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DEDICATION

This work is dedicated to the children and teachers working each day to co-create classrooms that are supportive, enriching, and full of joy. This work is especially for the Davids and the Rylands of the world who struggle to build positive experiences in classrooms and the teachers who strive to connect in meaningful ways.

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PROLOGUE

This dissertation adheres to a journal-ready format. Three journal articles prepared for submission to refereed journals comprise the first part of the dissertation. Manuscript I, Individual Differences in Experiences of Early Education is prepared for the journal *Child Development Perspectives*. Manuscript II, The Haves and the Have-nots: Associations Between Preschoolers' Developmental Profiles and Their Individual Experiences with Teachers is prepared for the journal *Child Development*. Manuscript III, Preschoolers' Self-Regulation and Academic Achievement: The Role of Individual Experiences with Teachers is prepared for the *Journal of Applied Developmental Psychology*.

Dissertation Abstract

Early care and education programs have demonstrated strong impacts on the development and school readiness of young children, with particular benefit for children growing up in poverty. Within these programs, teacher-child interactions have been identified as they key active ingredient underlying the impacts on children's development. However, limitations in conceptualization and measurement have hindered efforts to elucidate the most important features of teacher-child interactions and for whom and under what conditions these beneficial interactions occur and demonstrate impact. Guided by the Bioecological Model and Differential Susceptibility Theory, this dissertation first provides a conceptual framework to guide the examination of individual children's experiences with teachers and associations between individual experiences and development in preschool. The second paper utilizes a person-centered analytic approach to assess how multiple developmental characteristics of children associate with their individual experiences with teachers. Membership in the profile with low developmental skills across domains was associated with teacher reports of more conflict and less closeness and higher levels of observed conflict between teachers and children. The third paper examines the association between children's self-regulation and growth in academic skills and whether children's individual experiences with teachers mediates this association. Results provided little support for mediation, but indicated links between children's self-regulation and some aspects of experiences with teachers and academic growth.

MANUSCRIPT I

Individual Differences in Experiences of Early Education

This manuscript is prepared for submission to the peer-reviewed journal *Child Development Perspectives* and is the first of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

A substantial body of research supports the benefits of early childhood education and the key role teacher-child interactions play in driving these benefits. However, weak and mixed associations between observed teacher-child interactions and children's developmental gains are a persistent issue limiting concrete recommendations to the field. This paper highlights potential limitations associated with current practice of assessing teacher-child interactions at the classroom level and argues the importance of considering within-classroom variation to examine children's individual experiences with teachers as the most proximal precursors of growth in early education settings. Building on literature considering student-teacher relationships and children's evocative effects on their experiences with adults along with theory and literature demonstrating differential impacts of experiences across children, this paper provides a conceptual framework to guide future studies.

Keywords: Early childhood education, teacher-child interactions, student-teacher relationship, individual differences, differential susceptibility.

Individual Differences in Experiences of Early Education

Decades of research has demonstrated that high-quality preschool programs have positive effects for children, especially those who live in poverty, and that teacher-child interactions are the active ingredient underlying these impacts (Phillips et al., 2017; Yoshikawa et al., 2013). However, although many studies have documented associations between teacher-child interactions and child outcomes, most researchers report modest effect sizes which has prompted caution among researchers when pressed to provide specific implications for policy and program audiences.

Since the Study of Early Child Care (NICHD Early Childhood Research Network, 2002) first brought attention to mixed impacts of early care and education (ECE), researchers have utilized various approaches to try to clarify associations between quality of ECE experiences and children's developmental outcomes. Studies have examined thresholds of quality that may be necessary to produce impacts (Burchinal, Vandergrift, Pianta, & Mashburn; Burchinal et al., 2016), curvilinear associations of quality with child outcomes (Weiland, Ulvestad, Sachs, & Yoshikawa, 2013), as well as children's inherent differential susceptibility to caregiving environments (Pluess & Belsky, 2009b) with some success. Yet, continued efforts to more fully explicate the range of quality experienced in ECE and how those experiences associate with child outcomes (Burchinal, 2018; Weiland, 2018) are needed. To that end, this paper will focus on children's individual experiences in and responses to ECE settings by examining current conceptualization and measurement in the extant literature and propose next steps in the ongoing effort to better understand the mechanisms underlying impacts of ECE.

Differential Response to ECE Programs

Challenged by persistent findings of null, weak, and mixed associations between ECE quality and child outcomes, researchers have pursued multiple paths to more fully elucidate the associations. Children's differential susceptibility to caregiving environments has emerged as one factor in better understanding connections between environments and outcomes. As proposed by Belsky and Pluess (2009), differential susceptibility is the tendency for a subset of children to not only demonstrate greater risk when exposed to negative caregiving practices but also greater benefit when exposed to positive caregiving. Negative emotionality or difficult temperament has been identified as a key characteristic that disposes children to be differentially susceptible to caregiving environments with several studies documenting both more risk conferred by negative experiences and more benefits from positive experiences (see Belsky & Pluess, 2009, for a review). More limited work has documented other aspects of temperament as markers of differential susceptibility, including impulsivity (Lengua, Wolchik, Sandler, & West, 2000) and anger proneness (Smeekens, Riksen, Walraven, & van Bakel, 2008). Although much of the work documenting differential susceptibility has focused on parenting quality, findings extend to ECE environments as well (Pluess & Belksy, 2009a; Pluess & Belsky, 2009b).

Children's physiological response to stress has also been identified as a factor associated with differential susceptibility to ECE settings (Phillips, Fox, & Gunnar, 2011). Evidence indicates that not only do some children experience greater physiological stress in ECE settings, but that in some cases this exacerbated stress response occurs in children identified with poor self-control, social fearfulness, or negative emotionality (Dettling et al., 1999; Tout, de Haan, Kipp, Campbell & Gunnar,

1998; Watamura et al., 2003). Thus, it may be that identifying differentially susceptible children by temperament traits may be identifying the same children with more pronounced physiological reactivity to stress.

Although not explicitly designed to test differential susceptibility, other studies have identified similar patterns of differential response to ECE quality, with moderators including a wider range of child characteristics beyond temperament and stress reactivity. Response to ECE quality has been shown to vary by children's inhibitory control (Choi et al., 2016), effortful control (Liew, Chen, & Hughes, 2010), and functional risk factors (Hamre & Pianta, 2005). Children may also demonstrate greater gains from high quality ECE environments when they have greater family risk factors such as low income, low maternal education, or poor parenting (Hamre & Pianta, 2005; McCartney, Dearing, Taylor, & Bub, 2007; Vernon-Feagans, Bratsch-Hines, & The Family Life Project Key Investigators, 2013).

Additionally, children who are at risk for difficulties in school may garner greater benefits from positive relationships with teachers than their lower risk peers. Positive relationships with teachers have been demonstrated to reduce aggressive behavior, lower discipline referrals, and improve motivation and engagement for children with early behavior problems (Graziano, Garb, Ros, Hart, & Garcia, 2016; Hamre & Pianta, 2001; Silver, Measelle, Armstrong, & Essex, 2005). Similarly, among children who are identified as at risk due to lagging academic or behavior skills, those who develop positive relationships with teachers exhibit higher levels of academic achievement that peers with less positive relationships with teachers (Sandilos, Whitaker, Vitiello, & Kinzie, 2019). Taken together, this evidence highlights the protective effect of high

quality ECE experiences for children at risk due to difficult temperament, behavior problems, heightened stress response, and other individual and family risk factors.

Differential Experiences in ECE

Another possible issue underlying weak and mixed associations of ECE quality and child outcomes is related to measurement of classroom quality. One widely acknowledged limitation of current research is the conceptualization and measurement of quality at the classroom level rather than the child level. The most commonly used classroom observation tools focus on the global quality or *experience of the average child* in a classroom. By design, this approach disregards within-class variability and neglects to document the individual experiences of a child, which may not be correctly captured by classroom level scores. Importantly, if the experiences of individual children within a classroom are not adequately portrayed by global measures of quality, associations between classroom quality and child outcomes would be diluted and could result in the weak and mixed findings frequently reported.

Research has demonstrated that there is within-classroom variability in children's experiences with teachers, and that this variation is not random. For example, children's gender or race has been associated with different levels of conflict or closeness with their teachers (Jerome, Hamre, & Pianta 2009). Variability in children's individual experiences with teachers has also been linked to language and academic skills (Hughes, Luo, Kwok, & Lloyd, 2008; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006), classroom behaviors and social competence (Hamre, Pianta, Downer, & Mashburn, 2008; McKinnon, Blair, & The Family Life Investigators, 2018; Pianta, La Paro, Payne, Cox, & Bradley, 2002), and temperament (Rudasill et al., 2006). Notably, the interactions and relationships

experienced by individual children with teachers vary even in high quality classrooms, and some children do not (fully) experience the positive climate reflected in classroom-level scores (Sabol, Bohlmann, & Downer, 2018; Williford, Maier, Downer, Pianta, & Howes, 2013). Such within-classroom variation may result in over-estimation of impacts of ECE quality for some children while underestimating impacts for others. A more nuanced conceptual and methodological approach is needed to yield greater understanding and allow for more sophisticated recommendations for practice.

Twice Different: Differential Experiences and Susceptibility

One underlying assumption of differential susceptibility is that the predictor (i.e., caregiving quality) is independent of the moderator (i.e., child risk factor; Belsky & Pluess, 2009). Several studies of parenting have been able to document differential susceptibility with this criteria in place (e.g., Bradley & Corwyn, 2008; Kochanska, Aksan, & Joy, 2007) and have utilized statistical controls to offset non-independence in some cases (e.g., Pluess & Belsky, 2009a). However, this assumption is more difficult to meet in ECE research because most studies measure ECE quality at the classroom level rather than child level. In one exception, Pluess and Belsky (2009b) utilized a measure of children's individual interactions with teachers and established independence between interactions between target child and teachers and children's difficult temperament, the moderator of interest. In this study, differential effects of caregiving quality were supported, with lower quality care leading to more problem behaviors and higher quality of care leading to fewer problem behaviors, but only for children with difficult temperament.

Other studies, however, have repeatedly documented differences in children's individual experiences with teachers that are directly related to child risk factors, including not only temperament but also behavior and academic skills. Teachers' reports of perceptions, attributions, and relationships, along with observed interactions, have all been documented to differ across child characteristics (Carter, Williford, & LoCasale-Crouch, 2014; Erdena & Wolfgang, 2004; Howes, Phillpisen, Peisner-Feinberg, 2000; Rudasill & Rimm-Kaufman, 2009). Gender has been found to consistently associate with children's experiences with caregivers, with effects noted as early as infancy (Vallotton, 2009). Boys tend to develop relationships with teachers that are more conflictual and less close than the relationships girls have with teachers (Howes et al., 2000). Specific differences in teacher-child interactions have also been documented by gender, including the amount of didactic instruction (Early et al., 2010), pleasant conversation (Dobbs, Arnold, & Doctoroff, 2004), and positive engagement (Slot & Bleses, 2018) children experience with teachers, but other studies have failed to detect gender differences (Kim et al., 2018; Vitiello, Booren, Downer, & Williford, 2012). There is also some evidence of less close or more conflicted relationships between teachers and minority students or dual language learners (Jerome et al., 2009), but some studies of observed teacher-child interactions have failed to detect differences in positive engagement or conflict by child ethnicity or home language (Kim et al., 2018).

Children's language and academic skills may also shape the nature of their experience with teachers. Children who have strong language skills are likely to be more interactive and engage with teachers in a variety of conversations. These children may be engaging conversation partners for teachers, which might result in close relationships and

frequent interactions (Nurmi, 2012). Similarly, children with strong academic may be particularly rewarding to teach (Hughes et al., 2008), which might lead to more extensive instructional exchanges for children who enter the program with academic strengths. On the other hand, children who exhibit lower language skills may tend to have less positive relationships with teachers (Rudasill et al., 2006). It is also possible, though, that teachers may be motivated to provide additional support for children who enter the program with lagging academic skills (Pakarinen, Lerkkanen, Poikkeus, Siekkinen, & Nurmi, 2011). Further research is needed to explore the possibility that children's language and academic skills might be precursors to their experiences with teachers in early education classrooms.

Children's social-emotional development, such as self-regulation and behavior skills, also contribute to variation in experiences with teachers. Teachers consistently rate their relationships with children who have higher levels of internalizing or externalizing behaviors to have more conflict and less closeness than children without behavior issues (Nurmi, 2012). One study of relationships between preschoolers and their teachers found that more than half of the variance in teacher-child conflict was accounted for by problem behaviors (Hamre et al., 2008). Conversely, children who are more prosocial and demonstrate greater executive function and social skills tend to have more positive interactions with teachers (McKinnon et al., 2018; Pianta et al., 2002). These findings indicate that children's classroom behavior, for better or for worse, may be particularly salient to the experiences they have with teachers.

In sum, a significant body of evidence indicates that children's characteristics including demographics, academic skills, and social-emotional skills may play a role in

shaping their experiences with teachers. As noted, this violates a key component of the differential susceptibility model. However, as demonstrated by Pluess and Belsky (2009a), this limitation can, at least in some cases, be statistically corrected if one wishes to strictly test for differential susceptibility.

More broadly, it seems feasible that both differential susceptibility and differential experiences may simultaneously be occurring. If this is the case, then children may vary in the quality or nature of their experiences with teachers in a way that is associated with, or evoked by, their own characteristics. Then, children may subsequently display differential impact of their individual experiences with teachers, in line with the heightened level of plasticity documented in differential susceptibility. Indeed, this hypothesized series of inflection points of individual experience and response are well-aligned with the Bioecological Theory (Bronfenbrenner & Morris, 2006) which has guided nearly all ECE research despite the field's struggles to document the nuances of the proposed associations. For example, although there are several studies examining the association of child behavior problems and relationships with teachers marked by high levels of conflict and low levels of closeness (e.g., Hamre et al., 2008) and additional studies linking children's behavior problems with the differential impact of teacher-child interactions or relationships (e.g., Hamre & Pianta, 2001; Silver et al., 2005), no studies have previously combined these two conceptual models. This disparity in conceptualization and research practice has likely occurred, at least in part, due to the limitations of classroom-level observations described above. However, the development of measures that allow for child-level teacher-child interaction data to be gathered

provides a new opportunity to more accurately model associations between classroom experiences and children's characteristics and development.

Implications for ECE Research

In considering the areas of research reviewed above, one particularly complicated pattern of findings is that when moderation of impacts is found, effects of ECE quality are usually strongest for the most disadvantaged children (e.g., Choi et al., 2016). At the same time, evidence suggests that the same group of disadvantaged children are less likely to have positive experiences and relationships with teachers. Perhaps the approach of measuring quality at the classroom level and primarily examining main effects has lead to underestimating effects of positive experiences with teachers for some chidlren (i.e., the subgroup of difficult children who have positive experiences with teachers) while overestimating effects for difficult children who don't have positive experiences?

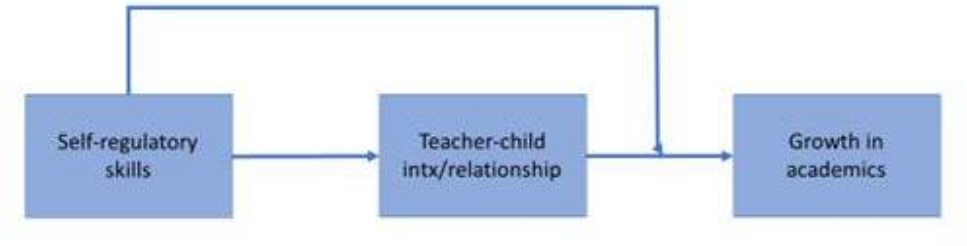
Recently, a few notable calls for a new wave of ECE research have been put forth by leaders in the field (Burchinal, 2018; Phillips et al., 2011; Weiland, 2018). Remarkably, each of these three statements has called for increased attention to variability in children's experiences within ECE classrooms. In her call to "pivot to the how" and focus on mechanisms underlying established preschool impacts, Weiland encourages researchers to develop and utilize more fine-grained conceptualization and measurement of instructional practices as well as the unique experiences of children in groups that evidence greater impacts of ECE, such as dual language learners, low-income children, and children with special needs. Similarly, Burchinal (2018) suggests the need for measures that track individual children's experiences of instruction and other interactions with teachers with much greater precision than currently evidenced in the

literature. Phillips and colleagues (2011) further suggest that nuanced coding to capture features such as teachers' individualized support of children's experiences with peers is needed. These calls, along with the evidence presented above, highlight the need for increasingly sophisticated conceptualization, measurement, and modeling of children's individual experiences with teachers as well as the precursors and impacts of those experiences.

Advances in statistical modeling and measurement approaches have positioned the field to begin to examine more complex models, such as the ideas outlined in this paper. Specifically, tools like the inCLASS (Downer, Booren, Lima, Luckner, & Pianta, 2010) and Child Observation in Preschool (Farran, Meador, Christopher, Nesbitt, & Bilbrey, 2017) provide more nuanced data describing children's experiences in the classroom that can be utilized to explore the dual questions of whether children's characteristics lead them to have different a different type or quality of interactions and relationships with teachers, as well as whether their experiences with teachers have a more pronounced effect on a subgroup of children who are differentially susceptible to influences due to difficult temperament or other risk factor. This question may be best answered utilizing a moderated mediation model (Preacher, Rucker, & Hayes, 2007) in which the independent variable also serves as a moderator of the association between the mediator and outcome variables (see Fig. 1). In the example illustrated in Figure 1, children's level of self-regulatory skills is hypothesized to predict the nature or quality of interactions or relationships with teachers. The interactions and relationships experienced with teachers are then hypothesized to predict children's growth in academics, with this association moderated by children's self-regulatory skills. Consistent with differential

susceptibility theory, I would expect the impacts of teacher-child interactions and relationships on children's growth in academics to be strongest for those at risk due to lagging self-regulatory skills. That is, compared to others, at-risk children may demonstrate greater positive impacts on academics when teacher-child interactions and relationships are low in conflict and high in warmth and rich interactions as well as greater negative impacts when interactions and relationships are of lesser quality.

Fig. 1. Hypothesized model of dual differences.



Addressing the questions and models outlined above will add substantially to the current understanding of *how* and *for whom* experiences with teachers have the most substantial impacts. Insights gained from this work could inform professional development efforts by emphasizing the need to attend to the nature and quality of teacher-child interactions and relationships with the most challenging children. Further research focused on *under what conditions* at-risk children are able to experience positive interactions and relationships with teachers may identify characteristics of teachers and programs that support the provision of positive experiences for all children. Finally, the degree to which children are differentially susceptible may itself be a function of

environmental experiences (Belsky & Pluess, 2009; Boyce & Ellis, 2005), suggesting the potential need to parse these associations even further.

In sum, although much has been learned about the potential positive impacts of high quality teacher-child interactions and relationships, many questions remain regarding the dynamic interplay between individual experiences with teachers and children's development. Programs and policymakers are eargerly awaiting guidance from researchers on how to provide maximum benefits for the most at-risk children. Examination of individual experiences with teachers, with a focus on outlining precursors, correlates, and outcomes of high quality experiences is an essential next step in documenting the role of early education in providing equitable opportunity to all children.

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MANUSCRIPT II

The Haves and Have-nots: Associations Between Preschoolers' Developmental Profiles and Their Individual Experiences with Teachers

This manuscript is prepared for submission to the peer-reviewed journal *Child Development* and is the second of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

Children's interactions and relationships with teachers are predictive of better outcomes academically and socially, with particular benefit for children who have high levels of behavior problems. However, evidence indicates that children with academic struggles or behavior problems may be less likely to experience the positive experiences with teachers that would yield these benefits. This study extends prior research by considering both positive and negative aspects of children's experiences with teachers, as reported by teachers and as observed by a research team member. Using a person-centered analytic approach, this study examined the overall patterns of children's development and whether children's developmental profile is associated with their experiences with teachers. Results indicate that children can be classified into four developmental profiles, and that children who are members of the lowest functioning profile experience less closeness and more conflict with teachers. Implications for further research and practice are discussed.

Keywords: Teacher-child interactions, student-teacher relationship, early childhood education, self-regulation, school readiness.

The Haves and Have-nots: Associations Between Preschoolers' Developmental Profiles and Their Individual Experiences with Teachers

Teacher-child interactions and student-teacher relationships have been identified as key active ingredients underlying the impacts of early care and education on young children (Liew, Chen, & Hughes, 2010; Phillips et al., 2017; Silva et al, 2011; Yoshikawa et al., 2013). Children whose teachers provide warm, sensitive, and rich interactions tend to have greater gains across domains, including social-emotional, self-regulatory, and pre-academic skills (Howes et al., 2008; Mashburn et al., 2008). Similarly, students who experience positive relationships with teachers in preschool tend to have positive relationships with early elementary teachers (Howes, Phillipsen, & Peisner-Feinberg, 2000) and demonstrate benefits to academic and social-emotional growth as well (Hamre & Pianta, 2005).

Importantly, children who enter preschool at greater developmental risk due lagging self-regulatory or language skills may benefit the most from high quality, positive interactions and relationships with teachers (Hamre & Pianta, 2005; Liew et al., 2010), sometimes with effects lasting beyond the preschool year (Graziano, Garb, Ros, Hart, & Garcia, 2016). At the same time, children who enter preschool with greater developmental risk may be less likely to have positive relationships with teachers (Hamre, Pianta, Downer, & Mashburn, 2008; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006). The majority of current research does not allow examination of child-level variation in interactions with teachers to better understand what processes may underlie the tendency to develop relationships marked by conflict and low levels of closeness (Burchinal, 2018), and further clarity of these teacher-child processes is needed to

effectively guide professional development and coaching. To that end, the current paper aims to extend current knowledge regarding children's individual experiences with teachers using a person-centered approach to simultaneously model a variety of child characteristics and examine associations between child profiles and teacher-rated relationship and observed teacher-child interactions.

Children's Individual Experiences with Teachers

Conceptual Framework

Bioecological Theory (Bronfenbrenner & Morris, 2006) highlights the role of the developing person in shaping the proximal processes (i.e., interactions with people or objects in the environment) and outlines a variety of characteristics of the developing person that may play a role in determining the amount and nature of interactions he or she experiences. Characteristics of the person that impact their experiences in interactions range from things that are relatively easy to observe like ethnicity or gender to more nuanced features like aptitude and cognitive abilities or behavioral regulation. Nurmi and Kiuru (2015) have extended this idea and provided a conceptual model that outlines how child characteristics may contribute to the interactions and relationships they experience by evoking emotional and cognitive responses from teachers. Together, these conceptual frameworks point to a variety of child characteristics including demographics, self-regulatory skills, classroom behavior, and academic skills all contributing to children's experiences with teachers.

Children's role in shaping their experiences with teachers

Consistent with Bioecological Theory, a great deal of evidence indicates that teachers engage differently with children, based at least in part on the child's own

characteristics. Teachers' perceptions, attributions, interactions, and perceived relationships have all been demonstrated to differ across children (Carter, Williford, & LoCasale-Crouch, 2014; Erdena & Wolfgang, 2004; Howes et al., 2000; Rudasill & Rimm-Kaufman, 2009). Child characteristics that have been associated with differential experiences with teachers include ethnicity, behavior, social competence, and academic achievement (Jerome et al., 2009; Rudasill & Rimm-Kaufman, 2009). The following sections will summarize the current knowledge base on the role of children's own characteristics in their interactions with teachers, specifically focusing on associations with children's language and pre-academic skills and social-emotional and self-regulatory skills.

Language and academic skills. Children's experiences with teachers may be shaped, in part, by the depth and strength of the language and academic skills. Children who enter the classroom with strong academic skills or those who pick up new material quickly may receive positive feedback from their teachers, encouraging feelings of connection and closeness. Teachers may also find it rewarding to teach children who are quick to learn and seek to interact with them more (Hughes, Luo, Kwok, & Lloyd). Children who linguistically advanced may also initiate interactions with their teachers, resulting in more frequent conversation for varied purposes and a growing sense of closeness over time (Nurmi, 2012).

However, not all children experience closeness with teachers, and lower language or academic skills can be a factor in that disparity (Rudasill et al., 2006). Children may not only struggle to have the language skills to engage in the conversations and interactions to build a positive relationship, the lack of language competence may lead to

inappropriate expression of frustration and diminished social competence with teachers and peers (McCabe & Meller, 2004) which could lead to negative interactions and conflict with teachers (Rudasill et al., 2006). On the other hand, some teachers may also be more motivated to provide additional support to children who enter the program with lagging language or academic skills (Pakarinen, Lerkkanen, Poikkeus, Siekkinen, & Nurmi, 2011). These findings suggest that children's academic and language skills may contribute to the nature of their experiences with teachers, but additional research is needed to better understand these associations.

Self-regulation and behavior skills. Children's experiences with teachers are also shaped by their self-regulation and behavior skills. When children are well-regulated and able to meet classroom behavior expectations, teachers are more likely to engage in positive interactions with them and to develop relationships that are close and relatively free of conflict (McKinnon, Blair, & the Family Life Investigators, 2018; Pianta, La Paro, Payne, Cox, & Bradley, 2002; Rudasill & Rimm-Kaufman, 2009). However, children who have lower levels of self-regulation tend to experience more negative and conflictual interactions and relationships with teachers (Howes et al., 2000). Teachers have less positive interactions and relationships with children who demonstrate high levels of internalizing or externalizing behaviors (Nurmi, 2012), but the differences may be especially pronounced for children with extensive externalizing behavior. Teachers' interactions with externalizing children tend to focus more on discipline and commands and less on conversational interactions (Dobbs & Arnold, 2009). Because externalizing behavior is aversive to teachers, many of these disciplinary interactions are likely to be negatively valenced and to be marked by anger and a lack of warmth (Birch & Ladd,

1998), potentially leading dysregulated children to persistently negative experiences with teachers.

In sum, the evidence available to date—in line with tenets of Bioecological Theory—suggests that children's characteristics, including their language, academic, self-regulation, and behavior skills, may be linked to their experiences with teachers. However, these findings are somewhat mixed and, in some areas, dated to prior eras of ECE. Other studies point to a more complex pattern of findings in which effects of one child characteristic on experiences with teachers are modified by another characteristic (Booren et al., 2012; Rudasill et al., 2006), indicating that additional research is needed to more fully describe the associations between children's characteristics and their experiences with teachers, as well as to what extent individual experiences with teachers may shape children's developmental trajectories. These questions are timely with the increasing emphasis on academics at early ages even among programs like Head Start that focus on the development of the whole child. Discerning how children's self-regulation (or lack thereof) bolsters (or hinders) their ability to engage in and benefit from classroom activities is key, particularly if their experiences with teachers vary in a way that fails to support their lagging skills. Similarly, identifying the extent to which children's language and academic skills are facilitating or limiting interactions with teachers will provide valuable insight for the field to ensure that children at all levels of skill sets are adequately supported.

Person-Centered Models of Children's Development

To date, nearly all the work examining associations between children's characteristics and their experiences with teachers have been conducted using a variable-

centered approach in which effects of individual variables are estimated separately, sometimes with a moderator effect included. Person-centered analytic approaches provide an alternative method to examine the co-occurrence of multiple characteristics and to detect underlying subgroups (i.e., profiles) of children who demonstrate similar combinations of characteristics (Lanza & Rhoades, 2013). In person-centered approaches, the statistical software models the data on specified variables to detect underlying patterns of covariance and identifies profiles into which the study sample can be grouped. The software assigns children to the best-fitting profile, and once model fit indices and conceptual rationale have reached satisfactory levels, these profile assignments are saved for use in additional analysis.

Researchers have used person-centered techniques to model children's development in various combinations of domains such as inattentiveness and language (Tambryaja, Rhoad-Drogalis, Khan, Justice, & Sawyer, 2019); executive function, math, and science (Sandilos, Whittaker, Vitiello, & Kinzie, 2019); and language, executive function, and peer-rated behavior (Abenavoli, Greenberg, & Bierman, 2017). Person-centered analysis of children's developmental skills sometimes results in profiles that represent groups that vary in the level of overall performance, with groups ranging from low performing to high performing and children's performance in all included domains being relatively equivalent (e.g., low attentive and low language to high attentive and high language; Tambryaja et al., 2019). Other studies reveal profiles that represent clusters of children with mixed performance of average or strong performance in one area and weaker performance in another (e.g., low academics and executive function and moderate behavior/learning approaches; Sandilos et al., 2019). Both types of results

garnered from person-centered analysis provides additional insight into the constellations of skills that a child simultaneously possesses and allows researchers to explore the precursors and outcomes associated with membership in a given profile.

Only two studies were found that have utilized person-centered approaches to document young children's characteristics and associated experiences with teachers. In one study, kindergarteners' motivation for science was examined using profile analysis (Patrick, Mantzicopoulos, Samarapungavan, & French, 2008). This study identified profiles of children that varied on perceived competence in, liking, and ease of learning science and found that children with low levels of competence in and high liking of science experienced less teacher support for learning compared to children who demonstrated higher science competence and liking. These findings demonstrate that a child's interest in classroom activities may not be sufficient to generate support for learning for children who are less competent academically, which is an important nuance that variable-centered methods would not likely reveal.

In a second example, Sandilos and colleagues (2019) examined school readiness profiles of preschoolers at the beginning of the year and to what extent the teacher-child relationship would predict children transitioning from one profile to another over the course of the school year. This study found that children who transitioned to higher functioning profiles (e.g., stronger academic skills) from the beginning to the end of the school year tended to have relationships with teachers with higher levels of closeness. Although the authors did not examine whether children's profile membership predicted the nature of the relationship with their teacher, this study demonstrates that children's development can be impacted differently by student-teacher relationship depending on

the child's developmental profile or level at the beginning of the academic year. Findings from this study also point out how developmental strengths in some areas combined with lesser strengths in other areas can be impacted by conflict or closeness with teachers, again providing more nuanced information than available from variable-centered approaches. However, Sandilos and her colleagues did not address whether children differed in their likelihood of experiencing conflict or closeness based on their developmental profile, leaving the important question of whether all children are equally positioned to experience the developmental benefits of positive experiences with teachers.

The Current Study

Accordingly, the current study employs a person-centered approach to extend the existing literature documenting connections between children's characteristics and the nature of their experiences with teachers. This study utilizes Latent Profile Analysis to simultaneously consider aspects of children's self-regulation and academic skills. To this end, this study addresses two aims.

Research Aims

1. Identify and describe developmental profiles of Head Start children, including their self-regulation, classroom behavior, and academic skills, in the fall of their 3- or 4-year-old year of preschool.
2. Examine the extent to which profile membership is predictive of children's interactions and relationships with teachers, controlling for child and classroom characteristics.

METHOD

Procedures

Data used in this study were collected as part of a larger ongoing study in partnership with a local Head Start program. Data were gathered using multiple strategies, including direct child assessment, classroom observation, and teacher questionnaires. Program administrative records were accessed to capture children's demographic information. Child assessments and teacher ratings of children's classroom functioning were collected in the fall of the academic year (September – early November 2015) and again in the spring (late March – May 2016). Children were assessed using standard protocols in a quiet space where they worked individually with a trained research team member. Classroom observations were conducted on one morning during the winter (January – early March 2016). The training and reliability protocol for data collectors is described below with the relevant measures.

Participants

Participants were 3- and 4-year-old children (n = 252) enrolled in 61 Head Start classrooms in a medium-sized city in the central region of the United States. All children met criteria for participation in Head Start, so the vast majority were from low-income families. The sample included approximately equal proportions of boys (54%) and girls, and was ethnically diverse (39% Hispanic, 25% African America, 17% White, 19% multiple or other races). The mean age of participants at the beginning of the school year was 44.4 months.

Children were selected to participate using a tiered sampling approach in which classrooms were first chosen randomly from the available Head Start classrooms and then

six children per classroom were selected, stratified by gender and home language to match classroom enrollment. Once a child was identified for the study, research assistants approached the parent at school drop-off or pickup to describe the study, answer any questions, and secure informed consent for their child's participation. Children's assent to participate was monitored by research assistants at each assessment visit, and children were allowed to refuse to participate and were returned to their classrooms if they became upset or chose to not continue the assessments.

Measures

Children's experiences with teachers. Children's experiences with teachers were measured in three ways, two of which were at the child level and one at the classroom level. Near the end of the school year, teachers rated their relationship with each study child using the Student Teacher Relationship Scale, short form (STRS; Pianta, 2001) which is a 15-item scale using a 5-point Likert response option ranging from *Definitely does not apply* to *Definitely applies*. The STRS yields two scores indicating the closeness (8 items, alpha = .841) and conflict (7 items, alpha = .922) between each child and teacher dyad. The STRS has been widely used and has demonstrated strong psychometric properties and predicts children's classroom behavior and academic outcomes (Pianta & Steinberg, 1992; Pianta, Steinberg, & Rollins, 1995).

Children's individual interactions with teachers were measured using the Individual Classroom Assessment Scoring System (inCLASS; Downer, et al., 2010) during the winter (January through early March). Prior to observations, research assistants attended two days of training provided by the inCLASS team and achieved 80 percent reliability using videos assigned by the trainer. Observers then visited each

participating classroom for one morning and stayed for approximately 4 hours of observation. During the classroom visit, the observer watched each study child in the classroom for 10-minute cycles, followed by 5 minutes of scoring. The observer continued observing until naptime and was instructed to obtain as many cycles per study child as possible (mean cycles = 3.67). The inCLASS results in scores for nine dimensions, and the three dimensions related to children's experiences with teachers were examined in this study: Positive Engagement, Communication, and Conflict. Scores ranging from 1 (low) to 7 (high) are assigned for each cycle, and scores were averaged across cycles to yield an estimate of each child's experiences with teachers. Prior evidence has documented the validity and reliability of the inCLASS for measuring preschoolers' classroom experiences, including construct validity and criterion-related validity (Downer, et al., 2010; Williford, Whittaker, Vitiello, & Downer, 2013). The inCLASS has demonstrated factorial validity for demographic characteristics, including scalar invariance for ethnicity and poverty status and configural invariance for gender (Bohlmann et al., 2019). The inCLASS has also demonstrated good predictive validity of relevant outcomes such as school readiness, literacy, and self-regulation (Sabol, Bohlmann, & Downer, 2018; Williford et al., 2013).

Global teacher-child interactions in each classroom were also observed in this study using the Classroom Assessment Scoring System (CLASS Pre-K; Pianta et al., 2008). Prior to observations, research staff attended a two-day training and completed video reliability trials as required by the authors of the measure. Coders were required to reach 80% reliability with master codes. On the same day as the inCLASS observation, a second observer visited the classroom and completed four 20-minute cycles of CLASS

scoring. The CLASS Pre-K provides scores on 10 dimensions that are aggregated across cycles and then collapsed into three domains based on the authors' guidance. The CLASS Pre-K has been widely used in studies of early education and has demonstrated good reliability and predictive validity (see Burchinal, 2018 for a review). For the current study, due to high intercorrelations among the domains (*r*s = 0.56 – 0.82), a composite measure of global classroom quality was computed by taking the mean of the three domains.

Child Assessments

Task-based self-regulation. Children's task-based self-regulation was measured using three direct assessments: the pencil tap, digit span, and Head Toes Knees Shoulders. The pencil tap (Diamond & Taylor, 1996) is a measure of inhibitory control in which children are asked to tap their pencil twice when the assessor taps once and vice versa. Following 3 practice trials, 16 trials are administered in a standardized order, and children receive 1 point per correct trial, so scores range from 0 to 16. A score of negative 1 (-1) was assigned for children who did not pass the trial items. For the current sample, reliability (Cronbach's alpha) was .86 in the fall and .88 in the spring. The pencil tap has been used widely with this age group of children and has been demonstrated to be a reliable and valid measure in this context and for children attending Head Start (Fuhs, Farran, & Nesbitt, 2015; Raver et al, 2012).

In the Digit Span task, children were asked to remember and repeat back strings of numbers to the assessor, with the strings becoming increasingly longer across trials. Following two practice items, trials were administered beginning with two-digit strings and increasing by one digit on every other trial until children answered two trials of the

same length incorrectly. Children were assigned 1 point for each correct trial, resulting in scores ranging from 0 to 11 in the current sample. The Digit Span has been utilized in several studies of Head Start children and other preschoolers and has been deemed a valid and reliable measure of working memory (Williford et al., 2013).

In the Head Toes Knees Shoulders task (HTKS), children's behavioral control is assessed in a way that taps the integration of working memory, cognitive flexibility, and inhibitory control (McClelland et al., 2014). This task is administered in three phases, the first involving natural response to a direction (e.g., "touch your toes"). In the second phase, children are asked to respond opposite to the instruction (e.g., when the assessor says, "touch your head," the child is instead supposed to touch his/her toes). The third phase includes additional commands and a rule change that increases the complexity of the task. In total, the task includes 30 trials, and children are awarded 2 points for each correct trial, with 1 point awarded if the child initially moved toward the incorrect body part but then self-corrected to the correct response, and 0 points awarded for an incorrect response. Possible scores ranged from 0 to 60. Prior research has documented the validity of the HTKS in assessing preschoolers' executive function in diverse samples (McClelland et al., 2014).

Teacher ratings of classroom behavior. Teachers rated children's classroom behavior and functioning using the *Devereux Early Childhood Assessment, Preschool 2nd Edition* (DECA; LeBuffe & Naglieri, 1999). Teachers were asked to rate items regarding the frequency of each child's behavior in the prior 4 weeks, using a scale ranging from 1 (never) to 5 (very frequently). Teachers' ratings yielded standard scores on two domains as identified by the developers of the DECA: Total Protective Factors (27 items) and

Behavior Concerns (10 items). Standard scores on the DECA have a mean of 50 and standard deviation of 10, with higher scores representing more total protective factors and more behavior concerns. The DECA has been used in other research as an indicator of social-emotional development and classroom behavioral functioning and has adequate reliability with test-retest coefficient of .55 and .74 and internal reliability coefficients of .71 and .94 for Behavior Concerns and Total Protective Factors respectively (Lien & Carlson, 2009).

Academic skills assessments. Children completed three assessments to examine their cognitive and academic functioning: Woodcock Johnson III (Letter Word Identification and Applied Problems Subscales; Woodcock, McGrew, & Mather, 2001), Expressive One-Word Picture Vocabulary Test (Martin & Brownell, 2011), and the Bracken School Readiness Assessment (Bracken, 2007). In the Woodcock-Johnson Letter Word Identification test, children were asked to name letters and read words based on prompts on the test flipbook. The Applied Problems subtest assesses children's early math skills, including counting, geometry, and problem solving. Children answer questions as prompted by the assessor, using visual supports presented to the child on the testing flipbook. In both subtests, children proceeded through the items until they reached the ceiling as outlined by the testing manual. Standardized scores were used in this study, and have a mean of 100 and standard deviation of 15. The Woodcock-Johnson has been used extensively to assess children's early academic functioning in Head Start and other preschool research. Woodcock-Johnson has strong demonstrated strong split-half reliability at ages 3 and 4 (*r*s = .97-.98 for Letter-Word and.92-.94 for Applied Problems)

and one-year test-retest reliability (r = .92 for Letter-Word and Applied Problem subscales).

The Expressive One-Word Picture Vocabulary Test (EOWPVT) is a measure of children's expressive vocabulary that has been validated for children starting at age 2. In this assessment, the assessor presents the child with a picture on the testing book and asks the child "what's this?" Children respond verbally and proceed through the items until a pattern of incorrect responses identify their ceiling as specified in the testing manual. For children who speak Spanish at home, we utilized the bilingual version of the EOWPVT, which allows for conceptual scoring in which children receive credit for answers in either Spanish or English. Standard scores were used in this study, with a mean of 100 and standard deviation of 15. The EOWPVT has demonstrated high internal consistency (alpha = .95) and test-retest stability (r = .97). It has also demonstrated strong criterion and content validity (Martin & Brownell, 2011).

The Bracken School Readiness Assessment is a multidimensional screener of children's school readiness. Utilizing a flipbook with graphics and other visual supports for children's engagement, assessors ask children questions in a series of subtests: color recognition, letters, numbers/counting, size/comparison, and shapes. These subtest scores were combined according to the testing manual and resulted in a single composite score of school readiness, with a population mean of 100 and standard deviation of 15. The Bracken has demonstrated adequate test-retest stability (r = .76 to .92) and split-half reliability (r = .95; Bracken, 2007).

Analytic Approach

The current study is designed to examine the question of how children's developmental characteristics at classroom entry relate to the nature of experiences they have with teachers as the year progresses. A person-centered analytic approach was employed to explore this question using a two-step process. To address the first aim of the study, latent profile analysis (LPA) was used to group children into most likely profiles based on fall scores on direct assessments of self-regulation and academics and teacher ratings of classroom behavior. Second, children's profile assignments were then entered into a multilevel regression model to predict aspects of the relationship and interactions with their teacher.

To classify children into developmental profiles at classroom entry, indicators of children's skills in fall 2015 were entered into a Latent Profile Analysis (LPA) using M*Plus*. Child-level variables include measures of task-oriented self-regulation (Pencil Tap, Digit Span, and Head Toes Knees Shoulders), classroom behavior (teacher-rated Total Protective Factors and Behavior Concerns), and academic skills (Woodcock Johnson Letter Word Identification and Applied Problems, Expressive One-Word Picture Vocabulary Test, and Bracken School Readiness Assessment). All child assessments were standardized using a *z*-score prior to running the LPA to aid interpretation. To determine the appropriate number of profiles, a series of models ranging from one to six profiles were estimated. The decision about the appropriate number of profiles to retain was guided by fit statistics from these six models (Nylund, Asparouhov, & Muthen, 2008), along with considerations about the theoretical and conceptual interpretability of the profiles. Smaller values of the Akaike Information Criteria (AIC), Bayesian,

Information Criteria (BIC), adjusted BIC (SABIC) indicate better model fit, and entropy values approaching 1 also indicate better fit (Byrne, 2001). Once the best fitting model and optimal number of profiles has been identified, group assignment for each child was saved to the data file.

Next, a set of multilevel regression models were conducted to predict components of children's experiences with teachers from profile membership, controlling for a set of child and classroom characteristics. These models were specified separately for five dependent variables: Student-Teacher Relationship Closeness, Student-Teacher Relationship Conflict, inCLASS Positive Engagement, inCLASS Communication, and inCLASS Conflict. Each of these models were ran using the Type = Complex specification in M*Plus* to account for the interdependence of data from children nested within classrooms. Child-level covariates included gender and race, and classroom-level covariates included a dummy code for whether the classroom enrolled children who are 3 or 4 years old and the aggregate CLASS score to control for overall classroom quality.

For all analyses, missing data were addressed using Full Information Maximum Likelihood (FIML). FIML is a preferred approach for analyses involving latent modeling because it provides parameter estimates that are less biased. FIML also generates more accurate fit indices than other approaches to missing data (Enders & Bandalos, 2001).

Results

Descriptive Statistics

Descriptive statistics and correlations for children's scores on direct and teacher-reported variables are reported in Table 1. Means and standard deviations are presented in

Table 1

Correlations Between Child Assessments and Ratings

Variables	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Pencil Tap	4.57	5.81	-								
2. Digit Span	3.71	2.32	.33**	-							
3. HTKS	4.18	8.21	.43**	.35**	-						
4. DECA TPF	50.86	9.93	.33**	.38**	.24**	-					
5. DECA Beh Concerns	49.58	9.27	-.33**	-.22**	-.14*	-.71**	-				
6. WJ Letter Word ID	95	12.34	.31**	.28**	.20**	.41**	-.37**	-			
7. WJ Applied Problems	96.73	13.39	39**	.38**	.29**	.43**	-.29**	.53**	-		
8. EOWPVT	97.68	15.67	.30**	.24**	.17**	.30**	-.18**	.36**	.57**	-	
9. Bracken	91.51	13.68	.32**	-.21**	-.08	-.21**	.17**	-.25**	-.27**	-.27**	-

Notes: HTKS = Head Toes Knees Shoulders. DECA = Devereux Early Childhood Assessment. TPF = Total Protective Factors. Beh Concerns = Behavior Concerns. WJ = Woodcock-Johnson. EOWPVT = Expressive One-Word Picture Vocabulary Test.

raw format to aid interpretation but were standardized prior to analysis. The three direct assessments of self-regulatory skills were moderately correlated with one another and more weakly correlated with teacher ratings of children's behavior and direct assessments of academic skills. The two domains of the DECA (teacher-rated classroom behaviors) were strongly correlated with one another and weakly to moderately correlated with direct assessments of academic skills. The assessments of academic skills were moderately correlated with one another in the expected direction.

Developmental Profiles

A series of latent profile models were conducted, specified to generate from one to six profiles. Fit indices for the six models are reported in Table 2.

The four-class solution was selected as the best-fitting because although it had a slightly lower entropy value than the three-class solution, the AIC, BIC, and SSABIC had lower values for the four-class model and then leveled out with the addition of subsequent profiles. Additionally, the four-class solution was deemed to have a more meaningful interpretation while retaining adequate sample size in each group (Nylund et al., 2007).

Table 2

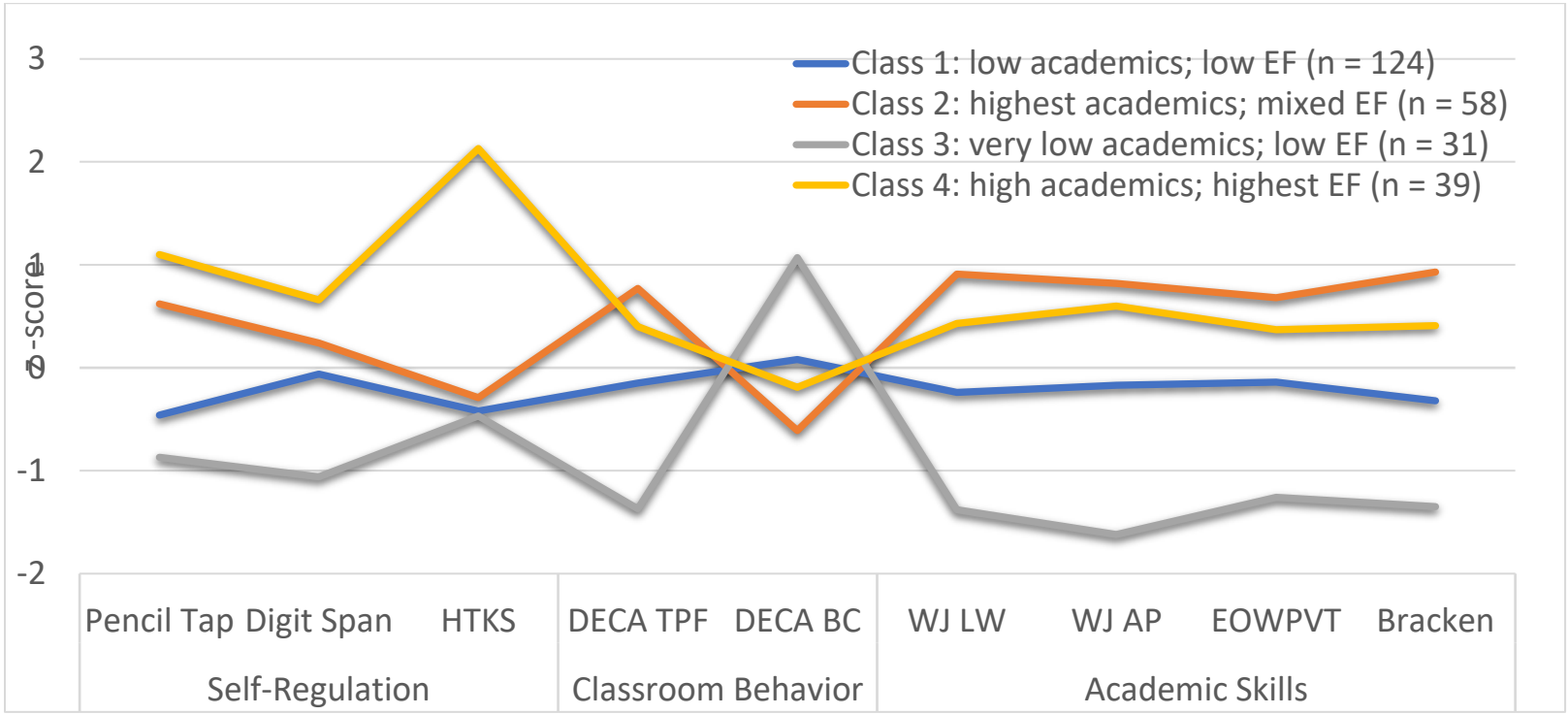
Model Fit for Child Assessments and Ratings

# of Profiles	AIC	BIC	SSABIC	Entropy
1	21124	21203	21133	-
2	20660	20782	20674	0.95
3	20359	20523	20378	0.94
4	20165	20373	20189	0.90
5	20041	20292	20070	0.90
6	19921	20214	19954	0.92

The resulting four-class solution is visually depicted in Fig. 1. Recall that for all measures other than DECA Behavior Concerns, higher scores indicate greater strength in

Fig. 1

Four Profile Solution



Notes. HTKS = Head Toes Knees Shoulders. DECA = Devereux Early Childhood Assessment. TPF = Total Protective Factors. BC = Behavior Concerns. WJ = Woodcock-Johnson. LW = Letter Word Identification. AP = Applied Problems. EOWPVT = Expressive One-Word Picture Vocabulary Test.

the measured skill. Class 1 is the largest class (n = 124) and is comprised of children who scored below the mean on all self-regulation and academic measures and were rated with slightly lower levels of protective factors and slightly elevated levels of behavior concerns; it is labeled “low academics, low EF”. Class 2 represents the second largest group of children (n = 58) and is marked by the highest levels of performance on the academic measures and mixed performance on self-regulation but rated most positively by teachers. It is labeled “highest academics; mixed EF.” Class 3 represents a group of children (n = 31) who have the lowest scores on both self-regulation measures and academic skills and were rated most negatively by teachers. It is labeled “very low academics; low EF.” Finally, Class 4 represents a group of children (n = 39) who scored most highly on self-regulation measures and above average on academics and were rated relatively positively by teachers. It is labeled “high academics; highest EF.”

Predicting Children’s Experiences with Teachers from Profile Membership

After identifying the four-class solution and each child’s most likely profile membership, a series of regression models (Table 3) were conducted to examine whether profile membership predicted features of the relationships and interactions children experienced with teachers. Due to multicollinearity, models were estimated separately for each dependent variable. Additionally, all models controlled for child gender and race/ethnicity, as well as for classroom age group and global quality. The Type = Complex command was used to adjust standard errors to account for nested data.

For student teacher relationships, Class 3 (very low academics/low EF) was found to have relationships with significantly less closeness and more conflict as compared to Class 4 (high academics/high EF). Class 1 (low academics/low EF) was rated as having

Table 3

Regression Models Predicting Children's Individual Experiences with Teachers

	STRS Closeness		**STRS Conflict**		**IC Positive Engagement**		**IC Communication**		**IC Conflict**	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Class 1	-0.18†	0.10	0.15	0.13	0.10	0.19	-0.30	0.20	**0.18***	0.09
Class 2	0.10	0.07	-0.15	0.13	0.32†	0.19	0.06	0.22	0.09	0.07
Class 3	**-0.51*****	0.12	**0.71*****	0.20	0.12	0.26	-0.39	0.27	**0.46****	0.13
Boys	**-0.21*****	0.05	**0.25****	0.09	-0.12	0.17	0.01	0.13	0.12	0.06
AA	0.05	0.08	0.16	0.18	0.23	0.24	0.06	0.23	0.00	0.11
Hisp	0.00	0.07	-0.18	0.14	-0.03	0.23	-0.10	0.19	-0.14†	0.07
Other	-0.17†	0.09	0.06	0.17	0.00	0.26	0.01	0.26	0.00	0.11
Pre-K	-0.01	0.11	0.11	0.12	-0.08	0.19	0.02	0.15	**0.17***	0.08
CLASS PK overall	**-0.16***	0.08	0.12†	0.07	0.12	0.15	0.09	0.12	0.04	0.05

Notes: All models control for nesting within classroom. Class 4, Females, White, and 3 year-old classrooms are reference groups.

marginally less close relationships with teachers than Class 4 ($p < .10$). Boys were also rated as having relationships with teachers marked by lower levels of closeness and higher levels of conflict than were girls. Contrary to expectation, overall classroom quality was negatively associated with teacher-rated closeness and marginally associated with higher levels of conflict.

Two of the three dimensions of the inCLASS observed teacher-child interactions yielded no significant predictors. At the trend level ($p < .10$), children in Class 2 (highest academics/mixed EF) were found to have observed interactions with teachers with marginally higher levels of positive engagement, compared to Class 4 (high academics/high EF). No other trend associations were found for observed positive engagement or communication with teachers.

Observed conflict with teachers was found to occur at higher levels for children in Class 1 (low academics/low EF) and Class 3 (very low academics/low EF) compared to Class 4 (high academics/high EF). Children who were enrolled in 4-year-old classroom were also more likely to have higher levels of observed conflict with teachers. Hispanic children had marginally lower levels of observed conflict with teachers.

Discussion

The goal of this study was to use person-centered analyses to examine whether profiles of children's development at the beginning of the academic year was associated with differential experiences with teachers in preschool. Specifically, children's developmental indicators from important developmental domains including executive function, classroom behavior, language, and early academic skills were used to group children into profiles by overall development. These profile assignments were then linked

to children's individual experiences with teachers, including observed positive engagement, communication, and conflict with teachers as well as teacher-reported levels of closeness and conflict in their relationship with each child. Consistent with theory and prior research, this study found that children's developmental profiles predicted differences in the level of observed conflict with teachers as well as closeness and conflict in their student-teacher relationship as reported by the teacher.

Profiles of Children's Development

The study implemented a person-centered approach to enable simultaneous consideration of multiple aspects of children's development. The Latent Profile Analysis technique utilized allows for a data-driven approach coupled with theory and conceptualization to identify groups of similar children within the overall sample. In the current sample, numerous measures of child functioning were entered into the Latent Profile Analysis, and a four-group solution was identified as the best fit. This solution included two classes who were relatively high functioning across all areas, with higher performance on the direct assessments of executive function distinguishing class 4 (high academics/high EF) from class 2 (highest academics/mixed EF). Another class, labeled class 1 (low academics/low EF) demonstrated moderately low levels of performance across all domains, with group means on all measures near the sample average. The final group, labeled class 3 (very low academics/low EF) had low scores in all areas (except teacher-rated DECA behavior problems where higher scores indicate more problems).

Child Profiles and Experiences with Teachers

Children's profile membership was found to predict their experiences with teachers for 3 of the 5 aspects examined. Teachers reported different levels of closeness

with children across developmental profiles and indicated that relationships with children in the very low academics / low EF class (class 3) were significantly lower than the relationships with children in class 4 (high academics / highest EF). Children in class 1 (low academics / low EF) were rated with marginally lower levels of closeness with teachers as well. These findings indicate that children who exhibit lower competence across EF, classroom behavior, and academics tend to have relationships with teachers that are less close. This is consistent with previous research documenting less positive relationships with teachers for children who have lower levels of language skills (Rudasill et al., 2006). A meta-analysis including studies on elementary school children also found that teachers reported more closeness with children who had stronger academic skills and classroom engagement and less closeness with children who exhibited high levels of externalizing behavior problems (Nurmi, 2012).

Similarly, children's profile membership was also linked to the level of conflict in the relationship as reported by the teacher. Children who exhibited very low academic skills, poor classroom behavior, and low levels of executive function (class 3) were rated by teachers as having significantly more conflict in their student-teacher relationship. Although little evidence exists regarding the influence of children's academic skills on the level of conflict they experience with teachers (Stipek & Miles, 2008), several studies have documented increased levels of conflict when children demonstrate higher levels of problem behaviors in the classroom (Hamre et al., 2008; Nurmi, 2012). This is particularly important because student-teacher conflict has been demonstrated to have lasting negative impacts on children's school adjustment (Silver, Measelle, Armstrong, & Essex, 2005).

The two positive components of observed child experiences with teachers, positive engagement and communication, were not found to vary across the identified groups of children. This finding is unexpected given prior research documenting more positive teacher-child interactions and relationships when children are socially competent and demonstrate higher levels of executive function (McKinnon et al., 2018; Pianta et al., 2002). However, one previous study indicated that teachers may tend to provide greater support in the classroom to children who are academically at risk (Pakarinen et al., 2011) which could explain the lack of differences by class. This may be particularly true in a setting like Head Start where the program is explicitly targeted at improving the development of at-risk children. The inCLASS specifically considers Positive Engagement with teachers to include close proximity of teacher and child and shared positive affect and communication with teachers to include sustained interactions with varied purpose. It may be that some children seek these types of interactions out themselves and teachers may intentionally engage in such interactions with children who are reticent or not well-regulated. Prior research using the inCLASS has demonstrated positive impacts of positive engagement and communication with teachers on a variety of child outcomes including academics (Sabol et al., 2018; Williford et al., 2013) and self-regulation (Williford et al., 2013), indicating that relatively equitable experiences of these positive interactions with teachers across children's classes by developmental levels is likely a desirable result.

In contrast, the observed level of conflict between children and teachers was found to differ by class membership. Children in class 1 (low academics / low EF) and class 3 (very low academics / low EF) were observed to have significantly higher levels

of conflict with teachers during typical classroom activities. Children who have low levels of EF and lower academic skills may struggle to keep up with instruction and to engage in a positive way with classroom activities. Children who have low levels of language along with low levels of EF may struggle to voice their concerns or express their emotions appropriately, resulting in negative affect and behavior problems in the classroom. Indeed, a meta-analysis found that children who performed well academically and demonstrated positive engagement in the classroom had low levels of conflict with teachers, whereas children with high levels of behavior problems had high levels of conflict (Nurmi, 2012).

Implications and Future Directions

This study provides initial evidence that children's overall developmental characteristics can play a role in their individual experiences with teachers as early as preschool. Contrary to expectation, no differences were found in children's experiences in positive engagement and communication with teachers. Further study is needed to determine the implications of these experiences with teachers and whether there might be some level of positive engagement and communication needed to positively impact children's development, but equitable experiences of positive engagement and communication across children is likely a positive finding.

Although not surprising, it is particularly concerning that children who are lagging behind in EF, classroom behavior, and academic skills at ages 3 or 4 are already experiencing higher levels of conflict with teachers. This is important because children who have high levels of behavior problems at early ages can be redirected to a more positive developmental trajectory and better school outcomes if they experience a

positive relationship with a teacher (Graziano et al., 2016; Hamre & Pianta, 2001). However, children's early experiences with teachers tend to predict later experiences with teachers (Howes et al., 2010), and children with behavior problems who have high levels of conflict with teachers may demonstrate increased behavioral risk as a result (Silver et al., 2005).

It may be that children's behavior problems are the most salient predictor of children's experiences with teachers. Some evidence seems to indicate that impacts of academic skills and other characteristics are diminished when children's levels of problem behaviors are entered into the model as well (Eisenhower, Baker, & Blacher, 2007; Hamre et al., 2008). Additional research is needed to examine the relative contribution of children's characteristics on their experiences with teachers. Such studies could identify which child characteristics are particularly challenging for teachers and allow for the more targeted professional development and coaching.

Limitations

The current study has several limitations that should be considered in interpretation and application of the results. First, although this study included a small gap in time between collection of child characteristics included in the profiles that served as predictor variables and the measurement of children's experiences with teachers, no claims for causality or direction of effects can be determined. Children's skills across developmental domains are likely related bidirectionally with their experiences with teachers. Second, early work with the inCLASS has demonstrated a great deal of variability from one observation cycle to the next (Vitiello, Booren, Downer, &

Williford, 2012), indicating that the low number of cycles per child used in this study may yield relatively unstable indicators of children's typical experiences with teachers.

Despite these limitations, this study has strengths supporting its findings as well. This study utilized several indicators of all key constructs, including executive function, classroom behavior, academic skills, and experiences with teachers. Many of these constructs are frequently represented with only a single indicator, and this rigorous, comprehensive measurement approach is a strength of this study. The person-centered analytic strategy used in this study also provides a different lens for understanding contributions of children's characteristics to their experiences with teachers that may be more representative of patterns of children and classroom experiences than obtained by variable-centered approaches.

Conclusion

Overall, this paper provides an important contribution to the field's understanding of links between children's characteristics and their individual experiences with teachers. This work extends prior research on student-teacher relationships by considering the joint contribution of various aspects of children's developmental capabilities and provides insight on how children's characteristics may shape the day-to-day interactions they experience with teachers. Additional research is needed to better understand variability in children's experiences with teachers and to examine implications and outcomes that are associated with the individual child experiences identified in this paper.

Although further work is needed to verify the findings and better describe associations between child characteristics and experiences with teachers, this study does offer some implications for policy and practice. The results suggest that it may not be

sufficient to improve global quality of ECE programs. Instead, programs and teachers may need additional support to examine and understand experiences of individual children in their programs and to employ strategies to ensure all children have positive experiences with teachers.

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MANUSCRIPT III

Preschoolers' Self-Regulation and Academic Achievement:

The Role of Individual Experiences with Teachers

This manuscript is prepared for submission to the peer-reviewed *Journal of Applied Developmental Psychology* and is the third of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

Preschoolers' self-regulation has been identified as a key facet of school readiness and a consistent predictor of academic growth across the preschool year and beyond. However, little is known about the mechanisms underlying this association and whether the mechanisms might provide points for intervention to bolster the academic growth of children who enter with low levels of self-regulation. This study considers whether children's interactions and relationships with teachers may be one such mechanism mediating the association between self-regulation and academic gains. Results indicated that children's observed self-regulation predicted higher levels of observed communication and teacher-rated closeness and lower levels of observed and teacher-rated conflict. Children's communication with teachers and teacher-reported closeness were positively associated with residualized academic gains from fall to spring. However, teacher-reported and observed conflict were not associated with academic growth. None of the indirect effects reached traditional levels of significance.

Keywords: School readiness, self-regulation, early childhood education, student-teacher relationship, teacher-child interactions.

Preschoolers' Self-Regulation and Academic Achievement:

The Role of Individual Experiences with Teachers

Children's self-regulatory skills—defined broadly as the ability to control one's attention, emotions, and behavior—are a key component of development that impact both daily experiences at school as well as academic development in preschool and beyond (Blair & Raver, 2015; Moffitt et al., 2011). Children's ability to regulate their attention, inhibit a pre-potent response, and store and recall new information is predictive of academic skills, even after controlling for general intelligence and cognitive processing speed (Fitzpatrick, McKinnon, Blair, & Willoughby, 2014). Similarly, children who demonstrate greater behavioral and emotional control tend to perform better academically in preschool and the transition to elementary school (Graziano, Reavis, Keane, & Calkins, 2007). Importantly, self-regulatory skills tend to be diminished in children in poverty, such as those served by Head Start, and self-regulation has been identified as one mechanism through which poverty impacts academic performance (Fitzpatrick et al., 2014).

Despite evidence that self-regulation in preschool is predictive of academic performance, as well as evidence that boosting children's self-regulatory capabilities through intervention can have added effects on academics (Bierman, Nix, Greenberg, Blair, & Domotrovich, 2008), the mechanisms by which self-regulation skills impact academic development are not well understood. One potential explanation is that children with greater self-regulatory skills are more able to benefit from classroom activities and instruction due to their ability to regulate their attention, emotions, and behavior. Because evidence indicates that teacher-child interactions are a key active ingredient driving

impacts of early education programs (Burchinal et al., 2016; Howes, et al., 2008; Keys et al., 2013; Mashburn, et al., 2008), if variation in children's self-regulatory skills resulted in differences in the interactions they have with teachers, these differences could partially explain the link between self-regulation and academic performance. Accordingly, the current study examines whether and to what extent preschoolers' individual experiences with teachers (i.e., interactions and relationships) mediate the association between self-regulatory skills and academic performance.

Theoretical Framework

This study draws on the Bioecological Model (Bronfenbrenner & Morris, 2006) and focuses on teacher-child interactions as the proximal process of interest. Consistent with the conceptualization of proximal processes, teacher-child interactions are strongly supported as a key contributor to children's development within early education contexts (Burchinal et al., 2016; Keys et al., 2013). The Bioecological Model suggests that various characteristics of the developing person contribute to the nature, frequency, and duration of proximal processes that occur. This indicates that in the current study, preschoolers are not passive recipients of the environment around them, but rather play a role in shaping their own experiences. Specifically, children's capacity to regulate their attention, emotion, and behavior may prompt different responses from teachers, resulting in child-level variability in the interactions and relationships each child experiences with his or her teacher. Thus, with the focus on proximal processes as the *primary engines* of development and the role of the child's characteristics in shaping the proximal processes he or she experiences, the Bioecological Model supports the proposed model that teacher-

child interactions and relationships may mediate the association between self-regulatory skills and academic outcomes.

Self-Regulation and Academic Achievement

Self-regulatory skills include children's capabilities to control and modulate their own attention, emotion, and behavior despite distracting or frustrating situations. Self-regulatory skills are conceptualized in various ways, depending largely on the disciplinary training of the researchers involved (Jones, Bailey, Barnes, & Partee, 2016). However, despite variation in terminology and measurement, there is general agreement that the constructs related to children's self-regulation are multidimensional and serve as key contributors to concurrent and future academic success (Ackerman & Friedman-Krauss, 2017; Jones et al., 2016). Differences in conceptualization include parsing children's skills and performance by whether the measurement occurs in a task that is emotionally charged or "hot" versus tasks that are not emotionally salient or "cool" (Zhou, Chen, & Main, 2012), as well as considering task-based self-regulation measured in a controlled setting versus measures that rely on observations or adult reports of children's behavior in the classroom context (Isquith, Gioia, Espy, 2004; Lipsey et al., 2017). Other researchers have demonstrated that for the preschool age period, when many self-regulatory skills are emerging and rapidly developing, that these skills may be best represented and understood as a unitary construct rather than separated into components (Wiebe et al., 2011; Willoughby, Blair, Wirth, & Greenberg, 2010).

For the purposes of the current study, self-regulatory skills is used as an umbrella term for the set of skills that allow children to control their emotions and behavior, initiate and sustain engagement in activities, and regulate their attention to classroom

activities and instruction while ignoring distractions. This conceptualization subsumes component skills that are often included in executive function as well as skills that are more emotionally laden. This approach works well for the current study given that children and teachers are interacting with one another in the classroom environment which necessarily involves use of self-regulatory skills in a context that is often emotionally charged.

Children's self-regulation skills have been identified as a key component of school readiness as children approach kindergarten (Blair & Raver, 2015) and have received substantial attention from researchers and practitioners (Jones et al., 2016). As noted by Blair and Raver (2015), this emphasis on self-regulation does not minimize the importance of academic skill development, but instead highlights a key mechanism by which poverty may hinder children's capacity to grow academically. Children who have greater self-regulation are more able to control their attention, emotions, and behavior potentially affording them greater impacts of enriching educational opportunities. For example, a child who is able to sustain attention on classroom instruction and activities despite distractions in the classroom environment is more likely to learn the new skills and content being taught compared to a child who is easily distracted and does not maintain attention on the classroom activities, resulting in a reduction in academic growth for the distracted child (Sasser, Bierman, & Heinrichs, 2015). Similarly, a child who is able to modulate their emotional response even when classroom tasks are difficult or something upsetting occurs may be more able to maintain calm engagement and productivity in classroom activities to learn the targeted skills (Graziano et al., 2006). In contrast, children who struggle to control their behavior and fail to meet classroom

expectations or become aggressive may distract themselves from the task at hand and possibly be temporarily removed from the instructional activities, interrupting their opportunity to learn the material presented in the classroom and grow academically (Montroy, Bowles, Skibbe, & Foster, 2014). In sum, children's ability to self-regulate plays an important role in their engagement in classroom activities, and in turn, with academic achievement.

Experiences with Teachers as Mediators

Effects of self-regulation on academic outcomes are thought to be, in part, directly due to the deployment of greater attention and working memory on academic learning at hand, but a meta-analysis found no evidence for a causal association (Jacob & Parkinson, 2015). The effects of self-regulation on academic outcomes may also be mediated by some underlying mechanisms, and better understanding this process could help identify where interventions might be possible to attenuate the effects of poverty. Candidates for mediation of the association between self-regulation and academic outcomes would need to be linked conceptually and empirically to children's self-regulatory capacity and to their later academic outcomes and likely should be a feature of children's experience within the classroom and learning activities. Children's experiences with teachers are one such possible mediator.

Children's experiences with teachers are typically conceptualized using one of two approaches: teacher-child interactions and teacher-child relationships. These constructs have some overlap in conceptualization but are disparate in operationalization and measurement. Although both constructs have been demonstrated to have associations with children's developmental outcomes, they have not typically been used together in

studies and little has been noted about their overlap or distinctions. Thus, this summary will combine studies using each of these approaches to provide an overview of evidence about children's experiences with teachers, highlighting instances in which knowledge is limited or differs by conceptualization approach.

The quality of teacher-child interactions in ECE classrooms are currently most frequently conceptualized to be comprised of three components: supports for emotional development, classroom organization, and instructional support for academic and cognitive development (Pianta, La Paro, Hamre, 2008). This is due, in part, to the widespread use of the Classroom Assessment Scoring System (CLASS; Pianta, La Paro et al., 2008) in policy and practice contexts. In the CLASS, scores are assigned in these three domains by combining observations of intensity, duration, and quality of the behavior markers in a given 20-minute cycle. Observers note the experience of the average child in the classroom (i.e., the experience most children are having) and score accordingly.

In comparison, the conceptualization of teacher-child relationships is more narrow in scope and focuses on the affective tone, or closeness and conflict, within the relationship between a specific child and his or her teacher (Pianta, 2001). The day-to-day interactions that occur between teachers and children are understood to have affective and cognitive components that are the basis for children's relationships with teachers and the mode through which academic content is delivered (Hamre et al., 2013).

Although components of the interactions and relationships children experience with teachers are grouped and labeled differently across measures, they can be viewed as fitting into three categories: positive interactions, rich communication, and negative

interactions. The sections below will describe how children's experiences with teachers, conceptualized in these three components, may function as mechanisms underlying the association between children's self-regulatory skills and academic achievement.

Positive Engagement with Teachers

Aspects of interactions that are thought to positively support children's emotional development include teacher warmth and sensitivity, along with respect for each child's autonomy and perspective. These warm and responsive interactions set the foundation for a close and positive relationship between children and teachers. Although most research examining impacts of emotional aspects of experiences with teachers has focused on social-emotional outcomes (Downer, Sabol, & Hamre, 2010), there is some evidence that preschoolers who experience more positive and responsive interactions with teachers may reap academic benefits as well. For example, positive teacher-child interactions in preschool have been associated with higher levels of literacy and vocabulary skills in first grade (McDonald-Connor, Son, Hindman, & Morrison, 2005). Similarly, children who experienced classrooms with warm and sensitive teachers throughout early elementary school demonstrated increased growth in reading from preschool to fifth grade (Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008). However, recent evidence indicates that children's academic development may be negatively impacted if emotional support is low (Weiland et al., 2013).

Although the mechanisms driving the associations are not fully understood, research indicates that children who experience close relationships with teachers may reap these benefits in the short-term via improved attitudes about school and social competence which can then lead to increased engagement and academic functioning

(Palermo, Hanish, Martin, & Fabes, 2007; Silva et al., 2011). Children who experience close relationships with teachers may exhibit rapid improvement in academic functioning, as demonstrated by transitions from a profile marked by lower levels of school readiness to a profile marked by higher levels of school readiness by spring of the preschool year (Sandilos, Whitaker, Vitiello, & Kinzie, 2019). These academic impacts of children's relationships with teachers have been demonstrated to have lasting effects (Liew, Chen, & Hughes, 2010) and may serve as a buffer for children who experience suboptimal home environments (O'Connor & McCartney, 2007) or who have intrinsic risk factors like low executive function (Liew et al, 2010).

Rich Communication with Teachers

Teacher-child interactions that include deep and rich conversational exchanges as well as self- and parallel-talk by teachers to describe classroom activities are hallmarks of high-quality classrooms (Pianta, La Paro et al., 2008). Preschoolers in classrooms with teachers who frequently engage in rich conversations with children and provide developmentally appropriate instruction tend to perform better on measures of cognitive and academic skills (Mashburn et al., 2008). Similarly, an analysis of a large, multi-state sample indicated that preschoolers demonstrated the greatest gains when teachers provided high levels of concept development, which includes interactions encouraging children's inferential thinking and analysis (Curby, Rimm-Kaufman, Ponitz, 2009). A recent study examining teachers' gains in providing instructional support found measurable differences in impacts on children's development, such that teachers who demonstrated greater growth in instructional practice resulted in children with greater gains in literacy (Goble, Sandilos, & Pianta, 2019). However, some evidence indicates

that effects of instructional support on children's academic gains may only be detectable within the high-quality range (Burchinal et al., 2010).

The metaphor of *serve and return* is often used to described optimal interactions between teachers and children, in which teachers and children take turns in the conversation and teachers respond in a way that is contingent upon a child's ideas and interests, and responsiveness to children's input is reflected in measures of classroom quality (Pianta, La Paro et al., 2008). One study using a different measure of teacher-child interaction found that the amount of time teachers spend listening to children is predictive of children's academic gains (Farran, Meador, Christopher, Nesbitt, & Bilbrey, 2017). Further, Farran and her colleagues found that specific interaction strategies such as asking inferential questions bolstered preschoolers' academic development. In sum, rich interactions with teachers require not only intentional utilization of vocabulary, description, and question-asking, but also must include times in which the teacher is silent and allows the child to think, to answer questions, and to engage as a conversation partner.

Negative Experiences with Teachers

Although much less common than positive and rich interactions in the classroom, at times children and teachers do experience conflictual or otherwise negative interactions. Sometimes these interactions may seem to precipitate from children's poor emotional and behavioral regulation, and when teachers are balancing many demands of the classroom, they may sometimes respond with harsh or punitive behavior management strategies. Due to measurement strategies, little is known about the unique impacts of negative interactions with teachers. Research examining student-teacher relationships

similarly provides little information about the impacts of conflict with teachers on children's academic outcomes, although there are clear negative impacts on children's social-emotional development (Silver, Measelle, Armstrong, & Essex, 2005). One study did find fewer gains in school readiness skills when children had more conflict with teachers (Stipek & Miles, 2008).

Measurement of Children's Experiences with Teachers

Children's experiences with teachers, as defined in the present study, include the day-to-day interactions that occur naturally during activities in the classroom and the nature of the relationship established between each child and teacher. As detailed above, teacher-child interactions and relationships have both been identified as consistent predictors of children's academic performance across domains (e.g., Burchinal et al., 2018; Liew et al., 2010). However, one widely acknowledged limitation of current research is that the commonly used classroom observation tools focus on the experience of the average child in a classroom which ignores within-class variability and may not accurately describe the individual experience of a child.

Although much has been learned from global ratings of teacher-child interactions experienced by children, not all children in a given classroom have an equivalent experience interacting with teachers. In fact, in early education environments, interactions between teachers and children should not be uniform across children and contexts. A key tenet of developmentally appropriate practice is the responsibility of the teacher to individualize his or her interactions with children, based on knowledge of each child's interests and developmental stage as well as culture (NAEYC 2009). Additionally, teachers should engage with children in a way that is responsive to the

current needs, desires, and emotions of the child. Thus, in a classroom implementing developmentally appropriate practice guidelines, one would expect to see purposeful variability in the interactions between the teacher and each child. Moreover, it is inconsistent with Bioecological Theory to assume that all children in the classroom have the same experience with their teachers and that these experiences would be uniform across time and context.

Although research to date has primarily focused on the interactions between teachers and the class as a whole, a small body of work indicates that the quality of children's experience with teachers varies within a given classroom (Booren, Downer, & Vitiello, 2012; Jeon et al., 2010). The variability of children's experiences within a given classroom and the importance of those experiences to children's development is foreshadowed by a rich literature examining student-teacher relationships (Birch & Ladd, 1997; Hamre & Pianta, 2001). One observational study indicated that even a basic descriptive snapshot of children's classroom experiences can provide predictive information for children's school readiness above and beyond what is measured by global indicators of quality (Chien et al., 2010). Another group of researchers adapted the Early Childhood Environment Rating Scale (Harms, Clifford, & Cryer, 1998) to provide scores for individual children's experiences within the classroom and found substantial variability, such that, even in classrooms with high levels of global quality, not all children were being involved in the classroom activities and interactions (Jeon et al., 2010).

A relatively new measure, the Individual Classroom Assessment Scoring System (inCLASS; Downer, Lima, Luckner, & Pianta, 2010) is one effort to develop a more

nuanced measure of children's individual experiences in the classroom and examines children's engagement with the teacher, peers, and tasks during typical classroom activities. Although research using this tool is limited, there is evidence for prediction to multiple aspects of children's developmental growth. Recent work by Booren and colleagues (2012) using the inCLASS provides additional support for within-classroom variability and also indicates the presence of within-child variability for teacher-child interactions depending, in part, on the child's activity during the observation cycle.

Children's individual experiences with teachers (i.e., within-classroom variability) appear to uniquely contribute to children's academic development based on the results of two studies. Children who tend to have more positive engagement with their teachers demonstrate greater growth in phonological awareness, although no effects were found for print knowledge, or receptive or expressive language (Sabol, Bohlmann, Downer, 2018). Additionally, children who had more negative engagement in the classroom had reduced gains in print knowledge, phonological awareness, and receptive vocabulary (Sabol et al., 2018; Williford, Whittaker, Vitiello, & Downer, 2013). Thus, taken together with impacts of student-teacher relationships reviewed above, individual experiences within the classroom do seem to provide a complementary lens and additional predictive power regarding children's developmental gains.

Children's role in shaping their own classroom experiences

Consistent with Bioecological Theory, a great deal of evidence indicates that teachers relate differently with children, based at least in part on the child's own characteristics. Teachers' perceptions, attributions, interactions, and perceived relationships have all been demonstrated to differ across children (Carter, Williford, & LoCasale-Crouch, 2014;

Erdena & Wolfgang, 2004; Howes et al., 2000; Rudasill & Rimm-Kaufman, 2009). Child characteristics that have been associated with differential experiences with teachers include ethnicity, behavior, social competence, and academic achievement (Jerome et al., 2009; Rudasill & Rimm-Kaufman, 2009).

Self-regulatory skills. The role children's self-regulatory skills may play in shaping their experience in the classroom has been examined with various predictors including children's classroom behavior and executive function. Children who have strong self-regulation skills tend to experience more positive interactions and relationships with teachers (McKinnon, Blair, & the Family Life Investigators, 2018; Pianta, La Paro, Payne, Cox, & Bradley, 2002). Teachers tend to more frequently engage in verbal interaction with children who exhibit higher levels of prosocial behavior (Phillips, McCartney, & Scarr, 1987). Children who have higher levels of self-regulation and positive emotionality and low levels of problem behavior are more frequently involved in social, unstructured conversations with teachers than are children with more difficult temperaments (Fry, 1983; Keogh, 2003).

However, children with high levels of problem behaviors—such as hyperactivity, aggression, and poor regulation—are at increased risk for academic difficulties and challenges with overall school adjustment (Arnold, 1997; Bulotsky-Shearer, Dominguez, & Bell, 2011; Ladd, 1996). Additionally, these same children are at risk for negative relationships with teachers (e.g., Buyse, Verschueren, Verachtert, & Van Damme, 2009; O'Connor, Dearing, & Collins, 2011), which, in turn, often lead to poor school outcomes including subpar academic performance, negative attitudes about school, lack of engagement in school, and further behavior problems (Birch & Ladd, 1997; Hamre &

Pianta, 2001). However, when teachers are able to develop positive relationships with problem behavior children, the positive relationships attenuate the effect of problem behaviors on children's school performance, allowing children to perform better academically than similar children with negative relationships with teachers (Baker, 2006; Ladd & Burgess, 2001). Moreover, children with difficult behavioral profiles may reap even greater benefits from positive teacher-child relationships than do less difficult children (Belsky & Pluess, 2009; Pluess & Belsky, 2009). Thus, the children who stand to benefit most from positive relationships with teachers are, in fact, least likely to experience them.

Notably, a positive relationship with teachers at an early age may be especially powerful in affecting children's later outcomes. For example, positive relationships with kindergarten teachers have been associated with higher levels of academic and behavioral functioning through the eighth grade, and this effect is even stronger for children who exhibit high levels of behavior problems in kindergarten (Hamre & Pianta, 2001). Similarly, children's relationships with their teachers in preschool have been associated with behavioral and academic outcomes through first grade (Pianta & Stuhlman, 2004), indicating that the impact of children's individual relationships with teachers may begin even before entry to formal schooling. Presumably, the quality of this crucial teacher-child relationship develops based on the numerous interactions that a teacher and child engage in day after day in the classroom. However, the nature of the interactions between teachers and individual children has been largely unexplored. Moreover, despite the sizeable body of literature that supports the idea that children with high levels of problem behavior tend to develop poor quality relationships with teachers (Birch & Ladd, 1997;

Howes, 2000; Hughes, Cavell & Jackson, 1999; Murray & Murray, 2004), almost nothing is understood about how this translates to a child's day-to-day experiences with his or her teacher. Do such children experience numerous disciplinary interactions each day? If so, does this emphasis on discipline have the unintended effect of minimizing opportunities for more positive interactions, such as those focused on play, conversation, and instruction? One could easily see how such a pattern could, over time, lead to lackluster academic performance and social development. Because teacher-child interactions may be especially important for children with high levels of problem behaviors, it is important to examine how teachers may interact with children who show relatively high rates of disruptive behaviors and poor effortful control.

Indeed, some evidence from studies of older children confirm that children vary in the amount of instruction they receive based on their behavior. Children who are disruptive and low in effortful control are at increased risk of receiving low levels of instruction (Birch & Ladd, 1998; Murray & Greenberg, 2000) This discrepancy may be because teachers are so busy managing dysregulated children's behavior that they lack time to engage in instructional interactions with these children. Alternatively, it may be that the teacher attempts to engage in instruction but the child either disengages (e.g., walks away) or begins acting inappropriately necessitating a shift to a disciplinary interaction. If these patterns hold in preschool classrooms, children who have low levels of self-regulation may be less likely to experience positive engagement and meaningful, rich communication with teachers and, in turn, be likely to have less academic growth during the preschool year.

The Present Study

The present study seeks to examine whether and to what extent children's individual experiences with teachers mediate the association between self-regulatory skills and academic gains in preschool. Although prior research documents consistent associations between self-regulatory skills and academic achievement, little is known about the mechanisms underlying that association. Teacher-child interactions and relationships are potential mediators as they have been conceptually and empirically linked to self-regulatory skills and academic achievement. However, no prior studies have examined the potential mediation by interactions and relationships between teachers and preschoolers to my knowledge.

Specifically, this study will address the primary research question: Do children's individual experiences with teachers mediate the association between children's self-regulatory skills and academic gains made in preschool? This research question will be considered for five components of children's experiences with teachers: observed positive engagement with teachers, observed communication with teachers, observed conflict with teachers, teacher-reported closeness with child, and teacher-reported conflict with child.

This study is unique in the combination of two measures of children's individual experiences with teachers, considering both the objective observation of teacher-child interactions along with teachers' perceived relationship with each study child. Although there is considerable overlap in the constructs of teacher-child relationships and interactions, they are thought to be distinct, yet related, constructs. Observations of interactions between individual children and teachers have been linked to teacher-

reported relationships, but unique information is gathered from each measurement approach indicating the importance of considering both aspects (Hartz, Williford, & Koomen, 2017). This study is also strengthened by its objective measure of self-regulation within the classroom context by utilizing classroom observations.

Method

Participants

Data for this study were collected as part of a larger evaluation and partnership with a Head Start agency. Participants were 3- and 4-year-old children (n = 252) enrolled in 61 Head Start classrooms in a medium-sized city in the central region of the United States. All children met criteria for participation in Head Start, so the vast majority were from low-income families. The sample included approximately equal proportions of boys (54%) as girls, and was ethnically diverse (39% Hispanic, 25% African America, 17% White, 19% multiple or other races). The mean age of participants at the beginning of the school year was 44.4 months.

Procedure

Children were selected to participate using a tiered sampling approach in which classrooms were first chosen randomly from the available Head Start rooms and then six children per classroom were selected, stratified by gender and home language to match classroom enrollment. Once a child was identified for the study, research assistants approached the parent at school drop-off or pickup to describe the study, answer any questions, and ask them to provide informed consent for their child's participation. Children's verbal assent to participate was monitored by research assistants at each

assessment visit, and children were returned to their classrooms if they became upset or chose to not continue the assessments.

Direct child assessments were completed at two time points, once in the fall (September – October) and again in the spring (late March – May). At the spring time point, teachers provided ratings of their relationship with each study child. Classroom observations were conducted on one morning during the winter (January – early March). Program administrative records provided children's race, age, gender, and number of days attended during the school year.

Research assistants were trained following guidelines by the authors of each measure prior to data collection. For child assessments, assessors demonstrated adherence to study and measure protocols and accurate scoring in at least one practice session prior to assessing any study children. Compliance to protocols and scoring guidelines were monitored throughout the duration of the child assessment windows, and any noted patterns of mistakes were corrected promptly. For classroom observations, research assistants were certified reliable after two days of training followed by video reliabilities as assigned by the trainer. Observers were required to score at least 80% accuracy within 1 point of the master codes. Observation scores were also double-checked by a second trained observer by comparing notes from the observation and the scores assigned. If scores were incongruent with observation notes, the observer was asked to clarify and the scores again adhering to the guidance provided in the CLASS or inCLASS manual.

Measures

Self-Regulatory Skills. Children's self-regulatory skills were measured within the classroom context using the Individualized Classroom Assessment Scoring System

(inCLASS; Downer, et al., 2010). The inCLASS observation was conducted by a trained research associate on one morning in the winter of the preschool year. For the inCLASS, research associates observe a target child for 10 minutes while taking notes about the child's experiences with classroom activities and other children and adults in the classroom. After 10 minutes of observation, the research associate takes 5 minutes to assign scores from 1 (low) to 7 (high) on 10 dimensions, and then proceeds to repeat the process and complete an observation cycle on the next study child in the room. Once the observer reaches the end of list of study children, she starts again with the first study child and continues collecting observation cycles until the teacher indicates that nap time was beginning, marking the end of the day's observations in classrooms. Observers were instructed to obtain as many cycles per study child as possible (mean cycles = 3.67).

Four dimensions of the inCLASS were used as indicators of children's self-regulatory skills in the classroom: Engagement, Self-Reliance, Behavior Control, and Conflict (reverse scored). Children's scores for each dimension were averaged across cycles (mean cycles = 3.67 per child), and then the mean score of the four dimensions were averaged (alpha = .63) to create an indicator of overall self-regulatory skills in the classroom. Observed self-regulation had a possible range of 1 to 7, with higher scores indicating greater competence in self-regulation.

Academic skills. Children completed three assessments to examine their cognitive and academic functioning: Woodcock Johnson III (Letter Word Identification and Applied Problems Subscales; Woodcock, McGrew, & Mather, 2001), Expressive One-Word Picture Vocabulary Test (Martin & Brownell, 2011), and the Bracken School Readiness Assessment (Bracken, 2007).

The Woodcock-Johnson has been used extensively to assess children's early academic functioning in Head Start and other preschool research. In the Woodcock-Johnson Letter Word Identification test, children were asked to name letters and read words based on prompts on the test flipbook. The Applied Problems subtest assesses children's early math skills, including counting, geometry, and problem solving. Children answer questions as prompted by the assessor, using visual supports presented to the child on the testing flipbook. In both subtests, children proceeded through the items until they reached the ceiling as outlined in the testing manual. Standardized scores were used in this study and have a mean of 100 and standard deviation of 15. Woodcock-Johnson has strong demonstrated strong split-half reliability at ages 3 and 4 (*r*s = .97-.98 for Letter-Word and.92-.94 for Applied Problems) and one year test-retest reliability (*r* = .92 for Letter-Word and Applied Problem subscales).

The Expressive One-Word Picture Vocabulary Test (EOWPVT) is a measure of children's expressive vocabulary that has been validated for children starting at age 2. In this assessment, the assessor presents the child with a picture on the testing book and asks the child "what's this?" Children respond verbally and proceed through the items until a pattern of incorrect responses identify their ceiling as specified in the testing manual. For children who speak Spanish at home, we utilized the bilingual version of the EOWPVT, which allows for conceptual scoring in which children receive credit for answers in either Spanish or English. Standard scores were used in this study, with a mean of 100 and standard deviation of 15. The EOWPVT has demonstrated high internal consistency (alpha = .95) and test-retest stability (*r* = .97). It has also demonstrated strong criterion and content validity (Martin & Brownell, 2011).

The Bracken School Readiness Assessment is a multidimensional screener of children's school readiness. Utilizing a flipbook with graphics and other visual supports for children's engagement, assessors ask children questions in a series of subtests: color recognition, letters, numbers/counting, size/comparison, and shapes. These subtests were combined according to directions provided in the testing manual and resulted in a single composite score of school readiness, with a population mean of 100 and standard deviation of 15. The Bracken has demonstrated adequate test-retest stability (r = .76 to .92) and split-half reliability (r = .95; Bracken, 2007).

Children's experiences with teachers. Children's experiences with teachers were measured in three ways, two of which were at the child level and one at the classroom level. Near the end of the school year, teachers rated their relationship with each study child using the Student Teacher Relationship Scale, short form (STRS; Pianta, 2001) which is a 15-item scale using a 5-point Likert response option ranging from *Definitely does not apply* to *Definitely applies*. The STRS yields two scores indicating the closeness (8 items, alpha = .841) and conflict (7 items, alpha = .922) between each child and teacher dyad. The STRS has been widely used and has demonstrated strong psychometric properties and predicts children's classroom behavior and academic outcomes (Pianta & Steinberg, 1992; Pianta, Steinberg, & Rollins, 1995).

Children's individual interactions with teachers were measured using the Individual Classroom Assessment Scoring System (inCLASS; Downer, et al., 2010) during the winter season (January through early March). The inCLASS results in scores for nine dimensions, and the three dimensions related to children's experiences with teachers were examined in this study: Positive Engagement, Communication, and

Conflict. Scores ranging from 1 (low) to 7 (high) are assigned for each cycle, and scores were averaged across cycles to yield an estimate of each child's experiences with teachers. Prior evidence has documented the validity and reliability of the inCLASS for measuring preschoolers' classroom experiences, including construct validity and criterion-related validity (Downer, et al., 2010; Williford et al., 2013). The inCLASS has demonstrated factorial validity for demographic characteristics, including scalar invariance for ethnicity and poverty status and configural invariance for gender (Bohlmann et al., 2019). The inCLASS has also demonstrated good predictive validity of relevant outcomes such as school readiness, literacy, and self-regulation (Sabol et al., 2018; Williford et al., 2013).

Global teacher-child interactions in each classroom were also measured in this study using the Classroom Assessment Scoring System (CLASS Pre-K; Pianta et al., 2008). On the same day as the inCLASS observation, a second research associate observed the classroom and completed four 20-minute cycles of CLASS scoring. The CLASS Pre-K provides scores on 10 dimensions that are aggregated across cycles and then collapsed into three domains based on the authors' guidance. The CLASS Pre-K has been widely used in studies of early education and has demonstrated good reliability and predictive validity (see Burchinal, 2018 for a review). For the current study, due to high intercorrelations among the domains (rs = 0.56 – 0.82), a composite measure of global classroom quality was computed by taking the mean of the three domains.

Results

Descriptive statistics and zero-order correlations among key study variables are presented in Table 1. Child age, number of days attended, and global classroom quality

Table 1

Correlations Between Child Assessments and Ratings

Variables	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Self-Regulation	4.98	0.63	-								
2. inCLASS Pos Eng	3.25	1.04	0.1	-							
3. inCLASS Comm	2.31	0.88	.20*	.64**	-						
4. inCLASS Conflict	1.24	0.44	-0.49**	-.14	-.10	-					
5. STRS Closeness	4.52	0.56	.20*	0.11	.22**	-.18*	-				
6. STRS Conflict	1.68	0.80	-.33***	0.02	0.02	.43***	.45***	-			
7. WJ Letter Word	99.59	12.44	.24**	-.02	0.15	*-.12	.29**	-.15*	-		
8. WJ Applied Probs	99.02	13.53	.22**	-.10	.10	-.13	.25***	-.13	.63**	-	
9. EOWPVT	99.99	14.31	.23**	-.07	0.13	-.18*	.19**	-.17*	.41**	.61***	-
10. Bracken	95.59	14.66	.25**	0.04	.16'	-.19*	.24**	.20**	.79**	.74***	.54***

Notes: Pos Eng = Positive Engagement. Comm = Communication. Applied Probs = Applied Problems.
EOWPVT = Expressive One-Word Picture Vocabulary Test.
*p<.05. **p<.01. ***p<.001.

were correlated with some key study variables (*r*s = .16 - .18, $p < .05$), so were controlled for in primary analyses. Mean differences by child gender and race were also identified (Fs = 2.12 – 15.26, *p*s < .05), so child gender and race were included as covariates in subsequent analyses as well.

Analytic Approach

Prior to conducting tests of the primary hypothesis, data reduction was utilized to minimize the number of statistical tests needed. Specifically, the outcome of interest, children's academic skills, were reduced from four indicators to one using factor analysis. A confirmatory factor model was estimated for end of preschool academic skills using M*Plus*. The model demonstrated adequate fit, $\chi^2(N = 252, df = 5) = 4.32$, $p = .5$, RMSEA = .00, CFI = 1.00, and SRMR = .02. Loadings were significant and in the expected direction. Factor scores were saved to the analytic file and utilized as an index of children's end of preschool academic skills in the primary analyses.

Next, path analyses were conducted to examine the primary research question regarding whether children's individual experiences with teachers mediate the association between children's self-regulatory skills and academic achievement at the end of preschool. As an initial step, I estimated direct effects of children's self-regulatory skills on academic achievement (*c* path). This model indicated a significant positive relation between children's self-regulatory skills in the fall and residualized academic skills in the spring ($\beta = .33$, $SE = 0.15$, $p < .05$).

Finally, models including mediation paths were estimated separately for each indicator of children's experiences with teachers, and each model controlled for children's race, gender, age in months, fall expressive vocabulary score, number of days

attended, and global classroom quality. For each model, the index score for children's academic outcomes was regressed on all covariates, the mediator variable for child's experience with teacher (*b* path; e.g., inCLASS Positive Engagement), and the independent variable children's self-regulatory skills. The variable for the child's experience with teacher was regressed on the independent variable children's self-regulatory skills (*a* path). The model indirect function was utilized to estimate indirect effects for each model. To obtain adjusted standard errors to account for the dependency in the data due to children nested within classrooms, the type = complex function was implemented in M*plus*. Full Maximum Information Likelihood estimation was used for all models to account for missing data. Standardized path coefficients are presented throughout.

Mediation models

The model examining indirect effects was first estimated for observed Positive Engagement with teachers. Results indicated that the direct effect of self-regulatory skills on children's Positive Engagement with teachers (path A) was not significant. The direct effect of Positive Engagement with teachers on residualized academic outcomes (path B) was also not statistically significant. Because neither path was significant, indirect effects were not estimated for Positive Engagement with teachers.

Next, the mediation model was estimated for children's Communication with teachers. This model indicated a significant direct effect of self-regulatory skills on children's Communication with teachers (path A), $\beta = .30$, $SE = .12$, $p < .05$. A significant direct effect of children's Communication with teachers on residualized academic outcomes (path B) was also supported, $\beta = .14$, $SE = .07$, $p < .05$. Results of the

indirect effects test indicated that children's Communication with teachers partially mediated the association between self-regulatory skills and residualized academic outcomes at the $p = .10$ level, $\beta = .05$, $SE = .03$ (CFI = .991, RMSEA = .03).

The mediation model examining children's observed Conflict with teachers revealed a significant direct effect of children's self-regulatory skills on their observed level of conflict with teachers, $\beta = -.31$, $SE = .04$, $p < .001$ (path A). However, the direct effect of children's observed conflict with teachers on residualized academic outcomes (path B) was not significant, $\beta = -.12$, $SE = .15$, $p = .45$). Because the B path was not significant, indirect effects were not estimated.

Next, the mediation model was estimated for each of the two components of the STRS, closeness and conflict. For STRS closeness, a significant direct effect of children's self-regulatory skills on teacher-reported closeness was identified, $\beta = .17$, $SE = .08$, $p < .05$ (path A). The direct effect of teacher-reported closeness on children's residualized academic outcomes (path B) was also significant, $\beta = .25$, $SE = .12$, $p < .05$. Results of the indirect effects test indicated that teacher-reported closeness partially mediated the association between self-regulatory skills and residualized academic outcomes at the $p = .10$ level, $\beta = .05$, $SE = .03$ (CFI = .862, RMSEA = .12).

The model examining teacher-reported (STRS) conflict as a mediator indicated a significant direct effect of children's self-regulatory skills on teacher-reported conflict (path A), $\beta = -.38$, $SE = .13$, $p < .01$. However, the direct effect of teacher-reported conflict on children's residualized academic outcomes was not significant, $\beta = .03$, $SE = .08$, $p = .69$. Because the B path was not significant, indirect effects were not estimated for teacher-reported conflict.

Discussion

The goal of the current study was to examine whether children's individual experiences with teachers mediate the association between children's self-regulatory skills and gains in academic achievement across the preschool year. Specifically, I tested whether children's observed Positive Engagement, Communication, and Conflict with teachers and the level of Closeness and Conflict reported by teachers explained part of the link between self-regulatory skills and academic gains. Results were mixed and indicated limited support for indirect effects via children's individual experiences with teachers.

Children's self-regulatory skills, as documented by classroom observers, were found to predict four out of the five indicators of children's individual experiences with teachers. Only children's observed Positive Engagement with teachers was not significantly associated with children's self-regulation. Predicting from children's individual experiences with teachers revealed fewer direct effects for children's academic outcomes, with two of the five tested paths reaching significance. Children's observed Communication with teachers and teacher-rated Closeness were positively associated with children's academic outcomes in spring. In contrast, children's observed Positive Engagement was not significantly associated with academic outcomes, nor were observed and teacher-rated levels of conflict between teacher and child. Overall, the results suggest that children's self-regulatory skills shape the experiences they have with teachers in both positive and negative aspects of teacher-child interactions and relationships, but the positive aspects of teacher-child experiences are what is impacting children's academic growth.

Self-regulatory Skills and Experiences with Teachers

These results are consistent with expectations driven by theory and extant empirical work regarding associations between children's self-regulatory skills and the nature of their experiences with teachers. This study's finding that children with higher levels of self-regulation are more likely to experience sustained and varied communication with teachers is consistent with prior research indicating that teachers engage in more conversational exchanges with children who are well-behaved and emotionally regulated (Keogh, 2003). Children who are more able to regulate their attention, emotions, and behavior are likely to be engaged in classroom activities and to match classroom expectations, freeing teachers from the need to redirect their behavior and to instead engage in rich interactions. When this pattern occurs repeatedly across days and weeks in the preschool setting, teachers are likely to develop and report a close relationship with the well-regulated child. Indeed, consistent with results from the current study, prior research indicates that teachers tend to report greater levels of closeness with children who exhibit strong self-regulatory skills (Nurmi, 2012; Pianta et al., 2002).

This study's finding that children's self-regulatory skills are negatively associated with conflict with teachers is consistent with other studies examining children's experiences with teachers. This pattern of heightened levels of conflict with teachers has been demonstrated both for children who struggle with internalizing or externalizing behavior problems (Nurmi, 2012) and for children who demonstrate lower overall executive functioning (McKinnon et al., 2018; Pianta et al., 2002). Children's behavior problems, in particular, have been noted as a strong predictor of conflict with teachers (Hamre et al., 2008).

The lack of association between children's self-regulatory skills and their level of observed positive engagement with teachers was somewhat surprising. Positive Engagement includes children seeking proximity to teachers and shared positive affect, as well as attunement between teacher and child (Downer et al., 2010). It may be that teachers utilize these skills in an intentional way with children who are less self-regulated, resulting in equivalent scores for children regardless of their level of self-regulation. It may also be that children who are less well-regulated seek out teachers' attention or are kept in close proximity for behavior management, and the combination of multiple behavior markers is conflated within the Positive Engagement score, resulting in no association with children's self-regulatory skills.

Experiences with Teachers and Academic Outcomes

Findings from this study indicate that children exhibit greater academic growth when they experience more sustained and varied communication with teachers as well as teacher-reported relationships with high levels of closeness. The impact of communication with teachers is consistent with literature demonstrating the role of teachers' global levels of instructional support, such as language modeling, concept development, and quality of feedback (Burchinal et al., 2016; Howes et al., 2008). Notably, the impacts of children's observed levels of communication with teachers in this study were estimated controlling for global classroom quality, so the effect of experiences individual children have communicating with teachers is above and beyond the effects of global instructional support. This finding is similar to results reported by Sabol and colleagues (2018) indicating that children's engagement with teachers predicted gains in literacy over and above effects of global classroom quality.

The direct effect of teacher-reported closeness with children on academic outcomes is also consistent with a substantial amount of evidence indicating the numerous benefits experienced by children who have positive relationships with teachers (Hamre & Pianta, 2001; Pianta & Stuhlman, 2004). Children who have close relationships with teachers may feel secure in the classroom environment and be able to engage more thoroughly in the instructional content being presented. A close relationship with teachers also allows children to feel comfortable asking questions and seeking assistance as needed, which may also yield academic benefits if content becomes challenging.

The finding that children's observed Positive Engagement with teachers was not significantly related to academic outcomes is somewhat surprising given the extant literature documenting the role of positive teacher-child interactions in supporting children's academic growth (Burchinal et al., 2014; Mashburn et al., 2008). Positive Engagement, as measured by the inCLASS, examines child-level indicators such as proximity-seeking and shared positive affect which are quite similar to behaviors considered for CLASS Emotional Support ratings. It may be that the test in this study which required impacts above and beyond classroom-level quality may have been too high of a bar to detect effects of individual-level experiences of Positive Engagement. However, in my data the correlation between global classroom quality was no greater for inCLASS Positive Engagement (r = .09, p = .23) than for Communication (r = .11, p = .18), which makes the role of global classroom quality in the models across the models seem less salient. The inCLASS tool is relatively new and has primarily been used with Positive Engagement and Communication combined as a joint indicator of overall

engagement with teachers, so comparisons are lacking in extant research. These results suggest different impacts of Positive Engagement and Communication and seem to indicate that warmth between a teacher and child is not sufficient to drive academic outcomes.

The lack of significant associations between observed and teacher-rated conflict on children's academic outcomes was also contrary to expectations. Previous studies examining impacts of teacher-child conflict have almost exclusively focused on children's social-emotional development with clear detrimental impacts for children who experience higher levels of conflict with teachers (Doumen, Koomen, Byse, Wouters, & Verschueren, 2012; Graziano et al., 2016; Howes, 2000). Limited evidence from prior research had documented associations between teacher-child conflict and academic achievement (Stipek & Miles, 2008). One recent study also reported unexpected findings for teacher-rated conflict with children, noting that children who moved from a profile of low academics to moderate academics tended to have higher levels of conflict with teachers (Sandilos et al., 2019). Perhaps some increased level of conflict may occur when teachers work to extend children's academic skills, and this conflict may not be detrimental to academic development in the preschool years.

Mediation by Children's Experiences with Teachers

Results from this study were not clearly supportive of the mediational role of children's experiences with teachers. Of the five indicators of children's experiences with teachers considered, only two met the initial requirement of significant A and B paths needed to identify indirect effects. In these two models, teacher-reported closeness and observed communication with teachers were found to be predicted by children's self-

regulatory skills and to predict children's academic outcomes, but the test of indirect effects provided by M*Plus* did not reach traditional levels of significance. This lack of significance is likely due to the non-normality of the product term *ab* computed for the test of indirect effects which is known to result in underpowered statistical tests (MacKinnon, Fairchild, & Fritz, 2007).

Future Directions

This paper focused on the evocative effects of children's self-regulatory skills in shaping the experiences they have with teachers which, in turn, impact academic outcomes. This approach was driven by the hypothesis that within-classroom variation in children's experiences with teachers warrants consideration. Numerous studies utilizing the more common approach of measuring teacher-child interactions at the classroom level have documented associations between similar constructs modeled in a different order, with positive and rich teacher-child interactions predicting children's self-regulatory skills and academic skills (e.g., Bierman et al., 2008; Son & Chang, 2018). Future research should consider the direction of effects between teacher-child interactions and self-regulation, perhaps utilizing more frequent measures of children's self-regulatory skills and experiences with teachers to detect reciprocal relations over time.

Other questions remain to be answered regarding the relative contributions of children's individual experiences with teachers compared to global classroom quality. It is increasingly clear that global measures of quality lack predictive power (Burchinal, 2018), but the impacts of global quality are still stronger than other, more distal indicators like teacher qualifications (Mashburn et al., 2008). Perhaps the interplay between children's individual experiences and global classroom quality is important, as suggested

by research examining interaction effects between classroom- and child-level ratings of quality (Williford et al., 2013). As noted in two recent conceptual papers (Burchinal, 2018; Weiland, 2018), the field clearly has much more work to do to develop the more nuanced understanding of classroom processes supporting children's development needed to guide policy and programs.

Limitations

The current study has a few limitations that should be noted and considered in interpretation of the results. First, although the short-term longitudinal nature of this study affords some information regarding the direction of associations, causality cannot be determined and associations could be bidirectional. As noted above, there is evidence of teacher-child interactions on children's self-regulation (Bierman et al., 2008; Son & Chang, 2018), so more complex associations should be considered moving forward. Second, this study utilized a broad conceptualization of self-regulation rather than considering the discrete components that underlie self-regulation, so further research should consider to what extent the identified associations hold for components of self-regulation and whether the associations vary by measurement strategy. Finally, teacher-child interactions in this study were captured on a single morning of each child's preschool year using a tool with limited scope and variability. Additional days of observation may be necessary to garner more stable estimates of children's experiences within the classroom (Vitiello, Booren, Downer, & Williford, 2012). As the inCLASS has been found to have limited variability in some cases (Kim et al., 2018), future research may also benefit from a more nuanced measure of child-level experiences with teachers.

Nonetheless, the study also has a number of strengths that are noteworthy. First, this study's use of observed levels of self-regulatory skills in the classroom context may provide a more accurate measure rather than widely-used teacher reports, which have been demonstrated to not associate with observed classroom behavior (Wolcott & Williford, 2015). Second, this study's examination of teacher-child interactions at the child level rather than the classroom level is an important contribution as the field aims to more fully elucidate pathways between children's classroom experiences and development. It also seems to be important to consider both observed and teacher-reported experiences between children and teachers as indicated by differential findings in this study and results elsewhere indicating that teacher report does not predict observed teacher-child interactions (Kim et al., 2018).

Overall, the results of this study reveal that children's self-regulatory skills, particularly when assessed within the classroom context, play a role in shaping the nature of children's individual experiences with teachers. The experiences children have with teachers then impact their academic gains. Although developmentally appropriate practice indicates the need to provide individualized instruction for children, teachers may need additional training and coaching to develop interactions and relationships with all children that are warm, engaging, and low in conflict. Evidence indicates that teachers can improve interactions with children with low levels of self-regulation when provided with targeted coaching and feedback (Williford et al., 2017). This study underscores the importance of such interventions to help teachers develop the rich communication and closeness with all children that are needed to bolster children's academic outcomes.

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APPENDIX A: PROSPECTUS

UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

CHILDREN'S INDIVIDUAL EXPERIENCES WITH TEACHERS: PRECURSORS AND ASSOCIATED OUTCOMES

A PROSPECTUS

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

SHERRI L. CASTLE
Norman, Oklahoma
2019

UNIVERSITY OF OKLAHOMA – TULSA

PROSPECTUS SIGNATURE FORM FOR THE EARLY CHILDHOOD PH.D.

PROGRAM

CHILDREN'S INDIVIDUAL EXPERIENCES WITH TEACHERS: PRECURSORS AND ASSOCIATED OUTCOMES

By: SHERRI L. CASTLE

Summer Semester, Year 2019 defended on ____/____/____

Student: _____ Successfully passed oral and written prospectus defense with suggested revisions.

_____ Unsuccessfully defended oral and written prospectus and will need to schedule a second defense date.

Prospectus Revisions submitted to:	**Dissertation Committee Members:**	**Approval**
_____ Chair _____ Committee Student and Chair set date for when revisions are due. ____/____/____.	_____ Dr. Diane Horm, Chair	☐ Yes ☐ No
	_____ Dr. Timothy Ford, Outside Member	☐ Yes ☐ No
	_____ Dr. Vickie Lake	☐ Yes ☐ No
	_____ Dr. Libby Ethridge	☐ Yes ☐ No
	_____ Dr. Kyong-Ah Kwon	☐ Yes ☐ No

Introduction

Ample evidence now exists that preschool has positive effects for children, particularly those who live in poverty, and that teacher-child interactions are the active ingredient underlying these impacts (Phillips et al., 2017; Yoshikawa et al., 2013). However, although associations between teacher-child interactions and child outcomes are somewhat consistent, the effect sizes are often modest which raises caution among researchers pressed to provide implications for policy and program audiences. One widely acknowledged limitation of current research is that the commonly used classroom observation tools focus on the experience of the average child in a classroom which ignores within-class variability and fails to describe the individual experience of a child, which may not be accurately reflected by classroom level scores. Importantly, if children's experiences within a classroom are not adequately captured by global measures of quality, this would dilute associations between classroom quality and child outcomes. This dissertation aims to extend work highlighting the importance of teacher-child interactions by exploring variation within children's experiences with teachers and how such variation within classrooms associates with child outcomes.

Significance of problem

Increasing numbers of 3- and 4-year-old children spend a substantial amount of time in preschool prior to formal school entry (Adams, Tout, & Zaslow, 2007), with children in full-day preschool spending on average 30 hours per week in school (Child Trends online report). Given these trends and growing evidence of the widespread benefits of supporting children's learning and development prior to school entry (Yoshikawa et al., 2013), early childhood education (ECE) environments have emerged

as an important developmental context that has attracted increased attention from researchers and policy makers alike.

The benefits of high quality early education programs, such as Head Start, have been well-established (e.g., Gormley, Phillips, & Gayer, 2008; Lee, Zhai, Brooks-Gunn, Han, & Waldfogel, 2014), but the actual mechanisms within early care experiences that support the improvements in children's functioning and the variability in these experiences that may partially explain why some children do not reap the same outcomes remain unclear. In the past few decades, researchers have documented links between numerous indicators of quality of early education programming—including teacher education level, ratio of teachers to children in classrooms, and access to a wide range of developmentally appropriate materials—and positive outcomes for children across developmental domains (Howes, 1990; NICHD ECCRN, 2000; Peisner-Feinberg, et al., 2001). More recent evidence, however, has highlighted the impact of the quality of teacher-child interactions, and findings indicate that teacher-child interactions are more consistently and strongly associated with child outcomes, above and beyond the effects of these other, more distal, indicators of quality (Burchinal et al., 2016; Howes, et al., 2008; Keys et al., 2013; Mashburn, et al., 2008).

Despite these promising findings, research on the effects of teacher-child interactions is not unequivocal. One concern regarding global measures of teacher-child interactions is that associations with child outcomes, when detected, are typically quite small in magnitude (Burchinal, 2018). In one striking example, Weiland, Ulvestad, Sachs, and Yoshikawa (2013) reported a main effect of program participation in Boston's Pre-K program, yet several null associations were found between observed teacher-child

interaction quality and children's developmental outcomes. These findings suggest that the most widely used measure of teacher-child interaction quality—the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008)—failed to detect salient classroom processes that were driving children's development. Because results that do not reach traditional levels of statistical significance are typically not published in educational research, the number of other studies with null results for links between teacher-child interactions and child outcomes is unknown. This pattern of findings suggest that further investigation is warranted, and due caution is needed to not become overly reliant on a single measure or approach to capturing children's experiences in the classroom.

Although research to date has primarily focused on the interactions between teachers and the class as a whole, a small body of work indicates that the quality of children's experience with teachers varies within a given classroom (Booren, Downer, & Vitiello, 2012; Jeon et al., 2010). Emerging evidence has demonstrated that children's individual experiences with teachers varies by child characteristics such as gender (Booren et al., 2012), and that variability in children's experiences with teachers is associated with children's outcomes (Sabol, Bohlmann, & Downer, 2018). The variability of children's experiences within a given classroom and the importance of those experiences to children's development is also underscored by a rich literature examining student-teacher relationships (Birch & Ladd, 1997; Hamre & Pianta, 2001). Teachers reported relationships with children have been shown to vary by child factors such as gender and ethnicity (Jerome, Hamre, & Pianta, 2009), and to predict to children's developmental outcomes across domains (Liew, Chen, & Hughes, 2010; Silva et al.,

2011). Taken together, the literature on child-level teacher-child interactions and student-teacher relationships support the notion that it is important to consider classroom processes at the level of individual children. However, further exploration is needed to better understand the range of children's experiences, including how children's experiences are shaped by and further impact children's characteristics and development. Accordingly, the current dissertation aims to address this gap in the literature.

Theoretical Foundations of the Proposed Work

This study draws on the principles of Bioecological Theory (Bronfenbrenner & Morris, 2006). Early versions of ecological theory conceptualized children's development as occurring within multiple layers of context, ranging from microsystems which are the most proximal context (such as the child's home) to macrosystems which include the most remote influences on children's lives (such as the government and the economy) (Bronfenbrenner, 1979). Bronfenbrenner posited that children's development was shaped largely by the unique and joint contributions of these contextual factors. In 2006, Bronfenbrenner and Morris extended the theory by introducing the PPCT model—Process, Person, Context, Time. In this model "Process" refers to proximal processes, which are defined as interactions between a child and another person or object that occur frequently and increase in complexity over time (Bronfenbrenner & Morris, 2006). These interactions are theorized to be the "primary engines of development" (Bronfenbrenner, 2005, p. 6), and it is through these interactions that children practice, develop, and refine skills in all domains of development, including language, cognitive, and social emotional skills.

The proximal processes—operationalized here as interactions with teachers—experienced by an individual child emerge from, and are shaped by, the joint contribution of the remaining three pieces of the model: Person, Context, and Time. Specifically, the theory states that certain aspects of the developing person, the context, or time may encourage the initiation of proximal processes and help to sustain the ongoing interaction, while other characteristics may hinder the beginning or continuation of the interactions. The current study will focus on the person and process components of the model. The specific proximal processes of interest in this study are teacher-child interactions, and person characteristics include a variety of child characteristics that may shape the experiences they have in their environment, including interactions with teachers. For example, a child's enthusiasm about upcoming class activities may be more likely to lead to positive interactions with the teacher than would more apathetic child behaviors. Further, a child who has higher levels of language and conversation skills may be more likely to experience sustained interactions with the teacher than would a child with lower levels of language.

Proximal Processes

The Bioecological Theory consists of two propositions that are central to the ideas it purports. Proposition I defines Proximal Processes as "progressively more complex reciprocal interaction[s] between an active, evolving biopsychological human organism and the person, objects, and symbols in its immediate external environment" (Bronfenbrenner & Morris, 2006, p. 797). The authors go on to specify that "to be effective, the interaction must occur on a fairly regular basis over extended periods of time" (p. 797). Interactions between preschoolers and their teachers occur frequently and

are increasingly more complex as the child's development proceeds. Therefore, teacher-child interactions fit the definition of Proximal Processes and thus can be studied employing this model. Indeed, the authors later specify teachers as one potential *significant other* with whom children may experience proximal processes.

The theory's second proposition builds on Proposition I and provides a foundation for examining variability of Proximal Processes, as well as factors associated with this variation. Proposition II states that Proximal Processes vary in their "form, power, content, and direction" (Bronfenbrenner & Morris, 2006, p. 798), indicating that studies of Proximal Processes should examine not only the frequency of interactions but also other features like nature and content as well. The proximal processes examined in the current study use two sources of data (observation and teacher report) to assess the frequency, quality, and emotional tone of interactions each child experiences with the teacher allowing for exploration of child-level variability on multiple aspects of interactions with teachers.

Consistent with the Bioecological Theory's emphasis on the importance of proximal processes in child development, some studies have found teacher-child interactions to be stronger predictors of child outcomes than other classroom or teacher characteristics. However, as noted above, results have yielded somewhat modest effect sizes in predicting child outcomes (Burchinal et al., 2008; Burchinal, Vandergrift, Pianta, & Mashburn, 2010). One possible reason for the small effect sizes is that, to date, most studies examining teacher-child interactions have utilized measures that assess interactions at the classroom level, in which observers consider the experience of all children in their classroom when assigning scores. These global measures of classroom

quality are, by design, focused on the experience of the average child in the classroom and are unable to parse out the within-class variability in children's experiences with teachers. In practice, this variability is thus treated like noise or measurement error, overlooking potential effects of within classroom variability. However, Bioecological Theory indicates that these proximal processes are a key potential "active ingredient" in children's development in the preschool context, so it is crucial to understand more about the child-level variability in teacher child interactions that are occurring.

Person Characteristics

In Bioecological Theory, the developing person is and always has been at the center of the model. In its more mature formulation, the theory emphasizes the role of the person in shaping his or her own context and development more heavily than in prior iterations (Bronfenbrenner & Morris, 2006; Tudge, Mokrova, Hatfield, Karnik, 2009). Specifically, Bronfenbrenner and Morris (2006) outlined how proximal processes experienced by a given individual are shaped, in part, by the unique and joint contributions of three types of person characteristics: Demand, Resource, and Force. Demand characteristics include traits that are immediately observable such as gender, age, and skin color that influence initial interactions with others because of the expectations formed based on these characteristics. For example, if a teacher believes that girls are more book-smart whereas boys are better suited to physical activity and sports, she might interact with girls and boys quite differently emphasizing academic activities with girls and sports with boys, particularly in initial interactions before more individualized knowledge about each child allows her to refine the focus of interactions.

The two other types of person characteristics, resource and force, are not immediately observable but often may be ascertained after a short interaction with a child (Bronfenbrenner & Morris, 2006; Tudge, et al., 2009). Resource characteristics include mental and emotional resources an individual possesses, particularly as developed through prior experiences, or other more innate traits like intelligence or access to material resources and supports. Force characteristics include temperamental differences and individual levels of motivation and persistence. Force, Resource, and Demand characteristics that an individual brings to a situation all work together to shape the nature and amount of interactions he or she will experience. In the context of a preschool classroom, children enter the classroom with a wide variety of past experiences and at different stages of development across various domains. For example, if a child is temperamentally disposed to high levels of negative reactivity, his or her interactions with the teacher may tend to involve discipline and guidance in handling emotions in an adaptive way. However, a child with an "easy" temperament may be more able to navigate classroom activities independently resulting in very little interaction with the teacher. To date, very little empirical evidence exists to support such specific speculations about the influence of children's characteristics. To add to this understanding, the current study considers children's executive functions, language skills, and classroom behavior and examines how these child characteristics may be associated with the nature and quality of interactions they have with teachers.

The Current Study

The purpose of this dissertation research is to examine the variability of teacher-child interactions that occur naturally in the preschool classroom and explore possible

sources of the observed variation, specifically focusing on characteristics of the child. Research to date has identified the frequency, intensity, and richness of teacher-child interactions that provide emotional support, classroom organizational support, and instructional support for preschoolers as key aspects impacting children's development (Hamre et al., 2013). Guided by Bioecological Theory (Bronfenbrenner & Morris, 2006), this dissertation builds on the existing literature by examining how individual children experience these aspects of teacher-child interactions and how variation in experiences impacts children's development through conducting two studies.

To begin to understand how children's unique individual experiences with teachers affect their development, one must first examine patterns of experiences with teachers and how those vary by children's characteristics. Accordingly, the first study will identify profiles of developmental characteristics—including language, cognitive, and self-regulation skills—and empirically assign children to the best fitting profile. Children's individual experiences with teachers, including observed interactions and teacher-reported relationships, will be examined to determine the extent to which these experiences vary across and within developmental profiles. This approach allows for a data-driven design in which multiple risk factors can be examined simultaneously to see if particular constellations of characteristics place children at greater likelihood of more or less positive and meaningful experiences with teachers.

The second study in this dissertation will build on the first study by investigating whether children's individual experiences with teachers might partially explain a well-documented association between self-regulation and children's academic performance. Specifically, this study will test whether children's level of self-regulation in the fall

predicts their experiences with teachers, which then in turn may predict their academic gains across the year. If children who enter the classroom with high levels of self-regulation experience more positive and generative interactions and relationships with teachers, this could lead to the more positive academic patterns that have been identified in the "skill begets skill" literature. Similarly, children with low levels of self-regulation may perform worse on academic outcomes because their self-regulation deficits lead to interactions with teachers that are less positive or enriching. If the association between self-regulation and academic performance is indeed partially mediated by experiences with teachers, this would provide a clear point of intervention to better support children with low levels of self-regulation.

Literature Review

This section provides a review of the current state of the field regarding conceptualization and measurement of teacher-child interactions and children's individual experiences with teachers. Additionally, this section includes a review of evidence linking these classroom processes to children's development both as a precursor and outcome of children's experiences with teachers.

Children's Experiences with Teachers

Children's experiences with teachers are typically conceptualized using one of two approaches: teacher-child interactions and teacher-child relationships. These constructs have some overlap in conceptualization but are disparate in operationalization and measurement. Although both constructs have been demonstrated to have associations with children's developmental outcomes, they have not typically been used together in studies and little has been noted about their overlap or distinctions. Thus, this summary will combine studies using each of these approaches to provide an overview of evidence about children's experiences with teachers, highlighting instances in which knowledge is limited or differs by conceptualization approach.

The quality of teacher-child interactions in ECE classrooms are most frequently conceptualized to be comprised of three components: supports for emotional development, classroom organization, and instructional support for academic and cognitive development (Pianta et al., 2008). In the widely-used Classroom Assessment Scoring System (CLASS; Pianta et al., 2008), scores are assigned in these three domains by combining observations of intensity, duration, and quality of the behavior markers in a given 20-minute cycle. Observers note the experience of the average child in the

classroom (i.e., the experience most children are having) and score accordingly. In comparison, the conceptualization of teacher-child relationships is more narrow in scope and focuses on the affective tone, or closeness and conflict, within the relationship between a specific child and his or her teacher (Pianta, 2001).

Importance of teacher-child interactions

The ways in which teachers interact with children have broad impact on children's development, in both the short- and long-term. Teachers' interactions with children can help encourage active engagement in the classroom (Pianta, Hamre, & Allen, 2012; Powell, Burchinal, File, & Kontos, 2008) and facilitate their development in language, literacy, math, and executive function, as well as nurture the development of social and emotional skills (Howes et al., 2008; Mashburn et al., 2008). Additionally, high quality interactions with teachers may help shape children's overall views of school, leading to adaptive approaches to learning and positive school adjustment (Pianta et al., 2012). These dispositions toward school and learning are important internal processes for children that help fuel their ongoing learning and development. Thus, children's interactions with teachers may have a cascading effect as their early experiences with teachers set the stage for academic and social success in school and beyond.

Teacher-child interactions have been related to cognitive and academic outcomes in numerous studies (e.g., Curby, Rimm-Kaufman, & Ponitz, 2009; Howes et al., 2008). Preschoolers in classrooms with teachers who frequently engage in rich conversations with children and provide developmentally appropriate instruction tend to perform better on measures of cognitive and academic skills (Mashburn et al., 2008). Similarly, an analysis of a large, multi-state sample indicated that preschoolers demonstrated the

greatest gains when teachers provided high levels of concept development, which includes interactions encouraging children's inferential thinking and analysis (Curby et al., 2009). A recent study examining teachers' gains in providing instructional support found measurable differences in impacts on children's development, such that teachers who demonstrated greater growth in instructional practice resulted in children with greater gains in literacy (Goble, Sandilos, & Pianta, 2019). However, some evidence indicates that effects of instructional support on children's academic gains may only be detectable within the high-quality range (Burchinal et al., 2010). Importantly, although the mechanisms are not well-understood, teachers' emotional supportiveness and classroom management skills can also garner benefits for children's cognitive and academic development (Downer, Sabol, & Hamre, 2010), but may have negative impacts if emotional support is low (Weiland et al., 2013).

Similarly, teachers' provision of high-quality interactions has positive impacts for children's social-emotional development and self-regulation skills. Teachers who exhibit effective classroom management skills allow children to have higher levels of behavioral engagement and have less time spent off-task (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). Over time, children in classrooms with frequent teacher-child interactions that are warm and sensitive tend to demonstrate higher levels of prosocial behavior and more adaptive social emotional development overall (Burchinal et al., 2008; Mashburn et al., 2008). Additionally, children who experience classrooms with high quality classroom organizational support, such as behavior guidance that is consistent and positive in nature, tend to exhibit stronger executive functioning, such as improved inhibitory control (Hamre et al., 2014; Rimm-Kaufman, Curby, Grimm,

Nathanson, & Brock, 2009). Moreover, frequent interactions with teachers that are sensitive and rich in content have been found to be especially beneficial to children who are at risk due to circumstances of living in poverty (cite) with effects demonstrated into the following academic year (Curby et al., 2009). Less evidence exists for cross-domain impacts on children's social-emotional development, but one study found that instructional support below the low-quality threshold was associated with lower levels of inhibitory control (Weiland et al., 2013).

Within-classroom variation in teacher-child interactions

Although much has been learned from global ratings of teacher-child interactions experienced by children, not all children in a given classroom have an equivalent experience interacting with teachers. In fact, in early education environments, interactions between teachers and children should not be uniform across children and contexts. A key tenet of developmentally appropriate teaching practice is the responsibility of the teacher to individualize his or her interactions with children, based on knowledge of each child's interests and developmental stage (Copple & Bredekamp, 2009). Additionally, teachers should engage with children in a way that is responsive to the current needs, desires, and emotions of the child. Thus, in a classroom operating in a developmentally appropriate manner, one would expect to see purposeful variability in the interactions between the teacher and each child. Moreover, it is inconsistent with Bioecological Theory to assume that all children in the classroom have the same experience with their teachers and that these experiences would be uniform across time and context.

Empirical evidence supports the notion of variability in children's experience of teacher-child interactions. For example, Curby, Brock, and Hamre (2013) reported that even when considering the classroom level "experience of the average child," there was significant within-classroom variability in the emotional support interactions provided by teachers throughout one day of observation. Notably, this variability was found to be associated with children's academic and social outcomes above and beyond the mean scores on emotional support. Another group of researchers adapted the Early Childhood Environment Rating Scale (Harms, Clifford, & Cryer, 1998) to provide scores for individual children's experiences within the classroom and found substantial variability, such that, even in classrooms with high levels of global quality, not all children were being involved in the classroom activities and interactions (Jeon et al., 2010). Recent work by Booren and colleagues (2012) provides additional support for within-classroom variability and also indicates the presence of within-child variability for teacher-child interactions. As noted by the CLASS authors themselves (Pianta et al., 2012), one must be careful to not interpret average experiences reported in studies as *typical*, and researchers must acknowledge and continue to work to describe and understand the variability of teacher-child interactions, as well as the factors that may contribute to this variation. The Bioecological Theory provides guidance for key areas to explore as possible sources of variability.

Impacts of individual experiences within the classroom

Although the evidence regarding effects of classroom-level teacher-child interactions has been relatively consistent among the published literature, effects are modest and sometimes null. These patterns have troubled researchers who continue to

refine conceptualization and measurement of children's experiences in classrooms. Prior evidence indicates that even a descriptive snapshot of children's classroom experiences can provide predictive information for children's school readiness above and beyond what is measured by global indicators of quality (Chien et al., 2010). A relatively new measure, the Individual Classroom Assessment Scoring System (inCLASS; Downer, Lima, Luckner, & Pianta, 2010) is one effort to develop a more nuanced measure of children's individual experiences in the classroom and examines children's engagement with teacher, peers, and tasks during typical classroom activities. Although research using this tool is limited, there is evidence for prediction to multiple aspects of children's developmental growth.

Children's academic skills appear to be shaped by their individual classroom experiences based on reports from two studies. Children who tend to have more positive engagement with their teachers demonstrate greater growth in phonological awareness, although no effects were found for print knowledge, or receptive or expressive language (Sabol et al., 2018). Additionally, children who had more negative engagement in the classroom had reduced gains in print knowledge, phonological awareness, and receptive vocabulary (Sabol et al., 2018; Williford, Whittaker, Vitiello, & Downer, 2013).

Children's gains in social-emotional and self-regulation development have also been linked to their individual experiences in the classroom, although evidence is mixed. Children's positive engagement with teachers was predictive of gains in self-regulation in one study (Williford et al., 2013), but Sabol and colleagues (2018) did not find effects of positive engagement with teachers on self-regulation (inhibitory control and approaches to learning). Negative engagement in the classroom was more consistently related to less

growth in self-regulation in the two studies using this measure to date (Sabol et al., 2018; Williford et al., 2013). Thus, although evidence is preliminary, individual experiences within the classroom do seem to provide a complementary lens and additional predictive power regarding children's developmental gains.

Impacts of student-teacher relationship on child outcomes.

Another approach to examining children's individual experiences with teachers has been to have teachers provide a rating of their relationship with individual children, resulting in a score for closeness and conflict between teacher and child (Pianta, 2001). Although there is considerable overlap in the constructs of teacher-child relationships and interactions, they are thought to be distinct, yet related, constructs. Observations of interactions between individual children and teachers have been linked to teacher-reported relationships, but unique information is gathered from each measurement approach indicating the importance of considering both aspects (Hartz, Williford, & Koomen, 2017).

A considerable amount of research has documented the impacts of teacher-child relationships, indicating positive effects on school readiness and adjustment into elementary school and beyond (e.g., Howes, 2000; Silva et al., 2011). Importantly, children's early relationships with teachers impact their engagement and perceptions about school, perhaps for many subsequent years (Doumen, Koomen, Byse, Wouters, & Verschueren, 2012; Silva et al., 2011). Children's earliest relationships with teachers establish a relatively stable pattern that they are likely to experience throughout their schooling career (Howes, Phillipsen, & Peisner-Feinberg, 2000; O'Connor, 2010). Children who are at risk for school difficulties may reap even greater benefits from

positive relationships with teachers. One study found that children who were previously demonstrating high levels of problem behaviors could be course-corrected onto a more positive developmental trajectory if they experienced a positive relationship with a teacher (Graziano, Garb, Ros, Hart, & Garcia, 2016). Similarly, children who were rated high on behavior problems but had a positive relationship with their teacher tended to evidence improved outcomes in discipline referrals and motivational engagement through eighth grade (Hamre & Pianta, 2001), whereas children with more conflict with their kindergarten teacher had increased level of aggressiveness through third grade (Silver, Measelle, Armstrong, & Essex, 2005). Thus, teacher-child relationships provide not only an important developmental context in the short-term, but also predict later outcomes.

Although the mechanisms driving the associations are not fully understood, research indicates that children who experience close relationships with teachers may reap these benefits in the short-term via improved social competence which can then lead to increased engagement and academic functioning (Palermo, Hanish, Martin, & Fabes, 2007). Children who experience close relationships with teachers may experience rapid improvement in academic functioning, as demonstrated by transitions from a profile marked by lower levels of school readiness to a profile marked by higher levels of school readiness by spring of the preschool year (Sandilos, Whitaker, Vitiello, & Kinzie, 2019). Conversely, children who experience high levels of conflict with teachers tend to achieve fewer gains in school readiness (Stipek & Miles, 2008). These academic impacts of children's relationships with teachers have been demonstrated to have lasting effects (Liew et al., 2010) and may serve as a buffer for children who experience suboptimal

home environments (O'Connor & McCartney, 2007) or who have intrinsic risk factors like low executive function (Liew et al, 2010).

Children's role in shaping their own classroom experiences

Consistent with Bioecological Theory, a great deal of evidence indicates that teachers relate differently with children, based at least in part on the child's own characteristics. Teachers' perceptions, attributions, interactions, and perceived relationships have all been demonstrated to differ across children (Carter, Williford, & LoCasale-Crouch, 2014; Erdena & Wolfgang, 2004; Howes et al., 2000; Rudasill & Rimm-Kaufman, 2009). Child characteristics that have been associated with differential experiences with teachers include ethnicity, behavior, social competence, and academic achievement (Jerome et al., 2009; Rudasill & Rimm-Kaufman, 2009). The following sections will highlight the current knowledge base on the role of children's own characteristics in their interactions with teachers, specifically focusing on associations with children's demographic characteristics, language and pre-academic skills, and social-emotional and self-regulatory skills.

Children's demographic characteristics. Although findings are mixed, some evidence indicates that children's experiences with teachers may vary based on the child's race or ethnicity, home language, and gender. Perhaps the most widely documented variation in preschoolers' experiences is comparing experiences of boys and girls. As early as infancy, boys and girls elicit different responses from adults including non-parental caregivers (Vallotton, 2009). As children grow, they establish relationships with teachers, and evidence consistently indicates that boys, on average, tend to experience relationships with teachers that are marked by less closeness and more

conflict than those experienced by girls (Howes et al., 2000). Research studies have documented gender differences in the amount of didactic instruction (Early et al., 2010), pleasant conversation (Dobbs, Arnold, & Doctoroff, 2004), and positive engagement (Slot & Bleses, 2018) children experience with teachers, but other studies have failed to detect gender differences (Kim et al., 2018; Vitiello, Booren, Downer, & Williford, 2012). Similarly, although some evidence has indicated less close or more conflicted relationships with minority students or dual language learners (Jerome et al., 2009), studies of observed teacher-child interactions have not found differences in positive engagement or conflict by ethnicity or home language (Kim et al., 2018).

Language and academic skills. As discussed above, researchers have consistently examined how children's experiences with teachers predict academic outcomes, but few studies have considered to what extent children's language and academic skills may shape the nature of their experience with teachers. Children who have strong language skills are likely to be conversation partners for teachers, which could lead to close relationships (Nurmi, 2012) and a greater amount of interaction. Additionally, children who flourish academically may provide positive reinforcement to teachers' instructional efforts (Hughes, Luo, Kwok, & Lloyd, 2008), resulting in more extensive instructional exchanges for children who enter the program with academic strengths. Conversely, children who enter the classroom with lower language skills may tend to have less positive relationships with teachers (Rudasill, Rimm-Kaufman, Justice, & Pence, 2006). However, teachers may also be prompted to provide greater support to children who enter the program academically at risk (Pakarinen, Lerkkanen, Poikkeus, Siekkinen, & Nurmi, 2011). Further research is needed to explore the possibility that children's language and

academic skills might be a precursor to their experiences with teachers in early education classrooms.

Self-regulation and behavior skills. Compared to links with academic skills, more early education research has attended to the role children's social-emotional development, such as self-regulation and behavior skills, may play in shaping their experience in the classroom. Overall, teachers tend to report more conflict and less closeness with children who exhibit higher levels of internalizing or externalizing behaviors (Nurmi, 2012). Notably, Hamre and her colleagues (Hamre, Pianta, Downer, & Mashburn, 2008) demonstrated that teachers' ratings of preschoolers' problem behaviors accounted for more than half of the variance in teacher-child conflict, indicating that children's behaviors are highly salient to the experiences they have with teachers. In contrast, children who are more socially competent or demonstrate greater executive functions tend to experience more positive interactions and relationships with teachers (McKinnon, Blair, & the Family Life Investigators, 2018; Pianta, La Paro, Payne, Cox, & Bradley, 2002).

Impacts of children's behavior on their experiences with teachers often have to do with teachers striving to maintain some level of control and attention in the classroom (Dobbs et al., 2004). Several studies document the tendency for teachers to use strategies with higher levels of power or control with children who demonstrate behaviors that disrupt the classroom environment. For example, children who are less focused and attentive are more likely to be engaged in interactions in which their teacher criticizes or corrects their behavior (Paget, Nagle, & Martin, 1984). Additionally, teachers' interactions with externalizing children tend to focus more on discipline and commands

and less on conversational or instructional interactions (Dobbs & Arnold, 2009; Van Acker, Grant, & Henry, 1996). Moreover, work by Dobbs and colleagues (2004) demonstrated that preschool teachers more frequently use commands with non-compliant children even when the child is not currently misbehaving, which suggests that teachers may be on heightened alert to the actions of these less-regulated, more-disruptive children and quickly jump to disciplinary interactions perhaps before the child's behavior warrants it. However, not all studies have found problem behavior to predict a reduction in positive teacher-child interactions (Doctoroff & Arnold, 2004).

In sum, the evidence available to date—in line with tenets of Bioecological Theory—suggests that children's characteristics including demographics, academic skills, and social-emotional skills may play a role in shaping their experiences with teachers. However, these findings are somewhat mixed and, in some areas, dated to prior eras of ECE. Other studies point to a more complex pattern of findings in which effects of one child characteristic on experiences with teachers are modified by another characteristic (Booren et al, 2012; Rudasill et al., 2006), indicating that additional research is needed to more fully describe the associations between children's characteristics and their experiences with teachers, as well as to what extent individual experiences with teachers may shape children's developmental trajectories. Accordingly, study one of this dissertation will build on the existing literature documenting connections between children's characteristics and the nature of their experiences with teachers. This study will utilize profile analysis to simultaneously consider aspects of children's self-regulation and academic skills.

Variability in individual experiences with teachers as mediator of child outcomes

Significant differences in reading and math skills by children's socioeconomic status are evident by kindergarten entry (von Hippel, Workman, & Downey, 2018) and persist throughout formal schooling (Downey, von Hippel, & Broh, 2004). Researchers have worked to understand factors underlying these disparities and have identified self-regulation and executive function as a mediator between SES and academic achievement (Dilworth-Bart, 2012; Fitpatrick, McKinnon, Blair, & Willoughby, 2014; Lawson & Farah, 2017). After identifying self-regulation as a key mechanism in the achievement gap, questions remain regarding the process through which these effects occur. Effects of self-regulation on academic outcomes are thought to be, in part, directly due to the deployment of greater attention and working memory on academic learning at hand, but a meta-analysis found no evidence for a causal association (Jacob & Parkinson, 2015). The effects of self-regulation on academic outcomes may also be mediated by some underlying mechanisms, and better understanding this process could help identify where interventions might be possible to attenuate the effects of poverty. Candidates for mediation of the association between self-regulation and academic outcomes would need to be linked conceptually and empirically to children's self-regulatory capacity and to their later academic outcomes and likely should be a feature of children's experience within the classroom and learning activities. Children's experiences with teachers are one such possible mediator. Thus, the second study of this dissertation will examine whether children's individual experiences with teachers—operationalized as observed teacher-child interactions and teacher reported relationships—mediates the effect of children's self-regulation on academic outcomes.

In summary, this dissertation has two primary aims. First, I will extend current work on children's role in shaping their own classroom experiences by considering a broader set of child characteristics and child experiences with teachers. Using a person-centered approach will allow me to examine how children's various characteristics work in conjunction with one another to impact the nature of their relationship and interactions with teachers. Second, I will conduct a test of the effects of children's individual experiences with teachers by examining whether and to what extent features of children's relationships and interactions with teachers mediate the association between children's self-regulatory skills at classroom entry with their academic gains across the academic year.

Method

Data used in this dissertation were collected as part of a larger ongoing study in partnership with a local Head Start program. Data were gathered using multiple strategies, including direct child assessment, classroom observation, and teacher questionnaires. Program administrative records were utilized for children's demographic information. Child assessments and teacher ratings of children's classroom functioning were collected in the fall of the academic year (September – early November 2015) and again in the late spring (late March – May 2016). Children were assessed using a standard protocol in a quiet space where they worked individually with a research team member. Classroom observations were conducted on one morning during the winter season (January – early March).

Participants

Participants were 3- and 4-year-old children (n = 252) enrolled in 61 Head Start classrooms in a medium-sized city in the central region of the United States. All children met criteria for participation in a Head Start center, so most were from low-income families. The sample included approximately equal proportions of boys (54%) as girls, and was ethnically diverse (39% Hispanic, 25% African America, 17% White, 19% multiple or other races). The mean age of participants at the beginning of the school year was 44.4 months.

Children were selected to participate using a tiered sampling approach in which classrooms were first chosen randomly from the available Head Start rooms and then six children per classroom were selected, stratified by gender and home language to match classroom enrollment. Once a child was identified for the study, research assistants

approached the parent at school dropoff or pickup to describe the study, answer any questions, and have them provide consent for their child's participation. Children's assent to participate was monitored by research assistants at each assessment visit, and children were allowed to refuse to participate and were returned to their classrooms if they became upset or chose to not continue the assessments.

Measures

Children's experiences with teachers. Children's experiences with teachers were measured in three ways, two of which were at the child level and one at the classroom level. Near the end of the school year, teachers rated their relationship with each study child using the Student Teacher Relationship Scale (STRS; Pianta, 2001) which is a 15-item scale using a 5-point Likert response option ranging from *Definitely does not apply* to *Definitely applies*. The STRS yields two scores indicating the closeness (8 items, alpha = .841) and conflict (7 items, alpha = .922) between each child and teacher dyad. The STRS has been widely used and has demonstrated strong psychometric properties and predicts children's classroom behavior and academic outcomes (Pianta & Steinberg, 1992; Pianta, Steinberg, & Rollins, 1995).

Children's individual interactions with teachers were measured using the Individual Classroom Assessment Scoring System (inCLASS; Downer, et al., 2010) during the winter season (January through early March). Prior to observations, research assistants attended two days of training provided by the inCLASS team and achieved 80 percent reliability using videos assigned by the trainer. Observers then visited each participating classroom for one morning and stayed for approximately 4 hours of observation. During the classroom visit, the observer watched each study child in the

classroom for 10-minute cycles, followed by 5 minutes of scoring. The observer continued observing until naptime and was instructed to obtain as many cycles per study child as possible (mean cycles = 3.67). The inCLASS results in scores for nine dimensions, and the three dimensions related to children's experiences with teachers were examined in this study: Positive Engagement, Communication, and Conflict. Scores ranging from 1 (low) to 7 (high) are assigned for each cycle, and scores were averaged across cycles to yield an estimate of each child's experiences with teachers. Prior evidence has documented the validity and reliability of the inCLASS for measuring preschoolers' classroom experiences, including construct validity and criterion-related validity (Downer, et al., 2010; Williford et al., 2013). The inCLASS has demonstrated factorial validity for demographic characteristics, including scalar invariance for ethnicity and poverty status and configural invariance for gender (Bohlmann et al., 2019). The inCLASS has also demonstrated good predictive validity of relevant outcomes such as school readiness, literacy, and self-regulation (Sabol et al., 2018; Williford et al., 2013)

Global teacher-child interactions in each classroom were also measured in this study using the Classroom Assessment Scoring System (CLASS Pre-K; Pianta et al., 2008). Prior to observations, research staff attended a two-day training and completed reliability trials as required by the authors of the measure. Coders were required to reach 80% reliability with master codes. On the same day as the inCLASS observation, a second observer visited the classroom and completed four 20-minute cycles of CLASS scoring. The CLASS Pre-K provides scores on 10 dimensions that are aggregated across cycles and then collapsed into three domains based on the authors' guidance. The CLASS Pre-K has been widely used in studies of early education and has demonstrated good

reliability and predictive validity (see Burchinal, 2018 for review). For the current study, due to high intercorrelations among the domains (*r*s = 0.56 – 0.82), a composite measure of global classroom quality was computed by taking the mean of the three domains.

Child Assessments

Task-based self-regulation. Children's task-based self-regulation was measured using three direct assessments: the pencil tap, digit span, and Head Toes Knees Shoulders. The pencil tap (Diamond & Taylor, 1996) is a measure of inhibitory control in which children are asked to tap their pencil twice when the assessor taps once and vice versa. Following 3 practice trials, 16 trials are administered in a standardized order, and children receive 1 point per correct trial, so scores range from 0 to 16. A score of negative 1 (-1) was assigned for children who did not pass the trial items. For the current sample, reliability (Cronbach's alpha) was .86 in the fall and .88 in the spring. The pencil tap has been used widely with this age group of children and has been demonstrated to be a reliable and valid measure in this context and for children attending Head Start (Fuhs, Farran, & Nesbitt, 2015; Raver et al, 2012).

In the Digit Span task, children were asked to remember and repeat back strings of numbers to the assessor, with the strings becoming increasingly longer across trials. Following 2 practice items, trials were administered beginning with two digit long strings and increasing by one digit on every other trial until children answered two trials of the same length incorrectly. Children were assigned 1 point for each correct trial, resulting in scores ranging from 0 to 11 in the current sample. The Digit Span has been utilized in several studies of Head Start children and other preschoolers and has been deemed a valid and reliable measure of working memory (Williford et al., 2013).

In the Head Toes Knees Shoulders task (HTKS), children's behavioral control is assessed in a way that taps the integration of working memory, cognitive flexibility, and inhibitory control (McClelland et al., 2014). This task is administered in three phases, the first involving natural response to a direction (e.g., "touch your toes"). In the second phase, children are asked to respond opposite to the instruction (e.g., when the assessor says, "touch your head," the child is instead supposed to touch his/her toes). The third phase includes additional commands and a rule change that increases the complexity of the task. In total, the task includes 30 trials, and children are awarded 2 points for each correct trial, with 1 point awarded if the child initially moved toward the incorrect body part but then self-corrected to the correct response, and 0 points awarded for an incorrect response. Possible scores ranged from 0 to 60. Prior research has documented the validity of the HTKS in assessing preschoolers' executive function in diverse samples (McClelland et al., 2014).

Teacher ratings of classroom behavior. Teachers rated children's classroom behavior and functioning using the *Devereux Early Childhood Assessment, Preschool 2nd Edition* (DECA; LeBuffe & Naglieri, 1999). Teachers were asked to rate items regarding the frequency of each child's behavior in the last 4 weeks, using a scale ranging from 1 (never) to 5 (very frequently). Teachers' ratings yielded standard scores on two domains as identified by the developers of the DECA: Total Protective Factors (27 items) and Behavior Concerns (10 items). Standard scores on the DECA have a mean of 50 and standard deviation of 10, with higher scores representing more total protective factors and more behavior concerns. The DECA has been used in other research as an indicator of social-emotional development and classroom behavioral functioning and has adequate

reliability with test-retest coefficient of .55 and .74 and internal reliability coefficients of .71 and .94 for Behavior Concerns and Total Protective Factors respectively (Lien & Carlson, 2009).

Academic skills assessments. Children completed three assessments to examine their cognitive and academic functioning: Woodcock Johnson III (Letter Word Identification and Applied Problems Subscales; Woodcock, McGrew, & Mather, 2001), Expressive One-Word Picture Vocabulary Test (Martin & Brownell, 2011), and the Bracken School Readiness Assessment (Bracken, 2007). In the Woodcock-Johnson Letter Word Identification test, children were asked to name letters and read words based on prompts on the test flipbook. The Applied Problems subtest assesses children's early math skills, including counting, geometry, and problem solving. Children answer questions as prompted by the assessor, using visual supports presented to the child on the testing flipbook. In both subtests, children proceeded through the items until they reached the ceiling as outlined by the testing manual. Standardized scores were used in this study, and have a mean of 100 and standard deviation of 15. The Woodcock-Johnson has been used extensively to assess children's early academic functioning in Head Start and other preschool research. Woodcock-Johnson has a high reliability with a Cronbach's alpha of XX for the Letter-Word subscale and YY for the Applied Problems subscale.

The Expressive One-Word Picture Vocabulary Test (EOWPVT) is a measure of children's expressive vocabulary that has been validated for children starting at age 2. In this assessment, the assessor presents the child with a picture on the testing book and asks the child "what's this?" Children respond verbally and proceed through the items until a pattern of incorrect responses identify their ceiling as specified in the testing manual. For

children who speak Spanish at home, we utilized the bilingual version of the EOWPVT, which allows for conceptual scoring in which children receive credit for answers in either Spanish or English. Standard scores were used in this study, with a mean of 100 and standard deviation of 15. The EOWPVT has demonstrated high internal consistency (alpha = .95) and test-retest stability (r = .97). It has also demonstrated strong criterion and content validity (Martin & Brownell, 2011).

The Bracken School Readiness Assessment is a multidimensional screener of children's school readiness. Utilizing a flipbook with graphics and other visual supports for children's engagement, assessors ask children questions in a series of subtests: color recognition, letters, numbers/counting, size/comparison, and shapes. These subtests were combined according to the testing manual and resulted in a single composite score of school readiness, with a population mean of 100 and standard deviation of 15. The Bracken has demonstrated adequate test-retest stability (r = .76 to .92) and split-half reliability (r = .95; Bracken, 2007).

Analytic Plan: Study 1

Study one is designed to examine the question of how children's developmental characteristics at classroom entry relate to the nature of experiences they have with teachers as the year progresses. A person-centered analytic approach will be utilized to explore this question using a two-step process. First, developmental profiles will be extracted and children will be assigned to the most likely profile. Second, children's profile assignment will then be entered in a multilevel regression model to predict aspects of the relationship and interactions with their teacher.

To classify children into developmental profiles at classroom entry, indicators of children's skills in fall 2015 will be entered into a Latent Profile Analysis (LPA) using M*Plus*. Child-level variables will measures of task-oriented self-regulation (Pencil Tap, Digit Span, and Head Toes Knees Shoulders), classroom behavior (teacher-rated Total Protective Factors and Behavior Concerns), and academic skill (Woodcock Johnson Letter Word Identification and Applied Problems, Expressive One-Word Picture Vocabulary Test, and Bracken School Readiness Assessment). All child assessments will be standardized using a *z*-score prior to running the LPA to aid interpretation. To determine the appropriate number of profiles, I will estimate a model fitting a one-class solution, and then proceed to fit models with one additional profile up to six profiles. The decision about the appropriate number of profiles to retain will utilize fit statistics from these six models (Nylund, Asparouhov, & Muthen, 2008), along with considerations about the theoretical and conceptual interpretability of the profiles. Smaller values of the Akaike Information Criteria (AIC), Bayesian, Information Criteria (BIC), adjusted BIC (SABIC) indicate better model fit, and entropy values approaching 1 also indicate better fit (Byrne, 2001). Once the best fitting model and optimal number of profiles has been identified, group assignment for each child will be saved to the data file.

Next, a set of multilevel regression models will be conducted to predict components of children's experiences with teachers from profile membership, controlling for a set of child and classroom characteristics. These models will be specified individually for five dependent variables: Student-Teacher Relationship Closeness, Student-Teacher Relationship Conflict, inCLASS Positive Engagement, inCLASS Communication, and inCLASS Conflict. Each of these models will be ran using the Type

= Complex specification in M*Plus* to account for the interdependence of data from children nested within classrooms and a Full Information Likelihood estimator to account for missing data. Child-level covariates will include gender and race, and classroom-level covariates will include a dummy code for whether the classroom enrolls children who are 3 or 4 years old and the aggregate CLASS score to control for overall classroom quality.

Analytic Plan: Study 2

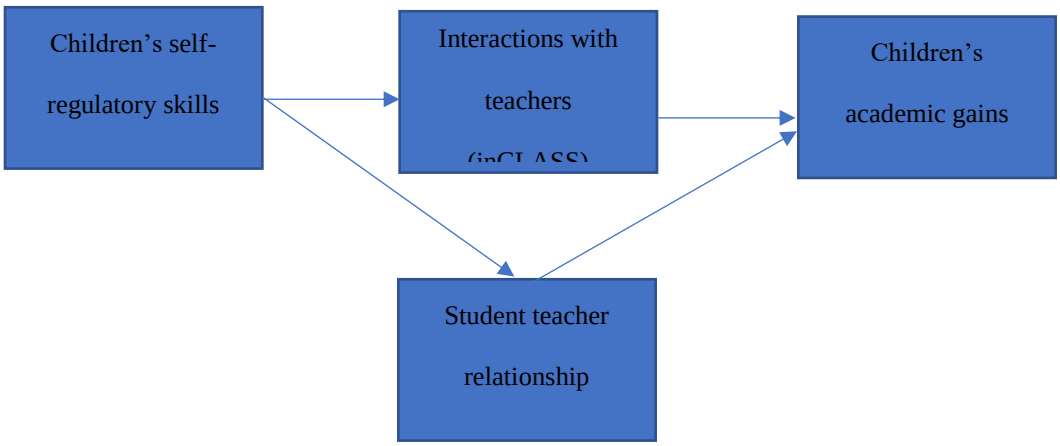
Study two is designed to test the hypothesis that children's individual experiences with teachers may be both shaped by children's characteristics and then subsequently impact children's development. For this study, I will examine whether a well-documented association between children's self-regulation and academic outcomes is partially mediated by their individual experiences with teachers. Because numerous measures were collected for each of these constructs, I will first utilize data reduction techniques to reduce the number of analytic models that will be examined.

Confirmatory Factor Analysis will be conducted using M*Plus* for both the set of independent variables (i.e., self-regulation) and dependent variables (i.e., academic outcomes) to assess whether or not each set of variables can be loaded onto a single factor or if more than one factor is represented in the data. Intercorrelations among the 5 components of children's experiences with teachers (3 inCLASS subscales and 2 student-teacher relationship subscales) will be examined to determine whether they should be loaded onto conceptual factors, or combined within or across measures for the analytic models. To identify the best fitting measurement models for each set of variables, I will

follow guidelines established by Kline (2011). Generally, model fit will be judged as satisfactory for $X^2 > .05$, CFI > .90, and RMSEA < .08.

Once a factor structure for the independent and dependent variables has been identified, I will conduct a series of Structural Equation Models (SEM) to assess the paths as indicated in Figure 1. Because it is currently unknown to what extent the experiences with teachers will be combined, they are represented separately in the proposed model. Type = Complex and Full Information Maximum Likelihood specifications will again be utilized to account for nested and missing data. The Indirect Effects command will be used to generate estimates of the indirect effects of children's self-regulation on academic skills via children's experiences with teachers, and this estimate will serve as the test of mediation.

Figure 1. Proposed model for study 2.



Potential Limitations

Although this work brings many strengths such as numerous measures of each construct and an innovative approach to examining children's experiences with teachers,

it does have several limitations that are worth noting. As with all correlational research, no causal conclusions can be reached or inferred. It is likely that any identified associations are bidirectional and dynamic in a way that is not possible to capture in this study. Additionally, some specific limitations of the inCLASS measure have been identified in the small body of research that has utilized it to date. Specifically, variability of scores by cycle have been noted to vary more widely across cycle that by child or classroom, indicating that this tool may be particularly sensitive to the specific context of the classroom during a given cycle (Kim et al., 2018; Vitiello et al, 2012). This was detected in studies that utilized a greater number of cycles per child than my data allow, so findings will need to be interpreted with caution. Additionally, Slot and Bleses (2018) found that stability within- and across-days of observation was weaker for children's interactions with teachers than for the peer- and task-oriented components of the inCLASS. Finally, the sample involved in the study is a low-income sample attending a high-quality early education program, so generalizability may be limited when considering other populations. Despite these limitations, this dissertation is positioned to expand current knowledge of variability of children's experiences in the classrooms, including how children shape and are shaped by these classroom experiences. Findings from this research will be an important contribution to the research as well as to programs and practice in the field of early education.

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Appendix A

Planned Articles for Dissertation

This dissertation will include three articles, with planned focus and targeted submission as follows:

1. A conceptual paper outlining the current knowledge of children's experiences in the classrooms and limitations to current understanding and measurement will be prepared as paper 1. This paper will be submitted to *Child Development Perspectives,* which is a leading journal in child development that publishes syntheses and conceptual papers on emerging or evolving lines of inquiry. The 1-year impact factor for *Child Development Perspectives* is 3.207.
2. The second paper produced for this dissertation will be an empirical article based on Study 1 as described in the prospectus. This paper will present the person-centered analysis examining how children's developmental profiles at class entry associates with their interactions and relationships with teachers. This paper includes a relatively novel approach to this question and a strong quantitative approach, making it a good fit for submission to *Child Development.* As the premier journal in the field, *Child Development* is the flagship journal of the Society for Research in Child Development and has a 1-year impact factor of 3.779 and a 5-year impact factor of 5.441.
3. The third paper produced for this dissertation will also be an empirical article and will describe Study 2 as presented in the prospectus. This paper will report on the test of whether children's individual experiences may partially mediate the association between self-regulation and academic outcomes. Because this paper includes a robust approach to a question of significance to the field of developmental psychology as well as to practitioners and policymakers in education, this paper will be submitted to the *Journal of Applied Developmental Psychology.* JADP focuses on applied developmental research in fields like education and has a 1-year impact factor of 2.310 and a 5-year impact factor of 2.636.

Note: Other journals under consideration for papers 2 and 3 are *Early Childhood Research Quarterly* (impact factor = 2.364, 3.415) and *Early Education and Development* (impact factor = 1.377 in 2017).