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The University of San Francisco

AN INVESTIGATION OF THE DEVELOPMENTAL GROWTH OF PRESCHOOL CHILDREN WITH DISABILITIES BEING SERVED IN INCLUSIVE SETTINGS IN COMPARISON WITH NONINCLUSIVE SETTINGS IN CALIFORNIA

A Dissertation Presented
to
The Faculty of the School of Education
Department of Learning & Instruction

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

by
Elizabeth Schroeder
San Francisco
May 2018

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THE UNIVERSITY OF SAN FRANCISCO

Dissertation Abstract

An Investigation of the Developmental Growth of Preschool Children with Disabilities Being Served in Inclusive Settings in Comparison with Noninclusive Settings in California

The purpose of this study was to perform a secondary data analysis to investigate the relationship between preschool setting and the developmental growth of all children receiving state-funded preschool special-education services in California in inclusive settings compared with all children receiving state-funded preschool special-education services in California in noninclusive settings.

To accomplish this purpose, a secondary data analysis of a longitudinal data set was conducted using the Desired Results Developmental Profile (DRDP, 2015) to measure progress across eight domains of child development over a 2-year time span and four assessment time points. This study used individual growth modeling to analyze developmental growth; more specifically, this study used hierarchical linear modeling (HLM). The study included all children receiving preschool special-education services in California (N = 78,999), in both inclusive and noninclusive settings and investigated differences between groups based on preschool setting.

The response variables for the study included eight domains scores that are combined into three Office of Special Education Programs (OSEP) outcome measures. Statistically significant differences were found between the developmental-growth trajectories of preschool children receiving special-education services in inclusive settings versus noninclusive settings. The results indicated that children served in

inclusive settings have a higher developmental-growth trajectory over time across all three OSEP outcome measures. In addition, statistically significant differences were found between the developmental-growth trajectories of preschool children receiving special-education services in inclusive setting versus noninclusive for seven of the eight domains on the DRDP (2015). The only domain that was statistically significant was the English Language Development domain. For preschool children diagnosed as having *other health impairments*, there is a statistically significant difference in developmental-growth trajectories between the two groups based on setting for the OSEP 1 and OSEP 3 scores.

Overall, these results indicate that children served in inclusive settings have a slightly higher developmental-growth trajectory than children served in noninclusive settings. Future studies may be conducted to build upon the HLM models that were used in the analyses as well as include additional information about severity of disability and other outcome measures in order to improve upon the present results.

This dissertation, written under the direction of the candidate's dissertation committee and approved by the members of the committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education. The content and research methodologies presented in this work represent the work of the candidate alone.

Elizabeth N Schroeder 5/1/2018
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CHAPTER I

STATEMENT OF THE PROBLEM

Early childhood is the most critical time in a child's development as it is the foundation for their lifelong educational developmental trajectory. The first 5 years of learning are a time of rapid acquisition of knowledge and skills and critical to how the child continues to develop as they grow (Nwokah & Sutterby, 2014). The environment within which the development of young children occurs across emotional, social, cognitive, and physical domains and directly effects them as adults and throughout their lives. In the 1920s, the National Association for Nursery Education (NANE) was founded, marking the beginning of the professionalization of early care and education for infants, toddlers, and preschoolers. The field experienced rapid growth during World War II as more and more women worked outside the home and, therefore, needed care for their young children. Continuing throughout the 20th century, this trend has carried over into the 21st century as most women now choose to work outside the home (McLean, Sandall, & Smith, 2016).

Decades of research have shown that investing in high-quality early childhood development, which lays the foundation for a successful adulthood, benefits the society at large (Buysse & Bailey, 1993; Odom & Diamond, 1998; Rafferty, Piscitelli, & Boettcher, 2003). Furthermore, scientific research has shown that participating in stable, responsive, and nurturing relationships and rich learning experiences leads to lifelong benefits for learning, behavior, and both physical and mental health. Conversely, negative experiences, either at home or in an educational environment, and heightened stress for a

young child can lead to weakened brain development and physical delays (Shonkoff & Richmond, 2009).

Numerous initiatives and policies have been developed and implemented to support the field of early-childhood education since the 1920s. Most notably, the National Association for the Education of Young Children (NAEYC), formerly known as NANE, continues to promote high-quality early learning for all young children, from birth through age 8, by connecting early-childhood practice, policy, and research. Although financial and policy support for early-childhood education services increased in the 20th century, prior to the mid-1900s there was little to no specific attention given to the provision of early care and education of young children with disabilities. The evolution of the field of early-childhood special education is linked closely to the field of early-childhood education. Both fields are focused on providing high-quality education and improved social-emotional development of young children.

The field of early-childhood special education has emerged as being of primary importance for young children with disabilities but did not receive formal support until the 1960s with the inception of the first Head Start programs. The landmark legislation that provided the foundation for subsequent policies and practices around the education of individuals with disabilities was the Education for All Handicapped Children Act (EHA) of 1975. In 2004, EHA was reauthorized and renamed the Individuals with Disabilities Education Act (IDEA, PL 108-446). IDEA ensures that more than 6.5 million infants, toddlers, children, and youths with special needs receive appropriate early intervention, special education, and related services (Center for Parent Information & Resources, 2014). Furthermore, IDEA strongly encourages the placement of young

children in inclusive settings with typically developing children (Barton & Smith, 2015). More specifically, IDEA mandated that school districts must ensure that children with disabilities, ages 3 to 21, are educated with children without disabilities to the maximum extent appropriate (Division of Early Childhood (DEC)/NAEYC, 2009). Therefore, young children with disabilities should be educated in inclusive settings to the greatest extent possible.

Several decades of research have shown that high-quality and inclusive early-education and intervention services for young children with disabilities can "(a) ameliorate, and in some cases, prevent developmental problems; (b) result in fewer children being retained in later grades; (c) reduce educational costs to school programs; and (d) improve the quality of parent, child, and family relationships" (Salisbury, 1991, p. 146). In addition, research investigating the effect of inclusion on typically developing children indicates that high-quality early-care and education services in inclusive settings are beneficial for all children (Barton & Smith, 2015).

Inclusion can be defined broadly as an educational setting or classroom where children with and without disabilities learn together (Barton & Smith, 2015). Inclusion extends well beyond the classroom and can refer to participation in all daily activities and routines. Preschool inclusion is different than inclusion in primary and secondary schools (Odom, 2002). First, curriculum is different in preschool settings. The focus is on developing new skills and knowledge, rather than on learning outcomes based on academic standards. Second, because all children in preschool are new learners, the "developmental gap" between children with and without disabilities generally is smaller than in later years. Last, there are no high-stakes achievement tests in preschool. As with

the measurement tool being proposed for use in this study, authentic or observational assessments are used more commonly to measure the development of preschoolers.

In their review of relevant research on preschool inclusion, Odom and Wolery (2003) summarized the literature on preschool inclusion. Their review included several key findings, one of which was that positive outcomes are reported for children with disabilities and typically developing children in inclusive settings. Furthermore, Odom and Wolery (2003) noted that other reviews of the literature have concluded that on standardized developmental measures, young children with disabilities perform equally well in inclusive and noninclusive settings.

Buysse and Bailey (1993) completed a comprehensive and exhaustive review of comparative studies regarding preschool inclusion. Their review was the most complete review of this field in research up to that point in time. The review included 22 studies, and of those studies, seven reported findings with regard to developmental outcomes. The results of the studies reviewed by Buysse and Bailey (1993) indicated that the mean level of children's performance over time, as measured by the standardized measures used in the studies, did not vary by type of setting, either inclusive or noninclusive. The studies included in this review had several limitations: in particular, the equivalency at the onset of the comparison groups was neither investigated nor mitigated.

Since 1993, several new studies have investigated the relationships between preschool setting and developmental outcomes of children with and without disabilities. The seven studies selected for comprehensive review in the present literature review in chapter II were determined to have reported findings with regard to developmental outcomes by preschool setting. These studies, when combined with the findings from the

review of studies prior to 1993, highlight several gaps in the present body of research investigating developmental outcomes and preschool setting. Prior research studies in this area have been conducted using limited samples in size, geography, and ethnic and socioeconomic diversity. In addition, most of those studies were conducted across only one or two points in time, and the measurement tools used were limited in domains of development measured.

Even though research provides supporting evidence about the positive outcomes related to preschool inclusion, the current literature has three major limitations. First, the studies specifically investigating the relationship of developmental progress to preschool setting have been conducted on a small scale; these studies have primarily been single-case studies or comparisons of small groups of children to other small groups. Few studies have been conducted on a large scale; the largest of the study samples has been 223 participants. Second, these studies have been limited in the dependent variables measured. Many studies include one or two developmental domains, such as language development and social-emotional measures, but no study included an investigation across all domains of early-childhood development. Finally, the relevant research is limited in studying this relationship between preschool setting and developmental progress over time. Many of the studies have reviewed this phenomena for a single point in time or within one year, but few have studied progress over multiple time points and children ages 3 through 5 years.

The present study addressed all three limitations. The study is large scale, focused on a complete set of developmental outcomes, and included four data points over 2 years. The study investigated the relationship between setting and developmental progress for

preschool-aged children with disabilities by researching a large-scale longitudinal data set. The results of the study provide additional evidence about the effect of inclusion on the development of young children with disabilities.

Purpose of the Study

The purpose of this study was to perform a secondary data analysis to investigate the relationship between preschool setting and the developmental growth of all children receiving state-funded preschool special-education services in California in inclusive settings compared with all children receiving state-funded preschool special-education services in California in noninclusive settings.

To accomplish this purpose, a secondary data analysis of a longitudinal data set was conducted using the Desired Results Developmental Profile (DRDP, 2015) to measure progress across eight domains of child development over a 2-year time span and four assessment time points. This study used individual growth modeling to analyze developmental growth; more specifically, this study used hierarchical linear modeling. The study included all children receiving preschool special-education services in California, in both inclusive and noninclusive settings, and investigated differences between groups based on preschool setting.

Educational Significance of the Study

This study is important for three main reasons. First, it adds to the body of research investigating the effect that inclusive settings have on children's learning by increasing the size or magnitude of the sample. Previous research comparing the development of children by preschool setting has been conducted almost exclusively on small sample sizes or with a single-case study (Buysse & Bailey, 1993; Diamond &

Carpenter, 2000). No previous studies have been conducted using a large scale (n > 250 children) data set, but the sample for the present study is drawn from the entire population of children being served by preschool special-education providers in California. In addition, the population of preschool-age children with disabilities in California comprises a diverse sample of children across several demographic variables including race, ethnicity, and disability category.

Second, the study extends the previous research by investigating developmental growth over multiple points in time. Previous studies regarding the effect of preschool inclusion generally have focused on a single data point, and few of them have included an analysis of developmental growth over more than one point in time. Prior research indicates that inclusive settings are connected to improved academic outcomes and success later in life. A longitudinal study provides more information about how students with disabilities progress over time when included with their typically developing peers.

Finally, this study investigated how the progress of children across multiple developmental domains is related directly to the setting in which the children are served. Prior research has shown that if children with special needs are served in inclusive settings, they are more likely to progress across all domains of development, including social-emotional, language, and cognitive measures. Studies investigating the effect of preschool inclusion have linked positive outcomes with increased social interactions and improved behavioral outcomes. A few studies have even investigated more than one dependent variable at once (Buysse, Goldman, & Skinner, 2002; Diamond & Carpenter, 2000; Hundert, Mahoney, Mundy, & Vernon, 1998). None of these studies, however, have attempted to investigate the effect of preschool setting across all domains of

development. This study presents statistically significant results about the developmental progress of young children with disabilities across eight different domains.

Beyond the extension of previous research, the present study contributes to the field of early-childhood special education by providing a definitive answer to the question of whether or not inclusion makes a difference for preschool-aged children with disabilities. Enormous amounts of time and resources are devoted to providing inclusive services for preschool children with a disability alongside their typically developing peers. The results of this study could be used to support future legislation that may lead to additional funding and support for providing inclusive opportunities for all children.

Theoretical Framework

A variety of formal theories and theoretical frameworks have influenced early-childhood special education (McLean et. al., 2016). In the United States, most of these theories have been situated in "psychology, applied behavior analysis, and developmental science, although sociology, systems theory, and neuroscience also influence practice" (Odom & Wolery, 2003, p. 165). Practitioners also have informal theories of practice that come from their work in the field with children and families (Odom, 2016). Of all the theories that have influenced the field of early-childhood special education, the theory that primarily underpins the present study investigating the effect of inclusive settings on children with disabilities is Urie Bronfenbrenner's (2005) ecological systems theory. This section provides an overview of Bronfenbrenner's theory and how it serves as a foundation for the present study.

Systems theory is often summed up with the adage that "a system is more than the sum of its parts." The idea is that the relationship between the active elements within a

system exert a strong influence on that system (Odom, 2016). Although several of the theoretical frameworks that are connected to practices in early-childhood special education are grounded in systems theory—including the ecological systems theory, family systems theory, and implementation science—the ecological systems theory is the most relevant conceptual model for the present study.

Bronfenbrenner's ecological systems theory has been one of the most influential theories on the field of early-childhood special education (Odom, 2016). In *Making Human Beings Human*, Bronfenbrenner's (2005) definition of the theory proposed that a child is influenced directly by the system he or she inhabits, such as family, friends, and teachers:

> Definition 1: The ecology of human development is the scientific study of the progressive, mutual accommodation, through the life course, between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by the relations between these settings, and by the larger contexts in which the settings are embedded. (p. 107)

The interactions a child has with other individuals directly effects how he or she develops. Because a child is a part of many different systems, such as school and home, the interaction between these systems also has a direct effect on how this child develops. With respect to early-childhood special education, the chain of interlinking systems can be considered as the school district, the school, the provider or teacher, and the family. All of these systems are linked and, therefore, have a direct effect on one another and ultimately on the education and development of the child.

In *Making Human Beings Human*, Bronfenbrenner (2005) discussed the research models that apply to studying development within context, the most common and simplest of which is the *social address model*. Examples of social addresses include

social class, family size, ethnicity, and race. More recently, as Bronfenbrenner (2005) noted, new demography variables have emerged such as home care versus day care, private versus public schools, and marital status of parents. The primary limitation to this model is that the researcher investigates the social address or attribute but fails to explore the effect the environment might have on development. For example, with respect to home care versus day care, the researcher studies the effect of increased social interactions in a day-care setting, rather than focusing on the unique attributes of the environment, such as greater access to outside space in a home setting.

A more complex research design model is the *person-context model*. With this type of study, characteristics of both the person and their environment are taken into account (Bronfenbrenner, 2005). These study designs enable the researcher to establish "ecological niches" that are defined by an intersection between two or more characteristics that can then be related to the outcome measure. This model has similar limitations to the social address model in that it does not take into account all possible factors that influence a child's development. But from Bronfenbrenner's (2005) ecological perspective, it possesses a structural feature that makes it useful to studying development in context by taking into account both personal and environmental factors.

The present study investigated child development as a product of both the environment represented by the educational setting (inclusive vs. noninclusive) and the specific social address for each child (disability category). In building the theoretical framework for this study, the goal was to understand more deeply the relationship between the environment, the disability, and the developmental outcomes. Ultimately, findings of the study are limited in interpretation because gaps remain in understanding

the *process* associated with the above environment and social characteristics. Meaningful results and a deeper understanding of the relationship between preschool setting and development growth, however, may be learned from the results of this study.

Background and Need

In this section, a history of early-childhood special education is presented, as well as background information about special education in the United States. A discussion of the disability categories and preschool settings is provided, because these two demographic variables are the primary independent variables of interest in this study. And finally, an overview of the California accountability system provides the detail needed to understand the context in which the DRDP is used in the State of California.

History of Early-Childhood Special Education in the United States

Several comprehensive articles on the history of early-childhood special education in the United States have been published. In 1991, Hebbeler, Smith, and Black published a comprehensive review of the evolution of federal educational policy in early childhood. That review stands as a comprehensive account of the history of services for young children with special needs. More recently, in 2016, McLean, Sandall, and Smith published an article in the *Handbook of Early Childhood Special Education* on the history of early-childhood special education. Their article provides a detailed account of the evolution of these services and the policies influencing this field. Rather than attempt to improve upon these exhaustive reviews, this section highlights the most important policies and events that have had an effect on the field of early-childhood special education since the 1920s.

The field of early-childhood special education, which began to take shape in the mid-1900s, is still relatively new (McLean et al., 2016). It was not until the 1920s that the newly founded National Association of Nursery School Educators began to lay the groundwork for a more comprehensive system of education for young children and early-childhood educators. During World War II, many women had to join the workforce, so there was a greater need for childcare (Darragh, 2010). As women continued to play a major role in the workforce throughout the 1950s and '60s, the field of early-childhood education gradually expanded.

Although early-childhood education expanded during the mid-20th century, the education of young children with disabilities continued to receive little attention (Peterson, 1987). During the mid-1900s, almost all public schools denied admission to children with disabilities, and their families were turned away (McLean et al., 2016). Because families struggled to find educational programs for their children, a role for parents as advocates began to emerge. The Council for Exceptional Children was founded in 1922 by early-childhood special-education professionals to connect people interested in "special children" and establish professional teaching standards (Kode, 2002). This organization helped to increase the research, public policy, and access to public schools for families of a child with a disability. Because of these early efforts, the latter part of the 20th century witnessed an explosion of development in the field of early-childhood special education. (McLean et al., 2016)

Federal and State Policy (1968–1986)

Several key federal and state policies have advanced the field of early-childhood special education and improved services for young children with disabilities and their

families. The evolution of federal policy in early-childhood special education has focused on multiple objectives and employed a variety of strategies in moving the nation closer to a more comprehensive system of services for young children with special needs. These initiatives were developed for a variety of reasons, including to stimulate interest and engagement in early-childhood special education, to share information across the field, to improve services to young children, to improve professional development for providers, and to help support state-level efforts to build an infrastructure (Hebbeler et al., 1991).

In the summer of 1965, Head Start began as an 8-week summer program to prepare young children for kindergarten. As it became clear that an 8-week program was not sufficient, the program began to expand. Head Start has grown over the years into a year-round preschool program for 3-, 4- and 5-year-olds. In 1972, legislation passed that required that children with disabilities make up at least 10% of Head Start enrollments. Head Start became the first major public early-childhood program providing inclusive services to children with disabilities (McLean et al., 2016).

The early years—1960s and ‘70s—of early-childhood special education were focused on engaging local programs and building a knowledge base of best practices for the field. The 1965 amendments to the Elementary and Secondary Education Act provided grants to schools to expand and improve special-education programs. This federal legislation (PL 89-313) was important in supporting local efforts and moving the United States toward universally available early-childhood services for all children, including children with special needs.

In 1968, PL 90-538 created the Handicapped Children’s Early Education Program (HCEEP), eventually known as the Early Education Program for Children with

Disabilities. HCEEP was the first federal special-education program targeted solely at the needs of young children with disabilities (Hebbeler et al., 1991). The main goal of this legislation was to discover new and improved approaches to working in the field of early-childhood special education (McLean et al., 2016). HCEEP funds were used as support for model programs to identify more formally best practices in the field of early childhood special education. By the mid-1970s, every state had at least one HCEEP project site. In 1970, the Congress passed PL 91-230, which provided grants to states for the education of handicapped children from preschool through secondary school. By 1975, more than 20,000 young children with disabilities and their families were being served directly or through collaboration.

By the mid-1970s, even with all the legislation in support of serving children with disabilities, an estimated one million school-aged children with special needs were still not receiving an education (Weintraub & Abeson, 1974). In 1975, the Congress passed PL 94-142, a landmark federal policy titled the Education for All Handicapped Children Act (EHA). That legislation, however, was limited with regard to the education of infants, toddlers, and preschoolers. Only if the state offered public education to young children did this law apply. PL 94-142 did include the Preschool Incentive Grant Program, which provided additional funding to states to expand special-education services for preschool-age children, although less than half of the states chose to participate in the first year of that grant program (Hebbeler et al., 1991).

In 1976, states were encouraged to improve early-childhood services through the development of the State Implementation Grants (SIGs) program (McLean et al., 2016). These more comprehensive grants focused on improving services through support for

activities such as needs assessments, the development of planning groups, research in the field of early childhood education, and the dissemination of these findings (Reaves & Burns, 1982). Initially only 16 states received the two-year SIG funding; by 1984, however, 43 states and territories had received SIG awards. State leaders indicated that the SIG awards enabled them to build capacity for planning and creating structures to help ensure statewide provision of services to young children with disabilities (Hebbeler et al., 1991).

In 1977, the Bureau for the Education of the Handicapped established Early Childhood Research Institutes to address the need for long-term research into how children were developing across different service settings. The institutes conducted research across eight primary focus areas, including home- versus center-based instructional programs, inclusive or typical classroom services, instructional practices, and assessment practices.

As a result of the research findings, by 1986 the Congress established a new program, as part of HCEEP (PL 98-199), that provided federal money to states for planning, developing, and implementing statewide services for young children with disabilities (McLean et al., 2016). This new legislation moved states and the whole country closer to a universal system for early-childhood education. Incentives were provided to states to create comprehensive policies and programs for early-childhood special education and about half of the states developed public policies for providing services for young children with disabilities.

In 1986, closely following PL 98-199, landmark legislation was passed that provided funding for young children with disabilities and their families. This new

legislation, referred to as the EHA Amendments of 1986, created Part B, Section 619 for preschool-aged children with disabilities and Part H (now known as Part C) for infants and toddlers with disabilities (McLean et al., 2016). The EHA Amendments required states to lower the age of free-and-appropriate public education (FAPE) from 6 years of age to 3 years of age under Part B services. This legislation also established voluntary early-intervention services for children with disabilities or at risk for disabilities from birth through age 2 under Part H.

In reviewing the long evolution and development of public policy in this field, it becomes clear that the federal government supported the states in their focus on implementing and supporting early-childhood special-education services.

Current Federal and State Policy (1986–Present)

In the 10 years after PL 99-457 was passed, states focused on developing policies to implement the new early-intervention and preschool requirements. By 1988, all states had applied for funding and were required to ensure that services were available to all eligible infants, toddlers, and preschoolers within 5 years. No major federal legislation regarding early intervention was passed in the years following PL 99-457: with one exception. Early Head Start was established in 1995 to provide services to children from birth to 3 years of age. Just as in 1972, the legislation mandated that children with disabilities make up at least 10% of Early Head Start enrollments.

In 1990, the Education of the Handicapped Act (EHA) was reauthorized and renamed the Individuals with Disabilities Education Act (IDEA). The Americans with Disabilities (ADA) also was passed in 1990, marking a major milestone for individuals with disabilities in the United States. Together, these two landmark legislations cemented

the increasing social value that people with disabilities are “people first” and that policy should reflect these values with the use of “people-first” language (McLean et al., 2016).

A number of amendments to IDEA have provided additional detail to some of the early childhood provisions of the law. The most recent amendments were passed in December 2004 (Individuals with Disabilities Education Act, 2004), with the final regulations being published in August 2006 for Part B and in September 2011 for Part C, infants and toddlers (U.S. Department of Education, 2006, 2011). Federal funding for IDEA and Head Start has increased over the years, but federal funding is not sufficient to serve all young children who are eligible to receive services.

The amount of change that has occurred in legislation and services to young children with disabilities is remarkable. A review of the history of federal policy for early childhood ultimately reveals, however, that notwithstanding more than 20 years of progress, universally available early-childhood services for children with disabilities has not been achieved. Although research and advocacy for early-childhood education has continued since the 1990’s, federal policy continues to evolve and provide additional support for the field with the ultimate goal that universally available early-childhood services are achieved.

Special-Education Implementation in the United States

The need for special-education services is supported by the sheer magnitude of the number of children with a diagnosed disability. Over 700,000 children from birth through age 21 are receiving special-education services in the United States. Under Part B of IDEA, the Secretary of Education provides funds to assist states in providing a free appropriate public education to children with disabilities, ages 3 through 21, who are in

need of special-education and related services. To be eligible for funding under the Preschool Grants for Children with Disabilities program and the Grants to States program for children ages 3 through 5, a state must make free-appropriate public education available to all children with disabilities, ages 3 through 5, residing in the state.

According to the *38th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 2016* (U.S. Department of Education, 2016), Part B has four primary purposes:

- to ensure that all children with disabilities have free appropriate public education available to them and receive special-education and related services designed to meet their individual needs,
- to ensure that the rights of children with disabilities and their parents are protected,
- to assist states and localities in providing for the education of all children with disabilities, and
- to assess and ensure the effectiveness of efforts to educate children with disabilities.

As of the fall of 2014, there were 736,170 children (ages 3 through 5) being served under Part B in the 50 states, the District of Columbia, and the Bureau of Indian Education schools (U.S. Department of Education, 2016), representing 6.1% of the entire population of all 3-, 4-, and 5-year-olds. In California, 78,598 preschool-aged children were served in the 2014–15 academic year (California Department of Education, 2017). This total represents 5.1% (U.S. Census Bureau, 2010) of all 3-, 4-, and 5-year-olds in the state.

In a report published in 2000 by the Center for Special Education Finance for the U.S. Department of Education, it was reported that during the 1999–2000 school year, the 50 states and the District of Columbia spent approximately $50 billion on special-education services (Chambers, Parrish, & Harr, 2004). The report noted that this total special-education cost translates to $8,080 spent per special-education student. Of the $50 billion of special-education funding, 9% of total spending is allocated to preschool programs. Preschool programs operated within public schools represent 8% of the total budget ($4.1 billion), whereas those outside public schools represent one percent ($263 million).

Because so many children are receiving preschool special-education services in the United States, there exists a great need for continued research in the field of early-childhood special education. Early-childhood-program administrators, teachers, and providers need relevant research about the most appropriate practices by which to serve children with disabilities. The proposed study aimed to provide findings across preschool settings and disability categories that relate to developmental outcomes and that potentially can be applied to program and classroom practices across early-childhood-education programs.

Preschool Inclusion

The inclusion of preschool-aged children with disabilities in classrooms with their typically developing peers is a relatively recent phenomenon. The concept has been written about since the early 1970s, but it has emerged as a legitimate alternative for children with disabilities and their families only since the 1990s (Odom, 2000). For more than 35 years, research consistently has demonstrated that providing services for young

children with disabilities in settings with their typically developing peers results in positive outcomes for all children (Barton & Smith, 2015). The Individuals with Disabilities Education Act (IDEA) of 2004 required that school districts must ensure that children with disabilities, ages 3 to 21, are educated with children without disabilities to the maximum extent appropriate.

Definition of Early-Childhood Inclusion

"Early Childhood Inclusion," the position statement jointly released in 2009 by the Division of Early Childhood and the National Association for the Education of Young Children, provides a formal definition of early-childhood inclusion:

> Early childhood inclusion embodies the values, policies, and practices that support the right of every infant and young child and his or her family, regardless of ability, to participate in a broad range of activities and contexts as full members of families, communities, and society. The desired results of inclusive experiences for children with and without disabilities and their families include a sense of belonging and membership, positive social relationships and friendships, and development and learning to reach their full potential. The defining features of inclusion that can be used to identify high quality early childhood programs and services are access, participation, and supports. (DEC/NAEYC, 2009, p. 2)

Three defining features of inclusion are listed in the final sentence of the DEC/NAEYC definition: access, participation, and support. The position statement provides additional detail about what each of these terms means.

Access refers to providing a wide range of appropriate and contextually relevant learning opportunities, activities, and settings for every child by enhancing physical accessibility through modifying and removing physical barriers to learning and offering many different learning opportunities. The primary goal is that all children have access to typical daily routines, activities, settings, and general-education curricula (Barton & Smith, 2015).

Participation means that adults promote belonging, participation, and engagement of all children with and without disabilities in inclusive settings in a variety of ways. Adults use a variety of instructional practices and techniques, including adaptations and accommodations to promote active participation and a sense of belonging for all children.

Supports refers to the system level of supports that must be in place to reinforce the efforts of service providers and agencies providing inclusive services for preschool children with disabilities. Supports might include professional-development opportunities for program administrators, service providers, and families. This element also requires that formal policies be in place to support high-quality preschool inclusion.

The *Joint Position Statement* of DEC and NAEYC has served as the primary guide for the provision of early-childhood inclusive opportunities to young children in the United States since its release in 2009. Professionals have used this statement as a guide on best practices, as well as an impetus for the development of curriculum, classroom supports, and professional development opportunities for educators serving children with special needs.

Components of Inclusion

Research since the 1980s regarding inclusive-service delivery for preschool children with disabilities has identified key components of effective inclusion practices (Barton & Smith, 2015; Gupta, Henninger, & Vinh, 2014; Richardson-Gibbs & Klein, 2014). Barton and Smith (2015) developed the *Preschool Inclusion Toolbox*, which includes an Inclusion Self Checklist that early childhood programs can use to assess their level of implementation across a list of seven desired components: (a) intentional, sufficient, and supported interactions between peers with and without disabilities; (b)

specialized, individualized supports; (c) family involvement; (d) inclusive, interdisciplinary services and collaborative teaming; (e) a focus on critical sociological outcomes; (f) effective, ongoing professional development; and (g) ongoing program evaluation.

In order for inclusion to be effective for all children, early-childhood programs must have the supports in place to provide services to children with disabilities, while also working with all students included in their class. The development of resources such as the *Preschool Inclusion Toolbox* (Barton & Smith, 2015), *First Steps to Preschool Inclusion* (Gupta et al, 2014), and *Making Preschool Inclusion Work* (Richardson-Gibbs & Klein, 2014) continue to be of primary importance to support the field in providing quality early-childhood inclusive opportunities.

Barriers to Inclusion

Even though federal policies and resources support the inclusion of preschool children with disabilities in classrooms with their typically developing peers, several barriers to inclusion persist. First, funding for IDEA Part B has not been increased, which means that funding for preschool special education is insufficient to meet the needs of the growing population of young children being diagnosed with a disability. The resulting shortage of trained professionals available to provide inclusive educational services has resulted in a lack of high-quality preschool classrooms where children can be served inclusively (Richardson-Gibbs & Klein, 2014). A fundamental difference exists between the core knowledge and skills of professionals in early-childhood special education and those in early-childhood education: Early-childhood special-education professionals must earn an advanced degree, whereas early-childhood-education professionals must have

training only in general early-childhood education curricula. And finally, regardless of the best intentions of administrators and educational leaders, there is a lack of understanding in the field about how to make inclusion work (Gupta et al., 2014).

Benefits of Inclusion

Although there are many barriers to providing inclusive preschool services to young children, there are many benefits to providing high-quality inclusive opportunities to 3-, 4-, and 5-year-old children with disabilities. In addition, there is no evidence that preschool inclusion has a negative effect on any child, with or without a disability, being served in an inclusive classroom (Richardson-Gibbs & Klein, 2014). The following review of research in chapter II on preschool inclusion provides details about the many benefits resulting from including children with disabilities with their typically developing peers.

Disability Categories

Thirteen official disability categories are used for the federal reporting of children with disabilities. California uses these same disability categories for state-level reporting on child data, with two exceptions. First, California does not use the "developmental-delay" category. IDEA allows states flexibility in the use of the developmental-delay category; the use of the category is optional. Only children ages 3 through 9 may be reported in the developmental-delay disability category, and then only in states with the diagnostic instruments and procedures to measure delays in physical, cognitive, communication, social or emotional, or adaptive development. States must have defined and established eligibility criteria for developmental delay in order to report children in this category, and California has opted out. Second, California splits the federal disability

category of “hearing impairments” into two categories: “hard of hearing” and “deafness.” A list of all disability categories used in California and a brief description of each category are included in Table 1.

In 2014, according to the U.S. Department of Education, the most prevalent disability category of preschool-age children served in Part B nationwide was speech and language impairment (43.7%). The next most common category was developmental delay (37.0%), followed by autism (8.9%). All other disability categories accounted for 10.5% of all 3-, 4-, and 5-year-olds served under IDEA, Part B (U.S. Department of Education, 2016).

As reported on the DataQuest website, California’s percentages by disability category are similar to the national totals (California Department of Education, 2017). The most common disability category in California is speech and language impairment (62%), followed by autism (22%). All other disability categories accounted for 16% of all preschool children served in California with a diagnosed disability.

Included in Table 2 are all totals by disability category from the California Department of Education’s DataQuest website for data reported in the December 2015 reporting cycle. For the purpose of the proposed study, only disability categories with cell counts greater than 1,000 were examined in the final data set.

Table 1
Disability Categories

Disability Category	Definition
Intellectual Disability	Significantly impaired intellectual and adaptive functioning
Hard of Hearing	Partial or total inability to hear
Deafness	Little to no hearing
Speech or Language Impairment	Difficulty in articulation of words
Visual Impairment	Decreased ability to see, to a degree that causes problems not fixable by usual means, such as glasses
Emotional Disturbance	Poor social or academic adjustment that cannot be otherwise explained by a physical-health impairment
Orthopedic Impairment	Injuries or pain in the human musculoskeletal system
Other Health Impairment	Having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, which result in limited alertness
Established Medical Disability	A disabling medical condition or congenital syndrome that is determined to require special education and services
Specific Learning Disability	Difficulty learning in a typical manner, usually caused by an unknown factor or factors
Deaf-Blindness	Little or no useful sight, and little or no useful hearing
Multiple Disability	Multiple impairments
Autism	Neurodevelopmental disorder characterized by impaired social interaction, verbal and nonverbal communication, and restricted and repetitive behavior
Traumatic Brain Injury	An injury to the brain caused by an external physical force, resulting in total or partial functional disability, psychosocial impairment, or both

Note: For more detail about the definition for each disability category, see Appendix A.

Table 2
Disability Category Totals for California as Indicated on the DRDP Assessment Records for Fall 2015

Disability Category	Totals	%
Intellectual Disability	3,692	4.7
Hard of Hearing	1,174	1.5
Deafness	440	0.6
Speech or Language Impairment	48,700	62.0
Visual Impairment	315	0.4
Emotional Disturbance	99	0.1
Orthopedic Impairment	1,442	1.8
Other Health Impairment	3,309	4.2
Specific Learning Disability	809	1.0
Deaf-Blindness	< 10	0.0
Multiple Disability	780	1.0
Autism	17,754	22.6
Traumatic Brain Injury	84	0.1
Total	78,598	

Preschool Setting

Because the foundation for current early-childhood inclusion practices began to emerge as early as the mid-1980s and thus have evolved and developed over the past 3 decades, young children with disabilities have been served in a variety of settings with varied levels of inclusion with their typically developing peers. The U.S. Department of Education currently has nine categories of educational environment in which children ages 3 through 5 may be served under IDEA, Part B. California uses the same nine categories for state reporting. The nine categories and brief descriptions of the settings are included in Table 3.

In 2014, 65.8% of preschool children with a disability in the United States were served in a regular early-childhood program for some amount of their time in school. In addition, 38.2% of those children received the majority of special-education and related

services in the regular early-childhood program. Children served in a separate class setting accounted for 23% of the total population (U.S. Department of Education, 2016).

Table 3
Federal Preschool Settings

Federal Program Setting	Description (California Department of Education, 2016)
Regular Early-Childhood Program at Least 10 hrs. per week and Majority	A program setting that includes at least 50 to 69% nondisabled children for at least 10 hrs. per wk AND a majority of special-education services provided in this setting.
Regular Early-Childhood Program at Least 10 hrs. per week Majority Elsewhere	A program setting that includes at least 50 to 69% nondisabled children for at least 10 hrs. per wk AND a majority of special-education services NOT provided in this setting.
Regular Early-Childhood Program Less than 10 hrs. per week Majority	A program setting that includes at least 50 to 69% nondisabled children for **less** than 10 hrs. per wk AND a majority of special-education services provided in this setting.
Regular Early-Childhood Program Less than 10 hrs. per week Majority Elsewhere	A program setting that includes at least 50 to 69% nondisabled children for **less** than 10 hrs. per wk AND a majority of special-education services NOT provided in this setting.
Separate Class	In this setting the student attends a special-education program in a class with less than 50% nondisabled children.
Separate School	A placement setting where children receive all special-education programs in public or private day schools designed specifically for children with disabilities.
Residential Facility	Where children receive all special-education and related services in publicly or privately operated residential schools or residential medical facilities on an inpatient basis.
Home	The setting where children receive all special-education and related services in the principal residence of the child's family or caregivers.
Service Provider Location	The setting where children receive all special-education and related services in the service provider location or other location not in any other category.

Note: For more detailed descriptions of federal program settings, see Appendix B.

In California, during the 2015–16 academic year, 53.6% of preschool-age children received special-education services in a regular early-childhood program for some amount of time. Of those children, 33.5% received the majority of their special-education and related services in their regular early-childhood program. A total of 32% of children were served in a separate class.

California's Preschool Accountability System

In order to comply with accountability required by federal law, the Special Education Division (SED) of the California Department of Education (CDE), in collaboration with the Early Education Services Division (EESD), developed the Desired Results Developmental Profile (DRDP) assessment (Desired Results Access Project, 2015). This instrument was implemented across all SED and EESD programs in the fall of 2015. The DRDP assessment enables California to report progress toward the three child outcomes required by the federal Office of Special Education Programs (OSEP) for both infants and preschool-age children with disabilities served by the CDE.

The DRDP, a developmental continuum along which children's knowledge and skills are measured from birth through 5 years of age, is composed of developmental domains representing important areas of learning and development for young children. The DRDP instrument is designed to guide program staff in observing and documenting children's developmental status and progress for the purpose of program improvement. The DRDP is based on recommended practices for naturalistic observation of young children by familiar adults as they participate in activities and routines in familiar environments. The preschool view of the DRDP includes 43 measures across six fundamental domains plus the English Language Development (ELD) domain for

children who are English learners. As indicated above, these domain ratings are used to address the three OSEP outcomes for federal reporting. A brief description of each domain under each OSEP grouping is included in Table 4.

Table 4
Domains of the DRDP (2015)

Domain	Description
OSEP 1	
Approaches to Learning and Self-Regulation (ATL-REG)	The ATL skills include attention maintenance, engagement and persistence, and curiosity and initiative. The REG skills include self-comforting, self-control of feelings and behavior, imitation, and shared use of space and materials.
Social and Emotional Development (SED)	The SED domain assesses children's developing abilities to understand and interact with others and to form positive relationships with nurturing adults and their peers.
OSEP 2	
Language and Literacy Development (LLD)	The LLD domain assesses the progress of all children in developing foundational language (LANG) and literacy (LIT) skills. These skills can be demonstrated in any language and in any mode of communication. Note: For the purpose of the study analyses, LLD was always split into LANG and LIT.
Cognition, Including Math and Science (COG)	The COG domain is made up of the Math (MATH) and Science (SCI) subdomains and focuses on observation, exploration of people and objects, and investigation of objects and concepts. Note: For the purpose of the study analyses, only the MATH measures were included.
OSEP 3	
Physical Development and Health (PD-HLTH)	The PD-HLTH domain assesses motor development and the development of routines related to personal care, safety, and nutrition.
English Language Development (ELD)	The ELD domain assesses the progress of children who are dual-language learners in learning to communicate in English.

Using the DRDP, assessment information is collected twice a year—fall and spring—for all children in California receiving preschool services from the California Department of Education. For children with a diagnosed disability, these assessments

require additional information about each child, including disability category and preschool setting. Given how many children are receiving preschool special-education services in California and all across the United States, the need to study this large-scale data set has never been more critical. The aim of this study is to analyze this information that already is available in order to improve practices for preschool children with special needs, both in the State of California and for the field of early-childhood special education at large.

Research Questions

In an effort to understand more deeply the effect that inclusion has on the developmental growth of preschool children with disabilities, the present study addressed the following research questions with respect to preschool children with disabilities in the State of California:

1. What is the nature of developmental growth, as represented by scores on the DRDP (2015), of children receiving preschool special-education services?
2. To what extent does the developmental growth of children receiving preschool special-education services in inclusive settings differ from those not served in inclusive settings?
3. To what extent does the developmental growth of children receiving preschool special-education services differ by disability category within preschool setting (inclusive vs. noninclusive)?

Definition of Terms

This section includes definitions of key terms and concepts for the study and is provided here to help the reader understand certain words used throughout the research. Although there may be alternative definitions for these terms, the definitions provided are the operational definitions that apply to the study.

Authentic assessment. "Authentic Assessment refers to the systematic recording of developmental observations over time by familiar and knowledgeable caregivers about the naturally occurring competencies of young children in daily routines" (Bagnato & Ho, 2006, p. 27). In this study, the DRDP (2015) is characterized as an authentic assessment, meaning that it is completed by special-education-service providers who are familiar with the child and rate the measures of the instrument after observing the child during their normal daily activities.

Disability. A range of deficits that effect one or more ways a student processes information or physically functions are termed disabilities. The ADA defined a person with a disability as a "person who has a physical or mental impairment that substantially limits one or more major life activity" (ADA National Network, n.d.). In the present study, the term *disability* is used to describe a trait of the study participants; that is a child with a diagnosed disability.

Disability Category. In this study, disability category refers to the 14 disability categories listed on the DRDP information page. The special-education teacher or provider must specify which one of the disability categories signifies the child's primary disability. A complete list and description of each disability category is provided in Appendix A.

Desired Results Developmental Profile 2015 (DRDP 2015). The observational assessment that California uses to assess all children from birth through 5 years being served by the California Department of Education, including infants and toddlers with an Individualized Family Service Plan (IFSP) and preschool-age children with an Individualized Education Plan (IEP). The DRDP is an observational assessment consisting of 43 measures that fall within six domains. The assessment is completed twice a year, in the fall and the spring. For more details, see the section on instrumentation in chapter III.

Developmental Growth. In the current study, developmental growth is a quantitative measure of development using the DRDP. The results of the DRDP outcome measures are provided in scale scores. Developmental growth is observed when scores increase from one assessment period to the next.

Early-Childhood Special Education. Early-childhood special education encompasses the services and supports provided to young children with diagnosed disabilities in accordance with IDEA.

Early-Education Support Division (EESD). The EESD provides leadership and support to contractors and the child-development community, ensuring high quality early-education programs are provided to children ages birth to 13 years (California Department of Education, n.d.).

Ethnicity. In the current study, ethnicity is a variable, collected by the Special Education Division of the California Department of Education, that indicates the ethnic background of the student. A “yes” indicates that the child is Hispanic or Latino, whereas a “no” indicates the child is neither (California Department of Education, 2017). This

variable was included in the final study data file and was analyzed as an independent variable.

Free-Appropriate Public Education (FAPE). FAPE is an educational right of children with disabilities in the United States that is guaranteed by the Rehabilitation Act of 1973 and IDEA. FAPE is defined as "the provision of regular or special education and related aids and services that are designed to meet individual needs of handicapped persons as well as the needs of non-handicapped persons and are based on adherence to procedural safeguards outlined in the law" (U.S. Department of Education, 2016, p. 25).

Hierarchical Linear Modeling (HLM). Hierarchical linear models, also referred to as multilevel models, are used most appropriately and effectively when variables are nested within other variables (Newman, Newman, & Salzman, 2010). With respect to the present study, the growth model was applied to analyzing the longitudinal data set.

Inclusion. Inclusion is the planned merging of people with and without disabilities. The National Association for the Education of Young Children published a joint position statement with the Division of Early Childhood in 2009 that defined early-childhood inclusion as "the values, policies, and practices that support the right of every infant and young child and his or her family, regardless of ability, to participate in a broad range of activities and contexts as full members of families, communities, and society" (DEC/NAEYC, 2009, p. 2). In the present study, inclusion means that the child spends the majority (>10 hours per week) of his or her educational hours in a classroom with his or her typically developing peers. See also Appendix B for details on the specific federal preschool settings.

Individualized Family Service Plan (IFSP). An IFSP is a plan for special services for children who are birth to 3 years of age with a diagnosed disability.

Individual Growth Modeling. The individual growth model is a statistical technique that is used to examine the trajectories of individuals over repeated measures on an outcome variable (Singer & Willett, 2003). With respect to the present study, this is the overarching "family" of statistical techniques in which hierarchical linear modeling (HLM) is included as the individual growth model. HLM was applied to the analysis for the present study.

Individuals with Disabilities Education Act (IDEA). IDEA encompasses the federal guidelines regulating services for students with disabilities.

Integrated Setting. An inclusive setting is an integrated setting where children spend most of their day in a classroom with their typically developing peers (DEC/NAEYC, 2009).

Individualized Education Plan (IEP). An IEP is a documented plan for special services for children 3 to 5 years of age with a diagnosed disability. An IEP is a written document required for all children with a diagnosed disability (IDEA, 2004). Ideally, an IEP is developed by the child's education team—including the special-education provider, general-education teacher, therapists, and others—and is reviewed and modified every year.

The National Professional Development Center on Inclusion (NPDCI). NPDCI works with states to provide professional-development opportunities for early-childhood teachers to ensure that they are prepared to educate and care for young children with disabilities in settings with their typically developing peers.

Noninclusion. Noninclusion is the planned segregation of people with disabilities from people without disabilities. In the present study, noninclusion means that the child does not spend the majority (>10 hours per week) of his or her educational hours in a classroom with his or her typically developing peers. See also Appendix B for details on the specific federal preschool settings.

Observational assessment. In an observational assessment, mastery of developmental skills is determined by observing a child over time as the child participates in classroom activities and daily routines (Bagnato & Ho, 2006). The instrument used in the present study, the DRDP, is an observational assessment.

Office of Special Education Programs (OSEP). OSEP is a federal agency responsible for improving results for infants, toddlers, children, and youth with disabilities, from birth through age 21, by providing leadership and financial support to assist states and local districts.

OSEP Score. The Desired Results Access Project used a set of four separate multidimensional and unidimensional Item Response Theory (IRT) models to estimate children's developmental scores for the eight developmental domains. The first three models are referred to as OSEP 1, OSEP 2, and OSEP 3 respectively. The fourth model consists of the ELD domain score. For the present study, the focused primarily on the three OSEP outcome measures, and the ELD domain was discussed under research question 3.

Part B. Since the enactment of the original legislation in 1975, children and youth (ages 3 to 22) receive special-education and related services under Part B of IDEA (U.S. Department of Education, 2011). Part B is so named because it is the second part of the

law itself. For school-aged children with disabilities, including preschoolers, Part B is the foundation upon which special-education and related services rest.

Preschool Setting. This is the program setting in which the student is receiving or has received special-education and related services according to the student's IEP (California Department of Education, 2017). This variable is being included in the final study data file and will be analyzed as an independent variable.

Segregated Setting. Segregated setting is another way to designate a noninclusive setting. (See definition of *noninclusive* above.) In a segregated setting, children do not spend the majority of the day in a classroom with their typically developing peers.

Special-Education Division (SED). The division of the California Department of Education that is responsible for ensuring services for all children with a disability in California.

Special Education Local Planning Area (SELPA). A local planning area responsible for developing and implementing a plan for providing special-education services to all students in a specific geographic area.

Special education. Services and supports provided to children with identified disabilities in accordance with IDEA.

Typically developing child. A child with no identified disabilities.

Summary

This chapter provides an overview of the purpose of the study, a discussion of the research problem, the significance of the present study, the theoretical framework in which this study is situated, and the background and need for this study. In addition, the proposed research questions and definition of terms have been presented in this chapter.

chapter II provides a review of the relevant literature and research related to the investigation of developmental growth and preschool setting. In chapter III, the methodology for the study is described, including details of the research design, sample, instrumentation, and data analysis procedures including a summary of the pilot study. Preliminary results, including descriptive statistics and sample demographic details, are also included in chapter III. The results for this study are presented in chapter IV. Finally, discussions of findings are presented in chapter V along with the limitations of the study, suggestions for future research, and implications for educational practice.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to present a review of the literature relevant to this study. This chapter includes a comprehensive review of research related to preschool inclusion, including a definition and description of the components of inclusive preschool settings. This information is followed by a review of relevant published literature reviews that investigate the effect of preschool inclusion on developmental outcomes and an in-depth review of selected studies most closely related to the proposed study. Finally, in an effort to provide more information about the local context within which this study is taking place, this review concludes with an overview of the statewide accountability system used to monitor student developmental growth for preschool children in California.

Research on Preschool Inclusion

Research investigating early-childhood preschool special education has shown that providing services for young children with disabilities alongside their typically developing peers benefits children both with disabilities and without (McLean, 2016). Several federally funded research institutes are conducting research investigations in this area, such as the Early Childhood Research Institute on Inclusion, the National Center for Special Education Research, and the National Child Research Center. In addition, numerous comprehensive reviews of the literature have documented the fact that inclusion is an effective practice for providing services to young children with and without disabilities (Bailey, Aytch, Odom, Symons, & Odom,1999; Buysse & Bailey, 1993; Odom, Buysse, & Soukakou, 2011).

In 2004, Odom et al. published a review of the literature around preschool inclusion. The identified 10 key themes that are supported strongly by the literature:

1. Positive outcomes are reported for children with disabilities and typically developing children in inclusive settings.
2. Children with disabilities engage in social interaction with peers less often than typically developing children in inclusive classrooms.
3. School systems are more likely to place children with mild disabilities in inclusive setting than children with severe disabilities.
4. Inclusion means different things to different people.
5. The quality of the early-childhood environments in inclusive settings appears to be, at least, comparable to quality in traditional special-education classes and community-based early-childhood programs serving only typically developing children.
6. Individualized instructional techniques and curricula have been employed in inclusive settings and have produced positive behavioral and developmental outcomes.
7. Teachers generally have positive attitudes about including children with disabilities in their classes but concerns also exist.
8. Family members generally express favorable attitudes toward the inclusion of their children in inclusive programs and positive attitudes increase over time.
9. A range of social-policy factors (e.g., program standards, fiscal issues) affect the implementation of inclusive programs, and the interpretation of policy by key administrators appears to have the most substantial impacts.
10. Cultural and linguistic characteristics of community and family shape the form that inclusion takes in the classroom and access that children have to inclusive programs. (p. 40)

Since the late 1990s, numerous resources have been published that support early-childhood practitioners in educating children with disabilities in inclusive settings (Barton & Smith, 2010; Gupta et al., 2014; Richardson-Gibbs & Klein, 2014). In addition, projects funded by grants from the Early Childhood Technical Assistance Center and the National Association of Education Young Children have been established to provide additional support. As so many resources have been invested in providing support to the field in order to increase the inclusion of children in settings with their typically developing peers, it has become important to conduct research studies investigating the relationships of preschool inclusion and child outcomes. Perhaps even

more importantly, a critical need to explore the relationship of preschool inclusion and developmental outcomes has emerged.

Research Investigating Preschool Inclusion and Developmental Growth

Research studies investigating preschool inclusion and its effect on developmental growth of young children have indicated, for the most part, that children with and without disabilities experience positive benefits (McLean et al., 2016). The following review of research provides details about past studies that are most relevant to this proposed study. This section is broken into two subsections: (a) a review of research prior to 1993, at which point a comprehensive review of the literature up that point was completed, and (b) a review of research since 1993.

Prior to 1993

In 1993, Buysse and Bailey published a comprehensive review of the literature comparing outcomes for young children with disabilities being served in segregated and integrated settings. The researchers have raised questions about the methodology of the 22 studies included in this review and they have cautioned not to over apply the results of these studies. Several variables of interest were included; research methodology, dependent measures, and programmatic variables were examined for the review of each study. The studies included children with disabilities between birth and 5 years of age, and all but three of the studies focused solely on preschool-age children who were 3, 4, and 5 years old. Sample sizes ranged from 2 to 135 participants. Their literature review was restricted to comparative studies that investigated segregated versus integrated settings.

Of the 22 studies included in the review, only seven reported findings with regard to developmental outcomes. Dependent measures of development used in the studies included the McCarthy Scale of Children's Abilities, the Peabody Picture Vocabulary Test, the Vineland Social Maturity Scale, the Alpern-Boll Developmental Profile, the Classroom Assessment of Developmental Skills, the Preschool Language Scale, the Woodcock-Johnson Psycho-educational Battery, the Peabody Fine Motor Scale, the Peabody Fine Gross Motor Scale, and the California Preschool Social Competency Scale.

After reviewing the results of these seven studies, Buysse and Bailey(1993) concluded that "the mean level of children's performance over time as assessed by standardized measures did not vary as a function of integrated versus segregated placement" (p. 449). Their discussion included information about the fact that the quality of the study designs varied widely across the seven studies, which could be the reason they came to this particular conclusion. Also, each study's research design was evaluated for threats to both internal and external validity, and the results of this validity evaluation ranged from five studies with no internal validity threats to one study with four validity threats. This lack of consistent validity results across studies also could account for their conclusion that preschool setting may not have a substantial effect on developmental outcomes for children with disabilities.

This survey article included discussion regarding other program-related factors that could account for the change in developmental scores, such as teacher training, level of instruction, peer interaction, or teacher-to-child ratio. Buysse and Bailey (1993) suggested that it would be inappropriate—and possibly a misinterpretation of the results—to suggest that inclusive settings never improve outcomes for children with

disabilities, given the potential that other factors may have influenced the results. Finally, the group means were used as the basis of comparison across all of these studies, and yet a comparison of the groups at the onset was not investigated. Therefore, it is possible that their conclusion regarding developmental outcomes could be accounted for by inequality of comparison groups at the onset of the studies.

This review of relevant studies prior to 1993 provides a guide to understanding the relevant research base up to that point, and the results of the 1993 review are supportive of the current study for two reasons. First, the review provides a summary of studies that are limited in sample size, diversity of sample population, and length of study. Second, the results provide information about the potential for investigating developmental outcomes related to inclusion, and Buysse and Bailey (1993) provided some suggestions for improving study methodology and analytical procedures to improve upon the results of the past.

Recent Studies

Since 1993, several new studies have investigated the developmental outcomes of preschool children with disabilities in inclusive versus noninclusive settings. In 2009, the National Professional Development Center on Inclusion (NPDCI) published a research synthesis on early childhood inclusion that provides a summary of key conclusions and supporting references for each synthesis point. One of the key synthesis points relates specifically to the current study: “Children in inclusive programs generally do at least as well as children in specialized programs. Inclusion can benefit children with and without disabilities, particularly with respect to their social development” (NPDCI, 2009, p. 2). Using the list of studies included in this document, as well as the results of a

comprehensive literature search, seven additional studies were identified that investigate the outcomes for preschool children with disabilities by setting.

Of the seven studies included in this review, four reported findings with regard to developmental outcomes. Dependent measures of development used in the studies included the Brigance Diagnostic Inventory of Early Development, the Uniform Performance Assessment System, the Vineland Adaptive Behavior Scales (Parent and Teacher Versions), the Preschool Language Assessment Instrument, and the Wechsler Preschool and Primary Scale of Intelligence. Each of these instruments measures a child's development across domains, including gross- and fine-motor skills, self-help skills, mathematics knowledge, speech and language skills, social and emotional development, and literacy skills. The other three studies were comparative studies of outcomes by preschool setting but employed nondevelopmental outcomes, such as friendship formation and social behaviors. Details for each study are provided in Table 5.

The four studies that investigated developmental outcomes all included preschool-age children, ranging from 2.5 to 6 years of age. The sample sizes for each study range from 30 to 223 participants. In addition, each study is a comparative study investigating inclusive versus noninclusive settings. The following review of these four studies will highlight the gaps in the present research base around preschool inclusion.

Rafferty, Piscitelli, and Boettcher (2003). In 2003, Rafferty, Piscitelli, and Boettcher conducted a study of the effect of inclusion on language development and social competence among preschoolers with disabilities. A total of 96 preschoolers were included in the study, with 68 being served in an inclusive setting and 28 in a noninclusive setting. Each child was measured at two points in time (October and May)

Table 5
Summary of Studies Comparing Inclusive and Noninclusive Settings

Authors	No. of subjects	Ages of subjects	Dependent measures	Preschool setting
Buysse, Goldman, & Skinner (2002)	120 D 213 ND	19 to 77 months	• Playmates and Friends Questionnaire for Teachers • Teacher Ratings of Children's Social Development • ABILITIES Index • Benefits and Drawbacks of Early Childhood Inclusion Rating Scale	45 classrooms in inclusive early-childhood programs in North Carolina
Diamond & Carpenter (2000)	8 D 55 ND	2 to 6 years	• Helping interview • Teacher questionnaire • Disability reference score	3 inclusive classrooms with 33 children with (*n*=8) and without disabilities (*n*=25). 30 children without disabilities enrolled in a regular early-childhood program
Guralnick, Connor, Hammond, Gottman, & Kinnish (1996)	30 D 42 ND	4.25 to 5.5 years	Observational measures: • Social Participation and Cognitive Play • Individual Social Behaviors • Peer Sociometric Ratings	12 separate playgroups, 6 children per playgroup. 6 playgroups were inclusive (4 without disabilities and 2 with), 3 groups all kids without disabilities, 3 groups all kids with disabilities

Table continues

Table 5 continued

Authors	No. of subjects	Ages of subjects	Dependent measures	Preschool setting
Holahan & Costenbader (2000)*	30 D	3 to 5 years	• The Brigance Diagnostic Inventory of Early Development	Two special-education classrooms, one inclusive (50% typically developing children) and one self-contained special-education classroom
Hundert, Mahoney, Mundy, & Vernon (1998)*	94 SD 66 D 63 ND	2.5 to 6 years	• Uniform Performance Assessment System • Teacher Vineland Adaptive Behavior Scale • Parent Vineland Adaptive Behavior Scale	173 preschool students, 48 SD in noninclusive classrooms, 46 SD in inclusive classrooms, 66 D in inclusive classrooms, and 63 ND in inclusive classrooms
Mills, Cole, Jenkins, & Dale (1998)*	66 D	31 to 75 months	• McCarthy Scale of Children's Abilities • Preschool Language Assessment Instrument (PLAI)	22 noninclusive classrooms, 22 inclusive special-education classrooms, and 22 inclusive regular-education classrooms
Rafferty, Piscitelli, & Boettcher (2003)*	96 D	33 to 57 months	• The Preschool Language Scale-3 • Social Skills Rating System (SSRS) • Wechsler Preschool and Primary Scale of Intelligence	68 inclusive classrooms and 22 noninclusive classrooms

Note: *Studies investigating the relationship between preschool setting and developmental outcomes. SD = severe disability, D = disability, ND = no disability.

on three instruments for language development, social competence, and cognitive ability. The Preschool Language Scale-3 was used to assess receptive and expressive language skills. The Social Skills Rating System (SSRS) was used to measure a child's social skills and problem behaviors.

Finally, in order to measure cognitive ability, the Wechsler Preschool and Primary Scale of Intelligence-Revised was used. The Wechsler can be broken down into six verbal subscales that consist of language-based items and the performance scale subscales consist of visual-motor items. These scores were used to classify a child as "Severely Disabled." If the child had a score at or below two standard deviations from the mean on either the verbal or performance scales, the child was categorized as severely disabled.

The study included an investigation of the two groups at the onset of the study (pretest) and found that the children in inclusive classrooms had greater developmental abilities as measured on the Wechsler. There were large effect sizes for auditory comprehension (d = 0.97), expressive language (d = 0.91), and social skills (d = 1.18), but not for problem behaviors (d = 0.03). Rafferty et al. (2003) noted that these findings indicate that it is more likely that a child who is higher functioning will be served in an inclusive setting. They also pointed out that, although they had discussed the differences in the comparison groups at the start of the study, no specific research design or analytical techniques were used to mitigate the effect of unequal comparison groups.

The study had two main research questions. The first was focused on the factors associated with language ability and social competence based on child, parent, and family characteristics. The results related to this research question are not relevant to the present

literature review. The second main research question, which was focused on the interaction between preschool setting and severity of disability in predicting developmental abilities, was broken into two specific subquestions:

1. Do children with less severe disabilities make greater growth in integrated settings than in segregated settings?
2. Do children with more severe disabilities make greater growth in segregated settings than in integrated settings? (Rafferty et. al., 2003, p. 469)

Table 6
Results of Hierarchical Multiple Regression Analyses Predicting Language Development at Posttest (N = 96)

	Auditory Comprehension *Beta at Each Step*				*Expressive Language* *Beta at Each Step*			
Predictor Variables	STEP #1	STEP #2	STEP #3	STEP #4	STEP #1	STEP #2	STEP #3	STEP #4
Pretest Score	0.84	0.81	0.73	0.27	0.85	0.83	0.72	0.71
Placement Type		-0.08	-0.07	-0.07		-0.05	-0.03	0.07
Degree of Ability			-0.12	-0.12			-0.18	-0.14
Program x Ability				-0.00				-0.14
F	223.60	113.17	77.21	57.27	237.60	118.82	85.36	64.83
df	(1, 92)	(2, 91)	(3, 90)	(4, 89)	(1, 93)	(2, 92)	(3, 91)	(4, 90)
Adjusted R^2	0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.73
R^2 Change	0.71*	0.01	0.01	0.00	0.72*	0.00	0.02*	0.01

Note: Inclusion = 0; Segregated = 1; Not Severe = 0; Severe = 1.
*Statistically significant at .05 level.

Table 7
Results of Hierarchical Multiple Regression Analyses Predicting Social Competence at Posttest (N = 96)

	Social Skills *Beta at Each Step*				*Problem Behaviors* *Beta at Each Step*			
Predictor Variables	STEP #1	STEP #2	STEP #3	STEP #4	STEP #1	STEP #2	STEP #3	STEP #4
Pretest Score	0.83	0.84	0.83	0.82	0.66	0.66	0.65	0.66
Placement Type		0.02	0.04	0.11		-0.17	-0.14	-0.22
Degree of Ability			-0.07	-0.04			-0.07	-0.09
Program x Ability				-0.11				0.10
F	215.02	106.55	71.85	54.04	73.33	40.52	27.13	20.31
df	(1, 94)	(2, 93)	(3, 92)	(4, 91)	(1, 94)	(2, 93)	(3, 92)	(4, 91)
Adjusted R^2	0.69	0.69	0.69	0.69	0.43	0.45	0.45	0.45
R^2 Change	0.69*	0.00	0.01	0.00	0.43*	0.03*	0.00	0.00

Note: Inclusion = 0; Segregated = 1; Not Severe = 0; Severe = 1.
*Statistically significant at .05 level.

Using hierarchical multiple regression procedures, the effect of program type and significance of disability were investigated. The results of the study indicated that for

both language development and social competence, the interaction between program type and significance of disability did not return statistically significant results, as seen in Tables 6 and 7 in the columns labeled Step #4. The results of the hierarchical multiple regression also indicated that pretest scores accounted for the majority of the variance in posttest scores, as seen in the columns labeled Step #1.

An additional series of analyses focused on investigating the developmental growth of preschool children with severe disabilities by setting. As seen in Table 8, posttest scores on language development and social competence did not differ for children with several disabilities in inclusive versus noninclusive settings. In contrast, the developmental growth of children with severe disabilities being served in inclusive settings was statistically significantly greater than that of their peers in noninclusive settings with larger effect sizes except for Problem Behaviors.

Table 8
Developmental Ability at Posttest According to Degree of Disability

	Inclusion (*n*=68)		Segregated (*n*=28)				
Degree of Disability	*M*	*SD*	*M*	*SD*	*t*	*df*	Cohen's *d*
			Auditory Comprehension				
Not Severe (*n*=49)	95.36	16.02	90.86	16.63	0.69	47	0.28
Severe (*n*=47)	72.42	15.40	61.38	11.48	2.69*	43	0.81
			Expressive Language				
Not Severe (*n*=49)	91.83	15.87	92.71	19.52	-0.13	47	-0.05
Severe (*n*=47)	70.08	15.69	58.90	9.70	2.84*	44	0.84
			Social Skills				
Not Severe (*n*=49)	93.74	12.06	92.43	19.69	0.24	47	0.10
Severe (*n*=47)	89.62	15.41	72.24	21.71	3.21*	45	0.94
			Problem Behaviors				
Not Severe (*n*=49)	106.67	14.16	106.57	17.53	0.02	47	0.01
Severe (*n*=47)	104.00	10.34	98.67	11.99	1.64	45	0.48

*Statistically significant at .05 level.

This study represents statistically significant and practically important results regarding ongoing efforts to understand the effects of inclusion on the development of preschool children with disabilities. First, the preschool children with less severe disabilities included in this study did not make greater developmental gains in inclusive

settings. In addition, children with more severe disabilities did not make greater developmental gains in noninclusive settings. Although these results are statistically significant, they are limited by several factors: the sample was small and drawn from one school, there were nonequivalent comparison groups, the study spanned a limited time period (October–May), and there was no control for the overall error rate for the statistical tests. Future studies should expand to include a more heterogeneous sample in both ethnic composition and socioeconomic status, control for nonequivalent comparison groups in research design and analytical procedures, and include data from across multiple time points. The current study addressed each one of these specific limitations.

Holahan and Costenbader (2000). In 2000, Holahan and Costenbader published their comparative study of developmental gains for preschool children with disabilities in inclusive and noninclusive classrooms. The study included 15 pairs of children ($N = 30$) with disabilities: 15 children were enrolled in inclusive classrooms, and the matched pairs were enrolled in a noninclusive classroom. Each child was measured twice, in fall and spring, on the Brigance Diagnostic Inventory of Early Development (Brigance), a criterion-reference inventory of 98 skills across 11 developmental domains. Three of the domains—self-help skills, general knowledge and comprehension, and social and emotional development—were selected for use in this study because they are representative of developmental growth in the areas of adaptive, cognitive, and social skills (Holahan & Costenbader, 2000).

The 30 children in the study were matched by chronological age, gender, initial level of functioning, related-services received, and attendance schedules to form 15 pairs, one child inclusively served and one child in a noninclusive setting. In order to

investigate whether the matching process was successful in creating two comparable groups, a one-way analysis of variance (ANOVA) was performed on the pretest variables (Table 9). There were no statistically significant differences in the two groups in age, related services, attendance schedules, or initial levels of functioning as measured by the Brigance.

Table 9
Analysis of Inclusive versus Self-Contained Group Comparability for Matching Variables

	Inclusive (n = 15)		Self-contained (n = 15)		
Variable	*M*	*SD*	*M*	*SD*	*F*
Chronological age (months)	54.73	4.01	53.87	5.11	0.27
Related services (minutes)	82.10	64.61	106.00	66.95	0.34
Developmental delay (months)[a]					
• Self-help skills	6.67	6.28	6.53	5.15	0.00
• General knowledge	5.14	5.88	7.00	5.63	0.75
• Social and emotional skills	7.20	7.22	8.53	6.55	0.28
• Composite score	6.60	4.85	7.33	4.79	0.17

[a] Developmental delay scores were calculated by subtracting each child's developmental age score for each domain, as measured by the Brigance Developmental Inventory of Early Development, from the child's chronological age.

The primary goal of this study was to examine the effects of classroom inclusion on the developmental and social growth of preschool children with disabilities. More specifically, the study investigated whether children initially functioning at a higher developmental level would make greater social and developmental gains in inclusive classrooms, whereas children initially functioning at a lower levels would demonstrate more growth in noninclusive settings. A series of two-way ANOVAs was used to address these research questions. The mean rates of growth per month for the two comparison groups of children are presented in Table 10, and the results of the two-way ANOVAs are presented in Table 11.

Table 10
Mean Rate of Growth per Month by Setting as Measured by the Brigance Developmental Inventory

	Inclusive setting		Self-contained setting	
Domain	*M*	*SD*	*M*	*SD*
Self-help skills	0.68	.52	0.62	.50
General knowledge	1.45	.79	1.09	.79
Social and emotional skills	1.53	.90	1.07	.89
Composite score	1.38	.70	0.99	.70

Table 11
Effects of Developmental Delay in Months and Educational Setting (Inclusive or Self-Contained) on the Rate of Growth of 15 Matched Pairs of Preschool Children

	Main effect		Interaction between delay and setting
	Developmental delay	Setting	
Domain	*F*	*F*	*F*
Self-help skills	3.25	0.15	0.89
General knowledge	2.31	0.37	0.27
Social and emotional skills	1.69	6.63*	4.69*
Composite score	0.00	2.76	0.98

*Statistically significant at .05 level.

A statistically significant interaction effect was found between delay in social and emotional skills and setting on the achieved rate of growth. The effect size was not provided by the researchers, but was calculated to be large (d = 1.12). Children who started at a low level of functioning in social and emotional skills progressed at an equal rate in both settings, but a child who started high in social and emotional skills made more progress in an inclusive setting. There were no statistically significant results found for developmental outcomes, the domains of general knowledge and self-help skills, or the overall composite score.

This study only partially provides support for the interaction between developmental growth and preschool inclusion. The researchers noted a number of limitations to the study. First, the Brigance is a criterion-referenced instrument for which "no psychometric properties are available," which means that it may be less useful in measuring developmental growth (Holahan & Costenbader, 2000, p. 233). Second, the adult-to-child ratios differ slightly from inclusive to noninclusive settings (5:1 to 4:1).

Third, random assignment to setting was not possible because the study took place in naturally occurring classrooms, which limited the ability to control for other variables such as parental choice or school preferences. Fourth, the study was restricted geographically and was conducted in only two settings, which limits the generalizability of the results based on population density, socioeconomic, and cultural backgrounds. Finally, it was not possible to control for teacher, instructional, or classroom differences across the two centers where the children were enrolled. All classrooms, however, used the same curriculum. The proposed study included a developmental measure that has been psychometrically validated and a sample was pulled from across the entire state of California.

Hundert, Mahoney, Mundy, and Vernon (1998). In 1998, Hundert, Mahoney, Mundy, and Vernon published their descriptive study of pre-assessment differences and gains of children with severe disabilities in segregated and integrated preschools over a preschool year. A total of 94 children with severe disabilities, 66 children with mild or moderate disabilities, and 63 typically developing children were included in this comparative study. Of the 94 children with severe disabilities, 48 were served in segregated preschool programs and 46 were in integrated programs. Each child was measured at two points during the year on four different measurements. The Uniform Performance Assessment System (UPAS) was used to measure the development of children across six domains, including preacademic, communication, social or self-help, gross motor, and behavior. Parents were asked to rate their child's development on the Vineland Adaptive Behavior Scale (VABS), which includes 297 items in four general domains: communication, daily living, socialization, and motor skills. The third outcome

measure was a classroom teaching rating of the child's level of development on the Vineland Adaptive Behavior Scale: Classroom Edition. This measure has fewer items than the parent version, but the items are almost identical. The teacher was required to indicate a child's "observed performance" and "expected performance" for each item. The final measure of a child's performance consisted of direct observation of the child's interactive play during three 30-minute classroom free-play periods, both at pre- and postassessment. Observers coded the type of social interaction and whether the child initiated interaction. Of primary interest were changes in the level of the child's interactive play from beginning to end of the school year (Hundert et al., 1998).

The study included an investigation of pre-assessment differences by setting. Tables 12 through 15 include the means, standard deviations, and z-score changes for each comparison group across the four measures. The pattern of results from across the first three measures were the same. The two groups with severe disabilities were not statistically significantly different from one another, but they did have a statistically significantly lower mean than the mild or moderate group of children. In addition, the mild or moderate group were statistically significantly lower than the typically developing group across the three measures. The only exception to these results was that the children with severe disabilities served in segregated settings had a statistically significantly lower mean than the children with severe disabilities served in inclusive settings on the moto development domain of the UPAS, F (1, 228) = 3.44. The calculated measure of practical import $\eta^2 = .01$.

Table 12
Mean Raw Pre- and Post-Assessment Scores for Uniform Performance Assessment System Scales and z-score Changes for Each Experimental Group

	SS (n = 48)			SI (n = 46)			MM (n = 66)			TD (n = 63)			
Domain	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*F*
Preacademic	14.0	17.7	0.37	16.6	20.1	0.47	36.2	42.5	0.52	54.3	62.7	0.82	14.68*
Communication	17.9	21.4	0.24	17.9	23.0	0.48	42.9	48.1	0.42	66.3	70.3	0.57	7.59*
Social/Self-Help	12.1	15.1	0.31	14.4	19.1	0.62	34.3	37.7	0.44	43.2	46.0	0.59	5.07*
Gross Motor	26.0	29.8	0.18	34.5	41.7	0.36	55.0	59.6	0.49	66.0	69.7	0.65	7.65*
Total Score	68.9	84.3	0.28	83.4	102.4	0.54	168.8	186.6	0.53	230.1	246.9	0.74	12.63*

*Statistically significant at .05 level.
Note: Abbreviation key: SS = children with severe disabilities in specialized settings, SI = children with severe disabilities in community settings, MM = children with mild or moderate disabilities in community settings, TD = typically developing children

Table 13
Mean Raw Pre- and Post-Assessment Scores for Teacher-Completed Vineland Adaptive Behavior Scale and z-score Changes for Each Experimental Group

	SS (n = 48)			SI (n = 46)			MM (n = 66)			TD (n = 63)			
Domain	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*F*
Communication	12.9	15.2	0.15	13.2	16.2	0.36	36.5	40.5	0.32	64.6	69.0	0.36	0.90
Daily Living	12.8	14.3	0.08	15.8	19.2	0.35	49.5	53.2	0.27	75.7	83.9	0.46	2.50
Socialization	10.5	13.8	0.42	13.4	16.5	0.29	32.5	35.0	0.32	49.7	55.1	0.38	0.22
Motor	9.7	11.5	0.14	13.9	16.3	0.27	32.7	35.1	0.31	46.4	49.1	0.37	0.73
Total Raw Score	45.9	54.7	0.19	56.2	67.3	0.41	151.3	164.5	0.34	236.5	257.1	0.46	1.61

*Statistically significant at .05 level.
Note: Abbreviation key: SS = children with severe disabilities in specialized settings, SI = children with severe disabilities in community settings, MM = children with mild or moderate disabilities in community settings, TD = typically developing children

Table 14
Mean Raw Pre- and Post-Assessment Scores for Parent-Completed Vineland Adaptive Behavior Scale and z-score Changes for Each Experimental Group

	SS (n = 48)			SI (n = 46)			MM (n = 66)			TD (n = 63)			
Domain	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*F*
Communication	20.8	21.3	0.09	26.5	32.0	0.38	48.3	54.2	0.39	74.7	79.4	0.41	1.69
Daily Living	18.8	20.6	0.12	31.7	36.3	0.32	63.3	54.2	0.44	82.4	88.3	0.51	2.23
Socialization	30.4	31.6	0.03	39.0	42.3	0.25	54.5	59.4	0.43	66.7	70.6	0.47	2.16
Motor	22.6	24.5	0.00	34.2	37.7	0.33	51.3	54.8	0.45	61.6	64.1	0.21	1.87
Total Raw Score	92.6	98.5	0.06	131.4	148.8	0.43	217.4	238.1	0.47	285.6	299.7	0.47	2.55

*Statistically significant at .05 level.
Note: Abbreviation key: SS = children with severe disabilities in specialized settings, SI = children with severe disabilities in community settings, MM = children with mild or moderate disabilities in community settings, TD = typically developing children

Table 15
Mean Raw Pre- and Post-Assessment Percentage of Play Codes during Free Play Sessions and z-score Changes for Each Experimental Group

	SS (n = 48)			SI (n = 46)			MM (n = 66)			TD (n = 63)			
Domain	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*Pre*	*Post*	*z*	*F*
No Play	13.9	12.9	-0.06	17.7	13.9	-0.22	9.4	12.5	0.45	10.6	9.1	-0.19	1.05
Isolated/ Occupied	4.5	4.8	-0.01	5.4	7.8	0.39	7.3	8.3	0.11	4.0	3.7	0.02	2.81*
Proximity Play	26.7	28.8	0.18	30.0	35.3	0.22	40.3	41.6	0.07	37.2	34.7	-0.13	0.89
Interactive Play	4.2	3.6	-0.15	7.8	7.1	-0.12	16.6	17.1	0.09	32.5	40.8	0.44	1.11
Negative Play	0.1	0.1	0.00	0.5	0.4	-0.02	0.9	1.1	0.08	0.03	0.3	-0.10	3.18*
Adult Interaction	50.5	49.1	-0.10	38.7	33.8	-0.22	23.7	18.4	-0.36	13.7	10.8	-0.33	0.18
Percentage of Play Initiations	19.3	25.3	0.26	28.2	27.0	-0.06	44.1	50.4	0.38	54.3	59.9	0.45	0.56

*Statistically significant at .05 level.
Note: Abbreviation key: SS = children with severe disabilities in specialized settings, SI = children with severe disabilities in community settings, MM = children with mild or moderate disabilities in community settings, TD = typically developing children

Overall, the results indicate that all groups of children increased their performance on the UPAS and the Vineland, with fewer gains for children with severe disabilities in segregated programs than children in the other three comparison groups, although with a small effect size. The developmental gains of children with severe disabilities in inclusive settings were moderate and equal to the gains of children with mild or moderate disabilities in inclusive settings. A similar pattern occurred in the results of the parent version of the Vineland, except that no statistically significant gains were reported for either group of children with severe disabilities.

For the social interaction measure, no gains were observed in the level of peer interaction for any groups of children with disabilities. The group of typically developing children showed moderate increases in their percentage of peer interaction over the school year.

These results, when taken together, suggest that children with severe disabilities who are served in specialized settings do not make greater gains developmentally or

socially than their peers served in inclusive settings. In addition, the amount of peer interaction for children with disabilities did not increase through the year regardless of setting or severity of disability.

Although these results are statistically significant, it should be noted that this study was descriptive—not experimental. Hundert et al. (1998) noted that there were several differences between the inclusive and segregated classroom settings that were not measured or taken into account in their analyses. An additional limitation acknowledged by the researchers is that their definition of "severe" was determined by the children's relative developmental delay, which may not be the appropriate method of determining severity. Future studies investigating the link between severity of disability and development should use a formal measure of severity for each child. The current study did not include a formal measure of severity of disability either, but the large sample size enables the use of specific disability categories as markers of severity.

Mills, Cole, Jenkins, and Dale (1998). In 1998, Mills, Cole, Jenkins, and Dale published their comparative study of three levels of inclusion on cognitive and language development of preschool children with disabilities. The three levels of inclusive setting included special-education-only, integrated-special-education, and mainstream placements, and the 66 preschool children included in the study were assigned randomly to one of these three settings. Twenty-two children were served in a special-education-only setting, 22 went into an integrated-special-education setting, and 22 were mainstreamed with typically developing children. Each child was measured twice between October and May on the McCarthy Scales of Children's Ability (MSCA) and the Preschool Language Assessment Instrument (PLAI). The MSCA is an intelligence test

for children 2.5 through 8.5 years of age. Domains of the test include verbal, perceptual, quantitative, memory, motor, and a general cognitive index (Mills et al., 1998).

Table 16
Repeated Measures ANOVAs on McCarthy Scales and PLAI

	Pretest		Posttest		
Measure	*M*	*SD*	*M*	*SD*	*F*
McCarthy GCI					
Special education–only	37.05	19.78	74.14	28.32	
Integrated	67.73	20.26	75.18	23.65	
Mainstreamed	64.91	16.52	65.33	16.16	
Time					6.01*
Interaction					1.25
McCarthy Verbal					
Special education–only	33.95	10.69	34.33	12.20	
Integrated	31.45	11.22	36.41	13.05	
Mainstreamed	30.09	9.84	30.14	9.60	
Time					3.47
Interaction					2.74
McCarthy Perceptual					
Special education–only	31.57	11.24	33.19	12.05	
Integrated	33.68	11.89	36.36	14.47	
Mainstreamed	33.48	10.15	33.76	9.54	
Time					3.49
Interaction					0.72
McCarthy Quantitative					
Special education–only	33.91	9.59	32.91	11.39	
Integrated	35.50	12.73	37.82	13.85	
Mainstreamed	32.00	9.19	32.95	9.89	
Time					0.64
Interaction					1.05
McCarthy Memory					
Special education–only	34.38	11.27	34.05	13.19	
Integrated	34.64	10.44	37.64	15.65	
Mainstreamed	32.38	9.21	30.00	10.20	
Time					0.01
Interaction					2.23
PLAI Total Appropriate					
Special education–only	.31	.27	.44	.20	
Integrated	.33	.26	.44	.24	
Mainstreamed	.31	.26	.37	.25	
Time					31.81*
Interaction					1.58

Note: McCarthy GCI = McCarthy Scales of Children's Abilities General Cognitive Index; PLAI = Preschool Language Assessment Instrument.
*Statistically significant at .05 level.

Analyses of variance procedures were used to compare the three groups on the pretests levels of both the McCarthy and PLAI measures. There were no statistically significant pretest measures. The means and standard deviations for the pre- and posttest

measures on the two tests were then computed and examined in order to investigate any differences between the gains of the three comparison groups. Repeated-measures ANOVAs with treatment and between-subjects factor and time as within-subjects factor were calculated and examined. The interaction of treatment and time was not statistically significant for any of the measures. The main effect of time was statistically significant for the McGarthy General Cognitive Index (GCI) and the PLAI. The results of these analyses are displayed in Table 16.

In addition to the ANOVAs, effect sizes were computed in order to quantify the differences between pre- and posttest for each of the comparison groups. As shown in Table 17, the largest effect sizes were associated with the integrated setting, followed by the special-education-only setting especially for the PLAI. The smallest effect sizes were associated with the mainstreamed setting except for the PLAI.

Table 17
Effect Sizes for Gains from Pre- to Post-test for Three Classroom Compositions

	Classroom Composition		
Measure	Special Education-Only	Integrated	Mainstreamed
McCarthy			
GCI	.36	.40	-.01
Verbal	-.01	.48	-.01
Perceptual	.17	.25	.02
Memory	-.10	.29	-.24
PLAI	.78	.64	.60

Note: Effect sizes computed by dividing pre-posttest difference by the pretest standard deviation, pooled across groups. McCarthy GCI = McCarthy Scales of Children's Abilities General Cognitive Index; PLAI = Preschool Language Assessment Instrument.

The primary goal of this study was to contrast the developmental growth of children served in three different classroom settings for children with disabilities. All children demonstrated statistically significant growth from pre- to posttest on both the McCarthy and the PLAI measures. The results of the ANOVA did not indicate statistically significant treatment differences based on setting; however, the effect size

analysis did indicate moderate effect sizes for the integrated special-education setting and special-education-only treatment. The results of this study are important in that they further extend the results that indicate preschool setting does have an effect on a child's developmental growth. The reliability of the findings, however, would have been enhanced by adding more measures of development across the study period. Finally, the size and geographic limitations of the sample may lessen the generalizability of the results.

Taken together, the results of the studies of the past (prior to 1993) and the four more recent studies reviewed support the need for this proposed study by highlighting several of the gaps that exist in the present body of research investigating developmental outcomes and preschool setting. First, samples have been limited by geographic location, socioeconomic and cultural diversity, and classroom settings. Second, developmental growth has not been examined over more than two points in time within a single year of receiving services in the specified setting. Finally, the measurement tools used have been limited in psychometric validation or scope of measurement. The current study added to past and recent research by using a large-scale sample, including data for four data points across 2 years on the Desired Results Development Profile (DRDP, 2015), a psychometrically validated assessment tool that measures development across six fundamental domains of development.

Educational Accountability

A public accountability system of schools using test scores is relatively new in the United States (Dorn, 1998). Data have been collected on public schools since the late nineteenth century, but historically that information has been used by school districts and

states only for internal planning and monitoring purposes. Only more recently, since the 1960s, has student data been more publicly reported.

Accountability for Children with Disabilities

The Individuals with Disabilities Education Improvement Act of 2004 (IDEA) included a heightened emphasis on accountability, focusing on improving educational results for children with disabilities. IDEA directs states to develop a 6-year State Performance Plan (SPP) and to submit Annual Performance Reports (APRs) related to the indicators specified in the SPP. Each SPP indicator contains information such as baseline data and measurable, rigorous targets. Indicator 7, preschool assessment, focuses on measurement of skills of preschool children with Individualized Education Programs (IEPs) in three specific Office of Special Education (OSEP) outcome areas:

> OSEP 1: Social relationships includes getting along with other children and relating well with adults;
> OSEP 2: Use of knowledge and skills refers to thinking, reasoning, problem-solving, and early literacy and math skills; and
> OSEP 3: Taking action to meet needs includes feeding, dressing, self-care, and following rules related to health and safety. (ECTA, 2015, p. 1)

California's Preschool Accountability System

In order to comply with federal law, the Special Education Division (SED) of the California Department of Education (CDE), in collaboration with the Early Education Services Division (EESD), developed the Desired Results Developmental Profile (DRDP, 2015) assessment. The instrument was implemented across all of the SED and EESD programs in the fall of 2015. The DRDP assessment enables California to report progress toward the three child outcomes requirements for both infants and preschool-age children with disabilities served by the CDE.

The DRDP, a developmental continuum for children from birth through 5 years of age, is composed of developmental domains representing important areas of learning and development for young children along which children's skills are measured. The DRDP instrument is designed to guide program staff in observing and documenting children's developmental status and progress for the purpose of program improvement. The DRDP is based on recommended practices for naturalistic observation of young children by familiar adults as they participate in activities and routines in familiar environments. The Preschool View of the DRDP includes 43 measures across six fundamental domains that were detailed in Table 4 in chapter I.

Since 2007, Special Education Local Plan Areas (SELPAs) have reported on preschool-aged children's growth by implementing the DRDP assessment. SELPAs report DRDP assessment data to the CDE, SED through the California Special Education Management Information System for all 3-, 4-, and 5-year-old children with IEPs (not in transitional kindergarten or kindergarten) each fall and spring. The DRDP data are used for the SPP/APR reporting on Indicator 7, according to the requirements of the Federal Office of Special Education Programs.

Summary of the Literature

Early-childhood special-education services and practices in the United States have evolved out of early-childhood practices and policies. Although research indicates that preschool inclusion is an effective practice that supports belonging, participation, and forming positive social relationships, few empirical research studies have investigated the relationship between preschool inclusion and developmental growth at a large-scale, longitudinal level across all domains of child development (Holahan & Costenbader,

2000; Hundert et al., 1998; Mills et al., 1998; Rafferty et al., 2003). The detailed review of past and recent research highlights several gaps in the research. First, samples have been limited by geographic location, socioeconomic and cultural diversity, and classroom settings. Second, developmental growth has not been examined over more than two points in time and more than one year receiving services in the specified setting. Finally, the measurement tools used have been limited in psychometric validation or scope of measurement.

CHAPTER III

METHODOLOGY

The purpose of this study was to examine the relationship between preschool setting and the developmental growth of preschool children. This study is an analysis of a large-scale longitudinal data set that includes all children receiving preschool special-education services in California over a 2-year period. What follows in this chapter are the details of the research design of the study, study population characteristics, the instrumentation used, study procedures, data-analysis plans, and a summary of the pilot study.

Research Design

This study is a secondary data analysis. In general, the purpose of a secondary data analysis is twofold: one, to investigate questions of the particular data set that have never been asked before and, two, to employ new techniques to analyze the data in a way that has never been done before. This study investigated both new research questions, as well as the application of new techniques to the data file. In order to address the research questions, differences in the response variables between the children were investigated.

Two existing data files that were merged to relate background variables, setting information, and Desired Results Developmental Profile (DRDP, 2015) scores for preschool special-education students were used. The first data file was obtained from the California Special Education Management Information System (CASEMIS) and the second file is the DRDP (2015) data file. This study addressed the influence of inclusive versus noninclusive settings on growth scores from the DRDP using the DRDP scores and the eight domain scores as the measures of developmental growth. The following

research questions were posed with respect to preschool children with disabilities in the State of California:

1. What is the nature of developmental growth, as represented by scores on the DRDP (2015), of children receiving preschool-special-education services?
2. To what extent does the developmental growth of children receiving preschool special-education services in inclusive settings differ from those not served in inclusive settings?
3. To what extent does the developmental growth of children receiving preschool special-education services differ by disability category within preschool setting (inclusive vs. noninclusive)?

The research design for this study involved a comparison of preschool children served in inclusive settings with children in noninclusive settings on the outcome measure. Because there is no random assignment of students to the different preschool settings, either inclusive or noninclusive, it was necessary also to obtain background variables on the children to investigate any differences between the two comparison groups across the demographic variables.

The final data file analyzed was created by merging 14 variables from two existing data files obtained from the California Department of Education (CDE) per specifications provided by the researcher. The first data file, from the CASEMIS Student Data Table, includes the four background variables (gender, ethnicity, race, and disability category) and the explanatory variable (preschool setting). The second data file was the DRDP data file, which includes the 11 response variables, the DRDP scores for the three main outcomes areas, and the eight domain scores for each child.

Data Sources and Instrumentation

Fourteen variables from two merged data sets were included in this study. The three classes of variables were included in the data set: background, explanatory, and response variables. The background and explanatory variables were all included in the CASEMIS data file; the 11 response variables were included in the DRDP data file. What follows in this section is a description of each of the three types of variables included in the final data file.

Background Variables

As part of their annual reporting to CDE, Special Education Local Planning Areas (SELPAs) must submit child information and demographic details to CASEMIS, a data-reporting and retrieval system for special education, developed by the CDE, Special Education Division (SED). The system is designed to assist local education agencies in submitting student-level data to the CDE.

The first group of variables that come from CASEMIS are the background variables that are included in the Student Data Table—Table A in CASEMIS. Table A includes a total of 67 fields for each student receiving special-education services in the state. For the purpose of this study, four variables of interest were gathered for each child from this table: gender, ethnicity, race, and disability category. The Statewide Student Identification (SSID) number for each child's records were used for matching purposes only. Details regarding each of the demographic variables included in this study are presented in Table 18.

Within the disability category variable are 14 distinct disabilities, however some categories have relatively few students. For the final analyses for research question 3, a

decision was made to include a specific disability category if the cell count was greater than 1,000 students, which resulted in eight of the disability categories being included in the final analyses. Disability categories included in the final analyses are speech and language impairment, autism, intellectual disability, other health impairment, hard of hearing, specific learning disability, orthopedic impairment, and multiple disabilities. Disability categories excluded in the final analyses are deafness, visual impairment, traumatic brain injury, emotional disturbance, and deaf-blindness.

Table 18
List of Demographic Variables from CASEMIS Student Data Table A

Variable	Description
GENDER	Gender identification of the student 2 categories: Male and Female
ETHNICITY	Ethnic background of the student. Reported as student is Hispanic, Latino, or Missing
RACE1	Student's race identification or background. 19 race categories: Asian Indian, Black or African-American, Cambodian, Chinese, Filipino, Guamanian, Hawaiian, Hmong, Japanese, Korean, Laotian, Native American, Other Asian, Other Pacific Islander, Samoan, Tahitian, Vietnamese, White, Intentionally Left Blank
DISABILIT1	Primary disability category of student. (For a complete list see Appendix A) 14 disability categories: Intellectual Disability, Hard of Hearing, Deafness, Speech or Language Impairment, Visual Impairment, Emotional Disturbance, Orthopedic Impairment, Other Health Impairment, Established Medical Disability, Specific Learning Disability, Deaf-Blindness, Multiple Disability, Autism, Traumatic Brain Injury

Explanatory Variable

In addition to the background variables described above, the explanatory variable (preschool setting) was obtained from CASEMIS Table A. The same matching procedures as described for the background variables were used to relate the preschool-

setting variable to the DRDP scores. The nine distinct preschool-setting categories were assigned to two groups that were labeled inclusive and noninclusive. Two of the nine setting categories were labeled inclusive because the child with an Individualized Education Plan (IEP) was spending more than 10 hours a week in a regular classroom. The other seven setting categories were labeled as noninclusive because the child with an IEP was spending less than 10 hours a week in a regular classroom. The final preschool-setting variable used in the analysis is a dichotomous variable with only two responses: inclusive or noninclusive. Details regarding the explanatory variable, preschool setting, are presented in Table 19.

Table 19
Explanatory Variable

Variable	**Responses**
FEDSET_PRS	Inclusive Settings (2) • Regular early-childhood program, more than 10 hours per week, majority of special-education services provided in the regular early-childhood program. • Regular early-childhood program, more than 10 hours per week, majority of special-education services provided in some location other than the regular early-childhood program. Noninclusive Settings (7) • Regular early-childhood program, less than 10 hours per week, majority of special-education services provided in the regular early-childhood program. • Regular early-childhood program, less than 10 hours per week, majority of special-education services provided in some location other than the regular early-childhood program. • Separate class • Separate school • Residential facility • Home • Service-provider location

Response Variables

The instrument used for this study to measure the developmental growth of the study participants was the Desired Results Developmental Profile. The 2015 version of the DRDP is an observational assessment developed by the CDE for young children and their families. The DRDP is used with all children participating in state–funded programs and services, including children with Individualized Family Service Plans (IFSPs) (infants and toddlers) and Individualized Education Programs (IEPs) (preschoolers).

The Desired Results Access Project, which is a special project under the Napa County Office of Education, is a contractor through the CDE, SED. The role of the Desired Results Access Project was to develop the DRDP (2015), as well as support the use of the instrument. This support includes providing professional development for early-childhood special educators using the DRDP (2015), producing final reports for federal accountability to the Office of Special Education Programs, and developing individual child and group reports for teachers.

As part of the instrument development, the Desired Results Access Project engaged in several activities related to instrument development best practices. The Project's website at www.draccess.org states that the

> Project engages in systematic and ongoing research regarding the use of the Desired Results Developmental Profile (2015) for children receiving special-education services. This research includes:
>
> - Scaling investigations, equating studies, item testing, and other descriptive and inferential analyses of DRDP datasets.
> - Research to enhance the utility of the DRDP.
> - Collaboration with local, state and national partners to disseminate evidence-based practices to the field. (Desired Results Access Project, 2015)

Only one formal report of instrument studies, however, has been published for the DRDP (2015): The Interrater Agreement Study. This study was conducted in the 2014–

2015 academic year with 31 assessor pairs who assessed 79 children. For the entire 56-measure instrument, the interrater agreement within one level was between 83% and 98%, averaging 92%.

In addition to the validity and reliability studies of the instrument, training and technical assistance supports are in place to ensure the fidelity of implementation of the DRDP. Certified Master Trainers provide preschool special-education providers with opportunities to be trained face-to-face in implementing the DRDP. In addition, the Desired Results Access Project website provides training modules and resources to support the use of the instrument. Providers are directed to observe children in their natural settings for at least 6 weeks in order to rate accurately their behavior. Once the observation period is complete, the providers must specify the latest developmental level that each child has mastered on each measure. The final rating on each measure is selected, recorded, and submitted to the state.

The DRDP is an observation-based protocol used by teachers to assign ratings on measures within each of eight learning domains. The preschool version of the instrument consists of 43 measures within 8 domains. The focus of each domain is on the acquisition of knowledge, skills, or behaviors that reflect each domain's developmental constructs. Details regarding the response variables are presented in Table 20. The Desired Results Access Project used a set of four separate multidimensional and unidimensional Item Response Theory (IRT) models to estimate children's developmental scores for the 8 developmental domains. A list of the four models, which were developed to reflect the OSEP early-childhood outcomes is provided in Table 20 (Desired Results Access Project, 2018). The IRT was built around these four separate models so that the scores could be

used for federal reporting to OSEP on an annual basis. Due to this fact, the outcome measures to be used for the present study to investigate each research question will include the four different DRDP scores; Outcome 1, Outcome 2, Outcome 3, and English Language Development (ELD). The analyses primarily focused on the three main outcome measures: OSEP 1, OSEP 2, and OSEP 3. The domain-score analyses, which includes ELD, proceeded after the OSEP outcome measures under research questions 2 and 3.

Table 20
DRDP (2015) Measurement Models

Model Name	Number of Domains	Domains
Outcome 1: Social Relationships	2	ATL-REG Attention Maintenance and Self-Regulation (7 measures) SED Social Emotional Development (5 measures)
Outcome 2: Knowledge and Skills	3	LANG Language (4 measures) LIT Literacy (6 measures) COG Mathematics (7 measures)
Outcome 3: Actions to Meet Needs	2	PD Physical Development (5 measures) HLTH Health (5 measures)
English Language Development	1	ELD English Language Development (4 measures)

Procedures

The first step was to obtain approval directly from the CDE, SED for use of the data file for conducting this research study, because the data are the property of the CDE. A formal letter of agreement was received from the CDE, SED on May 1, 2017 consenting to share the final data set as soon as available, August–September of 2017. The final consent letter is included in Appendix D.

The second step was to request a matched data set from the CDE,SED. As mentioned earlier, the two data sets were combined to create the final merged data file. The merging of the data files was performed by a data-analyst specialist from the Evaluation and Analysis Unit at the CDE, SED to produce the final complete data set. DRDP rating records were merged with the demographic variables from Table A using the SSID number. At the completion of the matching and merging the complete data, the SSID numbers were deleted, along with all identifying information for the children (i.e., first name and last name), and the final data set was given to the researcher.

To ensure the protection of the study participants' rights, an Internal Review Board (IRB) application was submitted to the University of San Francisco's Institutional Review Board for the Protection of Human Subjects. The application was reviewed and the IRB determined that it was not necessary to apply for approval because the study is a secondary data analysis.

Study Population

There are over 350,000 three-, four-, and five-year-old children receiving preschool education services in the State of California. Of those children, there are nearly 80,000 children with a diagnosed disability and receiving special-education services. To be specific, the population for this study is all preschool-aged children in California, 79,888 children, who have received special-education services in the 2015–2016 and 2016–2017 academic years (July 1–June 30). Of those children in the study population, approximately 60% of those students were receiving services in an inclusive educational setting, and 40% were served in a noninclusive educational setting.

Frequency tables were produced for four background variables by preschool setting, as well as descriptive statistics for the OSEP scores disaggregated by age category. The results of the calculations are provided in Tables 21 and 22. In general, the demographic make-up of the comparison groups (inclusive vs. noninclusive) are similar across the four demographic variables reviewed. The gender percentages for each group were similar with only a slightly higher, 1.1% increase for males in the noninclusive-setting group. The ethnicity percentages differed by less than 5% different across the two groups, with the inclusive group having a 2.7% higher (56.2%) total of Hispanic children than the noninclusive group. The percentage of English Learners differed about 5% between the two groups; the inclusive group has 5.2% more (43.4%) English Learners than the noninclusive group (38.2%).

The percentage break-down by disability group provided in Table 21 includes the details for each disability category. First, it should be noted that the majority (60%) of the children in the sample were being served in a noninclusive setting, whereas 40% were being served in an inclusive setting, which is very close to what would be expected from the statewide sample, as presented earlier in this chapter. Second, the general pattern of percentage breakdown for each group is similar. Speech and Language impairment is the most prevalent category, followed by Autism.

The three lowest percentages are children with a traumatic brain injury, emotional disturbance, and deaf-blindness. The inclusive group is more than 10% higher for children in the speech-and-language impairment category than the noninclusive group. The autism group is nearly 10% higher in noninclusive settings. The rest of the

percentage differences are all less than 5%. Overall, there are no major concerns about the distribution of disability categories across the two groups.

Table 21
Frequency and Percentage of Demographic Information by Preschool Setting

	Inclusive (n = 31,916)		Noninclusive (n = 47,972)		Total (N = 79,888)	
Demographic Variables	*f*	%	*f*	%	*f*	%
Gender						
Male	22,594	70.8	34,494	71.9	57,088	71.5
Female	9,322	29.2	13,478	28.1	22,800	28.5
Ethnicity						
Hispanic	18,018	56.5	25,639	53.4	43,657	54.6
Not Hispanic	12,857	40.3	21,532	44.9	34,389	43.0
Missing	1,041	3.3	801	1.7	1,842	2.3
English Learner						
Yes	13,852	43.4	18,238	38.0	32,090	40.2
No	18,064	56.6	29,734	62.0	47,798	59.8
Disability Category						
Speech & Language Impairment	21,695	68.0	27,127	56.5	48,825	61.1
Autism	5,883	18.4	13,065	27.2	18,948	23.7
Intellectual Disability	1,071	3.4	2,442	5.1	3,513	4.4
Other Health Impairment	1,014	3.2	1,764	3.7	2,778	3.5
Hard of Hearing	462	1.4	674	1.4	1,136	1.4
Specific Learning Disability	602	1.9	522	1.1	1,124	1.4
Orthopedic Impairment	371	1.2	733	1.5	1,104	1.4
Multiple Disability	335	1.0	676	1.4	1,011	1.3
Established Medical Disability	193	0.6	464	1.0	657	0.8
Deafness	144	0.5	260	0.5	404	0.5
Visual Impairment	96	0.3	156	0.3	252	0.3
Traumatic Brain Injury	28	0.1	54	0.1	82	0.1
Emotional Disturbance	15	0.0	27	0.1	42	0.1
Deaf-Blindness	4	0.0	8	0.0	12	0.0

The present study was conducted on a data file that included all preschool children with assessment results for any or all of the four assessment periods, Fall 2015 through Spring 2017. A total of 79,888 unique children were included in the final study sample, each with a varying number of assessments from 1 to 4, which resulted in a total of 164,254 assessment records.

Table 22
Number of Assessment Records per Child

Assessments	Number of Children
1	24,567
2	35,482
3	10,633
4	9,206
Total Children	79,888

Table 23
Means and Standard Deviations of DRDP Scores by Age Category and Preschool Setting

	Inclusive (n = 64,590)		Noninclusive (n = 99,591)		Total (N = 164,181)	
Age Category	Mean	Variance	Mean	Variance	Mean	Variance
OSEP 1						
3 to 3½	12.35	2.21	12.07	2.32	12.16	2.29
3½ to 4	13.45	2.35	13.10	2.51	13.23	2.46
4 to 4½	14.52	2.52	14.16	2.74	14.30	2.66
4½ to 5	15.53	2.76	15.11	3.00	15.29	2.91
5 to 5½	16.41	2.96	15.78	3.28	16.05	3.17
5½ to 6	16.63	3.37	15.62	3.51	16.06	3.49
Overall	14.76	2.90	14.18	3.05	14.41	3.00
OSEP 2						
3 to 3½	11.74	2.23	11.49	2.34	11.57	2.31
3½ to 4	12.92	2.38	12.59	2.53	12.71	2.48
4 to 4½	14.08	2.52	13.76	2.76	13.88	2.67
4½ to 5	15.18	2.75	14.79	3.01	14.96	2.91
5 to 5½	16.12	2.97	15.55	3.28	15.79	3.17
5½ to 6	16.36	3.44	15.46	3.67	15.85	3.59
Overall	14.34	2.95	13.79	3.11	14.00	3.06
OSEP 3						
3 to 3½	12.16	1.99	11.96	2.11	12.03	2.07
3½ to 4	13.18	2.18	12.90	2.28	13.00	2.25
4 to 4½	14.18	2.33	13.90	2.49	14.02	2.43
4½ to 5	15.15	2.54	14.84	2.72	14.97	2.65
5 to 5½	15.99	2.76	15.49	2.96	15.70	2.89
5½ to 6	16.16	3.07	15.39	3.25	15.72	3.20
Overall	14.42	2.68	13.95	2.79	14.13	2.76

There exists a varying number of assessments for some children who had an effect on the selection of the time variable. For example, a 4-year old child might have begun receiving preschool-special-education services in the fall of 2016 and, therefore,

would only have 2 assessments (fall 2016 and spring 2017) included in the final data set. There are many different entry or exit scenarios for preschool children with disabilities. The selection of the time variable is of critical importance to the accuracy of the final growth model and is presented in detail under research question 1 in Chapter IV. A breakdown of the number of assessments per child is provided in Table 22.

Finally, as a preliminary step in the analysis, means and standard deviation for the OSEP scores are presented by age category and setting in Table 23. In general, the means for the inclusive group are higher than the means of the noninclusive group within each age category. Overall, the mean overall OSEP scores for the inclusive group are higher than the mean overall OSEP scores for the noninclusive group.

Data-Analysis Models

To investigate the proposed research questions, a growth model was used to estimate the developmental growth of the study sample. Educational environments are among the most complex settings for examining and understanding change (Anderman, Gimbert, O'Connell, & Riegel, 2015). Student growth has been analyzed using a variety of methods, such as the individual growth model, linear growth modeling, and latent growth modeling (Raudenbush & Bryk, 2002). One commonly used model, hierarchical linear modeling (HLM), was employed for the present study.

HLM is used primarily in two types of situations: with cross-sectional and longitudinal data sets when outcome measures and data are nested (Anderson, 2012). In the present study, HLM was ideal for analyzing the longitudinal data, which includes four assessments over 2 years. Another advantage of using an HLM model for the present study was the ability to calculate and describe each student's individual growth trajectory

over time (Anderman et al., 2015). The HLM model made it possible to investigate individual change as defined by the multiple outcome measures over time, as well as to compare change between individuals within inclusive and noninclusive settings.

HLM is similar to a standard multiple linear regression (MLR) analysis but with a more complicated error structure. One of the advantages of using HLM was that, unlike MLR models, it produced appropriate standard errors that control for potential dependence due to nesting effects, whereas MLR models do not (Newman et al., 2010). That was of critical importance to the present study and was explored in depth in the pilot-study analyses presented later in this section. Another advantage of using HLM was that it provided a more flexible set of procedures for analyzing longitudinal data than repeated measures analysis of variance.

Data Analyses by Research Question

The current study analyses began by producing three baseline linear-individual-growth models for each of the three OSEP outcome measures. It should be noted that more complex models also were used to analyze the data, particularly with respect to research questions 2 and 3. Each subsequent model extended the baseline model by adding either fixed or random effects. Most data analyses that use HLM proceed down this logical path of defining the basic model and building from there, rather than outlining predetermined models for each research question at the onset (Singer & Willett, 2003). What follows is a description of the procedures followed to complete the analyses included in chapter IV.

Research Question #1 Overall Growth and Trajectory

The first research question addresses the extent to which children have grown developmentally over time and the trajectory of this developmental growth. To investigate the shape of the trajectories of the developmental-growth scores and decide whether the linear or curvilinear model should be used, the HLM analysis was conducted on the base Level 1 model that included both the linear and quadratic time variable:

$$Y_{ti} = \pi_{0i} + \pi_{1i}a_{ti} + \pi_{2i}a_{ti}^2 + \varepsilon_{ti},$$

where a_{ti} and a_{ti}^2 are time variables of interest (e.g., which are coded to indicate the linear and quadratic components hypothesized to describe the shape of the trajectories); π_{0i} is an intercept; π_{1i} and π_{2i} describe the linear and quadratic growth rates, respectively; and ε_{ti} represents variation in estimating growth within individuals.
If the polynomial for the quadratic time variable is statistically significant, then both the time variables will be retained in subsequent analyses.

Research question 1 explored the nature of the developmental growth on the three overall OSEP scores, as well as each of the eight domain scores. The data used to investigate this research question are multilevel, and, therefore, a two-level hierarchical linear model was used to investigate the developmental growth across each measure of development. In conducting the statistical tests, the significance level was set at .05. To control for overall error rate for the Level 2 models, a more conservative significance level was set at .01. Cohen's *d* was calculated and reported for all statistically significant results found.

To investigate the developmental growth of children across the outcome measures, the HLM Model utilizes a Level 1 and Level 2 model combined. The lowest

level of data, Level 1, is the specific measurement at a particular time. Each Level 1 measurement is nested within a particular student. The individual, then constitutes the Level 2 data. In the current study, the Level 2 model has 79,888 students and 1-4 repeated measures per individual over time.

The Level 1 repeated-measures level model is

$$OSEP\ Score_{ti} = \pi_{0i} + \pi_{1i}(time) + \varepsilon_{ti}.$$

where π_{0i} is the average OSEP score for the i-th student at the first time point (i.e., time = 0) and ε_{ti} is the within-individual random error that is the difference between the observed OSEP score at time t and the predicted (average) score of the i-th student. ε_{ti} is assumed to be normally distributed with variance σ^2 ($\varepsilon_{ti} \sim N(0, \sigma^2)$) which captures the within-individual variation. The Level 1 error term is modeled in the covariance error matrix structure. The selection of the final covariance error matrix structure is presented in detail under research question 1 in chapter IV.

Once the Level 1 model is set, the Level 2 individual-level models can be developed, which are as follows:

$$\pi_{0i} = \beta_{00} + \mu_{0i} \text{ and}$$

$$\pi_{1i} = \beta_{10} + \mu_{1i}.$$

Between individuals, β_{00} is the average OSEP score at the initial time point (i.e., time = 0) and β_{10} is the average monthly change in OSEP score for each increase in the time variable. Both μ_{0i} and μ_{1i} are between-individual random effects and are assumed to be normally distributed $\begin{bmatrix}\mu_{0i} \\ \mu_{1i}\end{bmatrix} \sim N(0, T)$, where $\mathrm{T} = \begin{bmatrix}\tau_{00} & \tau_{01} \\ \tau_{10} & \tau_{11}\end{bmatrix}$. μ_{0i} is the difference between the intercept (π_{0i}) of the i-th student from the average intercept β_{00}, and μ_{1i} is the difference between the estimated monthly change in OSEP score (π_{1i}) of the i-th

student from the average monthly change in OSEP score (β_{10}) across all the students. The variances of μ_{0i} and μ_{1i} are τ_{00} and τ_{11}, respectively that are the between-individual variation. Just as with the Level 1 error term, these Level 2 error terms were modeled as the covariance error matrix structures as part of research question 1 in Chapter IV as well.

Finally, to study the developmental growth over time of preschool children, the combined model, obtained by substituting the Level 2 models into the Level 1 model, is

$$OSEP\ Score_{ti} = \beta_{00} + \beta_{10}(time_{ti}) + \mu_{1i}(time_{ti}) + \mu_{0i} + \varepsilon_{ti}.$$

Where the last three terms represent the complex error term was examined in more detail in Chapter IV in terms of which covariance error matrix structures model the data best. What follows is a description of the data-analysis procedures that were used for research questions 2 and 3.

Research Question #2: Developmental Growth by Preschool Setting

The second research question addressed the effect of preschool setting on the developmental growth of children with disabilities over time. Question 2 explored the effect of inclusion or noninclusion on the overall OSEP scores as well as each of the eight domain scores. The data used to investigate this research question were multilevel; therefore, a two-level hierarchical linear model was used to investigate if developmental growth differs based on preschool setting across each measure of development. In conducting the statistical tests, the significance level was set at .05. To control for overall error rate for the Level 2 models, the significance level was set at .01. Cohen's *d* was calculated and reported for all statistically significant results found.

To investigate the differences by preschool setting, the Level 1 model remained the same and an explanatory variable was introduced into the Level 2 growth models:

SETTING (a dummy variable indicating preschool setting: 1 = inclusive, 0 = noninclusive). The base Level 2 models for research question 2 were

$$\pi_{0i} = \beta_{00} + \beta_{01}setting_i + \mu_{0i} \text{ and}$$

$\pi_{1i} = \beta_{10} + \beta_{11}setting_i + \mu_{1i}$.

Finally, to study the developmental growth over time of preschool children and any differences with respect to the preschool setting, the combined model used is

$$OSEP\ Score_{ti} = \beta_{00} + \beta_{01}setting_i + \beta_{10}(time_{ti}) + \beta_{11}setting_i(time_{ti}) + \mu_{1i}(time_{ti}) + \mu_{0i} + \varepsilon_{ti},$$

where β_{00} was the intercept indicating the average OSEP score, β_{01} was the estimate of the slope associated with the setting variable, β_{11} was the estimate of the slope associated with the cross-interaction term of time and setting, μ_{1i} is the variance associated with time, and μ_{0i} and ε_{ti} were the variances associated with the overall estimation.

Research Question #3: Developmental Growth by Preschool Setting and Disability Category

To address the third research question, the same data set and base Level 2 model as used for research questions 1 and 2 was used to investigate the potential differences between the developmental growth of young children with disabilities based on disability category and preschool setting. In other words, question 3 was whether or not inclusive settings improve the developmental growth of children with specific diagnosed disabilities. Mirroring the structure of the second research question, question 3 explored the effect of preschool setting on the three overall OSEP scores by disability group, as well as for each of the eight domain scores.

A Level 2 hierarchical linear model was used to investigate developmental growth nested within preschool setting by disability category across all domains. In conducting the statistical tests, the significance level was set at .05. In order to control for overall error rate for the Level 2 models, the significance level was set at .01. Cohen's *d* was calculated and reported for all statistically significant results found.

To investigate the effect of preschool setting, disability category, and the interaction between the two variables on growth rates, the same basic unconditional linear growth model was used as in research question 1 with the following variables: SETTING (preschool setting: 1 = inclusive, 0 = noninclusive) for each disability category: Intellectual Disability, Hard of Hearing, Deafness, Speech or Language Impairment, Visual Impairment, Emotional Disturbance, Orthopedic Impairment, Other Health Impairment, Established Medical Disability, Specific Learning Disability, Deaf-Blindness, Multiple Disability, Autism, and Traumatic Brain Injury. The combined two-level linear growth model was defined as

$$OSEP\ Score_{ti} = \beta_{00} + \beta_{01} setting_i + \beta_{10}(time_{ti}) + \beta_{11} setting_i(time_{ti}) + \mu_{1i}(time_{ti}) + \mu_{0i} + \varepsilon_{ti}.$$

This model was used to investigate the interaction between the different levels of predictors. For example, do children who are diagnosed as autistic make greater developmental growth in an inclusive or noninclusive setting?

Pilot-Study Analysis

A pilot study was conducted to assess the growth-analysis procedures described in the previous section. The pilot study sample, a small sample of the children included in the final data set, included 1,525 children with four assessments. The pilot study provided

an opportunity to explore the preliminary tasks required to prepare the data to conduct the final HLM model on a smaller data set. As a result of the pilot study analyses, several key considerations emerged.

First, with respect to the measurement of time and growth analysis, it was important to consider an alternate method for calculating the variable of time (Heck, Thomas, & Tabata, 2014). To reflect accurately time for the individual assessments, an alternate time variable was selected for the final analysis, and the selection of this time variable is presented in detail in chapter IV. The second issue with growth analysis concerns the use of centering of the time variable, which will change the meaning of the intercept. The third issue of using the growth model has to do with how the Level 1 error is structured over time. In the pilot study, four different errors structures were examined for goodness of fit and the Akaike Information Criteria (AIC) index was selected based on the results of the statistical analyses. This same analysis of the Level 1error structure and the Level 2 random effects was re-examined to determine the best fit for the final data set. All three models are discussed in chapter IV under research question 1 because all are needed to model accurately the nature of student growth.

Summary

This chapter has provided an overview of the research design for the study, the data sources and instrumentation used, study procedures, study population, data-analysis plans, and a summary of the pilot study. Chapter IV includes analyses related to each of the three research questions.

CHAPTER IV

RESULTS

The purpose of this study was to investigate the relationship between preschool educational setting and the developmental growth of preschool children with disabilities. This chapter has four sections: an analysis for each of the three research questions and a summary. For all research questions, the linear mixed-effects model (MIXED) procedure was used in SPSS version 25 to conduct hierarchical-linear-growth modeling in order to explore the developmental-growth trajectories with respect to the Desired Results Developmental Profile (DRDP 2015) outcome measures. Research question 1 concerned the shape and trajectory of the developmental growth of preschool children with disabilities. The developmental growth of preschool children with disabilities based on educational setting was investigated to address research question 2. Finally, the developmental growth of preschool children with disabilities based on both educational setting and disability category was addressed by research question 3.

Hierarchical linear modeling is a specific progression of model building that guided the analysis steps in the present study and is detailed in this chapter. The overall data-analysis strategy began by establishing the Level 1 model that is described and presented as part of the analyses for research question one. Once the Level 1 model was established, the Level 2 model built upon this base model. This Level 2 model was used to investigate research questions 2 and 3.

Results for Research Question 1

What is the nature of developmental growth, as represented by scores on the DRDP (2015), of children receiving preschool special-education services?

To address research question 1, several critical decisions first had to be made. These preliminary decisions are presented in the following sections: covariance matrix selection, missing data considerations, and time variable selection. At the completion of these steps, the growth-trajectory selection is presented and details of the findings for research question 1 are given.

Covariance-Matrix Selection

A critical step in selecting the appropriate model to use for the final growth analyses is to decide (a) the part of the model that describes the within-individual error structure (ε_{ti}), typically represented as a specific covariance pattern or structure over time (Heck, Thomas, & Tabata, 2014) and (b) the part of the model that describes the between-individual random effects, which is the 2x2 τ matrix of the intercept and slope variances and their covariance. To make these two decisions, different Level 1 error structures (autoregressive error, autoregressive with heterogeneity, scaled identity, and unstructured) were examined in preliminary analyses, along with different between-individual error structures. In the analysis below, both Level 1 and Level 2 covariance matrix structures were considered.

The fit statistics were compared for several combinations of Level 1 error structures and Level 2 random effects for each of the three main outcome measures, OSEP 1, OSEP 2, and OSEP 3 scores, and the best overall fit was considered along with the degrees of freedom used in the different models. The preferred statistic for investigating fit is the Akaike's Information Criteria (AIC; Heck et al., 2014), which are found in Table 24 for each model and outcome measure with differing covariance matrices. The lower the value of the statistic, the better the fit of the model. Based on the

fit statistics, the autoregressive error (AR1) covariance matrix was selected for use in the final models. The AR1 is a first-order autoregressive structure with homogenous variances and the correlation lessens as time points become further apart.

Table 24
Comparing Models, Number of Parameters, and AIC Index by OSEP Outcome

			AIC Index		
Model	Model Description	Parameters	OSEP 1	OSEP 2	OSEP 3
Model 1	Autoregressive Errors (AR1), Level 1 Unstructured, Level 2	9	707,738.46	701,260.27	689,638.17
Model 2	Autoregressive Errors (AR1), Level 1 Autoregressive Errors (AR1), Level 2	8	709,298.21	702,724.52	690,792.46
Model 3	Autoregressive Errors (AR1), Level 1 Scaled Identity, Level 2	7	709,383.51	702,794.54	690,865.69
Model 4	Autoregressive Errors with Heterogeneous Variances (ARH1), Level 1 Scaled Identity, Level 2	10	709,339.09	702,728.71	690,753.53
Model 5	Autoregressive Errors with Heterogeneous Variances (ARH1), Level 1 ARH1, Level 2	12	Model would not converge.		

In order to further investigate the most appropriate covariance matrix, a box plot of the OSEP scores for each category was inspected (Figure 3). The variance for each age category appears similar, but it is difficult to ascertain the exact equivalency of the variances from the plot alone. Variances were calculated for each age category and are included in Table 25. Based on the values, the variance at each time does not differ across the six age categories and follows a common pattern of becoming larger over time. Even though one might conclude the variances are equal, the autoregressive covariance structure, which estimates fixed variances, has a better fit index than the AR1 with heterogeneous variances structure (ARH1), which is a model that takes the increasing

variances into account. Therefore, the AR1 structure was selected as the final Level 1 model error structure.

Table 25
Means and Variances of DRDP Total Scores by Age Category

	OSEP 1		OSEP 2		OSEP 3	
Age Category	Mean	Variance	Mean	Variance	Mean	Variance
3 to 3.5	12.16	5.24	11.57	5.31	12.03	4.29
3.5 to 4	13.23	6.06	12.71	6.13	13.00	5.06
4 to 4.5	14.30	7.09	13.88	7.13	14.02	5.90
4.5 to 5	15.29	8.46	14.96	8.46	14.97	7.03
5 to 5.5	16.05	10.03	15.79	10.05	15.70	8.35
5.5 to 6	16.06	12.16	15.86	12.92	15.73	10.22
Overall	14.41	9.03	14.00	9.35	14.13	7.61

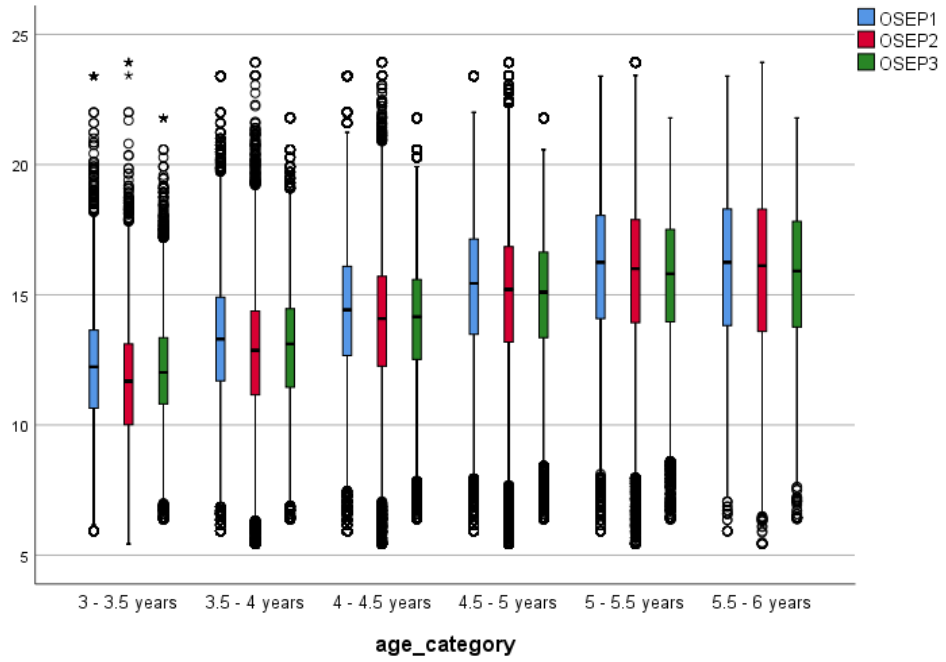

Figure 1. Box plot of OSEP scores by age category.

In addition to investigating the variances between time periods, the correlations between the various time points for the three OSEP-score variables were reviewed. By examining the correlations presented in Table 26, the correlations are smaller as the intervals become further apart, also suggesting an autoregressive covariance structure.

The OSEP scores are correlated highly across the different assessment time points, and the strength of the correlations decrease from the first time point to the last.

Table 26
Pearson-Product Moment Correlation Coefficients for OSEP Scores by Assessment Time Point

	Time 1	Time 2	Time 3	Time 4
		OSEP 1		
Time 1	1.00	.83	.69	.67
Time 2		1.00	.80	.74
Time 3			1.00	.86
Time 4				1.00
		OSEP 2		
Time 1	1.00	.84	.71	.69
Time 2		1.00	.82	.76
Time 3			1.00	.88
Time 4				1.00
		OSEP 3		
Time 1	1.00	.79	.64	.62
Time 2		1.00	.76	.69
Time 3			1.00	.84
Time 4				1.00

Based on the AIC Index, inspection of the boxplots, and review of the correlation coefficients for the OSEP-score variables, there is sufficient evidence to support the selection of the AR1 covariance matrix as appropriate at Level 1 of the final models and the unstructured covariance matrix structure at Level 2.

Missing Data

Incomplete data are common in large longitudinal data sets (Weiss, 2010) and true for the present data set. Because the data set under investigation was collected over a finite time span, Fall 2015 through Spring 2017, children have a varying number of assessments from 1 to 4. Due to advances in statistical-software program's ability to handle missing data, the missing values do not have to be imputed (Weiss, 2010). All of the data contribute to the calculations of the model, both the intercepts for DRDP scores,

and the growth trajectories of individual children. Imputing missing values was not necessary and all records were maintained from across all four assessment periods in the final data set (R.E. Weiss, personal communication, January 15, 2018).

The SPSS software uses the default setting of restricted-maximum-likelihood estimation (RMLE) to estimate the population parameters. RMLE uses all of the available data to generate parameter estimates; the estimator neither discards incomplete cases nor imputes missing values (Enders, 2011). RMLE identifies the population parameter values that have the highest probability of producing the sample data. In short, RMLE does not replace through calculation the missing values but implicitly uses the data via constraints put on the resulting parameter estimates.

Selection of the Time Variable

The definition of time is important to the analysis of longitudinal data (Weiss, 2010). In the present study, two different time variables were considered. The first time variable considered was the nominal time values of 0, 1, 2, and 3 that correspond to four different assessment points. The second time variable was age in months at the time of each assessment. Given that children can start and stop receiving preschool-special-education services at any time, it is not appropriate to use a time variable that is based on a specific time point, like 0 = Fall 2015. The present study includes children with anywhere from 1 to 4 assessments. In order to include all children in the data set, a time value was assigned to each record. As a result, the decision was made to select a time measure based on the child's age.

The time variable in use in the final data set is a continuous variable that is the child's age in months centered to the age when a child enters preschool, that is, at 3 years

of age or 36 months. The final time variable is the number of months over 3 years of age since each assessment was completed, that is, age in months at time of assessment – 36 (age 3 in months). For example, if the time variable is 3 for a specific child, then he or she was assessed 3 months after he or she turned 3 years old.

Growth-Trajectory Determination

The final decision covering the Level 1 growth models was to decide whether the growth trajectory of the models is linear, curvilinear, or some other shape. As the name implies, a linear growth model assumes a straight-line growth trajectory. Many growth processes, however, do not follow a linear trajectory (McCoach & Kaniskan, 2010). For example, there might be a "summer slump" between a spring assessment and the following fall assessment as students do not receive instruction during the summer months, which is not common with preschool-age children, as most preschools provide educational services year round. But assuming a linear-growth trajectory, a default option that often occurs without examining data, could be limiting and may result in a serious misspecification of the growth model (Weiss, 2010). When the Level 1 model is specified incorrectly, parameter estimates in the growth model can be biased as well as the estimates of the effects of the Level 2 variables on the slope and intercept (Singer & Willet, 2003).

As a first step, means and variances were calculated for the OSEP scores for all children included in the study disaggregated by age category; these data were reported in Table 25 in the previous section. The OSEP scores range from 0 to 25 points. The means display an expected pattern: a slight increase from one age group to the next. The DRDP (2015) is a developmental assessment that is built on a continuum from early

development (birth) through later development (transitioning to Kindergarten). Therefore, the average ratings are expected to increase steadily from one age category to the next. The variances follow a similar pattern, that is, increasing slightly each year that could be due to the fact that, for children with more severe disabilities, their ratings may become more "distant" from their same age peers over times, therefore, resulting in more variability in the average ratings as they develop.

Figures 2 to 4 are line graphs of the average OSEP scores. Each of the three line graphs has a slight flattening at the top, within the oldest age category that indicates the average OSEP scores do not increase as much during this age range, which may be due to the fact that children with disabilities served longer before transitioning to Kindergarten typically have more severe disabilities. Therefore, the developmental trajectory of these children included in the 5.5 to 6-year age category would not be expected to develop at the same rate as the overall population of children with disabilities. This plateau in mean scores, also may be due to a "ceiling effect" that occurs when children already have been rated at the highest developmental level and do not have a higher level available to master.

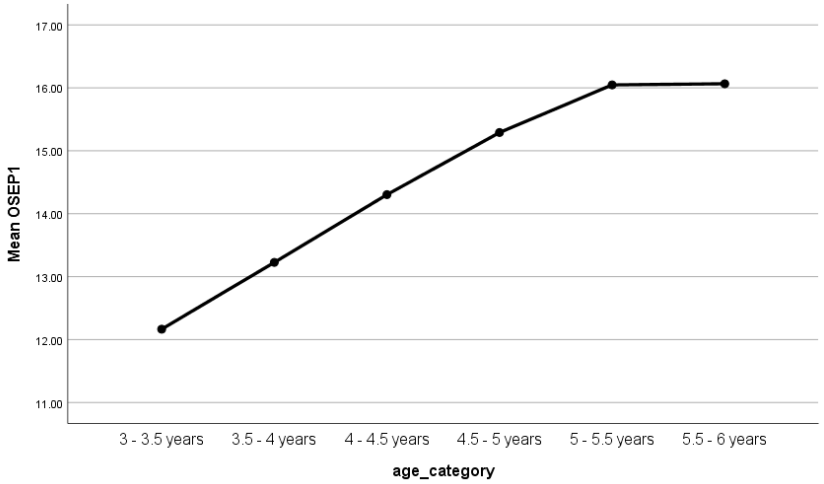

Figure 2. Line graph of means of OSEP 1 scores by age category.

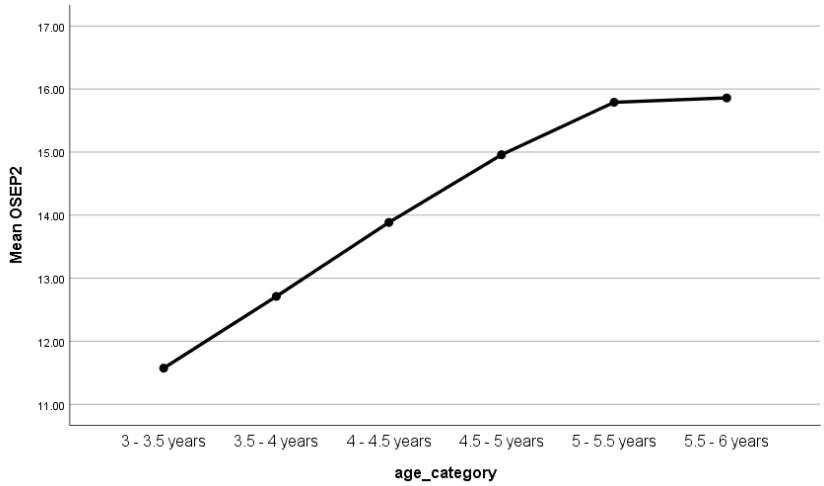

Figure 3. Line graph of means of OSEP 2 scores by age category.

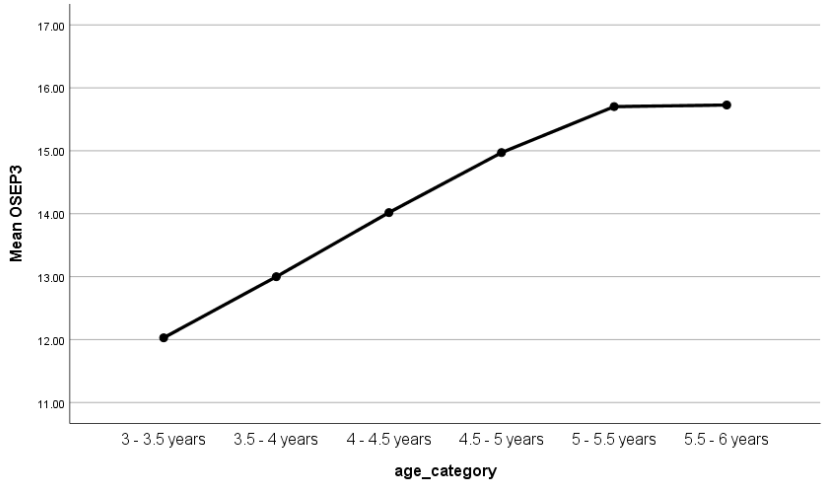

Figure 4. Line graph of means of OSEP 3 scores by age category.

The developmental growth trajectories for a sample of students' OSEP scores, shown in Figures 5 to 7, reveal that the majority of the natural developmental growth trajectories of student's in the sample are linear. (Note: these plots are using a "true" time variable that indicates the child's age in months at the time of the assessment.) Upon review of the 25 line graphs included in Figure 5, it appears that the progression of OSEP scores for individual children do not increase necessarily in a steady upward pattern over time for all students. The line graphs display very different progressions from the first assessment to the last.

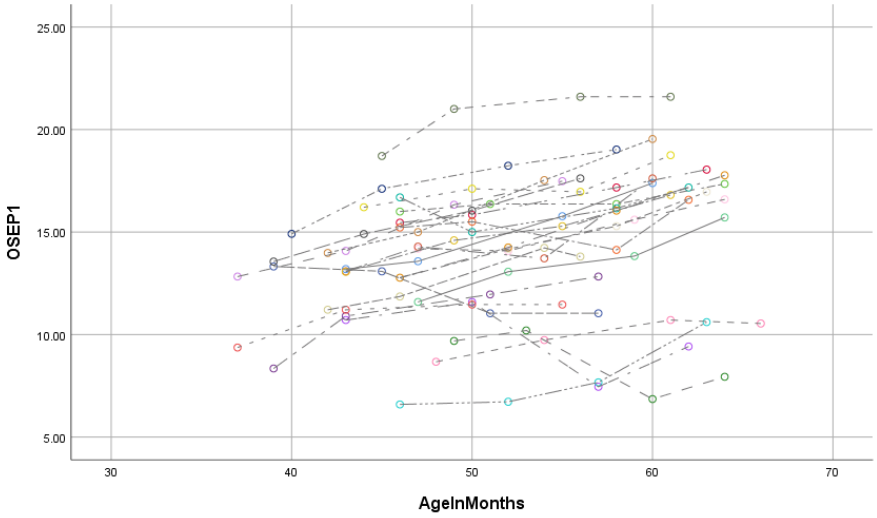

Figure 5. Individual growth trajectory plots of OSEP 1 scores for 25 randomly selected students for four assessments.

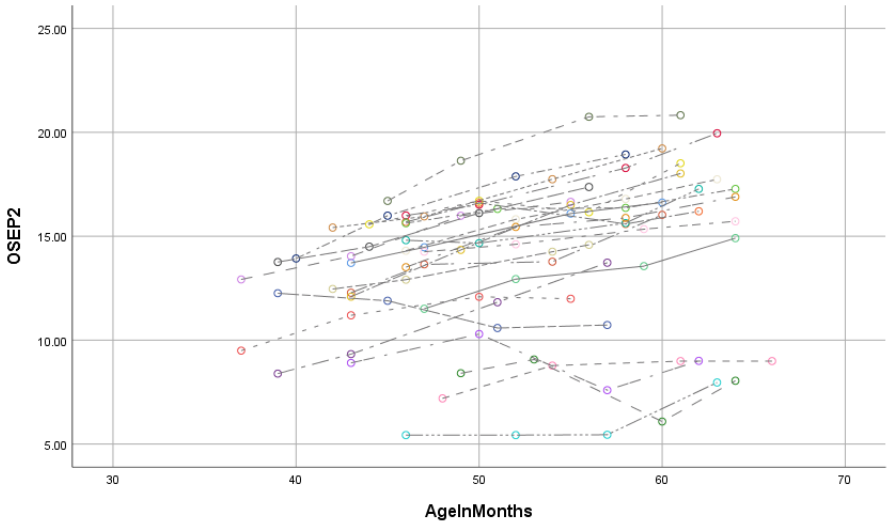

Figure 6. Individual growth trajectory plots of OSEP 2 scores for 25 randomly selected students for four assessments.

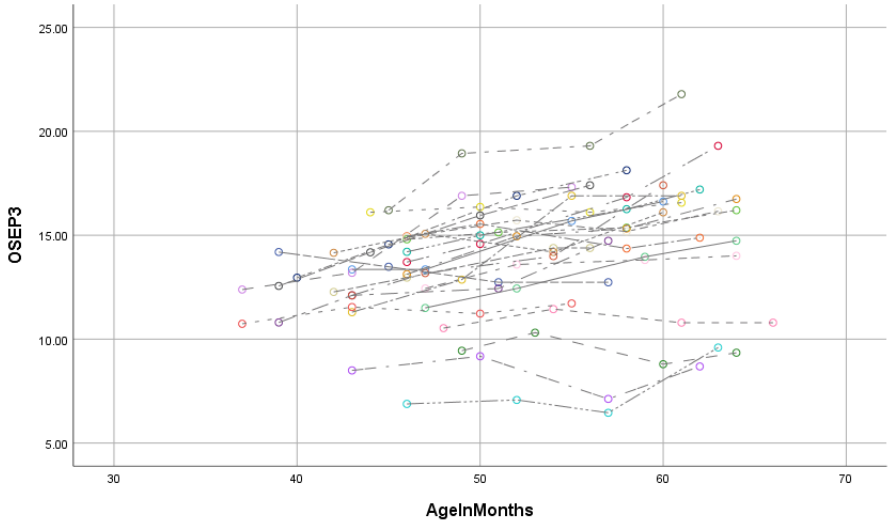

Figure 7. Individual growth trajectory plots of OSEP 3 scores for 25 randomly selected students for four assessments.

The plots of these individuals' linear growth trajectories over time suggest that most individuals are increasing in their knowledge (Figures 8 – 10). It should be noted that the intercepts appear to vary considerably, a condition expected for a range of developmental-skill levels at the first assessment point. The steepness of the growth over time also varies within this subset of individuals across all three OSEP outcomes. It is unclear if the linear model correctly represents the change over time of all individuals equally well.

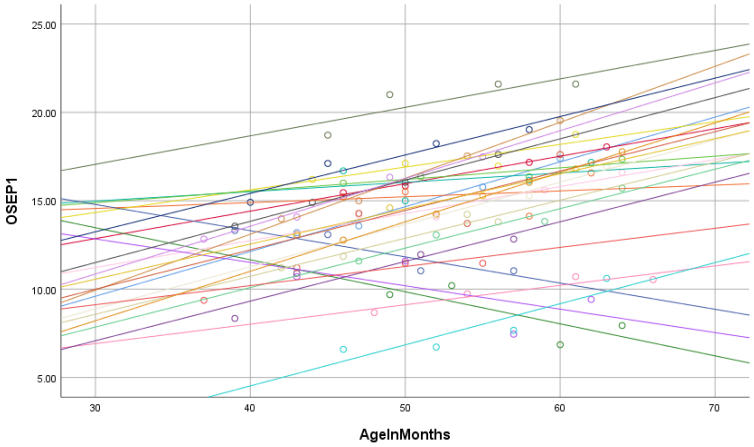

Figure 8. Individual linear growth trajectories of OSEP 1 scores for 25 randomly selected students for four assessments.

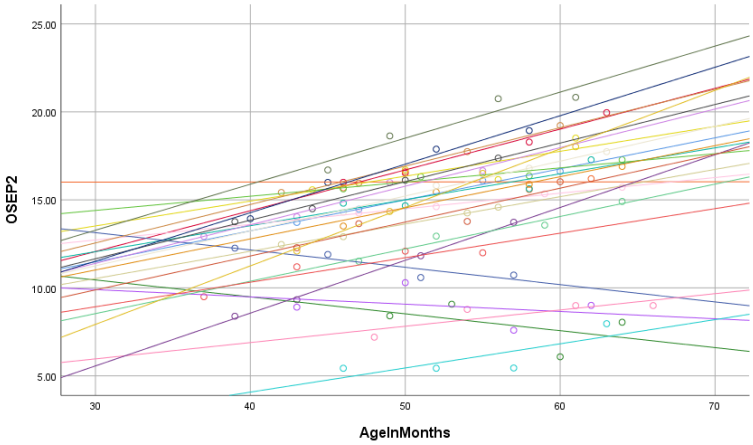

Figure 9. Individual linear growth trajectories of OSEP 2 scores for 25 randomly selected students for four assessments.

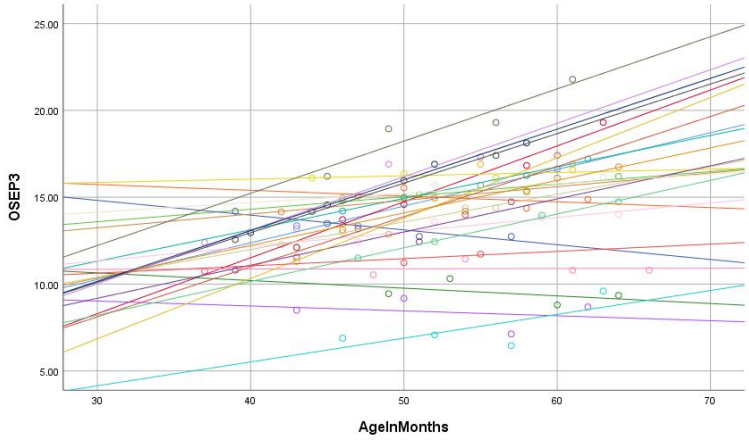

Figure 10. Individual linear growth trajectories of OSEP 3 scores for 25 randomly selected students for four assessments.

The next step in specifying the final Level 1 models, the basic Level 1 model including time (age in months centered), time squared (age in months centered and squared or the quadratic time variable), and time cubed (age in months centered and cubed) was conducted. The resulting estimates of fixed effects (Table 27) showed statistical significance for the linear, quadratic, and cubed time variables across all three OSEP outcomes. The models suggest that the linear component is necessary for describing developmental growth over time for OSEP 1, OSEP 2, and OSEP 3 ($\gamma = 0.20$, $\gamma = 0.20$, $\gamma = 0.20$). The quadratic and cubic components also are statistically significant;

however, the estimates are essentially zero and contribute such a small value to the final models. In addition, the overall line graphs of the data suggest a linear progression of the scores. Therefore, the final Level 1 models were decided to include only the linear time variable.

Table 27
Estimates of Fixed Effects for the Linear and Curvilinear Models by OSEP Outcome

	OSEP 1		OSEP 2		OSEP 3	
Parameter	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	11.14*	0.02	10.51*	0.02	11.24*	0.02
Age	0.23*	0.01	0.24*	0.01	0.19*	0.01
Age Squared	0.00*	0.00	0.00*	0.00	0.00*	0.00
Age Cubed	0.00*	0.00	0.00*	0.00	0.00*	0.00

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The Level 1 models were computed again, only including the linear time variable, and the results for both the fixed effects and the random estimates are presented in Table 28 for OSEP 1, Table 29 for OSEP 2, and Table 30 for OSEP 3.

Table 28
Fixed and Random Effects for the Basic Growth Model for OSEP 1

Parameter	Estimate	SE	*df*	*t*
		Fixed Effects		
Intercept	11.15	0.01	44,610.79	835.17*
Age	0.21	0.00	50,671.71	270.13*
		Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*
AR1 Diagonal (σ_e^2)	1.69	0.04		45.13*
AR1 Rho (ρ)	0.21	0.02		14.15*
Level 2: Between students, u_{ti}				
Intercept (τ_{00})	4.11	0.09		43.48*
Age (τ_{11})	0.01	0.00		33.08*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03	0.00		-7.16*
		Overall Model Criterion		
AIC Index	708,040.29			

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The intercept term represents the average OSEP 1 score starting point for a 36-month-old child. The OSEP scores range from 0 to 25, so 11.15 is a reasonable average

OSEP 1 score for a child who is 36 months old. The slope values can be interpreted as the value that the developmental score increases for each increase of a month in age of the child. For each additional month after turning 3 years of age, a child's average OSEP 1 score will increase by 0.21. The statistically significant *t* test for the growth term (age, t = 270.13) suggests that it should be retained in the model.

Next, the covariance parameters suggest that OSEP 1 scores vary across students in the study (Wald Z = 45.13). At Level 1, rho (ρ) represents the correlation between any two consecutive occasions across the time series (ρ = 0.21). Because the linear time variable was specified as a random effect, of primary interest is whether linear time varies between individuals in the study. The variation size of the within-individual growth parameter across individuals (UN 2,2) can be examined by referring to the Wald *Z* test (Wald Z = 33.08) in the variance components (Table 28). This statistically significant result suggests that growth (slopes) varies across the population of individuals. The UN (1,1) result suggests that there still is statistically significant residual variance in intercepts to be explained (Wald Z = 43.48). The covariance between the intercept and the slope (UN 2,1) is negative (-0.03) and also statistically significant (Wald Z = -7.16). These results lead to the conclusion that the variance in developmental growth across individuals should be examined further, which led to the investigations of research questions 2 and 3 where additional covariates were added to the model in order to further examine developmental progress of preschool children with disabilities.

The intercept term in Table 29 represents the average OSEP 2 score starting point for a 36-month-old child. The OSEP 2 scores range from 0 to 25, so 10.52 is a reasonable average overall score for a child who is 36 months old. For each additional month after

turning 3 years of age, a child's average OSEP 2 score will increase by 0.22. The statistically significant *t* test for the growth term (age, *t* = 290.34) suggests that it should be retained in the model.

Table 29
Fixed and Random Effects for the Basic Growth Model for OSEP 2

Parameter	Estimate	SE	*df*	*t*
		Fixed Effects		
Intercept	10.52	0.01	45,389.22	796.12*
Age	0.22	0.00	50,885.39	290.34*
		Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*
AR1 Diagonal (σ_e^2)	1.52	0.03		43.47*
AR1 Rho (ρ)	0.22	0.02		14.05*
Level 2: Between students, u_{ti}				
Intercept (τ_{00})	4.36	0.09		48.08*
Age (τ_{11})	0.01	0.00		37.51*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.04	0.00		-9.79*
		Overall Model Criterion		
AIC Index	701,489.04			

*Statistically significant at .05 level when the overall Type I error rate was controlled.

Next, the covariance parameters suggest that OSEP 2 scores vary across students in the study (Wald *Z* = 43.47). At Level 1, rho (ρ) represents the correlation between any two consecutive occasions across the time series (ρ = 0.22). Because the linear time variable was specified as a random effect, of primary interest is whether linear time varies between individuals in the study. The variation size of the within-individual growth parameter across individuals (UN 2,2) can be examined by referring to the Wald *Z* test (Wald *Z* = 37.51) in the variance components (Table 29). This statistically significant result suggests that growth (slopes) varies across the population of individuals. The UN (1,1) result suggests that there still is statistically significant residual variance in intercepts to be explained (Wald *Z* = 48.08). The covariance between the intercept and the slope (UN 2,1) is negative (-0.04) and also statistically significant (Wald *Z* = -9.79).

These results lead to the conclusion that the variance in developmental growth across individuals should be examined further, which led to the investigations of research questions 2 and 3 where additional covariates were added to the model in order to further examine developmental progress of preschool children with disabilities.

Table 30
Fixed and Random Effects for the Basic Growth Model for OSEP 3

Parameter	Estimate	SE	*df*	*t*
		Fixed Effects		
Intercept	11.18	0.01	43,607.17	889.24*
Age	0.19	0.00	51,960.52	253.37*
		Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*
AR1 Diagonal (σ_e^2)	1.75	0.04		46.74*
AR1 Rho (ρ)	0.25	0.01		17.35*
Level 2: Between students, u_{ti}				
Intercept (τ_{00})	3.07	0.09		35.48*
Age (τ_{11})	0.01	0.00		31.86*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03	0.00		-8.08*
		Overall Model Criterion		
AIC Index	701,489.04			

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The intercept term in Table 30 represents the average OSEP 3 score starting point for a 36-month-old child. The OSEP 3 scores range from 0 to 25, so 11.18 is a reasonable average OSEP 3 score for a child who is 36 months old. For each additional month after turning 3 years of age, a child's average OSEP 3 score will increase by 0.19. The statistically significant *t* test for the growth term (age, $t = 253.37$) suggests that it should be retained in the model.

Next, the covariance parameters suggest that OSEP 3 scores vary across students in the study (Wald $Z = 46.74$). At Level 1, rho (ρ) represents the correlation between any two consecutive occasions across the time series ($\rho = 0.25$). Because the linear time variable was specified as a random effect, of primary interest is whether linear time

varies between individuals in the study. The variation size of the within-individual growth parameter across individuals (UN 2,2) can be examined by referring to the Wald *Z* test (Wald *Z* = 31.86) in the variance components (Table 30). This statistically significant result suggests that growth (slopes) varies across the population of individuals. The UN (1,1) result suggests that there still is statistically significant residual variance in intercepts to be explained (Wald *Z* = 35.48). The covariance between the intercept and the slope (UN 2,1) is negative (-0.03) and also statistically significant (Wald *Z* = -8.08). These results lead to the conclusion that the variance in developmental growth across individuals should be examined further, which led to the investigations of research questions 2 and 3 where additional covariates were added to the model in order to further examine developmental progress of preschool children with disabilities.

The final step in analyzing research question 1 was to investigate the basic linear Level 2 models in order to explore overall growth for all the children in the final data set. These models represent the final growth models prior to the addition of the setting predictor. These models are based on the following equation, where Y_{ti} is defined by the OSEP 1, OSEP 2, and OSEP 3 scores

$$Y_{ti} = \pi_{0i} + \pi_{1i}(age\ in\ months - 36) + \varepsilon_{ti},$$

$$\pi_{0i} = \beta_{00} + \mu_{0i}, and$$

$$\pi_{1i} = \beta_{10} + \mu_{1i}.$$

Based on the output of the analysis presented in Tables 38 – 40 above, the Level 2 linear models for the final data set are

$$OSEP\ 1\ Score_{ti} = 11.15 + 0.21(age\ in\ months - 36),$$

$$OSEP\ 2\ Score_{ti} = 10.52 + 0.22(age\ in\ months - 36), \text{and}$$

$$OSEP\ 3\ Score_{ti} = 11.18 + 0.19(age\ in\ months - 36).$$

These three final Level 2 models were used to build the final Level 2 models that were used to investigate research questions 2 and 3.

Results for Research Question 2

To what extent does the developmental growth of children receiving preschool special-education services in inclusive settings differ from those not served in inclusive settings?

The two-level hierarchical linear model from research question 1 was used to investigate whether developmental growth differs based on preschool setting across each measure of development. As a reminder, the Level 1 linear growth model is

$$Y_{ti} = \pi_{0i} + \pi_{1i}a_{ti} + \cdots + \varepsilon_{ti}$$

or

$$OSEP\ Score_{ti} = \pi_{0i} + \pi_{1i}(ageinmonths - 36) + \varepsilon_{ij}.$$

In order to carry out these analyses, an explanatory variable was introduced into the Level 2 growth models: SETTING (a dummy variable indicating preschool educational setting: 1 = inclusive, 0 = noninclusive). The Level 2 models for research question 2 are

$$Y_{ij} = \pi_{0i} + \pi_{1i}(age\ in\ months - 36) + \varepsilon_{ij},$$

$$\pi_{0i} = \beta_{00} + \beta_{01}(setting) + \mu_{0i}, \text{ and}$$

$$\pi_{1i} = \beta_{10} + \beta_{11}(setting) + \mu_{1i},$$

where the βs represent the coefficient at the person-level and the πs represent the coefficients at a level below the person level or the student level. The first subscript represents a sequential count of predictors at Level 1, whereas the second represents a sequential count of the predictors at Level 2. In addition to adding the setting variable, a

cross-level interaction term must be added as a means of identifying subsets of students (e.g., children served inclusively and not) who are investigated for possible differences in growth trajectories. Once the setting variable and cross-interaction term have been added to the present model and the intercept and slope equations are substituted in the Level 1 model, the following combined model is obtained

$$Y_{ij} = \beta_{00} + \beta_{01}(setting) + \beta_{10}(age\ in\ months - 36) + \beta_{11}\big((ageinmonths - 36)\ X\ setting\big) + \mu_{1i}(age\ in\ months - 36) + \mu_{0i} + \varepsilon_{ij}.$$

OSEP 1: Social Relationships

The resulting estimates of fixed effects for the Level 2 model for the OSEP 1 outcome measure are provided in Table 41. Students' OSEP 1 score intercept (β_{00}) is 11.08, which is described as the students' grand mean OSEP 1 score adjusted for setting and can be interpreted as the initial OSEP 1 score for child who is 36 months old (age in months = 0) and served in a noninclusive setting (setting = 0).

Results of the first research question regarding whether or not setting is related to differences in average scores on the DRDP are included in Table 31 and suggest that the average OSEP 1 score was associated positively with the setting within which the child was served. The coefficient for setting ($\beta_{01} = 0.20$) suggests that the students served in inclusive settings would have an estimated grand-mean OSEP 1 score 0.20 higher than the noninclusive children, or 11.28 (i.e., 11.08 + 0.20).

Regarding student-growth rate differences related to setting that might explain variability in the OSEP 1 score growth rates between individuals, the linear interaction (age X setting) is statistically significant ($\beta_{11} = 0.01$). This coefficient can be interpreted as students receiving special-education services in inclusive settings demonstrate slightly

higher growth over time when compared with children served in noninclusive settings. At the present time, there is not a universally accepted approach to calculating effect sizes in HLM analyses (Christiansen et al., 2004). The recommendation of Feingold (2009) has been followed for calculating effect size by dividing the fixed effect estimate by the square root of the corresponding random effect. These are labeled Cohen's *d* effect-size values and were calculated for each result and are presented in Table 31. The cross-interaction term used to investigate difference in developmental growth trajectories based on setting does not meet the threshold for a small effect ($d < 0.20$).

Table 31
HLM Results of the Growth Model for OSEP 1: Social Relationships

Parameter	Estimate	Std. Error	*df*	*t*	d^a
			Fixed Effects		
Intercept	11.08	0.02	43,587.52	666.54*	
Age	0.21	0.00	50,549.51	207.87*	2.19
Setting	0.20	0.03	46,129.25	7.01*	2.01
Age X Setting	0.01	0.00	51,808.22	5.41*	0.10
			Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*	
AR1 Diagonal (σ_e^2)	1.70	0.04		44.92*	
AR1 Rho (ρ)	0.22	0.02		14.47*	
Level 2: Between students, u_{ti}					
Intercept (τ_{00})	4.07	0.09		42.96*	
Age (τ_{11})	0.01	0.00		32.70*	
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03	0.00		-6.99*	
			Overall Model Criterion		
AIC Index	707,738.46				

*Statistically significant at .05 level when the overall Type I error rate was controlled.
a Cohen's *d* calculation of $d = \beta/(\tau)^{1/2}$ where τ is the between-students variability of the slopes.

The values from Table 41 are included in the combined model to produce

$$OSEP\ 1\ Score_{ti} = 11.08 + 0.16(setting) + 0.21(ageinmonths - 36) + 0.01\big((ageinmonths - 36)\ X\ setting\big).$$

In addition to the quantitative analyses, the differences in developmental-growth trajectories in a graph of the different growth rates by setting are given in Figure 11. The line graph of the average OSEP 1 growth trajectories differentiated by setting indicates a steady increase in scores over time for both comparison groups with a slight dip at the end that is more pronounced for the noninclusive group. This dip might be due to the fact that children with more severe disabilities often continue receiving preschool special-education services as long as possible before transitioning to Kindergarten. Therefore, the average ratings for the noninclusive group would not be expected to increase as sharply as children being served in inclusive settings. The group fit lines for OSEP 1 scores, which are a graphical representation of the average slope for the comparison groups are found in Figure 12. The fit line for the group of children who are in the inclusive group has a slightly steeper slope than for those in the noninclusive group, which is consistent with the results of the HLM analyses.

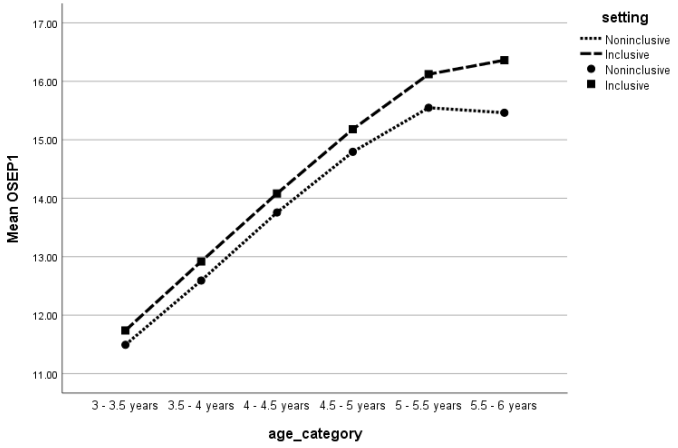

Figure 11. Line graphs for OSEP 1 scores differentiated by setting.

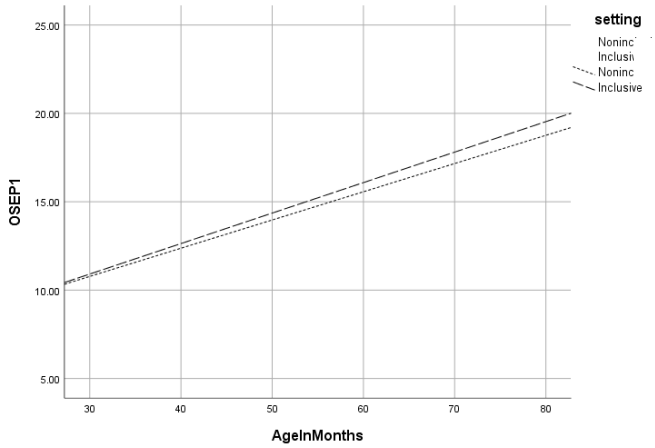

Figure 12. Growth trajectory lines for OSEP 1 scores by setting.

OSEP 2: Knowledge and Skills

Results of the expanded Level 2 model are presented next for the OSEP 2 outcome measure (Table 32). Students' OSEP 2 score intercept (β_{00}) is 10.47, which is the initial OSEP 2 score for child who is 36 months old (age in months = 0) and served in a noninclusive setting (setting = 0).

The first question that was investigated is whether the setting is related to differences in average achievement on OSEP 2. The results suggest that the average OSEP 2 score was associated positively with the setting within which the child was served (Table 32). The coefficient for setting ($\beta_{01} = 0.14$) suggests that the students served in inclusive settings would have an estimated grand-mean OSEP 2 score 0.14 higher than the noninclusive children, or 10.61 (i.e., 10.47 + 0.14).

Differences in student-growth rates related to setting were investigated by the linear interaction term (age X setting) that is statistically significant ($\beta_{11} = 0.01$). This coefficient can be interpreted as students receiving special-education services in inclusive settings demonstrate slightly higher growth over time when compared with children

served in noninclusive settings. The Cohen's *d* value for the cross-interaction term indicates that this result does not meet the threshold for a small effect ($d < 0.20$).

Table 32
HLM Results of the Growth Models for OSEP 2: Knowledge and Skills

Parameter	Estimate	Std. Error	*df*	*t*	d^a
			Fixed Effects		
Intercept	10.47	0.02	44,372.70	635.79*	
Age	0.22	0.00	50,773.93	223.54*	2.16
Setting	0.14	0.03	46,973.34	5.19*	1.40
Age X Setting	0.01	0.00	52,103.83	5.94*	0.09
			Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*	
AR1 Diagonal (σ_e^2)	1.53	0.04		43.29*	
AR1 Rho (ρ)	0.22	0.02		14.29*	
Level 2: Between students, u_{ti}					
Intercept (τ_{00})	4.33	0.09		47.70*	
Age (τ_{11})	0.01	0.00		37.24*	
τ_{00}, τ_{11} Covariance (τ_{01})	-0.04	0.00		-9.71*	
			Overall Model Criterion		
AIC Index	689,638.17				

*Statistically significant at .05 level when the overall Type I error rate was controlled.
a Cohen's *d* calculation of $d = \beta/(\tau)^{1/2}$ where τ is the between-students variability of the slopes.

The values from Table 42 are included in the combined model to produce

$$OSEP\ 2\ Score_{ti} = 10.47 + 0.22(setting) + 0.14(ageinmonths - 36) +$$

$$0.01\big((ageinmonths - 36)\ X\ setting\big).$$

In addition to the quantitative analyses, the differences in developmental-growth trajectories were reviewed in a graph of the different growth rates by setting (Figure 13). The line graph of the average OSEP 2 growth trajectories differentiated by setting indicates a steady increase in scores over time for both comparison groups with a slight dip at the end that is more pronounced for the noninclusive group, similar to the full data set and OSEP 1 scores. The group fit lines for OSEP 2 scores, which look similar to the fit lines for OSEP 1, are presented in Figure 14. The line for the group of children who

are in the inclusive group has a slightly steeper slope than the noninclusive group, which is consistent with the results of the HLM analyses.

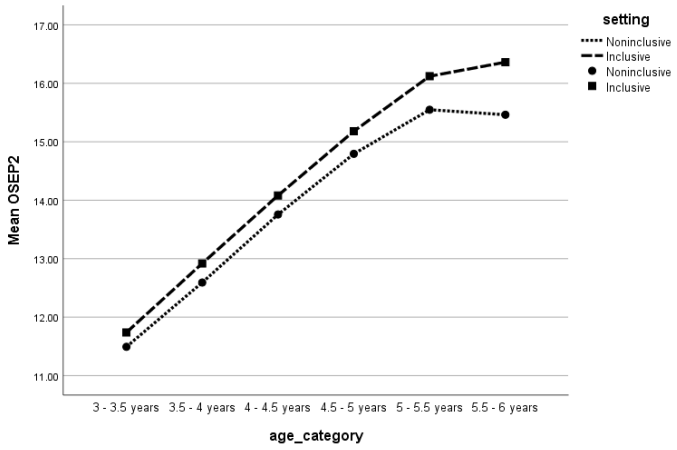

Figure 13. Line graphs for OSEP 2 scores differentiated by setting.

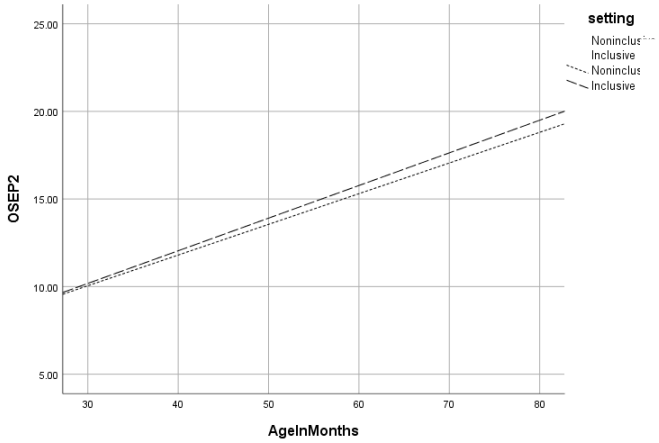

Figure 14. Growth trajectory lines for OSEP 2 scores by setting.

OSEP 3: Actions to Meet Needs

The expanded Level 2 model results are presented next for the OSEP 3 outcome measure. The resulting estimates of fixed and random effects are provided in Table 33. Students' OSEP 3 score intercept (β_{00}) is 11.12, which is the initial OSEP 3 score for child who is 36 months old (age in months = 0) and served in a noninclusive setting (setting = 0).

The next step in the analysis is related to differences in average achievement on OSEP 3. The results included in Table 33, suggest that the average OSEP 3 score was associated positively with the setting within which the child was served. The coefficient for setting ($\beta_{01} = 0.15$) means that the students served in inclusive settings would have an estimated grand-mean OSEP 3 score 0.15 higher than the non-inclusive children, or 11.27 (i.e., 11.12 + 0.15).

Table 33
HLM Results of the Growth Models for OSEP 3: Actions to Meet Needs

Parameter	Estimate	Std. Error	*df*	*t*	d^a
			Fixed Effects		
Intercept	11.12	0.02	42,502.44	711.13*	
Age	0.19	0.00	51,882.03	195.09*	2.03
Setting	0.15	0.03	45,161.41	5.69*	1.62
Age X Setting	0.01	0.00	53,071.23	4.79*	0.08
			Random Effects		
Level 1: Within students, ε_{ti}				*Wald Z*	
AR1 Diagonal (σ_e^2)	1.76	0.04		46.61*	
AR1 Rho (ρ)	0.25	0.01		17.59*	
Level 2: Between students, u_{ti}					
Intercept (τ_{00})	3.04	0.09		35.14*	
Age (τ_{11})	0.01	0.00		31.62*	
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03	0.00		-7.97*	
			Overall Model Criterion		
AIC Index			701,260.27		

*Statistically significant at .05 level when the overall Type I error rate was controlled.
a Cohen's *d* calculation of $d = \beta/(\tau)^{1/2}$ where τ is the between-students variability of the slopes.

Next, the differences in student-growth rates related to setting must be investigated and the linear interaction term (age X setting) is statistically significant ($\beta_{11} = 0.01$). This coefficient can be interpreted as students receiving special-education services in inclusive settings demonstrate slightly higher growth over time when compared with children served in noninclusive settings. The Cohen's *d* value for the cross-interaction term indicates that this result does not meet the threshold for a small

effect ($d < 0.20$). The values from Table 33 are included in the combined model to produce

$$OSEP\ 3\ Score_{ti} = 11.12 + 0.19(setting) + 0.15(ageinmonths - 36) + 0.01\big((ageinmonths - 36)\ X\ setting\big).$$

In addition to the quantitative analyses, the differences in developmental-growth trajectories in a graph of the different growth rates by setting are provided in Figure 15. The line graph of the average OSEP 3 growth trajectories differentiated by setting indicates a steady increase in scores over time for both comparison groups with a slight dip at the end that is more pronounced for the noninclusive group, similar to the full data set, OSEP 1, and OSEP 2 scores. The group fit lines for OSEP 3 scores, which look similar to the fit lines for OSEP 1 and 2, are provided in Figure 16. The line for the group of children who are in the inclusive group has a slightly steeper slope than for the noninclusive group, which is consistent with the results of the HLM analyses.

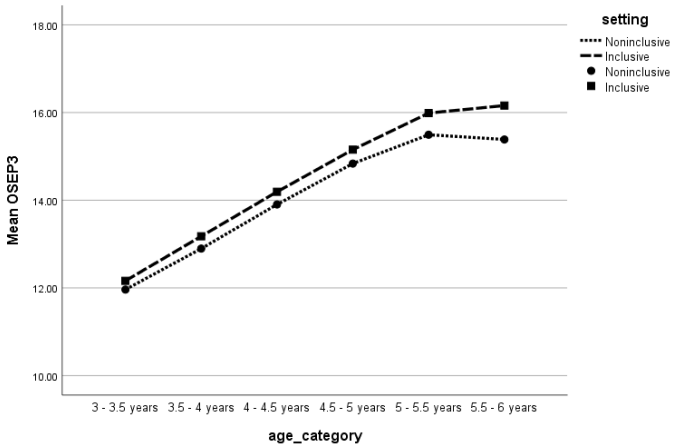

Figure 15. Line graphs for OSEP 3 scores differentiated by setting.

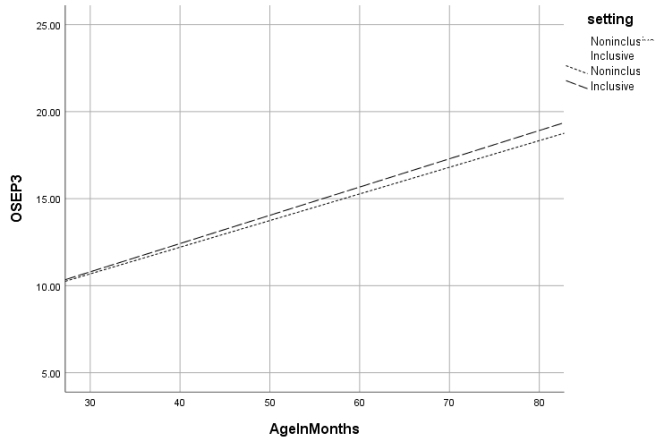

Figure 16. Growth trajectory lines for OSEP 3 scores by setting.

As a final summary of the HLM models, including the fixed and random effects, for each of the three OSEP outcomes, the results from each analysis of the model are provided in Table 34. All fixed effects are statistically significant. Furthermore, the cross-interaction term for age and setting is statistically significant in all models, indicating that the developmental trajectory of children differs by preschool setting.

Table 34
Summary of HLM Results by OSEP Outcome

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	11.08*	11.12*	10.47*
Age	0.21*	0.19*	0.22*
Setting	0.20*	0.15*	0.14*
Age X Setting	0.01*	0.01*	0.01*
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	1.70*	1.76*	1.53*
AR1 Rho (ρ)	0.22*	0.25*	0.22*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	4.07*	3.04*	4.33*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03*	-0.03*	-0.04*
		Overall Model Criterion	
AIC Index	707,738.46	701,260.27	689,638.17

*Statistically significant at .05 level when the overall Type I error rate was controlled.

Developmental Growth by Domains of the DRDP (2015)

In addition to understanding the effect of preschool setting on overall DRDP scores, the effect of preschool setting extending down to the eight domains of the DRDP (2015) instrument was investigated. The estimates for the intercept, age in months, setting, and age in months by setting cross-interaction term for each domain are presented in Table 35. Similar to the model using the three OSEP scores, all fixed variables are statistically significant for all domains, with the exception of the cross-level variable in the ELD domain. A child was rated on the ELD domain if another language other than English is spoken in their home. Therefore, only a subset of the study population of children received ELD domain scores (n = 34,552).

Table 35
Comparing Results of the Growth Models for Each Domain of the DRDP (2015)

Domain	Intercept	Age	Setting	Age X Setting	Cohen's d^a for Age X Setting
OSEP 1					
ATL-REG	12.04*	0.17*	0.16*	0.01*	.12
SED	9.76*	0.25*	0.25*	0.01*	.11
OSEP 2					
LANG	9.51*	0.25*	0.19*	0.01*	.10
LIT	11.03*	0.20*	0.13*	0.01*	.01
MATH	10.76*	0.21*	0.12*	0.01*	.10
OSEP 3					
PD	10.41*	0.22*	0.13*	0.01*	.08
HLTH	11.61*	0.17*	0.17*	0.01*	.13
ELD	9.68*	0.24*	0.26*	0.01	

*Statistically significant at .05 level when the overall Type I error rate was controlled.
a Cohen's d calculation of $d = \beta/(\tau)^{1/2}$ where τ is the within-group variability of the slopes.

Effect-size values were calculated for each statistically significant result and are included in Table 35. Based on the values for Cohen's d for the cross-level interaction terms for age in months and setting, the effect size does not meet the threshold for a small

effect ($d < 0.20$), which indicates that there are differences in the developmental-growth trajectories by setting in all eight domains of the DRDP. In general, children served in inclusive settings have a slightly higher trajectory than children served in noninclusive settings.

The intercept and slopes of ATL-REG and SED can be directly compared within the OSEP 1 group. On average, the initial ATL-REG scores (12.04) are higher than the initial SED scores (9.76). The estimate for setting for SED (0.25) is higher than for ATL-REG (0.16) indicating that when a child is served in an inclusive setting their average SED domain score increases more than for ATL-REG domain scores.

Within the OSEP 2 group, the intercept for LANG is the highest (11.03). The average initial LANG score is higher for a preschool child than LIT or MATH. The estimate for setting is the highest for LANG, indicating that inclusive settings increase the average LANG domain score more than for LIT or MATH.

The intercepts within the OSEP 3 group is higher for HLTH (11.61) than for PD (10.41). Conversely, the estimate for setting is higher for PD (0.22) than for HLTH (0.17), which indicates that when the setting is inclusive, the average PD domain score increases more than for HLTH.

Results for Research Question 3

To what extent does the developmental growth of children receiving preschool special-education services differ by disability category within preschool setting (inclusive versus noninclusive)?

The two-level hierarchical linear models from research question 2 were used to examine between-person variability in OSEP scores based on preschool setting for 8 of

the 14 disability categories. A disability category was selected for inclusion in the final analyses if over 1,000 children were present in the final data set. The final counts by disability category are included at the end of chapter 3 in Table 21 on page 76.

As a reminder, the Level 2 models for research question 2 are

$$Y_{ij} = \pi_{0i} + \pi_{1i}(ageinmonths - 36) + \varepsilon_{ij}$$

$$\pi_{0i} = \beta_{00} + \beta_{01}(setting) + \mu_{0i}$$

$$\pi_{1i} = \beta_{10} + \beta_{11}(setting) + \mu_{1i}$$

This section includes a brief overview of all the results for the eight disability categories for each of the three OSEP outcome measures summarized in one table. The rest of this section includes a more detailed breakdown of the results by disability category. The estimates for the intercept, age in months, setting, and age X setting cross-interaction term for each OSEP outcome for all eight of the included disability categories are provided in Table 36.

Based on the results presented, the cross-interaction term age X setting only was statistically significant for speech and language impairment for OSEP 3 and other health impairment for OSEP 1 and OSEP 3. These results indicate that, although the developmental-growth scores of preschoolers differed by setting for the other seven disability groups, there was no statistically significant difference in the developmental-growth trajectories based on preschool setting. What follows is a more detailed examination of the results for each disability category.

Table 36
Comparing Results of OSEP Scores by Disability Category

Domain	*N*	Intercept	Age	Setting	Age X Setting
OSEP 1					
Speech and Language Impairment	48,825	11.84*	0.22*	-0.02	0.00
Autism	18,948	10.14*	0.19*	0.22*	0.01
Intellectual Disability	3,513	9.54*	0.15*	0.44*	-0.01
Other Health Impairment	2,778	10.86*	0.19*	0.45*	0.02*
Hard of Hearing	1,136	12.37*	0.21*	-0.04	0.00
Specific Learning Disability	1,124	11.71*	0.20*	0.20	0.00
Orthopedic Impairment	1,104	10.57*	0.16*	0.82*	0.02
Multiple Disability	1,011	8.32*	0.09*	0.46*	-0.02
OSEP 2					
Speech and Language Impairment	48,825	11.09*	0.23*	-0.08*	0.00
Autism	18,948	9.86*	0.21*	0.29*	0.01
Intellectual Disability	3,513	8.73*	0.15*	0.37*	0.00
Other Health Impairment	2,778	10.21*	0.21*	0.49*	0.02
Hard of Hearing	1,136	11.58*	0.22*	-0.19	0.01
Specific Learning Disability	1,124	11.19*	0.20*	0.11	0.00
Orthopedic Impairment	1,104	9.89*	0.17*	0.71*	0.02
Multiple Disability	1,011	7.60*	0.09*	0.44*	-0.02
OSEP 3					
Speech and Language Impairment	48,825	11.68*	0.20*	0.01	-0.01*
Autism	18,948	10.74*	0.17*	0.22*	0.00
Intellectual Disability	3,513	9.71*	0.13*	0.19	0.00
Other Health Impairment	2,778	10.54*	0.17*	0.40*	0.02*
Hard of Hearing	1,136	12.01*	0.20*	-0.10	0.01
Specific Learning Disability	1,124	11.68*	0.19*	0.31	-0.01
Orthopedic Impairment	1,104	9.45*	0.13*	0.45*	0.02
Multiple Disability	1,011	8.14*	0.07*	0.48	-0.02

*Statistically significant at .05 level when the overall Type I error rate was controlled.

Speech and Language Impairment

The results of the Level 2 models for all three OSEP outcomes are presented in Table 37. For children diagnosed with speech or language impairments, students' OSEP score intercepts (β_{00}) are presented in Table 37 and can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for

child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having a speech or language impairment.

Table 37
Summary of HLM Results by OSEP Outcome for Children with Speech and Language Impairments

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	11.84*	11.09*	11.68*
Age	0.22*	0.23*	0.20*
Setting	-0.02	-0.08*	0.01
Age X Setting	0.00	0.00	-0.01*
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	1.67*	2.10*	1.68*
AR1 Rho (ρ)	-0.15*	0.28*	-0.25*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	3.27*	2.88*	2.98*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	0.06*	-0.05*	-0.05*
		Overall Model Criterion	
AIC Index	405,829.35	400,075.09	400,692.04

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The first question that was explored is whether the setting is related to differences in average achievement on the DRDP for children with speech or language impairments. The results suggest that the average OSEP scores are associated negatively with the setting within which the child was served for OSEP 1 ($\beta_{01} = -0.02$) and OSEP 2 ($\beta_{01} = -0.08$) and only slightly positively associated in OSEP 3 ($\beta_{01} = 0.01$). These coefficients for setting suggest that the students with a speech or language impairment served in inclusive settings would have an estimated grand-mean OSEP score lower than children served in noninclusive settings for OSEP 1 and OSEP 2 and only 0.01 higher for OSEP 3.

The second question was whether there are differences in student-growth rates related to setting for children with speech or language impairments. Regarding the setting variable that might explain variability in the OSEP score growth rates between individuals, the linear interaction (age X setting) is not statistically significant for OSEP 1 and 2 but is statistically significant for OSEP 3 ($\beta_{11} = -0.01$). The coefficient for OSEP 3 can be interpreted as there is a difference in the developmental-growth trajectory between students with speech or language impairments being served in inclusive settings or noninclusive settings. The children diagnosed with a speech or language impairment served in an inclusive setting grow, on average, 0.01 less than children served in noninclusive settings. This is the opposite result from the overall population.

In addition to the quantitative analyses, it can be useful to view graphically the data for the two groups in order to better understand the developmental growth of children diagnosed with a speech or language impairment. The line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes are provided in Figure 17. The dashed line represents the inclusive group and the dotted line is the noninclusive group. The two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight flattening in the oldest age category.

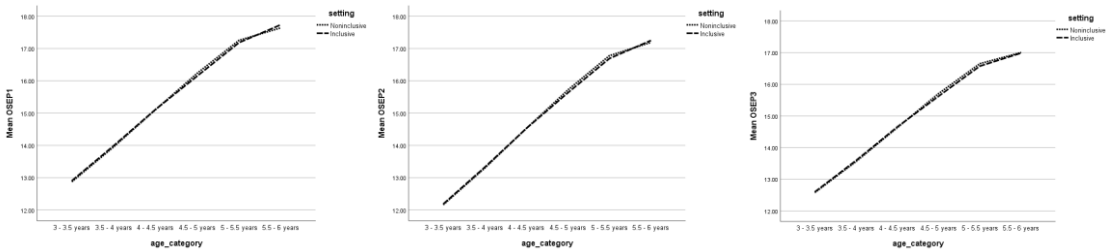

Figure 17. Line graphs for OSEP scores for children with speech and language impairments differentiated by setting.

Autism

Results of the Level 2 models for all three OSEP outcomes are presented in Table 38 for children diagnosed with autism. Students' OSEP score intercepts (β_{00}) and can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having autism.

Table 38
Summary of HLM Results by OSEP Outcome for Children with Autism

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	10.14*	9.86*	10.74*
Age	0.19*	0.21*	0.17*
Setting	0.22*	0.29*	0.22*
Age X Setting	0.01	0.01	0.00
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	1.62*	1.49*	1.72*
AR1 Rho (ρ)	0.38*	0.37*	0.42*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	3.05*	4.03*	1.85*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	0.01	0.00	0.00
		Overall Model Criterion	
AIC Index	173,037.76	175,303.93	166,293.32

*Statistically significant at .05 level when the overall Type I error rate was controlled.

Whether the setting is related to differences in average achievement on the DRDP for children with autism was investigated first. The results suggest that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures: OSEP 1 ($\beta_{01} = 0.22$), OSEP 2 ($\beta_{01} = 0.29$), and OSEP 3 ($\beta_{01} = 0.22$). These coefficients for setting suggest that the students with autism served

in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

The second question to explore is whether there are differences in student-growth rates related to setting for children with autism. Regarding the setting variable that might explain variability in the OSEP score growth rates between individuals, the linear interaction (age X setting) is not statistically significant for any of the three OSEP outcome measures. These coefficients can be interpreted as there is no difference in the developmental-growth trajectory between students with autism being served in inclusive settings or noninclusive settings.

In addition to the quantitative analyses, a graphic view of the data for the two groups is presented in order to better understand the developmental growth of children diagnosed with autism (Figure 18). The dashed line represents the inclusive group and the dotted line is the noninclusive group. The two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight flattening in the oldest age category.

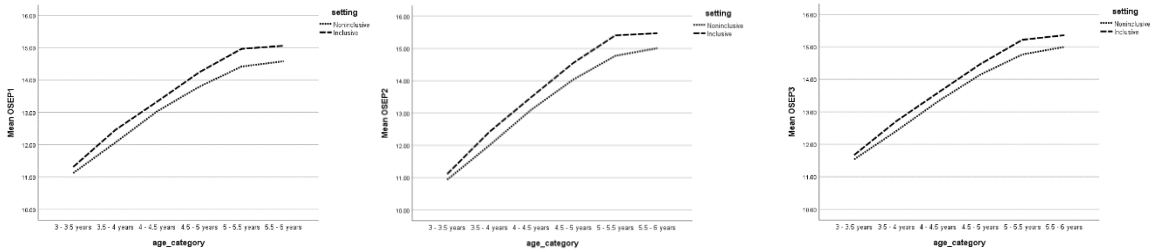

Figure 18. Line graphs for OSEP scores for children with autism differentiated by setting.

Intellectual Disability

The Level 2 model results for all three OSEP outcomes are presented in Table 39 for children diagnosed with an intellectual disability. Students' OSEP score intercepts

(β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having an intellectual disability.

Table 39
Summary of HLM Results by OSEP Outcome for Children with an Intellectual Disability

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	9.54*	8.73*	9.71*
Age	0.15*	0.15*	0.13*
Setting	0.44*	0.37*	0.19
Age X Setting	-0.01	0.00	0.00
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	0.90*	0.90*	0.92*
AR1 Rho (ρ)	0.20*	0.26*	0.25*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	3.21*	3.04*	2.11*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.04	-0.03	0.00
		Overall Model Criterion	
AIC Index	31,386.08	31,271.32	30,563.03

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The first question investigated was whether the setting is related to differences in average achievement on the DRDP for children with an intellectual disability. The results suggest that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures: OSEP 1 ($\beta_{01} = 0.44$), OSEP 2 ($\beta_{01} = 0.37$), and OSEP 3 ($\beta_{01} = 0.19$). These coefficients for setting suggest that the students with an intellectual disability served in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

Whether there are differences in student-growth rates related to setting for children with an intellectual disability was the second question investigated. Regarding the setting variable that might explain variability in the OSEP score growth rates between individuals, the linear interaction (age X setting) is not statistically significant for any of the three OSEP outcome measures. These coefficients can be interpreted as there is no difference in the developmental-growth trajectory between students with an intellectual disability being served in inclusive settings or noninclusive settings.

Viewing the graphical representation of the data for the two groups can be reviewed in order to better understand the developmental growth of children diagnosed with an intellectual disability. Figure 19 includes the line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes. The dashed line represents the inclusive group and the dotted line is the noninclusive group. The two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight flattening in the oldest age category.

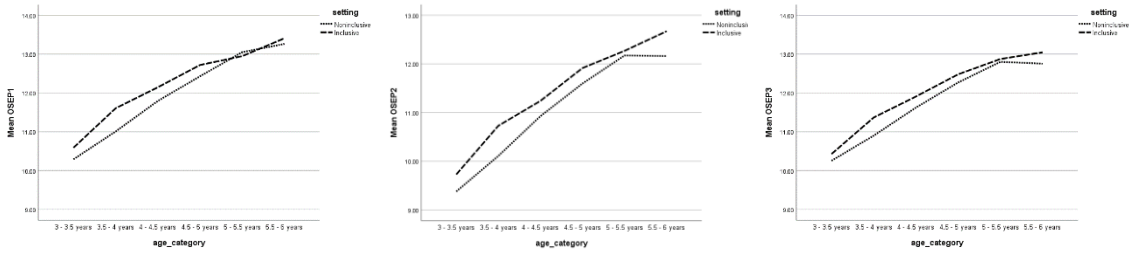

Figure 19. Line graphs for OSEP scores for children with an intellectual disability differentiated by setting.

Other Health Impairment

Results of the Level 2 models for all three OSEP outcomes for children diagnosed with other health impairments are presented in Table 40. Students' OSEP score intercepts (β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can

be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having other health impairments.

Table 40
Summary of HLM Results by OSEP Outcome for Children with Other Health Impairments

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	10.86*	10.21*	10.54*
Age	0.19*	0.21*	0.17*
Setting	0.45*	0.49*	0.40*
Age X Setting	0.02*	0.02	0.02*
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	1.79*	1.28*	1.93*
AR1 Rho (ρ)	0.43*	0.30*	0.54*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	2.51*	3.85*	1.56*
Age (τ_{11})	0.00	0.01*	0.00
τ_{00}, τ_{11} Covariance (τ_{01})	0.03	0.00	0.04*
		Overall Model Criterion	
AIC Index	26,105.85	26,423.08	25,477.78

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The first step in exploring this disability category is investigating whether the setting is related to differences in average achievement on the DRDP for children with other health impairments. The results suggest that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures, OSEP 1 ($\beta_{01} = 0.45$), OSEP 2 ($\beta_{01} = 0.49$), and OSEP 3 ($\beta_{01} = 0.40$). These coefficients for setting suggest that the students with other health impairments served in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

Differences in student-growth rates related to setting for children with other health impairments was also investigated for children with other health impairments. Regarding the setting variable that might explain variability in the OSEP score growth rates between individuals, the linear interaction (age X setting) is statistically significant for OSEP 1 and OSEP 3. These coefficients can be interpreted as there is a difference in the developmental-growth trajectory between students with other health impairments being served in inclusive settings from those served in noninclusive settings. These results mean that children with other health impairments served in inclusive settings have a slightly higher growth trajectory in OSEP 1 and 3 scores than children served in noninclusive settings. These results are consistent with the results of the overall study population.

Line graphs of the data for the two groups were obtained and can be reviewed in order to better understand the developmental growth of children diagnosed with other health impairments. Figure 20 includes the line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes and reveal that the two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight flattening in the oldest age category. The dashed line represents the inclusive group and the dotted line is the noninclusive group.

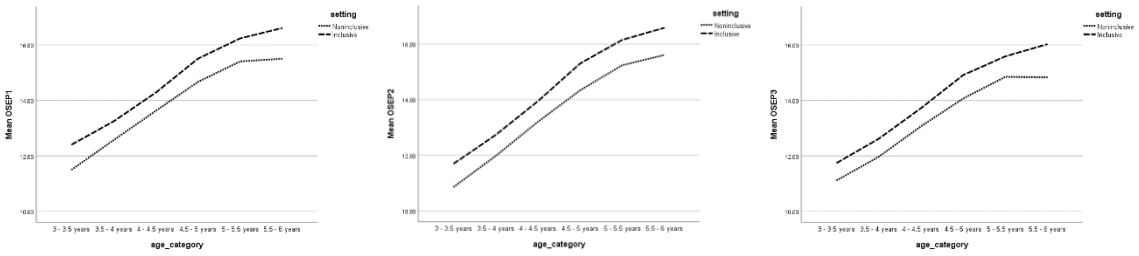

Figure 20. Line graphs for OSEP scores for children with other health impairments differentiated by setting.

Breakdown by Domain for Children with Other Health Impairments

In addition to understanding the effect of preschool setting on the OSEP scores for children with other health impairments, the effect of whether preschool setting extends down to the eight domains of the DRDP (2015) instrument was investigated. The estimates for the intercept, age in months, setting, and age in months X setting cross-interaction term for each domain are given in Table 41. The cross-interaction terms of age and setting are statistically significant for the OSEP 1 and 3 scores for children with other health impairments, and also statistically significant for five of the eight domains at the domain level. The effect sizes are all small for the statistically significant results.

Table 41
Comparing Results of the Growth Models for Each Domain of the DRDP (2015) for Children with Other Health Impairments

Domain	Intercept	Age	Setting	Age X Setting	Cohen's d[a] for Age X Setting
OSEP 1					
ATL-REG	11.83*	0.15*	0.33*	0.01*	0.24
SED	9.52*	0.23*	0.62*	0.02*	0.23
OSEP 2					
LANG	9.34*	0.24*	0.67*	0.02	
LIT	10.80*	0.19*	0.44*	0.01	
MATH	10.43*	0.20*	0.44*	0.02*	0.17
OSEP 3					
PD	9.68*	0.20*	0.47*	0.02*	0.09
HLTH	11.11*	0.15*	0.36*	0.02*	0.26
ELD	9.62*	0.21*	0.48	0.04	

*Statistically significant at .05 level when the overall Type I error rate was controlled.
a Cohen's d calculation of $d = \beta/(\tau)^{1/2}$ where τ is the within-group variability of the slopes.

Hard of Hearing

Children diagnosed as hard of hearing results of the Level 2 models for all three OSEP outcomes are presented in Table 42. Students' OSEP score intercepts (β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted

as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as hard of hearing.

Table 42
Summary of HLM Results by OSEP Outcome for Children who are Hard of Hearing

	OSEP 1	OSEP 2	OSEP 3
	Fixed Effects		
Intercept	12.37*	11.58*	12.01*
Age	0.21*	0.22*	0.20*
Setting	-0.04	-0.19	-0.10
Age X Setting	0.00	0.01	0.01
	Random Effects		
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	2.55*	2.44*	2.13*
AR1 Rho (ρ)	0.53*	0.54*	0.40*
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	2.84*	2.67*	1.91*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.04	-0.03	-0.02
	Overall Model Criterion		
AIC Index	10,427.60	10,379.76	10,262.30

*Statistically significant at .05 level when the overall Type I error rate was controlled.

Differences in average achievement on the DRDP for children who are hard of hearing were investigated. The results suggest that the average OSEP scores are associated negatively with the setting within which the child was served for OSEP 1 ($\beta_{01} = -0.04$), OSEP 2 ($\beta_{01} = -0.19$), and OSEP 3 ($\beta_{01} = -0.10$), which indicates that the students who are hard of hearing served in inclusive settings would have an estimated grand-mean OSEP score lower than children served in noninclusive settings across all three OSEP outcome measures.

The second question is whether there are differences in student-growth rates related to setting for children who are hard of hearing. The linear interaction (age X setting) is not statistically significant for any of the three OSEP outcome measures. These

coefficients can be interpreted as there is no difference in the developmental-growth trajectory between students who are hard of hearing being served in inclusive settings or noninclusive settings.

In addition to the quantitative analyses, line graphs of the data for the two groups can be reviewed in order to better understand the developmental growth of children diagnosed as hard of hearing. Figure 21 includes the line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes. The two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight dip in the oldest age category for the noninclusive group.

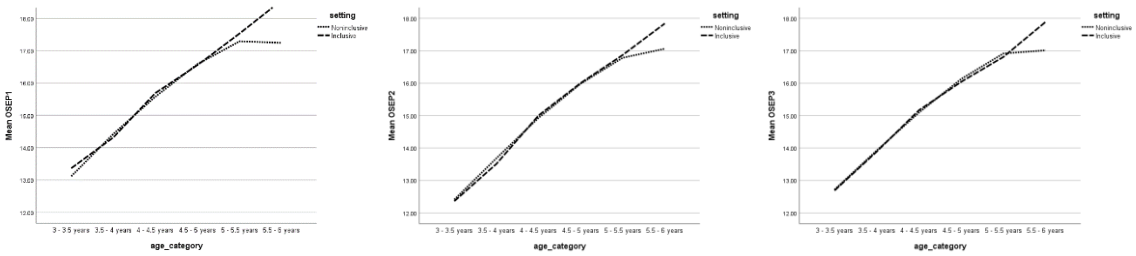

Figure 21. Line graphs for OSEP scores for children who are hard of hearing differentiated by setting.

Specific Learning Disability

In Table 43 are found the results of the Level 2 models for all three OSEP outcomes for children diagnosed with a specific learning disability. Students' OSEP score intercepts (β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having a specific learning disability.

Table 43
Summary of HLM Results by OSEP Outcome for Children with a Specific Learning Disability

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	10.71*	11.19*	11.68*
Age	0.20*	0.20*	0.19*
Setting	0.20	0.11	0.31
Age X Setting	0.00	0.00	-0.01
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	1.14*	0.88*	0.91*
AR1 Rho (ρ)	0.12	0.06	0.09
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	2.75*	3.56*	3.00*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	-0.03	-0.08*	-0.08*
		Overall Model Criterion	
AIC Index	10,337.90	10,159.96	9,980.23

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The first question that was investigated is whether the setting is related to differences in average achievement on the DRDP for children with a specific learning disability. The results suggest that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures, OSEP 1 ($\beta_{01} = 0.20$), OSEP 2 ($\beta_{01} = 0.11$), and OSEP 3 ($\beta_{01} = 0.31$). These coefficients for setting suggest that the students with a specific learning disability served in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

Whether there are differences in student-growth rates related to setting for children with specific learning disabilities was the second question. Regarding the setting variable that might explain variability in the OSEP score growth rates between individuals, the linear interaction (age X setting) is not statistically significant for any of

the three OSEP outcome measures. These coefficients can be interpreted as there is no difference in the developmental-growth trajectory between students with specific learning disabilities being served in inclusive settings or noninclusive settings.

The data for the two groups is presented as line graphs by plotting the means in order to better understand the developmental growth of children diagnosed with a specific learning disability. Figure 22 includes the graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes. The two groups have a very similar growth pattern overall across time for all three OSEP scores, including a slight drop in the oldest age category for the inclusive group.

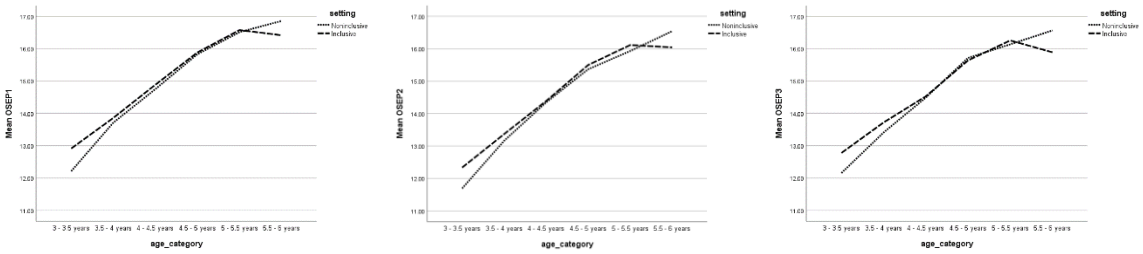

Figure 22. Line graphs for OSEP scores for children with a specific learning disability differentiated by setting.

Orthopedic Impairment

Results of the Level 2 models for all three OSEP outcomes are presented in Table 44 for children diagnosed with an orthopedic impairment. Students' OSEP score intercepts (β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having an orthopedic impairment.

Table 44
Summary of HLM Results by OSEP Outcome for Children with an Orthopedic Impairment

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	10.57*	9.89*	9.45*
Age	0.16*	0.17*	0.13*
Setting	0.82*	0.71*	0.45*
Age X Setting	0.02	0.02	0.02
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	2.63*	3.03*	1.08*
AR1 Rho (ρ)	0.59*	0.68*	0.35
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	4.59*	4.46*	3.41*
Age (τ_{11})	0.01*	0.01*	0.01*
τ_{00}, τ_{11} Covariance (τ_{01})	0.05	0.08*	0.02
		Overall Model Criterion	
AIC Index	10,894.67	10,824.97	9,869.60

*Statistically significant at .05 level when the overall Type I error rate was controlled.

With regards to whether the setting is related to differences in average achievement on the DRDP for children with an orthopedic impairment, the results suggest that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures: OSEP 1 ($\beta_{01} = 0.82$), OSEP 2 ($\beta_{01} = 0.71$), and OSEP 3 ($\beta_{01} = 0.45$). These coefficients for setting suggest that the students with an orthopedic impairment served in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

As to whether there are differences in student-growth rates related to setting for children with an orthopedic impairment, the linear interaction (age X setting) is not statistically significant for any of the three OSEP outcome measures. These coefficients can be interpreted as there is no difference in the developmental-growth trajectory

between students with orthopedic impairments being served in inclusive settings or noninclusive settings.

The graphical view of the data for the two groups for the developmental growth of children diagnosed with an orthopedic impairment (Figure 23) includes the line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes. The two groups have somewhat different growth patterns overall across time for all three OSEP scores. The noninclusive group's lines have a steady increase across the age categories, whereas the inclusive group has a sharp drop in the older age categories.

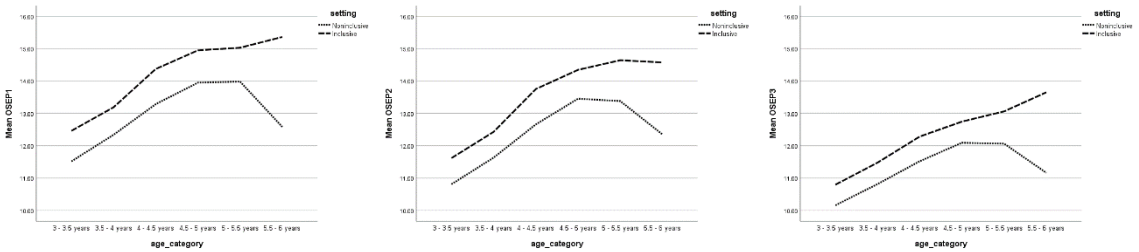

Figure 23. Line graphs for OSEP scores for children with an orthopedic impairment differentiated by setting.

Multiple Disabilities

The Level 2 model results for all three OSEP outcomes are presented in Table 45 for children diagnosed with multiple disabilities. Students' OSEP score intercepts (β_{00}) can be described as students' grand-mean OSEP score adjusted for setting and can be interpreted as the initial OSEP score for child who is exactly 3 years old (age in months = 0) and served in a noninclusive setting (setting = 0) and diagnosed as having multiple disabilities.

Table 45
Summary of HLM Results by OSEP Outcome for Children with Multiple Disabilities

	OSEP 1	OSEP 2	OSEP 3
		Fixed Effects	
Intercept	8.32*	7.60*	8.14*
Age	0.09*	0.09*	0.07*
Setting	0.46*	0.44*	0.48*
Age X Setting	-0.02	-0.02	-0.02
		Random Effects	
Level 1: Within students, ε_{ti}			
AR1 Diagonal (σ_e^2)	2.54*	0.63*	0.52*
AR1 Rho (ρ)	0.73*	0.17	0.16
Level 2: Between students, u_{ti}			
Intercept (τ_{00})	1.81	4.29*	2.97*
Age (τ_{11})	0.00	0.01*	0.00
τ_{00}, τ_{11} Covariance (τ_{01})	0.06*	-0.01	0.01
		Overall Model Criterion	
AIC Index	8,964.22	8,826.44	8,187.65

*Statistically significant at .05 level when the overall Type I error rate was controlled.

The results suggest, as to whether the setting is related to differences in average achievement on the DRDP for children with multiple disabilities, that the average OSEP scores are associated positively with the setting within which the child was served for all three outcome measures, OSEP 1 ($\beta_{01} = 0.46$), OSEP 2 ($\beta_{01} = 0.44$), and OSEP 3 ($\beta_{01} = 0.48$). These coefficients for setting suggest that the students with multiple disabilities served in inclusive settings would have an estimated grand-mean OSEP score higher than children served in noninclusive settings.

The second question was whether there are differences in student-growth rates related to setting for children with multiple disabilities. The linear interaction (age X setting) is not statistically significant for any of the three OSEP outcome measures. These coefficients can be interpreted as there is no difference in the developmental-growth

trajectory between students with multiple disabilities being served in inclusive settings or noninclusive settings.

In addition to the quantitative analyses, line graphs for the data for the two groups was used in order to better understand the developmental growth of children diagnosed with multiple disabilities. Figure 24 includes the line graphs of the means for each age category differentiated by setting for each of the three OSEP outcomes. The two groups have somewhat different growth patterns overall across time for all three OSEP scores. The noninclusive group's lines have a steady increase across the age categories with a slight dip near the end. While the inclusive group has a sharp drop in the oldest age category. Children with multiple disabilities display a wide range of physical and developmental impairments, so it is difficult to ascertain a specific reason why the growth patterns display such jagged patterns.

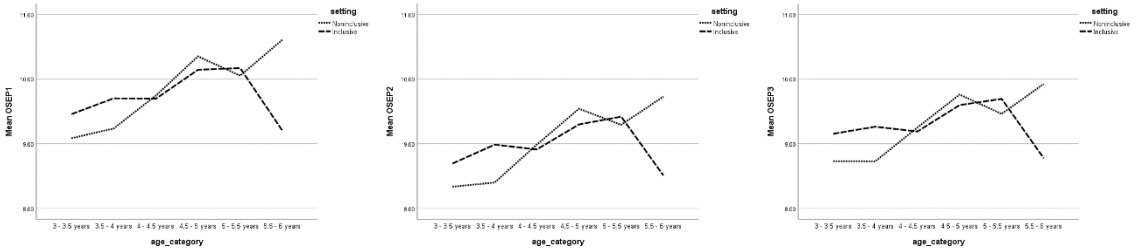

Figure 24. Line graphs for OSEP scores for children with multiple disabilities differentiated by setting.

Summary of Results

There were three research questions that were investigated in this dissertation. The first research question was an investigation of the shape of the developmental-growth trajectories of children receiving preschool special-education services. The results of the analysis indicate that OSEP scores increase over time with increasing variance and decreasing correlation over time. In addition, the developmental-growth trajectories were fit with linear models as the curvilinear and quadratic intercepts did not contribute

statistically significantly to the overall models for each of the three OSEP outcome measures.

Statistically significant differences in the developmental growth trajectories for preschool children receiving special-education services between the inclusive and noninclusive groups for each of the three OSEP outcomes resulted for research question two. In addition, there is a statistically significant difference for seven of the eight domains. The only domain to not return a statistically significant result was the ELD domain. The results indicate that children served in inclusive settings have a higher developmental-growth trajectory over time. The effect sizes for the statistically significant results did not meet the threshold for a small effect ($d < 0.20$).

For children diagnosed in specific disability categories. The third research question investigated differences in developmental growth trajectories. The analysis included 8 of the 14 possible disability categories. Only one disability category, *other health impairment,* indicated a statistically significant difference in developmental-growth trajectories between the comparison groups. The results indicated that children diagnosed as having other health impairment grew at a slightly higher trajectory on OSEP 1 and OSEP 3 scores when served in inclusive settings than children served in noninclusive settings within the same disability category.

CHAPTER V

SUMMARY, LIMITATIONS, DISCUSSION, AND IMPLICATIONS

The purpose of this study was to investigate the relationship between preschool educational setting and the developmental growth of preschool children with disabilities. This chapter begins with a summary of the study leading up to the research questions. Then, a summary of the findings is presented, followed by a discussion of the limitations of the study. Subsequently, a discussion of the findings is provided, in light of the limitations, which will lead to the conclusions of the study. Finally, this chapter closes with a section on the implications for research and practice.

Summary of the Study

Research has shown that the developmental-growth trajectory of a young child has a direct effect on how they continue develop throughout the rest of their lives. Decades of research has shown that investing in early-childhood development lays the foundation for a successful adulthood that benefits the society at large (Buysse & Bailey, 1993; Odom & Diamond, 1998; Rafferty, Piscitelli, & Boettcher, 2003). Furthermore, scientific research has shown that participating in stable, responsive, and nurturing relationships and rich learning experiences for a young child leads to lifelong benefits for learning, behavior, and both physical and mental health. The field of early-childhood special education has emerged as being of primary importance for young children with disabilities and is supported by legislation now known as the Individuals with Disabilities Education Act (IDEA, P.L. 108-446). IDEA ensures that more than 6.5 million infants, toddlers, children, and youths with special needs receive appropriate early intervention, special education, and related services (U.S. Department of Education, 2014).

Furthermore, IDEA strongly encourages the placement of young children in inclusive settings with typically developing children (Barton & Smith, 2015).

Research, beginning as far back as the 1970s, has shown that high-quality and inclusive early-education and intervention services for young children with disabilities can "(a) ameliorate, and in some cases, prevent developmental problems; (b) result in fewer children being retained in later grades; (c) reduce educational costs to school programs; and (d) improve the quality of parent, child, and family relationships" (Salisbury, 1991, p. 146). In addition, research investigating the effect of inclusion on typically developing children indicates that high-quality early-care and education services in inclusive settings are beneficial for all children (Barton & Smith, 2015).

In a review of relevant research on preschool inclusion, Odom and Wolery (1999) summarized the literature on preschool inclusion. The review included several key findings, one of which is that positive outcomes are reported for children with disabilities and typically developing children in inclusive settings. Furthermore, Odom and Wolery (1999) noted that other reviews of the literature have concluded that on standardized developmental measures, young children with disabilities perform as well in inclusive settings versus noninclusive settings.

Buysse and Bailey (1993) completed a comprehensive and exhaustive review of comparative studies regarding preschool inclusion in 1993. The review included 22 studies, and of those studies, seven reported findings with regard to developmental outcomes. The results of the studies reviewed by Buysse and Bailey (1993) indicated that the mean level of children's performance over time, as measured by the standardized

instruments used in the studies, did not vary by type of setting, either inclusive or noninclusive (Buysse & Bailey, 1993).

Since 1993, there have been several new studies that have investigated the relationships between preschool setting and developmental outcomes of children, both with and without disabilities. These studies, when combined with the findings from the review of studies prior to 1993, highlighted several gaps in the present body of research investigating developmental outcomes and preschool setting. Prior research studies in this area have been conducted using limited samples in size, geography, and ethnic and socioeconomic diversity. In addition, the majority of the studies were conducted across only one or two points in time. And finally, the measurement tools used were limited in domains of development assessed.

Therefore, this study addressed several limitations of the prior research in this area. The present study used a comprehensive measurement tool, encompassing a complete set of developmental outcomes and including four data points over 2 years. The purpose of this study was to perform a secondary data analysis to investigate the relationship between preschool setting and the developmental growth of all children receiving state-funded preschool special-education services in California in inclusive settings compared with all children receiving state-funded preschool special-education services in California in noninclusive settings.

This study is important because it provides an extension of previous research by increasing the size or magnitude of the sample. In addition, the study also extends the previous research by investigating developmental growth over multiple points in time. Finally, this study provides evidence that the progress of children across multiple

developmental domains is related directly to the setting in which they are served. Substantial amounts of time and training on the part of special-education service providers and resources are put into supporting and providing inclusive services for preschool with disabilities in educational settings with their typically developing peers. The results of this study may inform future decisions about resource allocations and policies about inclusive opportunities for young children.

Bronfenbrenner's (2005) ecological systems theory was adopted as a theoretical foundation for the study as it is the most relevant conceptual model related to inclusive practices in the field of early-childhood special education. Bronfenbrenner suggested that a child is influenced directly by the system he or she inhabits, such as, by family, friends, and teachers. This chain of interlinking systems has a direct effect on one another and on the education and development of the child. From this perspective, the goal of this study was to understand the relationship more deeply between the environment, disability, and developmental outcomes.

Using this theoretical framework as a foundation, a secondary data analysis of a large-scale longitudinal data set was performed in order to investigate the extent to which the developmental growth of preschool children served in inclusive settings differed from preschool children served in noninclusive settings. The data file was constructed from gathering student information and assessment results from all preschool-aged children served in the State by California Department of Education funded programs from Fall 2015 through Spring 2017.

The primary instrument used for this study to measure the developmental growth of the study participants was the Desired Results Developmental Profile (DRDP). The

2015 version of the DRDP is an observational assessment developed by the California Department of Education for young children and their families. The DRDP is used with all children participating in state–funded early-care and education programs and services, including children with Individualized Family Service Plans (IFSPs) and Individualized Education Programs (IEPs). It is an observation-based protocol used by teachers to assign ratings on measures within each of eight learning domains. The preschool version of the instrument consists of 43 measures (Desired Results Access Project, 2015).

The final data file was by created by merging 14 variables from two existing data files obtained from the California Department of Education per specifications provided by the researcher. The first data file was from CASEMIS Student Data Table that includes the four background variables (gender, ethnicity, race, and disability category) and the explanatory variable (preschool setting). The second data file was the DRDP data file that includes the eleven response variables, including the three Office of Special Education Programs (OSEP) outcome scores and the eight domain scores for each child.

Using this final longitudinal data file, this study was able to address the following research questions with respect to preschool children with disabilities in the State of California:

1. What is the nature of developmental growth, as represented by scores on the DRDP (2015), of children receiving preschool special-education services?
2. To what extent does the developmental growth of children receiving preschool special-education services in inclusive settings differ from those not served in inclusive settings?

3. To what extent does the developmental growth of children receiving preschool special-education services differ by disability category within preschool setting (inclusive vs. noninclusive)?

Summary of Findings

This study had three findings. First, there exists a statistically significant difference in the developmental-growth trajectories of preschool children receiving special-education services in inclusive settings versus noninclusive settings. The results indicated that children served in inclusive settings have a higher developmental-growth trajectory over time for all three OSEP outcome measures.

Second, there is a statistically significant difference in the developmental-growth trajectories of preschool children receiving special-education services in inclusive setting versus noninclusive for seven of the eight domains on the DRDP (2015). The only domain to not return a statistically significant result was the English Language Development (ELD) domain. These results indicate that children served in inclusive settings have a slightly higher developmental-growth trajectory than children served in noninclusive settings even at the domain measurement level.

Third, for preschool children diagnosed as having *other health impairments*, there is a statistically significant difference in developmental-growth trajectories between the two groups based on setting. The results indicate that children diagnosed as having *other health impairments* grew at a slightly higher trajectory on OSEP 1 and OSEP 3 scores when served in inclusive settings than children served in noninclusive settings within the same disability category.

Limitations

This study utilized, for the first time, a longitudinal database of DRDP (2015) scores for preschool children receiving special-education services in California. The data were not collected directly by the researcher, which resulted in several limitations of the study. Five central limitations of the present study are examined including the equivalency of the comparison groups, information about the severity of a child's disability, information about child placement decision-making, fidelity of implementation of the assessment tool, and a lack of additional developmental measurements.

First, due to the fact that the entire population of preschool children receiving special education services in California were included in the final data set, a randomized controlled design was not feasible and therefore, it is difficult to eliminate confounding influences that may be effecting the final statistical results of the study (Bishop, Snyder, Algina, & Leite, 2016). In order to mitigate these potential threats to the validity of the study results, other experimental designs and techniques can be employed. For example, propensity score matching is a method for balancing the comparison groups at the onset of the study in order to control for nonequivalent groups. Unfortunately, not enough variables were available in the final data set to adequately calculate a propensity score for each student.

Second, as mentioned above, this study does not include any measurement of the severity of disability for which each child is categorized. This variable potentially could be a statistically significant covariate in the growth model and, once added to the model, could further explain the variance in developmental growth related to setting. When children are diagnosed with profound or severe disabilities, their developmental-growth

trajectory is effected for the rest of their lives (Shell, Chen, & Hoover, 2006). Access to this information for the present study would have allowed the addition of this variable to the Level 2 model as a covariate and potentially could help in explaining the variance in developmental growth. It might be that when severity is held constant for all individuals in the final data set, the preschool setting variable has a greater effect on developmental growth than was found in the results of the present study.

Third, no systematically collected information is available about how LEAs are making placement decisions for preschool children with disabilities. For example, a child might be placed in a specific setting based on the severity of their disability. A search of the literature does not provide any practical or systematic methods of assigning preschool children to inclusive or noninclusive settings. This substantial area of missing information could help to further explain the differences between comparison groups, as well as provide more information about how to change or implement new policies that support the inclusion of children with disabilities.

Fourth, the primary assessment tool, the DRDP (2015), is an observational assessment, which has inherent flaws. As presented in chapter I, assessors are offered training via face-to-face trainings, online webinars, or from a master trainer. There is at present no formal measure of the depth to which an individual has been trained to implement the DRDP (2015) and rate children's knowledge and skills. Even though the Desired Results Access Project makes every effort to ensure the support of all special-education provider's use of the instrument, it is conceivable that misuse of the DRDP or inaccurate ratings may have led to unintended error in the developmental ratings of the children included in the study population.

Finally, one of the many benefits of using hierarchical linear modeling is that the model allows for the addition of a relatively limitless number of explanatory variables. The present study was a secondary data analysis of already existing data sets. As previously mentioned, the ability to collect additional information or measures was limited. The study would have benefitted by having other measures of development for the children included in this study, which would have allowed a more systematic balancing of the comparison groups. In addition, the other measure or measures could be used to characterize the groups and more deeply understand any differences between how the DRDP measures children's knowledge and skills versus other types of instruments.

Discussion of Findings

The findings from this study investigating the differences between the developmental-growth trajectories of preschool children receiving special-education services in inclusive settings versus noninclusive settings extend previous research investigating the effect of inclusive settings on young children with disabilities. The findings of the present study are situated within the broader area of early-childhood special-education, and those findings are presented in light of the relevant research, more specifically with regard to the research related to early-childhood inclusive practices.

In chapters I and II, relevant literature was presented and analyzed that was used to identify what is known about the effects of preschool inclusion and identified gaps in the present research around this area. There were three main gaps in the literature at the onset of this study. First, this study population greatly expands on the size, magnitude, diversity, and time scope of previous research studies. Second, because of the magnitude and diversity of the population, it was possible to study developmental-growth

trajectories for disability groupings that had not been explored in prior research studies. Finally, the majority of prior research did not use a measurement instrument that covers such a broad range of developmental domains. This section contains the findings within each one of the research questions relative to these gaps and offers information about how the present study results fit within the broader of range of research in preschool inclusion.

The findings from the study demonstrate that the developmental-growth trajectories of preschool children receiving special-education services in an inclusive setting are statistically significantly higher with a small effect size than those children served in noninclusive settings. Additionally, these statistically significant differences also are present at the domain-score level with small effect sizes as well. Finally, when looking at specific disability categories, the only group for which setting was a statistically significant variable in the developmental-growth trajectories was for children diagnosed as having *other health impairments*. Each of the main findings are presented in detail below.

Measuring Developmental Progress of Preschool Children with Disabilities Over Time

The first research question was aimed at investigating the nature of the developmental-growth trajectory of preschool children with disabilities. Addressing this question provides a deeper understanding about how preschool-age children with disabilities developmentally progress over time. Although one of the main study findings did not emerge from the investigation for this research question, there are important results to discuss from this part of the analyses.

Previous research of young children with disabilities has conducted with a small number of measurement occasions included in the study, therefore, limiting the ability of the researcher to have an in-depth understanding of growth trajectories for young children. Of the seven studies reviewed in detail in chapter II, none of them included outcome measures for more than one point in time, which results in the fact that no study of the relationship between preschool setting and developmental outcomes has been conducted using hierarchical linear modeling in order to mitigate nesting issues and identify the appropriate causes of variance.

In the current study, results of the analyses indicated that the DRDP (2015) assessment results for individual children indicate a linear developmental growth trajectory. The line graph of the means by age group were linear from the early ages to the latest. The linear model selection is consistent with Tayler, Cloney, and Niklas's (2015) analyses in their large-scale longitudinal study that investigated growth trajectories of young children over 3 years. The Tayler et al. (2015) study did not include children with disabilities, however, but the similarity between the developmental trajectories of children without disabilities to children with disabilities confirms that the present study's results are consistent with prior research in this area.

The data from these analyses suggest that preschool children with disabilities are developmentally growing on a linear path. In other words, the ratings collected for the children in the present study indicate a consistent increase over time relative to the child's age. In some educational data, "summer slumps" are common, especially with data collected on grade-school students (Blazer & Miami-Dade County Public Schools, 2011). Summer learning loss typically occurs between a measurement point in the Spring and

the measurement in the subsequent Fall. The present results did not indicate this type of drop in the results on the DRDP, which is consistent with the nature of preschool special-education services that are year-round services and do not take a specific summer break as do primary and secondary academic programs. These results also are consistent with the growth trajectory results for typically developing young children presented in the Tayler et al. study (2015).

While the growth trajectories did indicate a linear trajectory based on the line graphs, there were indications of a slight drop off in the oldest age group, 5 ½ to 6 years of age as seen in Figures 2 through 4 in Chapter IV. In addition, this pattern is even more pronounced for the "inclusive setting" group when the same line graphs are provided for the two comparison groups, as in Figures 11, 13, and 15. This drop-off may indicate a ceiling effect for these children. As mentioned previously, it is typical for the children being served in noninclusive settings to have more severe disabilities and even as they approach their 6th birthday, they may still have plenty of room to grow in comparison to their peers being served in noninclusive settings. Given that this pattern appears across all three line graphs for the OSEP outcomes, this is a pervasive phenomenon across domains.

Relationship Between Preschool Setting and Developmental Progress

The second research question was an investigation of the extent to which the developmental growth of children receiving preschool special-education services in inclusive settings differed from those not served in inclusive settings. Research results suggest that high-quality, inclusive preschool settings increase the developmental outcomes of young children with disabilities (Barton & Smith, 2015; Buysse & Bailey,

1993; Odom & Wolery, 2010). The present study expanded upon previous research by significantly increasing the number of students in the study, as well as investigating the effect of setting on different domains of development, rather than a single high-level measure of development.

Several major studies investigating the effect of preschool inclusive settings were included in the literature review. The studies are summarized in Table 5 in chapter II. In addition, a comprehensive review of studies prior to 1993 also was reviewed in detail in the literature review. Given the strong base of literature in this area, it should be noted that this study expanded on the gaps in this research in several ways. With respect to this particular research question, this study expanded the size and diversity of the samples included in other studies. Second, this study broadly investigated preschool setting related to developmental outcomes across far more domains than any other study.

A study by Buysse, David-Golman, and Skinner in 2002 investigated a sample of 120 children with disabilities and 213 children without disabilities to study the relationships between inclusive settings and developmental and social-emotional outcomes. In 1998, Hundert, Mahoney, Mundy, and Vernon studied a total of 173 preschool students in both inclusive and noninclusive settings to investigate the effect of setting on behavior measures. Of all the studies reviewed in the literature review, these two studies represent the largest sample sizes used to study the effect of preschool inclusion on any dependent measure prior to the present study.

The present study, included 79,888 preschool children diagnosed with a disability with 31,916 children being served in inclusive settings and 47,972 children served in noninclusive settings, which represents a substantial increase in sample size from

previous studies in this area. In addition, this study included representation from across all ethnicity, gender, and disability categories. Because the study included all preschool children receiving special-educations services in the State of California, the population is diverse and cell counts within the different demographic variables are high. As a result of the increase in magnitude and diversity of the sample, the current study was able to examine the extent to which the developmental growth of preschool children with disabilities differs by educational setting in a much more expansive way. The results indicate that there was a statistically significant difference in the growth rates between individuals by setting. These results can be interpreted as students receiving special-education services in inclusive settings demonstrate higher growth over time when compared with children serviced in noninclusive settings. Cohen's *d* was calculated for these results and indicated a small effect size.

Given the large population size for the present study, it is not surprising that a statistically significant result was found for the interaction between setting and time. What is more difficult to understand or explain is the very small effect size for this result. Based on a review of the descriptives for each group by setting, the children in the inclusive group, in general, are rated higher overall across the three OSEP outcomes measures. Meaning, the group is made up of children who are higher on the developmental scale than the group of nonincluded children. Children served in inclusive settings generally are more likely to be children with milder disabilities. Children with more severe disabilities often need more support and, therefore, are often served in more controlled or specialized classrooms, sometimes even at home. Given these presumptions, it would seem plausible that the inclusive group does not have quite as

much room to grow, as they are starting from a higher level of development already. Therefore, although the developmental-growth trajectory for the included group clearly is steeper than the trajectory for the nonincluded group, the trajectory may have been even more steep if the students did not top out on the scale.

Many of the prior studies in this area did not return statistically significant results, which might possibly be accounted for by small sample sizes, inaccurate outcome measures, or unsophisticated statistical techniques. For the prior studies that returned statistically significant results, measures of practical importance ranged from .01 (Hundert et al., 1999 & Mills et al., 1998) to 1.12 (Holahan & Costenbader, 2000). Obtaining small effect sizes in the present study is consistent with prior research on a general level, but it should be noted that prior research was conducted at varying levels of outcome measures (i.e., overall scores, domain scores), making it difficult to compare definitively effect-size results.

Relationship Between Preschool Setting and Developmental Progress by Domain

In addition to expanding on previous sample sizes and diversity, the present study investigated a broad spectrum of developmental domains as measured on the DRDP (2015). In addition to investigating the relationship of preschool setting with three OSEP outcome scores, the final Level 1 and Level 2 growth models were applied to each of the eight domains of the DRDP in order to investigate the relationship between setting and specific domains of development. Included domains in the present study are social-emotional development, attention to learning and self-regulated learning, language, literacy, mathematics, physical development, health, and English language development.

Prior studies have used comprehensive developmental measures but necessarily have not provided results for subdomains within the instrument.

The results of the analysis by domain returned similar results as the analysis with the three OSEP scores as the outcome measures. There are statistically significant differences in the developmental-growth trajectories by setting in seven of the eight domains of the DRDP instrument. The effect sizes range from 0.01 to 0.13, which do not meet the threshold for small effect sizes (d = 0.2, Cohen, 1988).

In a study by Rafferty, Piscitelli, and Boettcher (2003), there were large effect sizes for auditory comprehension, expressive language, and social skills, whereas problem behaviors had a small effect. Similar to the present study, Rafferty et al. (2003) noted that these findings indicate that it is more likely that a child who is higher functioning will be receiving services in an inclusive setting.

In 2000, Holahan and Costenbader found a statistically significant interaction effect between delay in social and emotional skills and setting on the rate of growth. In addition, the study results also did not include any statistically significant results related to self-help skills, general knowledge, or the overall composite. The present-study analyses indicated statistically significant results related to social emotional development and also returned a statistically significant result in the areas of self-help and the cognitive measures of language, literacy, and mathematics.

The study by Hundert, Mahoney, Mundy, and Vernon from 1998 found very similar results to the present study, as well as small effect sizes for those results. The Hundert et al. (1998) study investigated the relationship between preschool setting and measures of preacademic, communication, social or self-help, gross motor, and behavior

domains. All the tests of difference from pre to post were statistically significant; however, the effect sizes presented were very small. It should be noted that their study was intended to be descriptive and not experimental, but the present study results can certainly add to this body of work around preschool setting.

The study by Mills, Cole, Jenkins, and Dale (1998) included investigations of measures of verbal, perceptual, and language skills. The results of the analyses did not indicate statistically significant treatment differences based on setting. The effect-size analysis, however, did indicate moderate effect sizes for the integrated special-education setting and special-education-only treatment. The difference between nonstatistically significant results and moderate effect sizes may be due to the small sample size (n = 66) for this study.

In general, the present study results are consistent with previous research and even extend upon the results of previous studies by including statistically significant results in domains not previously researched or found to be statistically significant. In addition, the present study results make it possible to reflect upon and compare results across all eight domains, as well as compare effect sizes within those specific areas making it possible to identify developmental areas most impacted by preschool setting. While the cross-interaction term values (Table 35) are all the same, the setting coefficient values do provide an indication of which domain scores are most increased for children served in inclusive settings. The SED and LANG domains had the largest coefficients for the setting variable, 0.25 and 0.19 respectively. For children served in inclusive settings, their average domain scores increase nearly a quarter of a point for each month increase in their age.

Relationship Between Preschool Setting and Developmental Progress for Specific Disability Groups

The third research question was intended to investigate the extent to which the developmental growth of children receiving preschool special-education services differs by disability category within preschool setting (inclusive vs noninclusive). No previous studies exploring inclusion by disability category were located or reviewed prior to the present study commencing. As noted above, sample sizes in previous studies were limited (< 350 students) and, therefore, limited the ability to further investigate the results by smaller subgroups. Even with such a large sample of preschool children (n = 78,999), the two-level hierarchical linear model was used to examine DRDP scores based on preschool setting for only 8 of the 14 disability categories. A disability category was included in the analyses if there were over 1,000 children in the sample.

The results of the present study indicate that the developmental-growth scores for of preschoolers on the three OSEP outcome measures differed by setting for only the *other health impairment* disability category. In general, the OSEP scores differed by setting within each of the disability categories, however, their growth trajectories over time did not differ for more than the one group: *other health impairment*. IDEA defined other health impairments as

> Having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and adversely affects a child's educational performance. (IDEA, [§300.8(c)(9)])

Because the definition is so broad, it is not as clear how and when a child would be assigned to this disability category that makes it difficult to interpret the results of this finding.

No relevant research was found related to children diagnosed as having other health impairments and the effect of educational setting on their development. In fact, there was no literature available related to this disability category and development in general. One can only make general assertions about why this finding arose for the present study. The ability to participate fully in a typical educational environment generally would not be changed by a health impairment for children who have more specific health issues, such as diabetes or epilepsy. Other health impairments do not necessarily have a direct effect on cognitive development, and, therefore, a student in the disability category certainly would benefit from being included with their same-age peers in an inclusive classroom rather than being placed in a noninclusive setting.

It is also of interest that statistically significant results were not returned across seven of eight of the other disability categories. For example, one would have expected to potentially see a statistically significant effect of preschool setting for the OSEP 1 outcome related to social-emotional development for children diagnosed as autistic. One of the many benefits to children with disabilities of participating in an educational environment alongside their typically developing peers is the enhanced social interactions with their peers (Buysse, et. al., 2002).

Conclusions

This study set out to investigate, on a large-scale, the effect of inclusive practices on the developmental-growth trajectory of preschool children receiving special-education

services. The findings suggest that there is a statistically significant increase in the slope of the developmental-growth trajectories for children receiving special-education services in an inclusive setting. This study meaningfully adds to the current body of literature related to preschool inclusion and provides several implications for educational practice and future research.

Implications for Research

There are many possibilities for future research as a result of this study with regard to the effect of inclusion on preschool children receiving special-education services. Of utmost importance is that this study, for the first time, utilized a large-scale longitudinal data set of preschool children with disabilities. This final data set is now available to study, more deeply, either the present topic of the effect of inclusive settings on developmental progress or alternate explanatory variables. Given that no other study has ever investigated the effects of preschool inclusion so expansively, the research in this area should not only continue but also should be expanded upon in order to inform the field of early-childhood special education.

There are several suggested avenues down which future research studies could emerge. First, in order to ensure balanced comparison groups, it would be helpful to have other quantitative measure that could be used for propensity score matching methods. If another measure of development had been available in the present study, one could have used it to select more accurately the students in the final data file. The second implication for future research studies using this data file would be to collect information about the severity of the child's disability that would, as mentioned previously, make it easier to balance the comparison groups at the onset of the study. In addition, given the limited

research investigating the relationship of preschool inclusion with severity of disability that is a relatively unknown area of study, further research in this area would benefit the field of early-childhood special education.

Finally, the analyses for research question 3 led to a statistically significant result related to children with other health impairments. Future research should investigate more deeply the specific benefits of inclusive settings for children in this disability category, as well as continue investigating all disability categories for emerging trends. There may be more specific lessons that can be learned about the benefits of inclusive practices by studying these data by disability group.

Implications for Practice

Two main implications for practice resulted from the conclusions of this study. First, this dissertation includes evidence that providing inclusive educational environments to preschool children with disabilities is beneficial to a student's growth over time. Second, the present study included the development of a large-scale, longitudinal data file and hierarchical linear model from which future research can be built.

The primary implication for practice of this study is that inclusive preschool special education improves a child's developmental growth trajectory. A multitude of books, professional development resources, organizations, and even college course are dedicated to teaching and supporting inclusive practices across educational environments from birth through college. The present study provides another piece of evidence that for young children with disabilities is worthwhile to invest in professional development opportunities for teachers in both special and general education, in order to prepare them

better to serve children with disabilities, alongside all preschoolers. In addition, the results of this study support the continued policies and federal provisions through legislation requiring the accessibility of inclusive settings to all children.

Second, the other major implication of this study was the development of a hierarchical linear model that can be used to understand and predict the developmental growth of preschool children with disabilities. It is important to explore additional ways in which this information can be analyzed and shared with special-education practitioners and families of young children with disabilities. For instance, providing information to families about their child's developmental-growth trajectory could benefit parents by helping them to better understand their child's strengths and potential areas of growth. In addition, early-childhood special-education providers could benefit from reviewing a child's developmental growth in order to plan more appropriately and curriculum and instruction for individual children based on their unique strengths and needs. The developmental growth trajectory information could be built into the individual child reports provided through the DR Access Reports online reporting system.

Implications for Policy

The results of this study have implications for policy makers at the local, state, and federal levels. As mentioned previously, significant resources are allocated to support inclusive practices for preschool children with disabilities. Since 1991, the U.S. federal law has required that all children have access to free and appropriate education opportunities, including children with disabilities (Odom et. al., 2004). Additionally, for children with disabilities, this law required that these educational opportunities be in the least restrictive environment and in the closest possible proximity to typically developing

peers. With respect to preschool more specifically, studies examining the benefits of these inclusive settings on developmental growth are limited in breadth and depth. The results of this study provide a much more expansive investigation of the effect of preschool setting on the developmental outcomes for preschool children with disabilities. Policy makers at all levels may use these results to inform legislation either at the onset of writing or in assessing the direct effect on the developmental growth of young children.

It is of note that this study included California's entire population of 3-, 4-, and 5-year old preschool children with disabilities and that along with investigating the effect of preschool setting on developmental growth, this study represents the outcome of the state of California's policy for preschool special education children. In other words, the results of these analyses provide a description of the outcome of California's policy on inclusion. As mentioned in the limitations, the key to understanding this policy is to better understand how children with disabilities are placed in inclusive and noninclusive preschool settings. A search of the literature does not provide any additional information about how local education agencies are making placement decisions for young children with disabilities. Without a statewide plan or policy to better understand this issue, it may be impossible to ever really know exactly how preschool setting assignment is occurring across the state.

Summary

Arguably, the most critical point in a child's development are the early years, birth through 5 years of age, which is the starting point of a child's development and the foundation for their lifelong developmental-growth trajectory. A strong early-educational

experience is more likely to lead to an increased developmental-growth trajectory throughout their lives. Therefore, understanding this important time in a child's development is critical to the field of early-childhood education.

For young children with disabilities, the early years of development are even more important as these are the years in which both children with disabilities and their families establish the expected educational environment in which their child is served that often leads to expectations for how the child will be served throughout their entire educational career. Inclusive settings are acknowledged widely as the optimal setting in which children with disabilities should be served. So much so that the U.S. federal government enacted legislation that requires children be served in least restrictive environments alongside their same-aged peers. The current body of research in the area of preschool inclusion also supports this conclusion but is limited by the number of studies that have included large sample sizes and diverse samples.

In an effort to expand on prior research, the present study investigated the differences in the developmental-growth trajectories of children with disabilities being served in inclusive settings versus noninclusive settings using a large-scale longitudinal data set. The data indicated that preschool children with disabilities served in inclusive settings do indeed have a steeper developmental-growth trajectory than preschool children with disabilities served in noninclusive settings.

These findings are limited, however, by the lack of information about the severity of a child's disability therefore, future investigations into the effects of preschool setting on students with disabilities should include a measure of a severity of the child's diagnosed disability. Additionally, future studies would benefit from having information

about the fidelity of implementation of the outcome measure, allowing the researcher to attribute more clearly any error associated with the measurement tool. Finally, future research studies in this area should include more than one outcome measure for each child making it possible to provide more detail about the balance of the comparison groups.

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APPENDIXES

APPENDIX A

DISABILITY CATEGORIES

Disability Category	Definition (U.S Department of Education IDEA, 2004)
Intellectual Disability	Also known as general learning disability, and mental retardation (MR), is significantly subaverage general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance.
Hard of Hearing	Also know as a hearing impairment. Means an impairment in hearing, whether permanent or fluctuating, that adversely affects a child's educational performance but that is not included under the definition of deafness in this section.
Deafness	Deafness means a hearing impairment that is so severe that the child is impaired in processing linguistic information through hearing, with or without amplification that adversely affects a child's educational performance.
Speech or Language Impairment	Speech or language impairment means a communication disorder, such as stuttering, impaired articulation, a language impairment, or a voice impairment, that adversely affects a child's educational performance. A speech impairment is a difficulty in articulating words. A language impairment is a specific impairment in understanding and sharing thoughts and ideas.
Visual Impairment	An impairment in vision that, even with correction, adversely affects a child's educational performance. The term includes both partial sight and blindness.
Emotional Disturbance	A condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance: A. An inability to learn that cannot be explained by intellectual, sensory, or health factors. B. An inability to build or maintain satisfactory interpersonal relationships with peers and teachers. C. Inappropriate types of behavior or feelings under normal circumstances. D. A general pervasive mood of unhappiness or depression. E. A tendency to develop physical symptoms or fears associated with personal or school problems. The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance.
Orthopedic Impairment	A severe orthopedic impairment that adversely affects a child's educational performance. The term includes impairments caused by a

	congenital anomaly, impairments caused by disease (e.g., poliomyelitis, bone tuberculosis), and impairments from other causes (e.g., cerebral palsy, amputations, and fractures or burns that cause contractures).
Other Health Impairment	Having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that— A. is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and B. adversely affects a child's educational performance.
Established Medical Disability	A disabling medical condition or congenital syndrome that is determined to require special education and services.
Specific Learning Disability	Specific learning disability. (i) General. Specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.
Deaf-Blindness	Deaf-blindness means concomitant hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational needs that they cannot be accommodated in special education programs solely for children with deafness or children with blindness.
Multiple Disability	Multiple disabilities means concomitant impairments (such as mental retardation-blindness or mental retardation-orthopedic impairment), the combination of which causes such severe educational needs that they cannot be accommodated in special education programs solely for one of the impairments. Multiple disabilities does not include deaf-blindness.
Autism	Autism means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences.

Traumatic Brain Injury	Traumatic brain injury means an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. Traumatic brain injury applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. Traumatic brain injury does not apply to brain injuries that are congenital or degenerative, or to brain injuries induced by birth trauma.

APPENDIX B

FEDERAL PRESCHOOL SETTINGS

Federal Program Setting	Description (California Department of Education, 2016)
Regular Early Childhood Program at Least 10 hrs/wk and Majority	Regular Early Childhood Program or Kindergarten for more than ten hours per week, majority of special education services provided in the regular early childhood program or kindergarten. A program setting that includes at least 50 to 69% nondisabled children. Early childhood programs include, but are not limited to: · Head Start · Kindergarten · Reverse mainstream classrooms · Private preschools · Preschool classes offered to an eligible pre-kindergarten population by the public school system · Group childcare
Regular Early Childhood Program at Least 10 hrs/wk Majority Elsewhere	Regular early childhood program or kindergarten for more than ten hours per week, majority of special education services provided in some other location than the regular early childhood program or kindergarten.
Regular Early Childhood Program Less than 10 hrs/wk Majority	Regular Early Childhood Program or Kindergarten for less than ten hours per week, majority of special education services provided in the regular early childhood program or kindergarten. A program setting that includes at least 70% nondisabled children. Early childhood programs include, but are not limited to: · Head Start · Kindergarten · Reverse mainstream classrooms · Private preschools · Preschool classes offered to an eligible pre-kindergarten population by the public school system, and group childcare
Regular Early Childhood Program Less than 10 hrs/wk Majority Elsewhere	Regular early childhood program or kindergarten for less than ten hours per week, majority of special education services provided in some other location than the regular early childhood program or kindergarten.
Separate Class	In this setting the student attends a special education program in a class with less than 50% nondisabled children.
Separate School	This is a placement setting where children receive all special education programs in public or private day schools designed specifically for children with disabilities.
Residential Facility	This is where children receive all special education and related services in publicly or privately operated residential schools or

	residential medical facilities on an inpatient basis.
Home	This is the setting when children receive all special education and related services in the principal residence of the child's family or caregivers.
Service Provider Location	This is the setting when children receive all special education and related services in the service provider location or other location not in any other category.

APPENDIX C

CALIFORNIA DEPARTMENT OF EDUCATION, SPECIAL EDUCATION DIVISION APPROVAL LETTER

Elizabeth Schroeder

From: Theresa Costa Johansen <TCostaJohansen@cde.ca.gov>
Sent: Monday, May 1, 2017 1:03 PM
To: Elizabeth Schroeder
Cc: Kristin Wright; Shiyloh Becerril; Sheila Self
Subject: RE: Revised Dissertation Data Request Letter

Hello Ms. Schroeder,

Please use this email as confirmation that the California Department of Education, Special Education has received and reviewed your request to have access to Table A and Table E data for preschool age children with disabilities in California for the 2015-16 and 2016-17 school years.

In the letter you sent, you understand that staff at CDE will match student information data (Table A) with DRDP assessment results (Table E) and staff at CDE will subsequently remove all personally identifiable information, including SSID numbers, prior to providing you these data.

It is also clear that there will be a $60/hour charge for collecting, matching and de-identifying these data before providing you with the data records. CDE acknowledges that you will be using this information to conduct research for your dissertation and CDE staff will provide you access to these records during the summer of 2017.

Wishing you all the best in your research and this important analysis of student achievement results for preschool-age children.

Regards,

Theresa Costa Johansen, Ed.D.
Administrator: Policy & Program Services Unit
Special Education Division
California Department of Education
Phone: 916-445-4891