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Is the Proportion of Children With Disabilities in Inclusive Preschool Programs Associated With Children's Achievement?

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Abstract

This study applied multilevel modeling to examine the relationship between the percentage of children with mild/moderate disabilities in classrooms and children's language and literacy achievement over an academic year. The sample included 516 preschool children (mean age = 52.3 months, *SD* = 6.3) in 75 classrooms; 42% of the children had disabilities. The proportion of children with disabilities in a given classroom ranged from 7% to 92%. We found that the percentage of children with disabilities was not related to children's spring achievement for three outcomes: language, print-concept knowledge, and alphabet knowledge. These findings and further research directions are discussed.

Keywords

special education, inclusion, preschool, language, literacy

Approximately 740,000 children between 3 and 5 years of age in the United States have a disability (6.1%), with the most common types of disability affecting children involving speech/language impairments and developmental delays (U.S. Department of Education, Office of Special Education and Rehabilitative Services, & Office of Special Education Programs, 2016). In 2014, 66% of preschool-aged children with disabilities attended inclusive classrooms for part or all of their school day. Inclusive education refers to the placement of children with disabilities in age-appropriate general education classrooms alongside their typically developing peers (Fletcher, 2010). Children with mild or moderate disabilities are more likely to be placed in inclusive settings than those with more severe disabilities (Odom, 2000; Odom & Diamond, 1998). Inclusive preschool consists of more than the physical placement of children and includes full classroom participation, development of relationships with peers, and provision of specialized learning opportunities for children with disabilities (Weiland, 2016). Given that inclusive preschools can vary substantially in the number of children with disabilities served, it is important to consider whether the percentage of children with disabilities within a classroom may be influential to the learning of all children or any one subgroup of children (children with disabilities,

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children who are typically developing). The current study was conducted to examine the association between the proportion of preschool children with mild/moderate disabilities in inclusive classrooms and achievement of both typically developing children and children with disabilities in these settings.

The specific outcomes of interest in this study were children's language and literacy achievement during an academic year, which represent areas of development often compromised among children with disabilities. For instance, children with disabilities typically show significant impairments in their vocabulary skill, alphabet knowledge, and print-concept knowledge (Justice et al., 2015). Given that the skill levels of children's classmates appear to have significant influence on their language and literacy achievement over an academic year (Henry & Rickman, 2007; Justice, Logan, Lin, & Kaderavek, 2014), it seems plausible that having a relatively high proportion of children with disabilities in a classroom may inhibit growth in these skill areas over an academic year; however, this premise has not been empirically tested. Hence, the primary purpose of this study is to examine the potential consequences of an increased proportion of children with disabilities in inclusive classrooms to the language- and literacy-learning of all children within a classroom.

In general, advocates of inclusive practices emphasize specific benefits that can be derived from educating children with disabilities alongside their typical peers. One benefit of inclusion is that additional resources, such as teaching assistants or extra teachers, are frequently allocated to classrooms with children with disabilities (Barton & Smith, 2015; Fletcher, 2009). A second benefit is that inclusive classrooms tend to provide high levels of individualized, adaptive classroom instruction that benefit both children with and without disabilities (Barton & Smith, 2015; Guralnick & Bruder, 2016). Third, children with disabilities are given the opportunity to learn and socialize with peer role models, whereas typically developing children become more responsive to and supportive of other children (Rafferty & Griffin, 2005). Fourth, young children with disabilities are also likely to exhibit more positive and mature behaviors in inclusive classrooms (Odom et al., 2004). Finally, these classrooms provide typically developing children with more opportunities for friendships with children with disabilities and help typically developing children become accepting of differences between people (Odom, Buysse, & Soukakou, 2011; Rafferty & Griffin, 2005).

Nonetheless, there may be several potential negative effects of inclusion. For example, to accommodate children with disabilities, the level of classroom instruction and standards for language and literacy might be lowered (Pelatti, Dynia, Logan, Justice, & Kaderavek, 2016). Children's time with teachers and opportunities for interactions that support language and literacy development could be negatively affected with children receiving special education services taking more of the teacher's time at the expense of other students (Ruijs, van der Veen, & Peetsma, 2010). Finally, children with disabilities might disrupt the classroom and impede the learning of other children (Fletcher, 2009). Typically developing children may adopt the undesirable or disruptive behavior of children with disabilities (Ruijs & Peetsma, 2009). In addition, children with disabilities are more likely to experience peer rejection and engage in fewer social interactions than their peers in inclusive classrooms (Benjamin et al., 2017; Odom et al., 2004). Thus, children might have fewer opportunities to practice their language skills and benefit from the knowledge of peers.

Several studies have sought to examine specifically the effects of inclusion on typically developing children. Results from a systematic literature review showed little evidence of adverse effects of inclusion on typically developing elementary-grade children (Kalambouka, Farrell, Dyson, & Kaplan, 2007). Of the 26 studies included in this review, 23% of the studies found positive effects of inclusion, whereas 58% reported neutral effects and 9% reported negative effects of inclusion. Findings from a literature review by Salend and Garrick Duhaney (1999) were similar, showing that the placement of students without disabilities in inclusion programs does not

appear to be detrimental to their academic performance. This review also suggested that there may be social benefits for typically developing children, in that they gain a greater awareness of disabilities and increased sensitivity to differences among people (Odom et al., 2004). Previous literature suggests high-quality inclusive preschool settings all correlated with better outcomes for all children, including children who are typically developing (Barton & Smith, 2015). For example, children who are typically developing exceeded state-expected growth in preschool academic and social skills in a California school district inclusion program (Warren, Martinez, & Sortino, 2016).

Evidence on the effects of inclusion on children with disabilities has also been mixed. One literature review concluded there to be little to no positive effects of inclusion on children with disabilities (Lindsay, 2007), whereas another review reported mixed results (Salend & Garrick Duhaney, 1999). Literature reviews focused on preschool inclusion suggest young children with disabilities perform similarly on standardized developmental assessments in in traditional special education and inclusive settings (Odom, 2000). For example, preschool children with severe disabilities that attended inclusive classes exhibited higher scores in language development and social skills than children who did not participate in inclusive classrooms (Rafferty, Piscitelli, & Boettcher, 2003).

Overall, the inconsistent nature of research findings makes it difficult to draw clear recommendations and conclusions regarding the effectiveness of inclusive education for children with disabilities and for their typically developing classmates. One approach to understanding the conflicting research findings is to examine specific factors that may influence the effects of inclusive education (Ruijs, van der Veen, & Peetsma, 2010; Ruijs, Peetsma, & van der Veen, 2010). By moving beyond overall effects and focusing on specific classrooms factors, we can determine which classroom conditions of inclusive education are associated with positive benefits to children with and without disabilities (Ruijs, Peetsma, & van der Veen, 2010). For example, the knowledge and skills teachers gain in their preparation programs influence the effectiveness of inclusive classrooms (Guralnick & Bruder, 2016). Teacher licensure in early childhood and special education/intervention may help teachers develop the competencies needed to teach in inclusive settings. Teaching experience is also likely to play a role with the number of years of teaching experience linked to positive attitudes toward disabilities and inclusion (Kwon, Hong, & Jeon, 2017). Finally, teachers' ability to implement curriculum with adaptions and instructional practices for children of varying skill levels is important for high-quality inclusive classrooms (Guralnick & Bruder, 2016). In addition to teacher characteristics, another classroom factor that might be associated with children's achievement in preschool inclusive classrooms is the proportion of children with disabilities in each classroom. In classes with greater numbers of children with disabilities, achievement may suffer if teachers are unable to give children sufficient individual attention because more children with disabilities need extra support (Ruijs, Peetsma, & van der Veen, 2010). On the contrary, a positive association between the presence of children with disabilities and achievement might occur if teachers with several children with disabilities are more motivated to gain expertise in teaching children with disabilities and acquire skills that enhance their overall teaching.

Several studies have considered the relationship between the number of children with disabilities in the classroom and children's achievement. Demeris, Childs, and Jordan (2007) examined the relationship between the number of students receiving special education services in third grade classrooms and the performance of their typically developing peers' performance on reading, writing, and mathematics assessments. After controlling for differences in class size and socioeconomic status, the correlations between the number of students with disabilities and the average class achievement scores were small but statistically significant (.05-.07), indicating that the presence of more students receiving special education services does not negatively affect achievement of typically developing peers. Small positive effects were also found by Hanushek,

Kain, and Rivkin (2002) in a cohort study of children in Texas public schools, in which an increase in the proportion of children with disabilities in classrooms was associated with higher achievement for children without disabilities. A 10-percentage-point increase in the proportion of children with disabilities corresponded to a 0.02 *SD* increase in math achievement. A third study identified a variable effect of the proportion of children with disabilities within classrooms on student math achievement (Huber, Rosenfeld, & Fiorello, 2001). Some classrooms experienced positive effects of large numbers of children with disabilities, whereas other classrooms with several students with disabilities of children experienced negative effects. It may be that the effect of the number of peers on children's achievement varies as a function of disability. For example, Fletcher (2009) documented that the negative effects of having one classmate with emotional problems more than doubled when a first grade classroom had two children experiencing emotional problems.

In addition to considering the percentage of children with disabilities per classroom, some studies have created group variables based on percentages to ease interpretation of results and allow for examination of potential nonlinearities between groups (Ruijs, van der Veen, & Peetsma, 2010). Ruijs, Peetsma, & van der Veen, (2010) examined whether having no children with disabilities in primary school classrooms, a few children with disabilities (less than 10%), and more than a few students (greater than 10%) was associated with the achievement of typically developing children. No differences in language and arithmetic achievement were found for typically developing children across the three comparison settings. Another study investigated whether there were differences in achievement between primary-school children with disabilities who are the only child in the class with disabilities, children with disabilities in classes with a few other children with disabilities (less than 10%), and children with disabilities in classroom with a relatively high number of children with disabilities (more than 10%; Ruijs, Peetmsa, & van der Veen, 2010). The number of other children with disabilities in the classroom was not associated with the language and arithmetic achievement of children with disabilities.

To our knowledge, no research on the association between the proportion of children with disabilities and children's achievement has been conducted at the preschool level. Preschool inclusion differs from inclusion at other levels of schooling, suggesting that research focused specifically on this age group is important (Odom et al., 2004). There are several ways in which preschool inclusion is distinct from inclusion in later grades. First, early childhood education programs are frequently based on a variety of settings, including school systems, community child care, or Head Start classrooms, which may differ in important ways from public school education for older children (Barton & Smith, 2015; Johnson, 2017). For example, teacher–child ratios and class size policies are not the same across school levels (Odom et al., 2004). Second, the focus of the curriculum in early childhood education is significantly different from education curricula in the later years of school. In early childhood education programs, the emphasis is often on applying developmentally appropriate practices to foster children's skills in the motor, cognitive, and social domains (Guralnick & Bruder, 2016). Social integration, including successful peer interactions and the development of friendships, in the classroom is also a goal of inclusion at the preschool level. Preschool education is both child- and teacher-directed, whereas education curricula in older grades emphasize academic skills and are more teacher-directed (Odom et al., 2004). Third, the developmental skills gap between children with and without disabilities is smaller in preschool than at the older levels of schooling. Previous research and legislative priorities suggest that preschool programs are considered especially important for children with disabilities and their future school success (Warren et al., 2016). Finally, in recent years, federal and state accountability at the preschool level has increased. However, it is unknown how accountability systems, such as the use of Quality Rating and Improvement systems, will influence preschool inclusion programs (Guralnick & Bruder, 2016). It is possible that differences in

accountability between preschool and older years of schooling may differentially affect the practices of teachers in inclusion classrooms.

The contextual differences between preschool and other levels of school suggest that inclusion research at the elementary, middle, and high school levels may not generalize to preschool children. Thus, in the present study, we explicitly study inclusive early childhood classroom to explore the extent to which there is a relationship between the proportion of preschool children with mild/moderate disabilities in the classroom and children's language and literacy achievement. In addressing this aim, we control for average classroom skill levels, representing peer effects. In recent years, several studies have sought to determine the extent to which peer effects operate in preschool settings. A study of large-scale public preschool programs found that higher peer language abilities were related to children's gains in receptive and expressive language (Mashburn, Justice, Downer, & Pianta, 2009). The association between peers' language abilities and children's language growth for children was strongest for children with poorer language skills at the beginning of the school year. Similarly, Justice, Petscher, Schatschneider, and Mashburn (2011) found peer effects were strongest for children with low fall language skills in classrooms with lower average skill levels. These findings were replicated in a study of inclusion preschools classrooms where average language skills were associated with children's language skills (Justice et al., 2014). There was also a significant interaction between disability status and classroom language skills. Peer effects were the least important for children without disabilities in classrooms with high average language skills and the most consequential for children with disabilities in classrooms with lower language skills. This study did not examine the proportion of children with disabilities in preschool classrooms, as we do in this study. Considering both simultaneously is important: As the proportion of children with disabilities in a classroom increases, it is likely that the average skills of the classroom will decrease. Thus, by including peers' ability in our analyses, we are able to determine whether the proportion of the children with disabilities in classroom is uniquely associated with children's language and literacy achievement. In total, two research questions were addressed: First, is the percentage of children with mild/moderate disabilities in inclusive early childhood classrooms associated with the language and literacy achievement of children with and without disabilities, controlling for peer abilities? Second, does the relationship between the percentage of children with disabilities and children's achievement vary based on children's disability status?

Method

Participants

The study was based in 75 inclusive preschool classrooms in multiple districts in two states. Data on teacher background in these classrooms was self-reported by teachers using a background questionnaire completed in the Fall of the school year. The majority of the teachers were White/Caucasian (92.0%) with 2.7% Black/African American, 2.7% Asian, and 2.7% other/multiple races. A small portion of the sample (4.3%) identified as Hispanic or Latino. Most of the teachers were female (56%), were licensed to teach special education or work as an early interventionist (75%), and had a master's degree or higher (55%). Most teachers had several years of experience with 11% working as a lead teacher for 2 years or less, 14% for 3 to 4 years, 32% for 5 to 10 years, and 43% for 11 or more years. In almost all (99%) of the classrooms, teachers reported that there was more than one adult present, with 47% reporting two adults present, 40% three adults, and 12% four or more adults in the classroom.

The average class size was 14 (SD = 5). On average, about one half (M = 49%; SD = 23%) of the children in each classroom had disabilities and range in proportion from 7% to 92%. For the purpose of the present study, we sought to consent all children within a classroom to

participate in ongoing educational assessments to test a language and literacy intervention. Inclusion criteria for the larger intervention study consisted of (a) parent/caregiver consent, (b) English proficiency (i.e., English is child's primary language or child sufficiently understands and speaks English), and (c) adequate verbal and cognitive ability to participate in the child-level assessments, based on caregiver and teacher judgments. On average, about seven children from each classroom (52% of the classroom enrollment) were consented and participated in data collection, with data available from 2 to 11 children in classrooms (17%-100% of the classroom enrollment). Hereafter, child-level data represent this subset of children in the 75 classrooms. The percentage of classroom enrollment represented in our study is comparable with other recent studies of classroom composition where data available represented 44% to 63% of classroom enrollment (Justice et al., 2014; Justice et al., 2011).

The study consisted of 516 preschool children whose racial/ethnic background included 77% White/Caucasian, 13% Black/African American, and 10% other/multiple races. Thirteen percent were identified as Hispanic or Latino. The majority of the children were boys (58% boys, 42% girls) and the average age of the children at the beginning of the preschool year was 52.3 months ($SD = 6.3$). Forty-two percent ($n = 215$) of the children had identified disabilities, based on the presence of an Individualized Education Plan (IEP). Parents reported diagnoses for 81% of the children with IEPs on a background questionnaire. The most common disabilities were speech or language impairments (41.1%), developmental delays (21.1%), multiple disabilities (23.4%), and autism spectrum disorder (6.9%). There were also three cases of emotional disturbance (1.7%) and hearing impairment (1.7%) as well as two cases of other health impairments (1.1%), specific learning disability (1.1%), and orthopedic impairment (1.1%). There was one case of visual impairment (0.6%). Family incomes were reported in US$5,000 to US$25,000 increments. Twenty-two percent of the children came from households with family incomes of US$20,000 or less, 24% from households with incomes of US$20,001 to US$40,000, 15% from households earning US$40,000 to US$60,000, and 39% with family incomes greater than US$60,000. In terms of parental education, 6% of children's mothers completed some high school, 14% received a high school diploma or GED, 8% attained a high school diploma or GED plus a training certificate, 22% completed some college but did not earn a degree, 14% earned a AA/AS 2-year degree, and 36% received a bachelor's degree or higher.

All children attended publicly funded center-based preschools classrooms serving children with disabilities. The two states included in our study largely feature blended classroom types, thus no single type of preschool setting usually applies to a classroom. Recruited classrooms existed to serve children with disabilities with some using a "reverse mainstream" approach and some using other approaches. Teachers were asked to report on the type of preschool classroom setting by selecting one or more program classifications. There was variation in the type of preschool setting reported, with 9% of children attending classrooms reported as Head Start programs, 8% state-funded prekindergarten programs, 20% programs with multiple classifications (e.g., both Head Start and state-funded programs), 55% early childhood special education programs, 5% center-based preschool or daycare programs, and 2% other types of preschool programs. Information on the specific programs in the other classification was not available.

Measures

As part of the larger study in which classrooms, teachers, and children were involved, children completed individually administered language and literacy assessments in the Fall and Spring of the academic year. Assessments were completed by professional research staff at two collaborating universities in a quiet space within each child's school. The measures of relevance to this study represented children's language and literacy skills. Research staff completed a two-step training process. Research staff were required to complete an online training that consisted of

information on (a) the structure and materials of the measure and (b) how to reliably administer and score the measure. After the online training, staff had to correctly answer all the questions on a nine-item quiz on assessment information. Second, staff were required to score 95% or higher on the fidelity of assessment checklist during a live assessment administration.

Children's language skills. Language skills were assessed with the *Clinical Evaluation of Language Fundamentals Preschool–Second Edition* (CELF-2; Wiig, Secord, & Semel, 2004). The Core Language Score evaluates children's overall language ability and is derived from the Sentence Structure, Word Structure, and Expressive Vocabulary subtests. Scores are reported as standard scores ($M = 100$, $SD = 15$). In a normative sample, Core Language scores displayed high reliability with the test-rest correlation = .91 and average coefficient alpha = .90 across ages 3 to 6. CELF-2 scores demonstrate sufficient validity with scores producing moderate to high correlations with other language skill assessments in validation studies.

Children's literacy skills. Two measures were used to measure children's print-concept knowledge and alphabet knowledge. Print-concept knowledge was evaluated by the *Preschool Word and Print Awareness* (PWPA; Justice, Bowles, & Skibbe, 2006). The PWPA assesses 14 concepts of print, including children's knowledge of book and print organization and concept of letter and print. Concepts are measured during an adult–child shared storybook reading. Item response theory (IRT)-based standard scores ($M = 100$, $SD = 15$) are determined from a raw score computed by summing the number of correct answers. PWPA scores display adequate reliability with reliability of partial credit model IRT scores =.74 (Justice et al., 2006). Cabell, Justice, Konold, and McGinty (2011) found significant, moderate correlations between PWPA scores and other criterion-referenced measures of children's literacy skill, including children's alphabet ($r = .47$) and name writing ($r = .48$).

Alphabet knowledge was measured using the Letter Naming subtest of the *Phonological Awareness Literacy Screening* (PALS; Invernizzi, Meier, & Sullivan, 2001). Children are asked to point to and name all 26 uppercase letters, presented in a random order. A score (0-26) is computed by summing the number of letters correctly identified. PALS scores exhibit sufficient reliability with internal consistency coefficients ranging from .71 to 94 and inter-rater reliability for uppercase and lowercase letters = .99.

Analyses

The primary variable of interest, namely the percentage of children in each classroom with disabilities, was determined from teacher report. Specifically, in the winter of the year teachers reported the number of children with and without disabilities in their classrooms, which served as a primary predictor variable in this study. To account for the nesting of children within classrooms, we used multilevel modeling to predict children's language and literacy skills from the proportion of children with disabilities in each classrooms via the SAS mixed procedure. Missing predictor values were estimated using A Markov chain Monte Carlo (MCMC) multiple imputation method (Rubin, 1987; Schafer, 1997). The percent of missing data for each predictor variable ranged from 19% to 29%, with 16% of children missing information the proportion of children with disabilities in their classrooms. Adhering to recommendations by Von Hippel (2007), missing outcome data were not imputed. MCMC imputation for missing data was successful, with a relative efficiency mean of .9957 and a lowest relative efficiency value of .9883. All independent variables were grand-mean centered prior to analyses.

With three outcomes (language, print-concept knowledge, alphabet knowledge) of interest, we included several child-level controls in our multilevel prediction models: maternal education,

Table 1. Children's Scores in the Fall and Spring and Effect Size (*d*) of gains from Fall to Spring for Children With and Without Disabilities.

Measure and group	Fall	Spring	*d*
Language			
All children	88.98 (19.06)	92.89 (17.95)	0.21
Children without disabilities	97.16 (14.85)	100.48 (14.10)	0.23
Children with disabilities	77.33 (18.34)	82.15 (17.35)	0.27
Print-concept knowledge			
All children	93.86 (18.23)	107.12 (18.74)	0.72
Children without disabilities	99.97 (15.99)	112.63 (16.60)	0.78
Children with disabilities	85.25 (17.73)	99.34 (18.87)	0.77
Alphabet knowledge			
All children	11.16 (9.84)	17.07 (9.12)	0.62
Children without disabilities	12.38 (9.75)	18.93 (8.10)	0.73
Children with disabilities	9.44 (9.72)	14.48 (9.81)	0.52

Note. Values in parentheses are standard deviates. Language was measured by the CELF-2, print concept by the PWPA, and alphabet knowledge by the PALS. CELF-2 and PWPA scores were standard scores ($M = 100$; $SD = 15$). Alphabet knowledge scores ranged from 0 to 26. CELF = Clinical Evaluation of Language Fundamentals Preschool; PWPA = Preschool Word and Print Awareness; PALS = Phonological Awareness Literacy Screening.

family income, child gender, child age, corresponding fall scores, and disability status, with the latter based on whether the child had an IEP. Adult–child ratio in each classroom and peer skills were also controlled for in analyses. To estimate peer skills, average scores in each classroom for the three assessments were calculated from children in the classroom with available data from fall assessments. A measure of instructional quality in the winter of the preschool year was included as a covariate in initial models. Instructional quality was assessed the Classroom Assessment Scoring System, an observational instrument (Pianta, La Paro, & Hamre, 2008). We calculated an instructional quality domain score by averaging the Concept Development, Quality of Feedback, and Language Modeling dimensions.

Results

Table 1 provides children's assessment outcomes by time and by disability status. In comparisons of children's outcomes, the Satterthwaite approximation was used to account for differences in variances in the groups of interest when the assumption of equality of variances was violated. On average, children with disabilities had significantly lower scores on fall measures of language, $t(382.44) = 12.88$, $p < .001$, $d = 1.21$, print-concept knowledge, $t(509) = 9.80$, $p < .001$, $d = 0.88$, and alphabet knowledge, $t(505) = 3.35$, $p < .001$, $d = 0.30$, as compared with children who were typically developing. Children without disabilities also demonstrated higher levels of achievement than their peers with disabilities on spring measures of language, $t(393.48) = 12.70$, $p < .001$, $d = 1.18$, print-concept knowledge, $t(419.15) = 8.27$, $p < .001$, $d = 0.76$, and alphabet knowledge, $t(403.04) = 5.44$, $p < .001$, $d = 0.50$. Children with and without disabilities displayed similar levels of gains on language, $t(395.3) = -1.70$, $p = .09$, $d = -0.16$, and print concept knowledge, $t(381.56) = -0.96$, $p = .34$, $d = -0.09$, over the course of the year. However, typically developing children experienced more growth in alphabet knowledge than children with disabilities, $t(502) = 2.61$, $p < .01$, $d = 0.24$.

To address the first research question, we created a model that predicted children's spring achievement from the percentage of children in the classroom with disabilities, controlling for child and classroom characteristics (see Table 2). Coefficients with $p < .05$ were considered

Table 2. Results of Multilevel-Effects Models Using Percentage of Classroom Disability Composition to Predict Children's Academic Skills.

	Language skills		Print-concept knowledge		Alphabet knowledge	
Predictor	Estimate	*p*	Estimate	*p*	Estimate	*p*
Intercept	93.16	<.001	107.24	<.001	16.67	<.001
Age (months)	**–0.19**	**.003**	**0.51**	**<.001**	0.00	.97
Maternal education (years)	0.29	.23	**1.20**	**.002**	0.13	.41
Family income US$25,000-US$75,000[a]	0.22	.84	0.17	**.93**	1.18	.13
Family income greater than US$75,000[a]	2.09	.16	**2.11**	**.37**	0.54	.58
Gender (female = 1)	0.32	.69	1.89	.14	**1.19**	**.03**
Disability status	**–3.10**	**.001**	**–4.51**	**<.001**	**–1.87**	**.001**
Fall score	**0.76**	**<.001**	**0.43**	**<.001**	**0.65**	**<.001**
Adult–child ratio	1.91	.65	−2.82	.72	4.02	.19
Instructional quality	0.87	.29	0.61	.71	0.85	.16
Peer skills	−0.01	.86	0.14	.16	0.07	.31
Percentage of children with disabilities	1.04	.64	−0.31	.94	−2.85	.09

Note. Peer skills refer to the average fall score for all the students in a particular classroom. Coefficients in bold are statistically significant at $p < .05$.

[a]The reference group for income categories is family income less than US$25,000.

statistically significant. The percentage of children with disabilities did not significantly predict children's spring language (coefficient = 1.04, $p = .64$), print-concept knowledge scores (coefficient = −0.31, $p = .94$), and alphabet knowledge scores (coefficient = −2.85, $p = .09$). Peer skills were not associated with spring scores in any of the outcomes. Similarly, classroom factors, such as adult–child ratio and instructional quality, were not significant predictors of spring achievement. Disability status served as a significant predictor in all three models, such that children with disabilities scored lower on spring language (coefficient = −3.10, $p = .001$), print-concept knowledge (coefficient = −4.51, $p < .001$), and alphabet knowledge scores (coefficient = −1.87, $p = .001$) than their typically developing peers.

To answer the second research question on whether the effect of classroom disability composition varied based on the child's disability status, we examined the interaction between disability status and the percentage of children with disabilities (see Table 3). There was no significant interaction between disability status and percentage of children with disabilities on children's spring language (coefficient = −5.93, $p = .55$), print-concept knowledge (coefficient = −12.57, $p = .49$), or alphabet knowledge scores (coefficient = 0.02, $p = .99$). These results indicate children with and without disabilities are not differentially influenced by the percentage of children with mild/moderate disabilities.

Discussion

This study examined whether the percentage of children with mild/moderate disabilities within early childhood special education classrooms was associated with children's achievement in language and literacy skills. The classrooms in the study served children with and without disabilities; thus, our work allowed us to assess whether the proportion of children with disabilities in early childhood classroom yields different effects for children with and without disabilities. There has been limited work in this area in older grades (Demeris et al., 2007; Fletcher, 2009; Hanushek et al., 2002) but to our knowledge, no research conducted at the preschool level. Given

Table 3. Results of Multilevel-Effects Models Using Interaction of Disability Status and Percentage of Classroom Disability Composition to Predict Children's Academic Skills.

	Language skills		Print-concept knowledge		Alphabet knowledge	
Predictor	Estimate	*p*	Estimate	*p*	Estimate	*p*
Intercept	93.14	<.001	107.23	<.001	16.66	<.001
Age (months)	**–0.19**	**.004**	**0.52**	**<.001**	0.00	.96
Maternal education (years)	0.29	.22	**1.20**	**.002**	0.14	.40
Family income US$25,000-US$75,000[a]	0.25	.83	0.20	.91	1.18	.13
Family income greater than US$75,000[a]	2.13	.15	2.11	.37	0.55	.58
Gender (female = 1)	0.33	.69	1.90	.14	**1.19**	**.03**
Disability status	**–3.11**	**.001**	**–4.51**	**.002**	**–1.87**	**.001**
Fall score	**0.76**	**<.001**	**0.43**	**<.001**	**0.65**	**<.001**
Adult-child ratio	2.26	.60	−1.69	.84	4.02	.20
Instructional quality	0.87	.30	0.58	.73	0.85	.17
Peer skills	−0.02	.72	0.13	.20	0.07	.32
Percentage of children with disabilities	6.42	.49	11.13	.51	−2.85	.66
Disability status Percentage of children with disabilities	−5.93	.55	−12.57	.49	0.02	.99

Note. Peer skills refer to the average fall score for all the students in a particular classroom. Coefficients in bold are statistically significant at $p < .05$.

[a]The reference group for income categories is family income less than US$25,000.

that the percentage of children with disabilities in an early childhood classroom is a malleable feature of the early-education setting, determining whether children in classrooms with relatively higher proportions of children with disabilities has consequence to educational policy.

Our results show that the percentage of children in the classroom with disabilities was not associated with children's spring achievement in language, print-concept knowledge, and alphabet knowledge. These results suggest that including more children with mild/moderate disabilities in early childhood preschool classes was not detrimental to children's learning in these skills areas. Importantly, these effects were observed in the context of important covariates, including peer skills levels, thus can be considered as distinct from peer effects that operate in preschool settings.

Our study is the first to examine the presence of peers with disabilities and children's achievement in preschool inclusion classrooms. Research findings on the relationship between the number of children with disabilities and children's performance at other grade levels are mixed. Several studies have found no effects or a positive relationship between increased proportions of children in the classroom with disabilities and achievement (Demeris et al., 2007; Hanushek et al., 2002; Ruijs, Peetsma, & van der Veen, 2010). Results from these studies suggest an increased presence of children with disabilities may benefit children or at the very least is not detrimental to children's learning. Our study makes an important contribution by examining classroom disability composition in preschool. Preschool inclusion differs from inclusion at other levels of schooling, suggesting research focused specifically on this age group is important For example, many preschool inclusive programs are anchored in community child care or Head Start classrooms as well as school systems (Barton & Smith, 2015). In addition, preschool education is both child- and teacher-directed, whereas education in later years of schooling tends to be more teacher-directed (Odom et al., 2004). Finally, the gap between the competencies of children with and without disabilities is smaller in preschool and high-stakes achievement testing is not present in preschool programs.

It is important to consider what this study clarifies about inclusive practices and how it advances the field. First, for three critical language and literacy outcomes, a higher proportion of preschoolers with disabilities in a classroom had no negative effect on children's achievement for typically developing children or children with disabilities. Thus, we would argue that it is not necessary to "cap" the number of children with disabilities in early-education settings, at least based on concerns that having a relatively high number of children with mild/moderate disabilities may be detrimental to learning and development. Second, when examining children's growth in alphabet knowledge over the year, we found that typically developing children experienced larger gains than children with disabilities. This was not the case for the other two outcomes in this study, vocabulary and print-concept knowledge, in which gains over the year were similar for the two subgroups of children.

Given the implications of this study, there are several limitations to acknowledge. First, the current study is limited to language and literacy measures of achievement. There are more dimensions of children's development, including mathematics and social-emotional competencies, which should be considered. Future studies should include a range of developmental areas to examine whether the relationship between the proportion of children with disabilities in the classroom and children's performances varies across subject area. In addition, this study was based on correlations limiting our ability to make causal claims regarding the impact of the presence of children with disabilities on children's achievement. Future work using experimental designs is necessary to examine the causal impacts of the proportion of children with disabilities in the classroom. We also do not have information on whether children attended part-time or full-time preschool programs. In addition, we were able to control for adult–child ratio in the classroom, but did not have information on other resources and supports that may vary as a function of the number of children with disabilities.

It important to note this study is exploratory in nature. Study selection criteria restricted the sample of children with disabilities to children who were considered moderate to high functioning. Children were required to have adequate verbal and cognitive ability, as judged by caregivers and teachers, to participate in the child-level assessments. This is a limitation of our study as perceptions of children's abilities vary across informants and direct assessments of child skills did not occur prior to study enrollment. Thus, the children with disabilities in the current study may not be representative of the type and severity of disabilities found in preschool inclusion classrooms. Future work should include a more representative sample of preschool children with disabilities. It is also possible that the type of disability (behavioral, cognitive, or physical) may influence class dynamics in different ways. For example, Fletcher (2009) suggests classmates with serious emotional problems are particularly detrimental to children's learning. Fletcher (2009) focused on children with severe emotional disabilities and found that the presence of a classmate with serious emotional problems had a negative effect on children's academic achievement in first grade. However, other studies have found no differences in the achievement of typical developing children and children with disabilities based on the type of disability of children included in their class (Ruijs, van der Veen, & Peetsma, 2010; Ruijs, Peetsma, van der Veen, 2010). Research in this area is needed for at the preschool level.

In conclusion, the results of this study suggest that the percentage of children with mild/moderate disabilities is not associated with children's spring achievement in language, print-concept knowledge, and alphabet knowledge. Furthermore, the relationship between the percentage of children with disabilities and children's achievement did not vary based on children's disability status. These results suggest that including more children with mild/moderate disabilities in early childhood preschool classes was not detrimental to the language and literacy growth of children with and without disabilities.

Author's Note

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