educational wonder-worker: The methods of Maria Montessori" and is published in *McClure magazine* (Gutek & Gutek, 2016; Povell, 2010).

October: Montessori school of San Angelo in the Pescheria Quarter is established, and is the school featured in Tozier's article below (Gutek & Gutek, 2016).

October 28: Howard Warren of Princeton University writes his article "The house of childhood: A new primary system at the New Jersey State Pediatric Society" (Matheson & Zimmerman, 1986). It is later published in the *Journal of Educational Society*. It may be the first article about the Montessori philosophy published in an American Peer Reviewed Journal.

December: Tozier writes an article in McClure magazine with the subheading "The School of San Angele in the Roman slums" (Gutek & Gutek, 2016).

First Montessori school in the United States opens in Tarrytown, at the home of Edward Hayden, under the guidance of Anne E. George (Gutek & Gutek, 2016; Kramer, 1976/1988).

Dr. Montessori resigns from her teaching role at the University of Rome and her private medical practice to focus on the education of young children.

A Montessori training course is conducted in Milan (Trabalzini, 2011).

## **1912**

January: Tozier writes "The Montessori apparatus" which is published in *McClure magazine* (Gutek & Gutek, 2016).

Montessori American Committee is established by Ann George. McClure and the Bells (Appelbaum, 1971; Kramer, 1976/1988; Gutek & Gutek, 2016).

*The Montessori Method* is translated by Anne George and was published in the United States for the first time, becoming number two on the bestseller list for that year.

March: Howard Warren, of Princeton University publishes his article “The house of Childhood”: A new primary system, in *The Journal of Educational Psychology*.

April: The article Montessori Methods appears in *Journal of Education* (Matheson & Zimmerman, 1986).

May: Dr. Montessori writes an article entitled “Disciplining children” and is published in *McClure magazine*. This is the first article Montessori writes for a US magazine publication (Gutek & Gutek, 2016).

Anne George writes an article entitled “Dr. Maria Montessori: The achievement and personality of an Italian woman whose discovery is revolutionizing educational methods” and was published in *Good House-Keeping* (Gutek & Gutek, 2016).

Dorothy Fisher publishes *A Montessori mother*. The book is in response to her visit with Dr. Montessori and the observation of the Montessori school at Franciscan Convent on the Via Giusti in Rome. The book positively endorsed the Montessori method (Gutek & Gutek, 2016).

George opens a school in Washington D.C., at the request of Alexander Graham Bell and his wife Mabel (Gutek & Gutek, 2016).

The first Australian teacher, Mary Simpson, visits Italy, to observe Dr. Montessori’s work (Connell, 1995).

Adele Costa Gnocchi takes a second course with Dr. Montessori (Honegger Fresco, 2001).

The Montessori Society for the United Kingdom is founded in London (Trabalzini, 2011).

December 20: Renilde Montessori, Dr. Montessori’s mother, passes away (Maccheroni, 1947).

## **1913**

January 15: The First International Course in Rome is held, attended by students from all over the world, including Adele Costa Gnocchi, Anne George, and Helen Parkhurst (Trabalzini, 2011) and four students from Australia (Connell, 1995), as well as Katherine Moore, Emily Greenman, Elizabeth Harrison, Margaret Naumburg, and Dr. Mary Powell Jordan, from the United States (Montessori 2015). The course lasts four months with lectures on philosophy occurring three times a week at Dr. Montessori’s home in Rome. One day a week students conduct practical studies of the Montessori apparatus at Montessori schools throughout Rome (Matheson & Zimmerman, 1986).

Alexander Graham Bell, Mabel Bell and S.S. McClure found Montessori Educational Association of America (Appelbaum, 1971; Gutek & Gutek, 2016; Kramer, 1976/1988).



November 21: Dr. Montessori travels to the United States on the S.S. Cincinnati (Montessori, 2013; Schnepf, 2010; Matheson & Zimmerman, 1986)

December 3: Dr. Montessori arrives in New York (Montessori, 2013; Schnepf, 2010; Matheson & Zimmerman, 1986). Montessori is met by the committee of the Montessori Education Association based in Washington; D.C. Montessori traveled to Washington D.C. for a reception held in her honor at the White House (Matheson & Zimmerman, 1986).

December 6: Dr. Montessori lectures in Washington, D.C., “moving pictures” of Dr. Montessori’s classroom in Rome are shown for the first time (Matheson & Zimmerman, 1986).

December 8: Dr. Montessori lectures at Carnegie Hall in New York under the auspices of Montessori Education Association (Appelbaum, 1971). Montessori is introduced by John Dewey (Gutek & Gutek, 2016). This was not her first speaking engagement as indicated in Gutek & Gutek, (2016), as her first appearance is in Washington, D.C. verified by newspaper articles (Matheson & Zimmerman, 1986).

December 9: Dr. Montessori lectures in Philadelphia. Montessori meets with Helen Keller and Thomas A. Edison (Matheson & Zimmerman, 1986).

December 10: Dr. Montessori arrives back in New York. Montessori meets with Mrs. P. Stuyvesant Pillot along with 25 other notable New Yorkers and representatives of the Montessori Education Association (Matheson & Zimmerman, 1986).

December 11: Dr. Montessori lectures at the Brooklyn Academy of Music under the auspices of the Brooklyn Institute of Arts and Sciences (Matheson & Zimmerman, 1986).

December 12: Dr. Montessori travels to Boston. Montessori stops in Providence, RI to meet with the Board of Education which had adopted her method (Matheson & Zimmerman, 1986).

December 13: Dr. Montessori gives two lectures in Boston (Matheson & Zimmerman, 1986).

December 14: Dr. Montessori travels back to New York (Matheson & Zimmerman, 1986).

December 15: Dr. Montessori gives her second lecture at Carnegie Hall (Matheson & Zimmerman, 1986).

December 16: Dr. Montessori travels to Pittsburg to give lectures (Matheson & Zimmerman, 1986).

December 17: Dr. Montessori lectures in Pittsburg and then travels to Chicago (Matheson & Zimmerman, 1986).

December 19 & 20: Dr. Montessori lectures in Chicago (Matheson & Zimmerman, 1986).

December 23: Dr. Montessori attends a reception at the Women's Cosmopolitan Club. The event is attended by the Montessori committee, the President of the Board of Education, William Churchill and president of the Women's Cosmopolitan Club, Mrs. Adams Brown (Matheson & Zimmerman, 1986).

December 24: Dr. Montessori leaves for Liverpool on the Cunardar Luisitania (Matheson & Zimmerman, 1986).

First Montessori schools opens in Spain.

*The Montessori manual for teachers and parents* is written by Fisher. Photographs are provided by Carl Byoir. Montessori later rejects this unauthorized publication as it highlights the materials as being the essential component of the Montessori method (Gutek & Gutek, 2016).

Costa Gnocchi obtains a diploma in Moral Education from the Royal Institute of Education (Honegger Fresco, 2001).

## **1914**

Second International Training Course is held at Castel Sant' Angelo in Rome (Trabalzini, 2011; Gutek & Gutek, 2016). Mabel Hubbard, Alexander Graham Bell's wife, is in attendance. Hubbard later opens two Montessori schools, one in Washington D.C. and another in Nova Scotia (Appelbaum, 1971; Trabalzini, 2011).

May: Women's Congress takes place in Rome. Dr. Montessori provides a reception for American delegates to repay the hospitality received during the American tour. All American students in her training are in attendance as well (Matheson & Zimmerman, 1986).

Montessori training course is conducted in Milan (Trabalzini, 2011).

A conference in England titled New Ideals in Education is convened which discusses the theory and practice of Maria Montessori (Holmes, 1995).

*Dr. Montessori's Own Handbook* (Montessori 1914/2011) is published in New York to distinguish her work from the writings of Fisher's book (Gutek & Gutek, 2016).

The first Children's House opens in the Netherlands (Trabalzini, 2011).

## **1915**

March 1: The Children's House in the *Casa della Maternita* is opened under the direction of Maccheroni with the authority of Father Casulleras. Maccheroni experiments using liturgy to teach young children in Barcelona (Trabalzini, 2011). Another title of the school is noted as "The children's house in the church" (Montessori, 1965b).

April 11: Montessori departs Naples for second trip to the United States (Montessori, 2015).

April 19: Montessori arrives in New York on the passenger ship Duca degli Abruzzi (Montessori, 2015).

April 20: Dr. Montessori speaks at a Montessori Teachers Conference in New York (Montessori, 2015).

April 21: Dr. Montessori visits P.S. 45 in the Bronx visits Angelo Patri, then travels by train to Chicago (Montessori, 2015).

April 23: Dr. Montessori participates in a reception in her honor at the Blackstone Hotel (Montessori, 2015).

April 24: Montessori goes onwards to San Francisco via train from Chicago (Montessori, 2015).

April 25: Montessori arrives in San Francisco.

April 26: Montessori leaves San Francisco and travels to Los Angeles to provide lecture classes on educational theory and practice (Montessori, 2015).

May 6: Dr. Montessori participates in a reception in Pasadena, California (Montessori, 2015).

May 7: Dr. Montessori gives her first lecture in California (Montessori 2015).

May 23: Italy joins the first World War (Montessori, 2015).

August 16-27: Dr. Montessori addressed the International Kindergarten Union and the National Educational Association (NEA) held in Oakland, California. The full proceedings can be found in the *Journal of Proceedings and Addresses of the Fifty-Third Annual Meeting and International Congress on Education*. Dr. Montessori's lectures are entitled: "My system of education", "The mother and the child", "Education in relation to the imagination of the little child", "The organization of intellectual work in school" (Matheson & Zimmerman, 1986). The lecture entitled "The mother and the child" emphasizes the care of the newborn child and the first three years of development.

August - November: Third International Course in San Francisco is conducted on the grounds of the Panama-Pacific International Exposition (Matheson & Zimmerman, 1986).

The famous glass pavilion at the Panama-Pacific International Exposition in San-Francisco is created. A Montessori classroom is observed by visitors.

November 25: Alessandro Montessori, Dr. Montessori's father, passes away. (Kramer, 1976/1988 Montessori, 2015)

December 20: Dr. Montessori leaves for Spain (Montessori, 2015).

## **1916**

Dr. Montessori writes *L'Autoeducazione nelle scuole elementari*, translated as *The advanced method I and II* (Schnepf, 2010; Trabalzini, 2011).

The Fourth International Course is held in Barcelona (Trabalzini, 2011).

Dr. Montessori moves to Barcelona until the coup in 1936 (Pendleton, n.d.).

### **1916 – 1917**

Dr. Montessori works alternately in Spain and in the United States directing the Seminari Laboratori di Pedagogia (Lillard, 1972).

### **1917**

Freud writes to Dr. Montessori saying that he and his daughter, Anna, a child psychoanalyst, are followers and supporters of her educational method favoring a better humanity.

Dr. Montessori publishes *The advanced Montessori method: Spontaneous activity in education* (1964). The first ten pages are written specifically about the infant.

Dr. Montessori travels for the third time to the United States (Trudeau, 1984).

Meets Dutch biologist, Hugo Vries, and begins exploring the concept of sensitive periods (Honegger Fresco, 2017).

### **1918**

Dr. Montessori receives a private audience with Pope Benedict XV. Montessori receives an apostolic blessing for *Il Metodo della Pedagogia Scientifica* (Trabalzini, 2011).

June 26: *La Societa Amici del Metodo Montessori*, translated as *The society of friends of the Montessori method*, is formed in Naples (Povell, 2010).

### **1919**

International Course in London is held with 250 students, chosen from 2000 applicants. This is the first year in London and is conducted every alternate year until 1939 (Maccheroni, 1947).

The Society of the Friends of the Montessori Method begins plans and sends invitations to have a course conducted in Naples, the first course in Naples occurs in 1923 (Trabalzini, 2011).

### **1920**

Montessori lectures at Amsterdam University.

New Education Fellowship (NEF) now known as World Education Fellowship, is founded by Beatrice Ensor and Dr. Montessori becomes an active member (Röhrs, 1995). This membership is documented to occur in 1922 by NAMTA.

### **1921**

Dr. Montessori provides training courses in London and Milan.

Dr. Montessori participates in the first International Congress of New Education in Calais (Honegger Fresco, 2017; Kramer, 1976/1988).

Dr. Montessori speaks to parents in Belgium and Austria about newborns and young children in the family (Centro Nascita Montessori, n.d.)

## **1922**

Montessori publishes *Bambini Viventi nella Chiesa in Naples*. This is later published in English as *The Child in the Church*.

First Montessori school opens in Austria.

April 22: Dr. Montessori appoints Government Inspector of Schools in Italy by Antonio Anile (Lillard, 1972; Povell, 2010)

Dr. Montessori speaks at several conferences in Naples (Trabalzini, 2011).

First Montessori conference is held in Germany (Trabalzini, 2011).

## **1923**

Montessori receives Doctor Honoris Causa from the University in Durham.

Dr. Montessori conducts several conferences in Brussels, later collected and published in the book *The Child in the Family* (Trabalzini, 2011).

Dr. Montessori lectures in Vienna.

Montessori training course is held in Naples (Trabalzini, 2011).

## **1924**

Dr. Montessori founds and publishes a journal entitled *The call of education, psycho-pedagogical journal international organ of the Montessori movement*. The journal is published in English, French and Italian (Trabalzini, 2011).

Montessori training course is held in Amsterdam.

Mussolini meets with Dr. Montessori, resulting in official recognition and widespread establishment of Montessori schools by the Italian government. *Ente Morale Opera Montessori* was set up in Rome for the propaganda and dissemination and safeguarding the Montessori method (Trabalzini, 2011).

First Montessori school opens in Germany under the direction of Clara Grunwald. All Montessori schools begin to close in 1930 due to the Nazi regime (Trabalzini, 2011).

## **1925**

Dr. Montessori holds training course in London. Mario Montessori, her son, is in attendance and receives his Montessori diploma.

First Montessori International congress is held in Helsinki in collaboration with the New Education Fellowship (Honegger Fresco, 2017; Standing, 1957/1998).

Dr. Montessori visits New York and meets with poet Rabindranath Tagore (Trabalzini, 2011).

## **1926**

February 21: Montessori training course is conducted in Milan (Trabalzini, 2011).

Dr. Montessori travels to Argentina to attend conferences (Trabalzini, 2011).

Dr. Montessori speaks on Education and Peace at the League of Nations.

The third edition of *The Montessori Method* is published. Chapters are edited, and a chapter added entitled *Religious Education*. Much of the chapter is taken from her 1922 book, *The Child in the Church* and Montessori adds a discussion about a religious sensitive period (Trabalzini, 2011).

## **1927**

May: A Montessori journal is published, entitled *L'Idea Montessori (The Montessori Idea)*. The journal is published from May 1927 – August 1929 (Trabalzini, 2011).

May: Standing documents and later publishes Dr. Montessori's personal discourse on religious education, found in Chapter 3 of *The Child in the Church* (Montessori, 1922/1965c).

Dr. Montessori visits schools in Ireland for the first time, including the Montessori school of Waterford (Honegger Fresco, 2017).

Montessori Society of Argentina is founded. Dr. Montessori lectures in Buenos Aires, La Plata, and Cordoba.

## **1928**

The *Regia Scuola di Metodo Montessori*, translated as Royal School of the Montessori Method, opens in Rome and is directed by Montessori. The school also trains teachers (Trabalzini, 2011). The school closed in 1936 (Honegger Fresco, 2017)

Dr. Montessori lectures at Cambridge, The Spiritual Training of the Teacher. Notes compiled from this lecture can be found in Chapter 3 and 4 of *The Child in The Church* (Montessori, 1965c, 1965d).

Costa Gnocchi opens her 3-6 school, *apre la "Scuoletta"* or "Tiny School" in the Taverna Palace in Rome. This was the only classroom to stay open during Mussolini's rule (De Serio, 2016; The Montessori Institute, n.d.).

The book *Das Kind in der Familie*, based on Dr. Montessori's lectures given in Vienna in 1923 is published in German.

### **1929**

International Congress takes place in Elsinore, Denmark, at which time the Association Montessori Internationale (*AMI*) is founded. Mario Montessori becomes the Director General with the aim of the association to coordinate the many Montessori organizations, safeguard the Montessori educational idea, organize international training, and control the rights on publications and manufacturing of Montessori materials (Trabalzini, 2011).

*The Child in the Church* (1965) is translated into English by E.M Standing.

### **1930**

February 3: Dr. Montessori is featured on A *Time Magazine* cover (Schnepf, 2010).

Dr. Montessori lectures at the Convent of the Assumption located in Kensington, London. Notes compiled from this lecture can be found in Chapter 3 and 4 of *The Child in The Church* (Montessori, 1965d, 1965e).

The 15<sup>th</sup> International Training course is held in Rome. Adele Costa Gnocchi was in attendance (Honegger Fresco, 2001; Trabalzini, 2011).

Lectures in Vienna and meets Anna Freud, founder of child psychoanalysis and daughter of Sigmund Freud.

The British branch of *AMI* opens.

Dr. Montessori observes hospitalized newborns, infants, and toddlers at Barcelona hospital (Centro Nascita Montessori, n.d.)

### **1931**

Ghandi and Dr. Montessori meet, and visit Montessori schools in Rome (Pendleton, n.d.). Ghandi meets Montessori in London at the Round Table Talks (Trudeau, 1984).

Dr. Montessori lectures in Berlin (Pendleton, n.d.).

The 16<sup>th</sup> International Training Course is held in Rome. Adele Costa Gnocchi is in attendance (Honegger Fresco, 2001; Trabalzini, 2011). Afterwards, the Italian Ministry of Education provides approval for the course. It was later declared that the course was conducted illegally. The teacher's qualifications were not legally recognized (Trabalzini, 2011).

The 17<sup>th</sup> International Training Course is held in England. Adele Costa Gnocchi is in attendance (Honegger Fresco, 2001; Trabalzini, 2011).

Dr. Montessori publishes another Montessorian journal entitled *Montessori* (Trabalzini, 2011).

Dr. Montessori leaves Italy and does not return until 1947 (Trudeau, 1984).

### **1932**

Dr. Montessori gives a lecture entitled Peace and Education which is published by the International Bureau of Education, Geneva. Lecture notes can be found in Chapter 1 of *Education and peace* (Montessori, 2007)

The second International course is held in Nice, France (Trabalzini, 2011)

An international course is held in Nice, France (the second one in Nice).

International Montessori Congress is held in Nice, France (Honegger Fresco, 2017; Standing, 1957/1998).

*La Vita in Cristo* is published in Rome and in London in English as *The Mass Explained to Children* and in Madrid in Spanish as *Ideas Generales Sobre Mi Metodo*.

Dr. Montessori presents at the University of Lausanne and University of Zurich (Trabalzini, 2011).

### **1933**

All Montessori schools close in Germany under the Nazis regime (Schnepf, 2010; Trabalzini, 2011).

An international Montessori Training course is held in Amsterdam, the third to be held in Amsterdam.

An international Montessori Congress is held in Amsterdam (Honegger Fresco, 2017; Standing, 1957/1998; Trabalzini, 2011).

Training courses are also held in London, Dublin, and Barcelona. Notes from the Barcelona course can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 2009).

### **1934**

An international Course is held in Rome. Piaget was in attendance (Honegger Fresco, 2017).

An international Montessori Congress is held in Rome (Standing, 1957/1998; Trabalzini, 2011). Her method is banned from Italy due to her refusal to agree with the fascist political views.

### **1935**



September: DR. Montessori lectures at convent in London. Notes are transcribed into *The child Society and the World: Unpublished speeches and writings* (Montessori, 2009; Schulz-Benesch, 2008).

### **1936**

Montessori gives a course of lectures on teaching religion at Assumption College in London. Chapter 1 of *The Child in the Church* is the copulation of these lectures (Montessori, 1965b).

Fifth International Montessori Congress in Oxford, England is held. Principles of Montessori Education for Elementary and Secondary schools is developed. Adele Costa Gnocchi is present (Honegger Fresco, 2001).

Dr. Montessori leaves Barcelona for England, then Amsterdam due to the General Franco's coup. The Netherlands became Dr. Montessori's permanent residence when not traveling to promote her philosophy.

Dr. Montessori sets up a training center and model school in Laren, Netherlands, close to Amsterdam. The first Montessori Elementary training course is held there. AMI headquarters were also moved there.

*Das Kind der Familie*, is translated and published into English under the title, *The Child in the Family*.

Costa Gnocchi has *The Child in the Family* published in Umbria, Italy despite the fascist rule (Centro Nascita Montessori, n.d.).

*The Secret of Childhood* is published in London.

September 3: Montessori addresses the European Congress or Peace in Brussels. The lecture notes can be found in Chapter 2 of *Education and Peace* (Montessori, 1949/2007).

The Fascist Regime closes the *Scuola di Metodo*. Opera Montessori closes soon after (Trabalzini, 2011).

### **1937**

March 3: 22<sup>nd</sup> International Montessori course is held in London.

Parallel course to the International course in London is conducted at the Convent of the Assumption at Kensington Square. Notes can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

Sixth International Montessori Congress is held in Copenhagen, the theme being Educate for Peace". Adele Costa Gnocchi is in attendance (Honegger Fresco, 2001). Lecture notes can be found in Chapter 3& 4 of *Education and Peace* (Montessori, 1949/2007)

December 28: Dr. Montessori lectures at the International School of Philosophy in Amersfoort. Adele Costa Gnocchi is present (Honegger Fresco, 2001). Dr. Montessori's lecture notes can be found in Chapter 12 of *Education and Peace* (Montessori, 1949/2007)

### **1938**

Seventh International Montessori Congress in Edinburgh, Scotland (Honegger Fresco, 2017; Standing, 1957/1998). Adele Costa Gnocchi is in attendance (Honegger Fresco, 2001). Portions of this lecture can be found in text in *The Four Planes of Education* (Montessori, M. M., 1971).

November 18: 1<sup>st</sup> Montessori training course in Laren, Netherlands takes place. Excerpts from this course can be found in *The Child, Society, and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

### **1939**

March: Dr. Montessori gives a lecture in London, England. Portions of the lecture can be found in text in *The Four Planes of Education* (Montessori, M. M., 1971).

November, International Training course given in Rome and taught by Adele Costa Gnocchi and Maria Antoinietta Paolino. Dr. Montessori signs the diplomas. Gianna Gobbi participates in the training course (Honegger Fresco, 2001).

November 14: Dr. Montessori is invited to give the first course in India by the Theosophical Society. The course was held in Kalakshetra, Madras near Adyar, now Chennai, at the Anne Besant School (AMI, 2008; Indian Montessori Federation, n.d.; Schnepf, 2010)) and ran concurrently with the course in Rome (Grazzini, 2004, Schulz-Benesch, 2008).

*God en het Kind (God and the child)* and *The Erdkinder and the functions of the university: The reform of education during and after adolescence* is published in the Netherlands.

Costa Gnocchi stays in touch with Dr. Montessori, communicating about the education of children under the age of three. Costa Gnocchi begins enrolling toddlers in her school and leading the young classroom (Honegger Fresco, 2001).

Dr. Montessori publishes *From Childhood to Adolescence* and *Education and Peace*.

### **1940**

Dr. Montessori presents lectures at Assumption College on Religious education. Portions of the manuscript are found in Chapter 13 in *The Child in the Church* (Montessori, 1965f), however this contradicts the Indian Montessori Foundation (n.d.) timeline of Montessori's travels in India.

### **1941**

February: Dr. Montessori lectures at University of Madras. Excerpts of notes can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

Italy enters the Second World War, and as an Italian, Dr. Montessori was confined in Madras, currently Chennai. Her son, Mario, is returned to her from a concentration camp as her 70th birthday present.

Adele Costa Gnocchi's school remains operational until 1941. Costa Gnocchi enrolls children for classrooms for toddlers, preschool and elementary and began experimenting with the Montessori practice for middle school children. Gianna Gobbi led a classroom of toddlers (Honegger Fresco, 2001).

First course given in Ahmadabad (Trudeau, 1984); however, this is not supported by Indian Montessori Foundation (n.d.) with the third and only *AMI* course being held in Adyar that year.

Costa Gnocchi's school closes due to bombing from 1941- 1942 (Honegger Fresco, 2001).

### **1942**

January 1: India Montessori training course take place in Adyar, Madras. Excerpts from lectures can be found in *The child, society and the world: Unpublished Speeches and Writings* (Montessori, 1979/2009).

*Reconstruction in Education* is published in India.

### **1944**

April: Sixth *AMI* Course is held in India, in Ahmadabad. Later transcribed and published as *The Absorbent Mind* (Schnepf, 2010), this information is contradicted by others stating that the 1948 Montessori course in Ahmadabad was the course translated into *The Absorbent Mind* (Trabalzini, 2011).

July: Dr. Montessori delivers lectures in Sri Lanka that concludes in September (Tradeau, 1984) and are transcribed as *What You Should Know About Your Child* (Prakasam, 1949/2007). There are other historical documents that contradict this (Schnepf, 2010).

### **1945**

All India Montessori Conference is held in Jaipur (Kramer, 1976/1988). Excerpts from this course can be found in *The Child, Society and the World* (Montessori, 1979/2009).

### **1946**

Dr. Montessori's course lecture in India on *cosmic education* can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

*Education for a New World* is published in India.

Dr. Montessori visits Scotland.

A series of lectures entitled "The child: guidelines for a harmonious development" is given by Costa Gnocchi at Palazzo Taverna (Barchiesi, 2013).

March – June: Course held in Karachi, India. Complete transcription found in *Dr. Maria Montessori's 1946 lectures – Karachi, India* (Kripalani, 2002).

July 30: Dr. Montessori returns to Europe (Kramer, 1976/1988; Trabalzini, 2011).

Montessori Opera is reopened in Italy (Trabalzini, 2011).

December 10: A training course is held in London and a parallel course is given in Edinburgh (Standing, 1957/1998). Some of the London course notes can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 2009).

### **1947**

July: AMI Training course in Adyar, India is conducted by Jer Garda.

Montessori Centre in London is established by Maria and Mario Montessori (Pendleton, n.d.).

Costa Gnocchi opens La Scuola Assistenti all'Infanzia in Rome. This becomes the model for all other Assistant to Infancy training programs (AMI, 2013). Centro Nascita Montessori (n.d.) has this date as 1949. Grazia Honegger Fresco, along with Rita Carusi, Rosa Maria Muzzarelli, Anna Di Palermo, Rosa Donadoni are the first AIM educators to work with children under 36 months (Honegger Fresco, 2017).

### **1948**

Training course in Ahmedabad, Madras and Poona, India takes place. Montessori lectures in Bombay (Indian Montessori Foundation, n.d.). The training and lessons in Ahmedabad collectively were titled The Absorbent Mind focusing on infants. The training in Madras and Poona was for elementary teachers (Honegger Fresco, 2017)

Model school opens in Gwalior under the supervision of Dr. Montessori.

Dr. Montessori visits Montessori Training Centre and model school in Ceylon, India.

*The Discovery of the Child, To Educate the Human Potential* and *What You Should Know About Your Child\** and *Child Training* are published in India (Kramer, 1976/1988).

*\*What You Should Know About Your Child* is a compilation of notes from Montessori's course focusing on infants in Ceylon, given the same year, compiled and translated by Ghana Prakasam (Schnepf, 2010).

Costa Gnocchi's AIM (*Assistenti all' Infanzia Montessori*) School or (National School Assistant to Infancy or The Montessori Assistant Training College) is opened. Montessori is added to the title later. The school's intent is to train educators working with infants, toddlers and their mothers (Honegger Fresco, 2001). De Serio (2016) indicated this occurred in 1949.

### **1949**

August: International Congress is held in San Remo, Italy: “Man’s formation in the reconstruction of the world.” At the conference Dr. Montessori meets with Costa Gnocchi about the work at the “little school.” Dr. Montessori stated, “It is a great task, the protection of the newborn, do not forget it, but carry it forth, as far as possible” (Honegger Fresco, 1990). Costa Gnocchi and Dr. Vitetti report to the congress about their work at AIM (Honegger Fresco, 2001).

*Education and Peace* first published in Italy under the title *Educazione e Pace* (Centro Nascita Montessori, n.d.).

*The absorbent mind* is published in India and *The Formation of Man* are published.

Dr. Montessori is nominated for the Nobel Peace Prize.

Dr. Montessori is awarded the French Legion of Honor and Dutch Order of Orange-Nassau (Honegger Fresco, 2001).

Training course is held in Pakistan assisted by Mario Montessori and Albert Joosten.

Dr. Montessori gives a public lecture in Paris. Notes can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

### **1950**

Eighth International Montessori Congress is held in San Remo, Italy.

Dr. Montessori becomes a member of the Italian Delegation at the UNESCO meeting in Florence about the International Year of the Child”.

International Conference in Amsterdam is held in honor of Dr. Montessori’s 80th birthday.

Dr. Montessori is nominated for the Nobel Peace Prize for a second time.

Dr. Montessori lectures in Scandinavia and Innsbruck (Trabalzini, 2011).

April 15: Dr. Montessori speaks on a radio broadcast on World Radio. Excerpt from the broadcast can be found in *The Child, Society and the World* (Montessori, 1979/2009).

September 18: Dutch Order of Orange-Nassau is awarded to Dr. Montessori, as well as a Doctor Honoris Causa granted by the University of Amsterdam (Trabalzini, 2011).

A.M. Joosten takes over AMI Montessori training in India (Indian Montessori Foundation, n.d.).

### **1951**

April – June: Rome training course is held. Excerpts from this course can be found in *The Child, Society and the World: Unpublished speeches and writings* (Montessori, 1979/2009).

June: Dr. Montessori attends the first UNESCO governing board meeting in Wiesbaden (AMI, 2005).

December: Dr. Montessori writes to UNESCO in response to an invitation “The forgotten citizen” (AMI, 2005).

Last training course run by Dr. Montessori is held in Innsbruck, Austria.

Dr. Montessori is nominated for the Nobel Peace Prize for the third time.

Ninth International Congress in London is held, this is Dr. Montessori’s last public engagement.

### **1952**

May 6: Dr. Montessori dies at Noordwijk Zee in the Netherlands. On her tomb is written, "I beg the dear all-powerful children to unite with me for the building of peace in Man and in the World."

### **1953**

Tenth International Montessori Congress is held in Paris

### **1954**

Centre for the Catechesis of the Good Shephard is founded in Rome. Promoted by Sofia Cavalletti, Gianna Gobbi and Adele Costa Gnocchi (Cavaletti, Coulter, Gobbi, Montanaro, 1995).

Formation of Man is published in English.

### **1955**

Silvana Quattrocchi Montanaro is asked to teach the hygiene lectures at the Montessori Training School for Assistant to Infancy in Rome by Adele Costa Gnocchi (Montanaro, 2002).

### **1957**

Costa Gnocchi establishes the Centro Nascita Montessori, or Montessori Birth Center (Honegger Fresco, 2001; AMI, 2013). In 1961 it officially takes the name.

### **1960**

Costa Gnocchi’s AIM school becomes a state school (Centro Nascita Montessori, n.d.).

Costa Gnocchi opens Centro Nascita Montessori (The Montessori Birth Center) in Rome. A center for research on newborns and Assistant formation (Centro Nascita Montessori, n.d.)

### **1963**

March 21: Costa Gnocchi found the Montessori Association for the Religious Education of the Child (Honegger Fresco, 2001).

Elena Gianini Belotti is entrusted to manage the Centro Nascita Montessori (Honegger Fresco, 2001).

Rita Brandimarte receives her Assistants to Infancy diploma in Rome under Adele Costa Gnocchi at AIM (Centro Nascita Montessori, n.d.; Honegger Fresco, 2001; Varga, 1998).

### **1964**

The Montessori Assistant Training College is closed (De Serio, 2016).

### **1965**

Dr. Cesare Pignocco presents at the 8<sup>th</sup> National Montessori Congress in Ancona about the work and training at Centro Nascita Montessori (Honegger Fresco, 2001).

### **1966**

First Birth to Three AMS environment opens in Dayton Ohio by Rita Brandimarte Messineo who had received training from Costa Gnocchi in 1963 (Honegger Fresco, 2001; Varga, 1998).

AIM publishes *These are our children*”, about newborns and children in the first three years of life according AIM School (Centro Nascita Montessori, n.d.).

### **1967**

March 7: Adele Costa Gnocchi passes away in Rome (AMI, 2013; Montanaro, 2002).

The US Patent and Trademark Trial and Appeal Board deny exclusive trademark and registration of the term Montessori to any one organization.

### **1970**

The original Casa dei Bambini opening on January 6, 1907 is re-opened on January 6, 1970 (Honegger Fresco, 2001).

### **1975**

Jane Mack, Pam Wyse, Rita Brandimarte Messineo and Virginia Varga conduct a four-week workshop of birth to three environments in Dayton, Ohio under the approval of AMS (Varga, 1998).

### **1976**

May: Jane Mack, Pam Wyse, Rita Brandimarte Messineo and Virginia Varga visit Italy and the Montessori Birthing Center (Centro Nascita Montessori, n.d.; Varga, 1998).

Rita Kramer writes Maria Montessori’s biography.

### **1977**

Centro Nascita Montessori and Associazione Centro Nascita Montessori organize training courses for medical and social workers at maternity and pediatric hospitals, as well as daycare teachers and parents (Centro Nascita Montessori, n.d.).

**1979**

June 9: The AMS conducts a birth to three Seminar at the University of Dayton, Ohio

Dr. Montanaro is invited by *AMI/USA* to the United States (Stephenson, 2013). Dr. Montanaro gave a one-week Infant and Toddler Workshop in Tarry Town, NY. Forty participants attended (Varga, 1989). The same event is listed as a two-week event in *The Joyful Child* p 271 (Stephenson, 2013).

Dr. Montanaro, Adele Cost Gnocchi, Lia Celli and Gabriela Bartoli conduct A-I course in Rome. Out of the eight in attendance, six were Americans, including Judi Orion who became an *AMI* teacher trainer (The Montessori Institute, n.d.). This event is listed as occurring in 1980 in *The Joyful Child* (Stephenson, 2013).

The AMS grants permission to CMTE/NY to provide teacher training for birth to three environments (Varga, 1998).

**1980**

*AMI* Assistants to Infancy diploma course is conducted in Rome (The Montessori Institute, n.d.). Documentation from Centro Nascita Montessori (n.d.) states this was 1983.

UNICEF 'Convention on the Rights of the Child' are adopted directly from Dr. Montessori's writings (Barres, 2004).

**1981**

CMTE/NY host their first Birth to Three Teacher Training program with eight participants conducted by Ginny Varga (Centro Nascita Montessori, n.d.; Varga, 1998).

**1982**

Grazia Honegger Honegger Fresco runs seminar for Centro Nascita Montessori at Cleveland University in Ohio (Centro Nascita Montessori, n.d.).

**1983**

First *AMI* Assistants to Infancy course held in the US in Texas is conducted by Judi Orion, Gianna Gobbi and Dr. Montanaro (Lillard, & Jessen, 2009; The Montessori Institute, n.d.). This course was listed as being conducted in 1981 in two separate documents (Slabaugh, 2013, Stephenson, 2013).

**1984**

Quaderno Montessori magazine begins publication.

**1990**

Dr. Montessori is honored in Italy and is placed on the 1,000 Lire paper currency note.

**1994**

January 29: Gianna Gobbi, original pioneer of the *A-I* movement passes away (Barchiesi, 2013).



July: Grazia Honegger Honegger Fresco comes to the United States and lectures at CMTE/NY, an AMS approved training (Varga, 1998).

### **1996**

International Montessori Congress is held in Rome and sponsored by the Centro Nascita Montessori and CMTE/NY (Varga, 1998).

Grazia Honegger Honegger Fresco visits the US for a second time (Varga, 1998).

### **2005**

In the United States, Community Playthings begins making Montessori birth to three furniture (J. Maendel of Community Playthings, personal communication, April 12, 2016).

\*The only books Montessori wrote are *The Montessori Method*, *The Advanced Montessori Method* and *Montessori's Own Handbook*. All other books are compilations of lecture notes transcribed and translated by students and colleagues. There is discussion in the academic community about the validity of the translations and accurate account of the content (Feez, 2007; Schnepf, 2010).

## Appendix A

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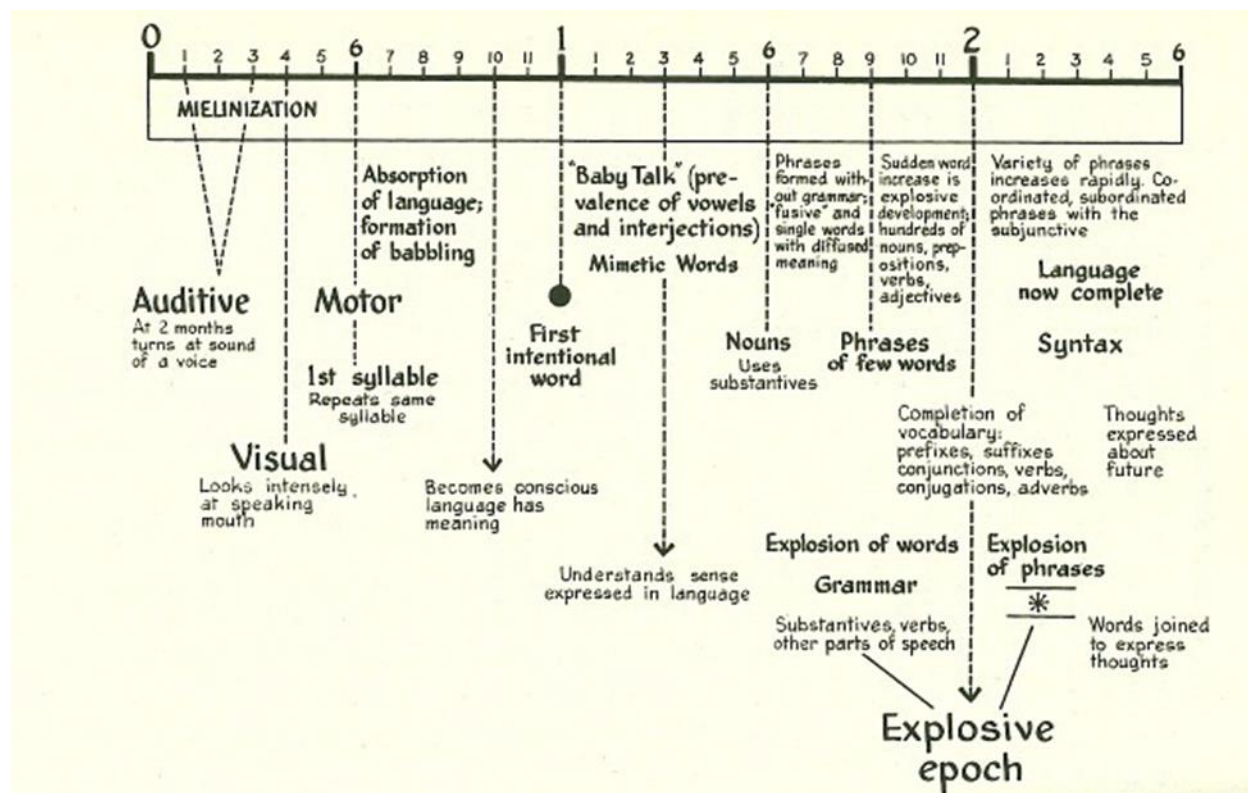
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## Appendix B

### Dr. Montessori's Language Development Chart



Dr. Montessori's figure for the development of language introduced in the *Absorbent Mind* (Montessori, 1997, p 113).

## Appendix C

### Permission Letters for Student and Staff Participation.



Dear Parents/Guardians,

Your child is being asked to volunteer in a research study called *From Birth to Three Language Acquisition: Influence of Ambient Language in the Montessori Setting*, conducted by Claudine Campanelli, a doctoral student in the Interdisciplinary Educational Studies at LIU Post under the supervision of Dr. Lynn Cohen, Professor, Interdisciplinary Studies at LIU Post. The purpose of this research is to add to current research of the effectiveness of pedagogical techniques. As a Montessorian, I strive to add to current understanding on improving education for children. I am conducting a research study on infant and toddler language acquisition in multi-age classrooms, specifically focused on ambient language in Montessori settings. The ambient language (language overheard by the child) will be measured using the LENA™ system. The LENA™ system is a device that will record and track all language spoken in the room by the teachers and children. The tool tracks how much language is spoken and will assist in the measurement of ambient language in the classroom. The LENA™ tool is a wearable device that does not hinder normal classroom participation.

#### What Will Be Asked of Your Child

Only the youngest and oldest child on each given day will be asked to wear the LENA tool. The LENA tool will be placed inside the wearable cotton vest. There will be no discomfort to your child as the tool weighs less than 3 Oz. This will be worn for two hours each morning. If your child refuses to wear the vest, your child will not be forced or coerced to wear it. Language materials will be added to the classroom for three-weeks between February 1, 2019 and May 31, 2019. A typical Three-period lesson will be observed two times during the study. This lesson will be observed and annotated by myself to determine the number of children that could accurately identify verbally or by pointing to the target language objects. Classroom observations and the LENA™ tool will be used to evaluate and measure ambient language. The assessment will occur during school hours and there will be no interference in classroom routines or risks to have your child participate in this study. While there is no direct benefit to

your child for participation in the study, it is reasonable to expect that the results may provide information of value for the field of language acquisition and early childhood development.

#### Your Child's Identity Will Remain Confidential

Your child's identity as a participant will remain confidential. Their name will not be included in any forms, questionnaires, or other study-related documents other than this consent form. This consent form is the only document identifying your child as a participant in this study; and it will be stored securely in the researcher's home office available to the researcher and faculty advisor. Data will be collected and stored on a password protected computer which sole purpose is for the study. The computer will be stored in a locked safe in the researcher's home office. The data will be destroyed at the end of the legally prescribed 3 years. Results will be reported in the dissertation and subsequent publications related to this study. If you are interested in these results, you may contact Claudine Campanelli, the principal investigator.

#### What If You Have Questions?

Please feel free to contact me if you have any questions or require additional information:

If you have questions about the research you may contact the investigator, Claudine Campanelli:

[Claudine.campanelli@my.liu.edu](mailto:Claudine.campanelli@my.liu.edu), (516) 456 9611 or Dr. Lynn Cohen at LIU Post at (516) 299 3675. If you have questions concerning your child's rights as a subject, you may contact the Institutional Review Board Administrator, Lacey Sischo at (516) 299-3591.

Your child's participation in this research is voluntary. Refusal to participate or discontinue participation at any time will involve no penalty or loss of benefit to which they are otherwise entitled.

Your signature indicates you have fully read the above text and have had the opportunity to ask questions about the purpose and procedures of this study. Your signature also acknowledges receipt of a copy of the consent form as well as willingness for your child to participate.

Sincerely,

Claudine Campanelli

---

Please sign and return this permission form to your child's teacher

\_\_\_\_\_ I understand the LENA™ tool is an audio recording device, and the participation of my child is voluntary. **I give consent** for my child to participate in the language study conducted by Ms. Campanelli., to be observed and the use of LENA™ recording device.

\_\_\_\_\_ I understand the LENA™ tool is an audio recording device, and the participation of my child is voluntary. **I do not give consent** for my child to participate in the language study conducted by Ms. Campanelli, including observations and the use of the LENA™ recording device.

\_\_\_\_\_  
Child's Name

\_\_\_\_\_  
Parent Name

\_\_\_\_\_  
Parent Signature/Date

Claudine Campanelli  
\_\_\_\_\_  
Typed/Printed Name of Investigator

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Investigator

\_\_\_\_\_  
Date



Dear Staff member,

You are being asked to volunteer in a research study called *From Birth to Three Language Acquisition: Influence of Ambient Language in the Montessori Setting*, conducted by Claudine Campanelli, a doctoral student in the Interdisciplinary Educational Studies at LIU Post under the supervision of Dr. Lynn Cohen, Professor, Interdisciplinary Studies at LIU Post. The purpose of this research is to add to current research of the effectiveness of pedagogical techniques. As a Montessorian, I strive to add to current understanding on improving education for children. I am conducting a research study on infant and toddler language acquisition in multi-age classrooms, specifically focused on ambient language in Montessori settings. The ambient language (language overheard by child) will be measured using the LENA<sup>TM</sup> system. The LENA<sup>TM</sup> system is a device that will record and track all language spoken in the room by the teachers and children. The tool tracks how much language is spoken and will assist in the measurement of ambient language in the classroom. The LENA<sup>TM</sup> tool is a wearable device that does not hinder normal classroom participation.

#### What Will be Asked of You

You will be requested participate in an informational session about the study. The session will review the purpose of the study, the Montessori Three-period, how to pronounce the target words, how to turn on the digital recorder, how to place it in the wearable vest, and how to charge it when not in use. The recorder will only be worn by the children and not the teaching staff. Only the youngest and oldest child on each given day will be asked to wear the LENA tool. The LENA tool will be placed inside the pocket of the wearable cotton vest. There will be no discomfort to the child as the tool weighs less than 3 Oz. This will be worn for two hours each morning. If the child refuses to wear the vest, the child will not be forced or coerced to wear it.

Language materials will be added to the classroom for three-weeks between February 1, 2019 and May 31, 2019. One basket with five objects with assigned nonsense target words. A typical Three-period lesson will be observed two times during the study. This lesson will be observed and annotated by myself to determine the number of children that could accurately identify verbally or by pointing to the target language objects. Classroom observations and the LENA™ tool will be used to evaluate and measure ambient language.

The assessment will occur during school hours and there will be no interference in classroom routines or risks to you to participate in this study. While there is no direct benefit to you for participation in the study, it is reasonable to expect that the results may provide information of value for the field of language acquisition and early childhood development.

#### Your Identity Will Remain Confidential

Your identity as a participant will remain confidential. Names will not be included in any forms, questionnaires, or other study-related documents other than this consent form. This consent form is the only document identifying you as a participant in this study; and it will be stored securely in the researcher's home office available to the researcher and faculty advisor. Data will be collected will be stored on a password protected computer, locked in a safe at the researcher's home office. Data from the study will be destroyed at the end of the legally prescribed 3 years. Results will be reported in the dissertation and subsequent publications related to this study. If you are interested in these results, you may contact Claudine Campanelli, the principal investigator.

#### What If You Have Questions?

Please feel free to contact me if you have any questions or require additional information:

If you have questions about the research you may contact the investigator, Claudine Campanelli: [Claudine.campanelli@my.liu.edu](mailto:Claudine.campanelli@my.liu.edu), (516) 456 9611 or Dr. Lynn Cohen at LIU Post at (516) 299

3675. If you have questions concerning your child's rights as a subject, you may contact the Institutional Review Board Administrator, Lacey Sischo at (516) 299-3591.

Your participation in this research is voluntary. Refusal to participate or discontinue participation at any time will involve no penalty or loss of benefit to which they are otherwise entitled.

Your signature indicates you have fully read the above text and have had the opportunity to ask questions about the purpose and procedures of this study. Your signature also acknowledges receipt of a copy of the consent form as well as willingness for you to participate.

Sincerely,  
Claudine Campanelli

---

Please sign and return this permission form to your child's teacher

\_\_\_\_\_ I understand the LENA™ tool is an audio recording device and that my participation is voluntary. **I give consent** to participate in the language study conducted by Ms. Campanelli., to be observed and the use of LENA™ recording device.

\_\_\_\_\_ I understand the LENA™ tool is an audio recording device, and my participation is voluntary. **I do not give consent** to participate in the language study conducted by Ms. Campanelli, including observations and the use of the LENA™ recording device.

---

Staff Name

---

Staff Signature /Date

---

Claudine Campanelli

---

Typed/Printed Name of Investigator

---

Date

---

Signature of Investigator

## Appendix D

### LIU IRB Approval Letter

LONG ISLAND UNIVERSITY  
UNIVERSITY OFFICE OF SPONSORED PROJECTS  
BUSH-BROWN HALL, UNIVERSITY CENTER

**NOTICE TO ALL RESEARCHERS:**

*Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation, suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.*

**TO:** Dr. Lynn Cohen  
Claudine Campanelli (Student Investigator)

**FROM:** Dr. Lacey Sischo, IRB Administrator  
LIU Institutional Review Board

**DATE:** February 28, 2019

**PROTOCOL TITLE:** Birth to three language acquisition: Influences of ambient language in the Montessori setting

**PROJECT ID NO:** P 18/12-207

**REVIEW TYPE:** Expedited

**ACTION:** Approved

With the receipt of the additional information, your project has been given **expedited approval** as defined in 45 CFR 46.110 (Category 7). Please note the following:

1. Approval for sites other than Long Island University, if any, is given only for those indicated in the original application and from which appropriate letters of approval have been received by the IRB.
1. Your approval period for this project expires **February 27, 2020** unless you submit an appropriate continuation request. No activities involving human participants may take place after this expiration date.
2. The project must be conducted as presented in the application. No changes or alterations may be made to study methods, recruitment process, subject pool, test instruments, consent forms, etc. without prior IRB approval. Revisions and amendments to the research activity must be promptly reported to the IRB for review and approval prior to the commencement of the revised protocol (the only exception is in those situations where changes in the protocol are required to eliminate apparent, immediate hazards to the subject).

The IRB must be notified immediately of any unanticipated problems or adverse events affecting risk to subjects.



3. If consent form(s) have been approved for the research activity, only IRB approved, stamped consent forms may be used in the consent process (copy attached if appropriate). Please destroy all previous versions. Make sure to retain a copy of the approved, stamped consent document, as it must be submitted to the IRB at the time of submission of your annual renewal. One signed copy of the stamped form must be given to the subject, one must be placed in subject's file/chart (if appropriate), and the principal investigator must keep one. You are responsible for maintaining signed consent forms for a period of at least three years after study completion.
  4. If consent is on-line, the on-line form should include language/indication of the IRB approval and expiration date as would be found on a hard-copy/paper form.
- 



#### Verification of Institutional Review Board (IRB) Approval

**LIU Protocol ID:** P 18/12-207

**Protocol Title:** Birth to three language acquisition: Influences of ambient language in the Montessori setting

**Expiration Date:** February 27, 2020

**Signature:** \_\_\_\_\_

A handwritten signature in cursive script, appearing to read "Lacey Sischo", is written over a horizontal line.

**Name/Title:** Lacey Sischo, PhD, IRB Administrator

Phone: (516) 299-3591  
Fax: (516) 299-3101  
E-mail: lacey.sischo@liu.edu

Appendix E  
International Phonetic Alphabet

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC)

© 2005 IPA

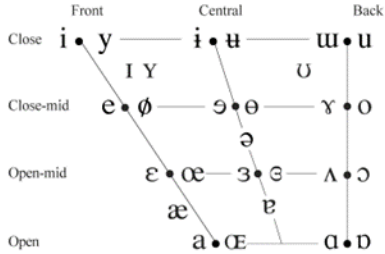
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	ɓ Bilabial	ʼ Examples:
ǀ Dental	ɗ Dental/alveolar	ɓʼ Bilabial
ǃ (Post)alveolar	ɗʰ Palatal	ɬʼ Dental/alveolar
ǂ Palatoalveolar	ɠ Velar	kʼ Velar
ǁ Alveolar lateral	ʄ Uvular	sʼ Alveolar fricative

VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

OTHER SYMBOLS

ɱ Voiceless labial-velar fricative	ɕ ʑ Alveolo-palatal fricatives
ɰ Voiced labial-velar approximant	ɺ Voiced alveolar lateral flap
ɥ Voiced labial-palatal approximant	ɺɻ Simultaneous ʃ and x
ħ Voiceless epiglottal fricative	
ʕ Voiced epiglottal fricative	Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.
ʡ Epiglottal plosive	

kp ts

SUPRASEGMENTALS

- ˈ Primary stress
- ˌ Secondary stress
- ː Long
- ˑ Half-long
- ˚ Extra-short
- ˘ Minor (foot) group
- ˙ Major (intonation) group
- Syllable break
- ˌ Linking (absence of a break)

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ɲ̥

◌ <sup>◌</sup> Voiceless	◌̥ ◌̜	◌̤ Breathy voiced	◌̤ ◌̜	◌̦ Dental	◌̦ ◌̜
◌̤ Voiced	◌̤ ◌̜	◌̥ Creaky voiced	◌̥ ◌̜	◌̧ Apical	◌̧ ◌̜
◌̧ Aspirated	◌̧ ◌̜	◌̨ Linguolabial	◌̨ ◌̜	◌̩ Laminar	◌̩ ◌̜
◌̨ More rounded	◌̨ ◌̜	◌̩ Labialized	◌̩ ◌̜	◌̪ Nasalized	◌̪ ◌̜
◌̩ Less rounded	◌̩ ◌̜	◌̪ Palatalized	◌̪ ◌̜	◌̫ Nasal release	◌̫ ◌̜
◌̪ Advanced	◌̪ ◌̜	◌̫ Velarized	◌̫ ◌̜	◌̬ Lateral release	◌̬ ◌̜
◌̫ Retracted	◌̫ ◌̜	◌̬ Pharyngealized	◌̬ ◌̜	◌̭ No audible release	◌̭ ◌̜
◌̬ Centralized	◌̬ ◌̜	◌̭ Velarized or pharyngealized	◌̭ ◌̜		
◌̭ Mid-centralized	◌̭ ◌̜	◌̮ Raised	◌̮ ◌̜	(ɹ̥ = voiced alveolar fricative)	
◌̮ Syllabic	◌̮ ◌̜	◌̯ Lowered	◌̯ ◌̜	(β̥ = voiced bilabial approximant)	
◌̯ Non-syllabic	◌̯ ◌̜	◌̰ Advanced Tongue Root	◌̰ ◌̜		
◌̰ Rhoticity	◌̰ ◌̜	◌̱ Retracted Tongue Root	◌̱ ◌̜		

- ˥ Extra high
- ˦ High
- ˧ Mid
- ˨ Low
- ˩ Extra low
- ˩˥ Downstep
- ˩˦ Upstep
- ˨˩ Rising
- ˨˦ Falling
- ˨˧ High rising
- ˨˨ Low rising
- ˨˩˦ Rising-falling
- ˩˥˦ Global rise
- ˩˦˨ Global fall

**Appendix F**  
**Montessori Three-period Lesson Fidelity Tool (B-3)**

**Classroom ID** \_\_\_\_\_ **Observer:** \_\_\_\_\_ **Date** \_\_\_\_\_  
**SCORE** \_\_\_\_\_

Directions: Researcher and Montessori trained individual observes the Three-period lesson being conducted in the classroom. Using a Likert type scale and the 12 questions below, document each observation of the three-period lesson by circling the best response.

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

1. Language shelves are not cluttered but are appealing and inviting

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

2. There is a variety of choice- language materials for each category (at least 4 sets per category - objects, cards and objects {Exact & Similar} and cards only)

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

3. Replicated items are realistic and of appropriate proportions

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

4. Language cards are realistic representations of objects

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

5. All four categories are represented: Real &/or replicated objects, Objects with exact cards, objects with similar cards and Language cards only.

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

6. Children's interest are followed through material choices

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

7. Children's interests are followed through conversations initiated or maintained

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

8. Extension games are used to extend learning

<b>Strongly Agree</b> <b>5</b>	<b>Agree</b> <b>4</b>	<b>Neutral</b> <b>3</b>	<b>Disagree</b> <b>2</b>	<b>Strongly disagree</b> <b>1</b>
-----------------------------------	--------------------------	----------------------------	-----------------------------	--------------------------------------

9. Guide invites child to language activity

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

10. Practitioner concisely practices the first lesson of the TPL (This is...)

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

11. Practitioner concisely practices the second lesson of the TPL (Show me...)

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

12. Practitioner concisely practices the third lesson of the TPL (What is this?)

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

13. Practitioner ends the lessons when the child does not demonstrate understanding of the first period lesson

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

14. Practitioner goes back to the first lesson when the child does not demonstrate understanding

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

15. Practitioner ends lesson when the child does not demonstrate comprehension in the second period lesson

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

16. Practitioner revisits the first lesson when the child does not demonstrate comprehension in the second period lesson

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

17. Practitioner ends lesson when the child does not demonstrate vocal mastery in the Third period of the lesson

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

18. Practitioner revisits first and second lessons when the child does not demonstrate vocal mastery in the third period of the lesson

<b>Strongly Agree</b> 5	<b>Agree</b> 4	<b>Neutral</b> 3	<b>Disagree</b> 2	<b>Strongly disagree</b> 1
----------------------------	-------------------	---------------------	----------------------	-------------------------------

## Appendix G

### Fidelity Criteria Support Documentation

Criteria	Resource
<b>Language Area of Classroom</b>	
Language shelves are not cluttered but are appealing and inviting	Bettmann, 2003, 2016
There is a variety of language materials for each category (at least 4 sets per category)	S. Brady, personal communication, August 22, 2016
Replicated items are realistic and of appropriate proportions	Campanelli, 2000
Language cards are realistic representations of objects	Campanelli, 2000; S. Brady, personal communication, August 22, 2016
All four categories are represented: Real &/or replicated objects, Objects with exact cards, objects with similar cards and Language cards only.	Campanelli, 2000; S. Brady, personal communication, August 22, 2016
<b>Engagement</b>	
Children's interests are followed through material choices	Bettman, 2003; S. Brady, personal communication, August 22, 2016,
Children's interests are followed through conversations initiated or maintained	S. Brady, personal communication, August 22, 2016
Extension games are used to extend learning	Campanelli, 2000
Guide invites child to language activity	Campanelli, 2000; S. Brady, personal communication, August 22, 2016
<b>Pedagogical Compliance of presentation</b>	
Practitioner concisely practices the first lesson of the Three Period Lesson (This is...)	Cossentino, 2005; Montessori, 1967;
Practitioner concisely practices the second lesson of the Three Period Lesson (Show Me...)	Cossentino, 2005; Montessori, 1967
Practitioner concisely practices the third lesson of the Three period lesson (What is this?)	Cossentino, 2005; Montessori, 1967
Practitioner ends the lessons when the child does not demonstrate understanding of the first period lesson	Campanelli, 2000
Practitioner goes back to the first lesson when the child does not demonstrate understanding	Jackson, 2011
Practitioner ends lesson when the child does not demonstrate comprehension in the second period lesson	Campanelli, 2000
Practitioner revisits the first lesson when the child does not demonstrate comprehension in the second period lesson	Jackson, 2011
Practitioner ends lesson when the child does not demonstrate vocal mastery in the Third period of the lesson	Campanelli, 2000
Practitioner revisits first and second lessons when the child does not demonstrate vocal mastery in the third period of the lesson	Jackson, 2011

## Appendix H

### Classroom Daily Activity Log

Classroom ID \_\_\_\_\_ (Provided by Researcher) Date: \_\_\_\_\_

Directions: For each date write down the number of times classroom staff presented the target vocabulary. Please indicate who presented the Three-Period Lesson, Lead Teacher (LT) or the Assistant Teacher (AT). Indicate changes or variables for all children in attendance.

#### Example:

Date:	12/2/2016	12/3/2016	12/4/2016	12/5/2016	12/6/2016
Times Introduced	2 (LT)	1 (AT)	1 (LT)	3 (AT)	0
Notes: Document occurrences that are not typical (change of routine or child behaviors).	J.K. new child to class	A.S. bit B.N.	AT out sick	xxx	LT pulled for meeting during Work Cycle

#### Week 1

Date:					
Times Introduced					0
Notes: Document occurrences that are not typical (change of routine or child behaviors).					

#### Week 2

Date					
Times Introduced					
Notes: Document occurrences that are not typical (change of routine or child behaviors).					

#### Week 3

Date					
Times Introduced					
Notes: Document occurrences that are not typical (change of routine or child behaviors).					

## Appendix I

### Montessori Classroom Survey

Directions: Survey is to be completed by the Lead Teacher or Center Director and returned back to researcher along with research materials (LENA™ tools, computer etc.) at the end of the study. Complete the questions below best to your knowledge.

Classroom ID: \_\_\_\_\_ (Provided by Researcher) Operating hours of the Classroom:

\_\_\_\_\_

In what state is the classroom located? \_\_\_\_\_ State Regulated Ratio & classroom maximum?

\_\_\_\_\_

Number of assigned children to the classroom? \_\_\_\_\_ Number of assigned staff \_\_\_\_\_

Highest level of education of Lead Teacher? \_\_\_\_\_

Montessori Credentials (Credential affiliation and age level trained in) of Lead Teacher?

\_\_\_\_\_

Highest Level of education of Assistant Teachers?

\_\_\_\_\_

Montessori credentials (Credential affiliation and age level training in – including Assistant course) of Assistant Teachers? \_\_\_\_\_

Years of experience of Lead Teacher \_\_\_\_\_

#### **Demographic Questions:**

***Please provide round numbers regarding current children assigned to classroom.***

Total number of boys? \_\_\_\_\_ Total number of girls? \_\_\_\_\_

Asian or Pacific Islander \_\_\_\_\_ Black or African American \_\_\_\_\_ White/Caucasian \_\_\_\_\_

Hispanic \_\_\_\_\_ American Indian or Alaskan Native \_\_\_\_\_

Mixed Ethnicity \_\_\_\_\_

Primary language spoken by children at home? (Write the number of children for each selection)

English \_\_\_\_\_ Spanish \_\_\_\_\_ Chinese \_\_\_\_\_ French \_\_\_\_\_ German \_\_\_\_\_ Italian \_\_\_\_\_ Korean \_\_\_\_\_ Russian \_\_\_\_\_

\_\_\_\_\_

Other:

\_\_\_\_\_

***Write the number of children in the classroom for each family/caregiving arrangement below.***

Children from traditional family homes (married or cohabitating couples and guardians of child)

\_\_\_\_\_

Children in non-traditional family homes (aunt/uncle or grandparents are caregivers/guardians) \_\_\_\_\_

Children from single parent homes (divorced/separated/non-married/widowed/widower) \_\_\_\_\_

Children from blended family homes (Step parents/siblings) \_\_\_\_\_ Children living shelters

\_\_\_\_\_

Children living in foster care \_\_\_\_\_

## Appendix J

## Pre and Post Test Target Nonsense Word Acquisition Documentation

Classroom ID: \_\_\_\_\_

PRETEST/POSTTEST Date \_\_\_\_\_

Directions: Indicate a “YES” or “NO” in each column during the three-period lesson

Observation during the second and third Lesson of the presentation.

[illegible]



**Appendix K**  
**Target Nonsense Word Tally of Classroom Audio Recordings**

Classroom ID: \_\_\_\_\_

Dates: \_\_\_\_\_

Articulation of Target Nonsense Words Tally

<b>Subject</b>	<b>mɛk</b>	<b>dʌsɛt</b>	<b>pɛm</b>	<b>bɜːsʌ</b>	<b>kæk</b>	<b>sug</b>
Adult 1						
Adult 2						
Adult 3						
LENA Child 1						
LENA Child 2						
Other Child						

## Appendix L

### Roster

Class	Gender	Child	Age in Months
A-Room	Female	GO	24
	Male	LT	26
	Male	LS	26
	Female	GG	30
	Female	AR	30
	Female	Gr G	31
	Male	OIN	31
	Male	Os N	31
	Male	I A	33
	Female	E B	34
G-Room	Male	NS	15
	Male	JT	14
	Female	LS	11
	Male	EK	12
	Male	CN	11
	Male	AS	17
E-Room	Female	PP	21
	Male	CC	20
	Male	SE	22
	Male	ED	24
	Male	BZ	21
	Female	AC	20
	Female	LK	20
	Male	WG	21
	Male	GE	24
	Female	IH	25
T-Room	Male	WR	22
	Female	KP	32
	Female	LV	39
	Male	VJ	35
	Male	MM	35
	Male	LJ	40
	Female	ST	33
	Female	NJ	31
O-Room	Male	DF	40
	Female	AD	29
	Female	LO	29
	Male	IR	29
	Female	NP	28
	Male	TH	29
	Male	JS	25
	Male	NN	28
	Male	KN	28
	Male	DJ	29
M-Room	female	KT	25
	Male	LM	25
	Male	NL	27
	Male	LP	27
	Female	LC	27
	Male	RW	26
	Male	MF	25
	Female	IL	24
	Male	LH	24
	Female	MS	23
	Male	SK	21
	Male	FS	18

## Appendix M

### STATA Analysis

Effect size based on mean comparison

```

                Obs per group:
mek_Recognition==0 =      25
mek_Recognition==1 =      14

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.2783361	-.5249569	.0409201

Effect size based on mean comparison

```

                Obs per group:
mek_Recall==0 =      32
mek_Recall==1 =       7

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.0378174	-.3386532	.2738554

Effect size based on mean comparison

```

                Obs per group:
dussett_Recognition==0 =      27
dussett_Recognition==1 =      12

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.1509331	-.4296029	.1699035

Effect size based on mean comparison

```

                Obs per group:
dussett_Recall==0 =      34
dussett_Recall==1 =       5

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.3342581	-.5648641	-.020274

## STATA Analysis Continued

Effect size based on mean comparison

```

                Obs per group:
pame_Recognition==0 =      28
pame_Recognition==1 =      11

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.2967072	-.5381848	.0211452

Effect size based on mean comparison

```

                Obs per group:
pame_Recall==0 =          35
pame_Recall==1 =           4

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.263096	-.5138914	.0570881

Effect size based on mean comparison

```

                Obs per group:
bursa_Recognition==0 =      29
bursa_Recognition==1 =      10

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.0232656	-.3264528	.2865956

Effect size based on mean comparison

```

                Obs per group:
bursa_Recall==0 =          34
bursa_Recall==1 =           5

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.2561198	-.5087973	.0644189

## STATA Analysis Continued

Effect size based on mean comparison

```

Obs per group:
Kack_Recall==0 =      31
Kack_Recall==1 =       8

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	-.0826642	-.3755078	.2337173

Effect size based on mean comparison

```

Obs per group:
kack_Recognition==0 =    27
kack_Recognition==1 =    12

```

Effect Size	Estimate	[95% Conf. Interval]	
Point-Biserial r	.0188666	-.2904204	.3227404

## Appendix N

### Fidelity Results

Classroom	Test 1 PI	Test 1 CA	Test 2 PI	Test 2 CA
T-Room	42	90	64	90
E-Room	60	60	60	60
O-Room	28	63	26	63
A-Room	66	78	90	78
G-Room	31	35	38	36
M-Room	88	88	88	88

Note: PI=Primary Investigator. CA= Co-Assessor

## Appendix O

### Tally of Overhead Target Words Spoken by Various Sources

Participant	DOB	Gender	Source	mek	dusset	pame	bursa	kack	sug
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
<b>A-room</b>	-	-	-						
Oldest	8/18/2016	Female	Adult Language	79	59	64	48	35	17
			adult 2 language						
			Child Language	13	10	10	6	6	4
			Other child(ren)	43	22	31	20	19	6
Youngest	6/16/2017	Female	Adult Language	43	46	46	27	21	1
			adult 2 language						
			Child Language	5	3	4	2	2	1
			Other child(ren)	10	8	12	3	6	3
<b>G-room</b>									
Oldest			Adult Language	20	3	7	6	14	0
			Adult 2 Language	0	0	0	0	0	0





Oldest	Adult Language	49	47	45	53	38	3
	Adult 2 Language	10	8	3	12	3	0
	Child Language	49	53	58	37	69	0
	Other child(ren)	1	1	2	1	5	0
<b>Youngest</b>	<b>Adult Language</b>	23	25	21	30	18	0
	Adult 2 Language	0	0	0	0	0	0
	Child Language	8	8	12	6	21	0
	Other Child(ren)	0	0	0	0	0	0
<b>O-room</b>							
<b>Oldest</b>	<b>Adult Language</b>	45	39	25	39	28	2
	Child Language	42	40	31	14	53	1
	other child(ren)	20	15	12	14	28	0
<b>Youngest</b>	<b>Adult Language</b>	32	42	23	32	29	2
	<b>Adult 2 Language</b>	0	0	0	0	0	0
	Child Language	9	9	6	7	8	0
	other child(ren)	12	14	9	13	18	0

**M-room**

Oldest	Adult Language	16	19	15	18	14	5
	Child Language	10	5	8	4	10	6
Youngest	<b>Adult Language</b>	40	39	47	48	44	8
	Child Language	1	1	4	2	7	0
	other child(ren)	9	5	4	3	12	0

---

## Appendix P

### Full Analysis of Paired *t*-tests

#### M-Classroom paired *t*-test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pretest	9	0	0	0	0	0
mek_Re~n	9	.3333333	.1666667	.5	-.0510007	.7176674
diff	9	-.3333333	.1666667	.5	-.7176674	.0510007

mean(diff) = mean(pretest - mek\_Recognition)      t = -2.0000  
 Ho: mean(diff) = 0      degrees of freedom = 8

Ha: mean(diff) < 0      Ha: mean(diff) != 0      Ha: mean(diff) > 0  
 Pr(T < t) = 0.0403      Pr(|T| > |t|) = 0.0805      Pr(T > t) = 0.9597

#### O-Classrom paired *t*-test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pretest	8	0	0	0	0	0
mek_Re~n	8	.5	.1889822	.5345225	.053128	.946872
diff	8	-.5	.1889822	.5345225	-.946872	-.053128

mean(diff) = mean(pretest - mek\_Recognition)      t = -2.6458  
 Ho: mean(diff) = 0      degrees of freedom = 7

Ha: mean(diff) < 0      Ha: mean(diff) != 0      Ha: mean(diff) > 0  
 Pr(T < t) = 0.0166      Pr(|T| > |t|) = 0.0331      Pr(T > t) = 0.9834

#### A-Classroom paired *t*-test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pretest	9	0	0	0	0	0
mek_Re~n	9	.3333333	.1666667	.5	-.0510007	.7176674
diff	9	-.3333333	.1666667	.5	-.7176674	.0510007

mean(diff) = mean(pretest - mek\_Recognition)      t = -2.0000  
 Ho: mean(diff) = 0      degrees of freedom = 8

Ha: mean(diff) < 0      Ha: mean(diff) != 0      Ha: mean(diff) > 0  
 Pr(T < t) = 0.0403      Pr(|T| > |t|) = 0.0805      Pr(T > t) = 0.9597

### E-Classroom paired *t*-test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pretest	6	0	0	0	0	0
mek_Re~n	6	.1666667	.1666667	.4082483	-.2617636	.595097
diff	6	-.1666667	.1666667	.4082483	-.595097	.2617636

mean(diff) = mean(pretest - mek\_Recognition)      t = -1.0000  
 Ho: mean(diff) = 0      degrees of freedom = 5

Ha: mean(diff) < 0      Ha: mean(diff) != 0      Ha: mean(diff) > 0  
 Pr(T < t) = 0.1816      Pr(|T| > |t|) = 0.3632      Pr(T > t) = 0.8184

### G-Classroom Paired *t*-test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pretest	5	0	0	0	0	0
mek_Re~n	5	.2	.2	.4472136	-.355289	.755289
diff	5	-.2	.2	.4472136	-.755289	.355289

mean(diff) = mean(pretest - mek\_Recognition)      t = -1.0000  
 Ho: mean(diff) = 0      degrees of freedom = 4

Ha: mean(diff) < 0      Ha: mean(diff) != 0      Ha: mean(diff) > 0  
 Pr(T < t) = 0.1870      Pr(|T| > |t|) = 0.3739      Pr(T > t) = 0.8130

## Appendix Q

### LENA Analysis with Recall and Recognition Results

Classroom	% of silence	% of noise	% of distant language	mek_ recog	mek_ recall	dussett_ recog	dussett_ recall	pame_ recog	pame_ recall	bursa_ recog
E-room	7.3	3.33	44.66	16.67	16.7	16.17	0	50	16.67	33.33
G-room	21.54	5.37	41	20	20	20	0	0	0	20
M-room	0	0	61.8	33.33	0	33.33	11.11	11.11	0	33.33
O-room	4.7	3	71.88	50	25	37.5	25	37.5	12.5	12.5
A-room	21.69	3.96	53.84	33.33	22.2	22.22	0	22.22	0	22.22
T-room	10.37	3.6	66.12	100	50	100	100	100	100	50



## VITA

### CLAUDINE CAMPANELLI

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#### EDUCATION

LIU Post; Brookville, New York

Doctoral Program, Interdisciplinary Studies in Education, expected graduation June 2021

St. Joseph's College; Patchogue, New York

Executive Masters in Business Administration (MBA) and Masters in Human Resource Management

The Montessori Institute; Denver, Colorado, AMI (Association Montessori International)

Assistant to Infancy Diploma

Towson State University; Towson, Maryland

Bachelor of Science,

Speech – Language Pathology and Audiology

SUNY Morrisville; Morrisville, New York

Associate of Science

Interdisciplinary Studies

#### CERTIFICATIONS

[Employing Abilities @ Work Certificate \(awarded by SHRM\)](#), [Council of Professional Recognition \(CDA Professional Development Specialist\)](#), [New York State Training and Technical Assistance Professional Credential](#), Massachusetts EEC Professional Certificate Infant/Toddler Lead Teacher and Director qualified

#### PROFESSIONAL EXPERIENCE

##### **[New York Early Childhood Professional Development Institute](#)**

**(CUNY Research Foundation) Dual appointment** October 2017 – Present

Director of Career Development and Higher Education July 2019 - Present

Early Childhood [Career Development Center](#)

##### **[CUNY School of Professional Studies \(SPS\)](#)** Undergraduate and Graduate Early Childhood Education Program

Director in collaboration with the NY Early Childhood Professional Development Institute- 2017 - Current

Managing the [Child Development Associate \(CDA\)](#) and [Child Program Administrator Credential \(CPAC\) programs](#) at CUNY SPS

##### **Touro College** Summer semesters 2017 – 2019

Adjunct Faculty

*Graduate Course Experience* (Learning Management System: Blackboard

*SEDN 635 The Study of Disabilities in Infancy and Early Childhood*

##### **Molloy College** January 2017 – June 2018 (Spring Semesters Only)

Adjunct Faculty

*Undergraduate Course Experience:* (Learning Management System: Canvas

EDU 336 Curriculum and Methodology in Early Childhood Education, Birth – Grade 2

**CA Technologies, Islandia, New York - 1997–2016**

Manager/Director (Member of the CA Technologies Benefits Team)

CA Montessori Children's Center - 2011 to 2016 (Islandia)

An AMI Montessori School, [NAEYC Accredited](#) and Star rated in the [NYS QualityStars](#) Program.

A corporate benefit to CA Technologies Employees

*Previous Titles: Assistant Teacher, Lead Teacher, Program Coordinator, Project Manager, Assistant Director, Manager/Director (Australia).*

- Opened and managed schools in Australia and India. Supported operations in Europe and six schools in North America, including temporary director in Massachusetts and England.

**VOLUNTEER EXPERIENCE**

Suffolk County Woman's Advisory Commission: Second VP and Commissioner of 10<sup>th</sup> Legislative District (September 2017 – Present). Chair: Child Care Services for Woman in the Labor Force Committee

[All Wheels Up, Inc. \(AWU\)](#) – Founding board member; 2011 – 2021.

Long Island Infant Leadership Circle -2016 – Present

Suffolk AEYC Board member –2001 – 2016 (Board President- 2009 – 2013, Conference Committee & Leader 2002 – 2009)

New York State Early Learning Guidelines contributor – Published 2012

NAEYC National Grant committee - 2009

BOCES Advisory Council Member – 2015 - current

Guest Speaker at BOCES, LIU-Post, St. Joseph's College, and Molloy College.

Early Years Institute Committee member and Advisory Panel Member 2010- 2014

NAEYC validator 2004 – 2006

**PROFESSIONAL AFFILIATIONS**

American Education Research Association ([AERA](#)); Association Montessori International ([AMI](#)); American Montessori Association ([AMS](#)); Association for Supervision and Curriculum Development ([ASCD](#)); National Association of Early Childhood Teacher Educators ([NAECTE](#)); National Association for the Education of Young Children ([NAEYC](#)), New York State and local chapter (NYSAEYC and Suffolk AEYC), World Organization for Early Childhood ([OMEPE](#)), The Association for the Study of Play ([TASP](#))

**RECENT HONORS AND AWARDS**

2019 [Honor Society of Phi Kappa Phi](#), 2015 [Omicron Delta Kappa Honor Society](#), [2015 Exchange Magazine Emerging Leader Award](#); 2013 American Heart Association Heart-Saver Award for saving the life of a colleague providing CPR and AED support