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Examining Contributors to Preschoolers' Classroom Engagement using Structural Equation Modeling

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Examining Contributors to Preschoolers' Classroom Engagement using Structural Equation Modeling

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by

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ABSTRACT

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The purpose of this study is to demonstrate whether and how teacher-child interactions, teacher-child relationships, children's self-control, parents' education levels, teachers' teaching experience and education levels, and classroom physical environment impact children's engagement levels. Preschoolers from Head Start programs and a university childcare center (N = 135, M = 54.93 months, SD = 7.50) and 15 preschool classroom teachers in East Tennessee participated in the study. Classroom head teachers rated children's engagement, teacher-child interaction, teacher-child relationships, and children's self-control using provided questionnaires. The primary researcher assessed the classroom physical environment and determined the reliability for the Children's Physical Environments Rating Scale (CPERS). The structural equation modeling (SEM) statistical approach was employed to analyze the data.

The results showed that the level of preschoolers' engagement in classroom learning activities was directly associated with their self-control (β = .37, p < .001). Preschoolers' engagement was not indirectly associated with children's self-control through teacher-child interaction. The level of engagement of preschoolers in classroom learning activities did not directly associate with teacher-child relationships but was indirectly associated with the teacher-child relationship

through children's self-control (β = .20 , p < .001). When separating the two subscales of teacher-child relationship (closeness and conflict), teacher-child closeness was directly associated with children's engagement level (β = .22, p = .003). In addition, teacher-child conflict was both directly (β = - .17, p = .022) and indirectly associated with child's engagement level through children's self-control (β = .26, p < .001). Classroom physical environment did not directly predict the level of engagement of preschoolers, while indirect relationships were found between the classroom physical environment scores and the level of engagement of preschoolers, and the relationship was mediated by children's self-control (β = .09, p = .050).

The study offers implications for teachers as they work on enhancing children's engagement level in their learning activities. Future research suggested by this study include further exploration of intervention strategies to increase children's active engagement. Increasing sample size and obtaining reliability of the measures on children's behaviors would also improve the rigor of the study.

DEDICATION

This work is dedicated to my father, Rujie Zhao. He is a wonderful father with a great personality. His love, care, and encouragement always motivated me in my further studies. He is my role model. He taught me the importance of persistence and diligence when pursing my goals. Without him, I might not have been able to obtain my undergraduate degree, let alone finishing this PhD journey. I really appreciate that I have such a great father.

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CHAPTER 1

INTRODUCTION

Introduction

Chapter 1 provides an introduction for this study. This chapter is organized around research problems about children's engagement in the early childhood field, theoretical framework for conducting this study, seven research questions addressed in this study, and hypotheses regarding the seven research questions.

Statement of the Problem

When pertaining to education, engagement is the amount of time a child spends with materials, or interacts with caregivers or peers in a developmentally appropriate manner (Doke & Risley, 1972; McWilliam, Trivette, & Dunst,1985). As a key component of school achievement, engagement has gained much attention from many perspectives. Researchers, educators and policymakers consider increasing students' levels of engagement as the major factor in addressing the issue of low school achievement, student boredom, and the rates of school dropouts (Fredricks, Blumenfeld, & Paris, 2004). The level of engagement also helps to identify at-risk students in order for educators to provide appropriate interventions and promote their learning (Fredricks et al., 2011).

Many schools and districts have considered active student engagement as the explicit goal in improving students' school achievement (National Research Council and Institute of Medicine, 2004). In other words, these insititions regard students' engagement as a key indicator of school success. As Skinner, Kindermann, and Furrer (2009) indicated, unless students actively

engage with learning activities, their learning cannot be considered a success, because students' active engagement influences their school achievement. Numerous studies have demonstrated that children's engagement was not only associated with their current developmental outcomes (e.g., Georges, Brooks-Gunn, & Malone, 2012; McWayne, Fantuzzo, & McDermott, 2004), but also predicted their later school achievement (Guo, Breit-Smith, Connor, Shuyan, & Morrison, 2015; Hughes, Luo, Kwok, & Loyd, 2008; Ladd & Dinella, 2009; Ponitz, Rimm-Kaufman, Grimm, & Curby, 2009; Williford, Maier, Downer, Pianta, & Howes, 2013).

Despite the importance of engagement in children's learning, research indicates a continuing low level of student engagement in US schools (Skinner, Furrer, Marchand, & Kindermann, 2008). Therefore, further research on enhancing children's engagement is necessary, especially for children in their early years, because early engagement can predict their later school achievement (Ladd & Dinella, 2009).

Beginning in 1984, researchers developed scales to assess children's engagement (McWilliam, 1984). Since that time, educators have examined factors that might associate with children's engagement, and confirmed several primary contributions to engagement. Major factors influencing children's engagement included teacher-child interaction (Aydogan, Farran, & Sagsoz, 2015; Cadima, Doumen, Verschueren, & Buyse, 2015; McWilliam & Scarborough, 2003; Ponitz et al., 2009; Sjoman, Granlund, & Almqvist, 2016; Williford et al., 2013;), teacher-child relationships (Archambault, Pagani, & Fitzpatrick, 2013; Cadima et al., 2015; Hughes & Kwok, 2007; Portilla, Ballard, Adler, Boyce, & Obradovic, 2014; Searle, Miller-Lewis, Sawyer, & Baghurst, 2013), and child's self-control (Brock, Rimm-Kaufman, Nathanson, & Grimm,

2009; Cadima et al., 2015; Portilla et al., 2014; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009; Williford et al., 2013).

Most studies about teacher-child interaction focused on assessing classsroom level interaction (Aydogan et al., 2015; Bailey, Denham, Curby, & Bassett, 2016; Ponitz et al., 2009; Sjoman et al., 2016), while few examined the individual level of interaction between a teacher and a typically developing child. In addition, some researchers posited that children in well-designed classroom environments were more likely to be engaged (Raspa, McWilliam, & Ridley, 2001; Ridley, McWilliam, & Oates, 2000). Previous studies about the influence of classroom environment on children's engagement combined the physical environment constructed with other indicators of classroom quality (e.g., teacher interaction and program structure) in a single score. Therefore, it is still not clear whether the independent component of physical environment contributes to children's engagement and to what extent it influences engagement. In the current study, physical environment was a separate independent measure of classroom quality. Because limited research has examined the way in which these factors (teacher-child relationship, teacher-child interaction, and child's self-control) combined to affect children's engagement, this study addressed the influence of the physical environment on children's engagement, the factors influencing children's engagement, and the pathways of the associations among these variables.

Theoretical Framework

Ecological Theory

Bronfenbrenner (1979a) argued that most studies of human development focused on out-of-context observations of behavior instead of employing the interrelationship between the developing child and the changing micro and macro environments. He proposed that child

development was a complex process and is affected by the environment in which the child lives, and by the larger contexts that surrounded that environment. As Bronfenbrenner (1979b) described:

> The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contexts in which the settings are embedded. (p. 21)

He and his colleagues further emphasized this concept in his other work which stated that, “Human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment” (Bronfenbrenner & Morris, 1998, p. 996).

Bronfenner (1979a) posited that everything in the environment in which a child lives affects a child’s development. His ecological theory proposed a model comprised of five environmental systems. He explained the five levels of environments as microsystem, mesosystem, exosystem, macrosystem, and chronosystem. The microsystem is the system closest to the child, including family, school, neighborhood, and peers, that has a direct effect on the child. The mesosystem addresses the interactions in the person's microsystem and the way in which those interactions affect each other. The exosystem consists of institutions or persons that do not have direct influence on children but that indirectly affect their experience. The

macrosystem incorporates cultural environment in the individual lives, influencing development. The chronosystem includes the environmental events and transitions througout a child's life that influence a person's development (Bronfenbrenner, 1979b).

According to Bronfenbrenner's description of ecological theory, children's development does not occur in a vacuum, and is not just influenced by only one factor. For example, children are in the classrooms where teachers interact and build relationships with children within the classroom's physical environment. In addition, children have individual personalities, their teachers provide certain skills, and their parents' interact with them in different ways at home, all of which may contribute to children's positive behaviors and active engagement.

Transactional Theory

Sameroff and Chandler (1975) proposed the transactional theory, which posited that individuals and environments are interdependent and interact with each other. Building on Bell and Chapman's (1968) reinterpretation of the relationship between children and adults, the researchers pointed out that most studies tested the effects of parents' interactions on children's behaviors, while possibly disregarding the role that children played in shaping parents' behaviors. Thus, in this theory, behavior is bidirectional, rather than unidirectional. Parents influence children's behavior, and in turn, children's behavior affects parents' reactions to the children's behaviors.

Figure 1 shows Sutherland and Morgan (2003)'s transactional model between the teacher and the child. Both the environment and children's behavior shape their learning, which in turn changes the environment. Thus, a child's behavior is not the result of only the teacher's behavior

or his or her own behavior. Rather, behavior is a result of the integrated interaction between the child and the environment, which includes the teacher. Figure 1 illustrates the transaction model, which begins when the teacher reprimands the child's inattention during the learning activity to which the child responds with noncompliance/disruption, which may lead to the teacher's avoidance or decrease of interaction with the child. The resulting change may cause the child's learning engagement and academic standing to be at-risk.

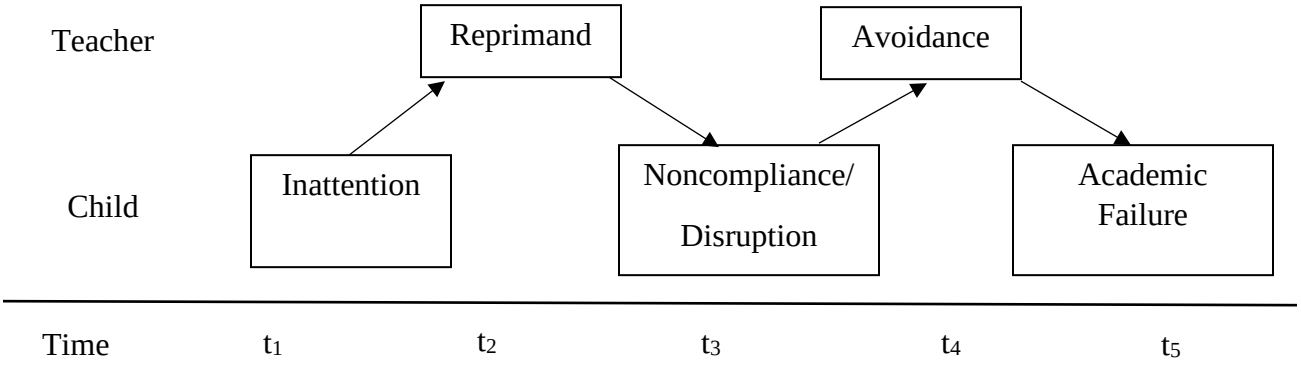

Figure 1. Example of transactional process from inattention to academic failure.

In early childhood classrooms, teachers' interactional approach influences children's behavior, which in turn, may affect the way teachers react to their behaviors and their relationships with them. During the process of the interaction between the teacher and the child, as Sutherland and Morgan (2003) described above, a complex web of factors might influence their behaviors and affect their engagement level.

Research Questions

Seven research questions were addressed in this study:

RQ1: Is the level of preschoolers'engagement in classroom learning activities directly associated with their self-control or mediated through teacher-child interaction quality?

RQ2: Is the level of preschoolers' engagement in classroom learning activities directly associated with the teacher-child relationship or mediated through children's self-control?

RQ3: Is the level of preschoolers' engagement associated with the quality of classroom physical environment?

RQ4: Are fathers' and mothers' education levels associated with the level of preschoolers' engagement through children's self-control?

RQ5: Are teachers' years of teaching experiences associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ6: Are teachers' levels of education associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ7: Are teachers' years of teaching experience and levels of education associated with the level of preschoolers' engagement through the quality of the classroom physical environment?

Hypotheses

Based on the existing research about children's engagement, the study proposed the following hypotheses:

HO1: The level of engagement of preschoolers in classroom learning activities is directly associated with their self-control and is mediated through the quality of teacher-child interaction.

HO2: The level of engagement of preschoolers in classroom learning activities is directly associated with the teacher-child relationship and is mediated through children's self-control.

HO3: Classroom physical environment is associated with the level of engagement of preschoolers.

HO4: Children's self-control mediates the association between fathers' and mothers' education level and the level of preschoolers' engagement.

HO5: The teacher-child relationship and teacher-child interaction mediates the association between teachers' years of teaching experience and preschoolers' engagement in the classroom.

HO6: The teacher-child relationship and teacher-child interaction mediates the association between teachers' education level and preschoolers' engagement in the classroom.

HO7: The quality of classroom physical environment mediates the association between teachers' years of teaching experience and preschoolers' engagement, and between teachers' education level and preschoolers' engagement.

Definition of Terms

Engagement - This definition, adopted from research studies on children's engagment, includes the amount of time a child spends with materials, or interacts with caregivers or peers in a developmentally appropriate manner (Doke & Risley, 1972; McWilliam, Trivette, & Dunst, 1985).

Teacher-child Interaction - Teacher-child interaction is the teacher's perception of his/her interaction with the child in the daily routine of the classroom. It involves four aspects of interaction: child behavior, communication, teacher engagement, and the teacher skills in maintaining the child's engagement (Almqvist, 2006).

Teacher-child Relationship - Teacher-child relationships are defined as the degree and emotional quality of involvement between teacher and child. It includes two aspects of relationships: closeness and conflict (Pianta, 1994).

Self-control - Children's self-control is the ability to think and to plan before acting. In the current study, it refers to cognitive and behavioral self-control (Humphrey, 1982).

Physical Environment - For the purposes of this study, the definition of physical environment, adopted from Moore (2010), refers to the childcare center size, density, privacy,

well-defined activity settings, modified open-plan space, and a variety of technical design features.

Preschoolers - Preschoolers are children of 3 to 5 years old (NAEYC, 2017).

Preschool Program - Preschool programs provide early care and education for children of 3 to 5 years old. They help preschoolers develop various skills that make them ready for school (Encyclopedia on Early Childhood Development, 2017).

Structural Equation Modeling (SEM) - Structural equation modeling (SEM) is a general statistical modeling technique combining factor analysis, regression and path analysis (Hox & Bechger, 1998).

Chapter Summary

Given the importance of young children's engagement in their learning and current research, the current study explored the factors that might contribute to children's engagement levels and the interactions among these factors using structural equation modeling (SEM). These factors are: teacher-child interaction, teacher-child relationship, children's self-control, and classroom physical environment. Chapter 2 addresses previous research and literature related to these factors.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter is organized around the independent and dependent variables related to the study, and provides information from previous research about these concepts the research explored, how the studies were designed, and what results were found. This review of the research literature located the research gap on children's engagement and provided a perspective from which to design the current study. In addition, the chapter reviewed the associations among the variables, which provided information that was used to build the research model for this study.

Engagement

Definition of Engagement

In *Random House Webster's Unabridged Dictionary* (1966), engaged is defined as choosing to involve oneself in or commit oneself to something. *Webster's Third New International Dictionary* (1961) conceptualizes engagement as becoming involved or entangled. *Webster's Ninth New Collegiate Dictionary* (1983) defines engagement as being actively involved in or committed. *Merriam-Webster's Collegiate Dictionary* (11th ed.) (1993) identifies engagement as inducing someone to participate.

The definition of engagement in children has different foci; there are three predominant dimensions. The first definition of engagement focuses on children's overall engagement and assesses the amount of time children spend in developmentally appropriate learning activities.

For instance, some researchers specify engagement as the amount of time a child spends with materials or interacts with caregivers or peers in a developmentally appropriate manner (Doke & Risley, 1972; McWilliam, 1984; McWilliam et al., 1985). A second definition divides engagement into two constructs: behavioral and emotional engagement (Finn, 1989; Li, Lerner, & Lerner, 2010; Mih & Mih, 2013). Behavioral engagement refers to students' participation in their learning, while emotional engagement notes students' effect on the environment. A third definition of engagement is a multifaceted concept, which includes behavioral, cognitive, and emotional engagement (Connell, 1990; Fredricks et al., 2004). Researchers demonstrated that the definition of engagement should include all three components, which should be studied simultaneously instead of separately. For the purposes of this study, the researcher defines engagement as the amount of time a child spends with materials or interacts with caregivers or peers in a developmentally appropriate way (Doke & Risley, 1972; McWilliam, 1984; McWilliam et al., 1985).

Numerous studies have identified that critical elements of children's engagement, such as children's attention, participation, involvement, and persistence (de Kruif & McWilliam, 1999; Mahoney & Wheeden, 1999), were associated with children's concurrent academic achievement (McWayne et al., 2004). In addition, these elements of children's engagement also predicted children's academic achievement in their later elementary school years (Alexander, Entwisle, & Dauber, 1993; Chien et al., 2010; Georges et al., 2012; Ladd & Dinella, 2009). The following studies clearly showed these associations.

Critical Elements of Engagement and Achievement

McWayne et al. (2004) examined the contributions of multiple children's competencies (e.g., general classroom competencies, specific approaches to learning, and interpersonal classroom behavioral problems) to the children's early academic success. Participants included 195 Head Start children from 32 classrooms in 17 childcare centers. The approaches to learning included competence motivation, attention/persistence, and attitude toward learning. Attention/persistence, an important component of children's engagement (Mahoney & Wheeden, 1999; de Kruif & McWilliam, 1999), along with general classroom competencies, demonstrated significant associations with children's concurrent academic scores (partial $R^2 = 10.89$, $p <$ .0001).

A number of longitudinal studies have examined the prediction association between children's engagement and school achievement. Georges et al. (2012) in a large sample size examined the relationship between children's attention, a core component of engagement (de Kruif & McWilliam, 1999), and later academic achievement. This longitudinal study analyzed the relationship between children's attention and achievement at both the individual and classroom level with 14,537 kindergartners in 2,109 classrooms. Trained assessors tested children's mathematical and literacy skills at the beginning and the end of their kindergarten year, and classroom teachers rated the children's attention using the Approaches Toward Learning Scale in the Early Childhood Longitudinal Study–Kindergarten Class of 1998-99 (ECLS-K). The Approaches Toward Learning Scale was a composite score of children's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and

organization. It indicated each child's attention level. The results showed that children with higher attention problem scores gained fewer mathematical and literacy skills. The differences of scores between children with attention problems and children without attention problems was larger than the achievement gap based on the SES or ethnicity differences.

Alexander et al. (1993), conducted a four-year longitudinal study to examine the influence of children's behaviors on their short- and long-term school achievement. The researchers used a stratified random sampling approach to select 790 first graders. Children's participation, cooperation, and attention were the potential predictors in this study assessed in year 1, year 2, and year 4. Some researchers have suggested that participation and attention are critical elements of children's engagement (de Kruif & McWilliam, 1999; Mahoney & Wheeden, 1999). The results showed that children's participation and attention, not cooperation, affected their reading and math score in all three years.

Engagement and Achievement

Researchers have developed several scales to assess children's engagement (Bichay, 2016; Hughes et al., 2008; Hughes & Kwok, 2007; Ladd & Dinella, 2009; Williford et al., 2013). These scales clearly define children's engagement and examine the associations between engagement and their current school achievement as well as the prediction of an association between children's engagement and their later school achievement.

The following two studies explored the concurrent relationship between children's engagement and school achievement. In the first study, Bichay (2016) examined the relationship between children's engagement and their learning achievement. A sample of 655 Head Start

preschoolers in 71 classrooms participated in the study. Children's engagement, internalizing behavior (cognitive behavior), and language and math performance were evaluated. Bichay (2016) used the Individualized Classroom Assessment Scoring System (inCLASS) (Downer, Booren, Lima, Luckner, & Pianta, 2010) to observe children's engagement with teachers, peers, and tasks. A structural equation modeling statistical approach was used to analyze the data. The results revealed that classroom engagement with tasks mediated the relationship between internalizing behavior and children's language and math achievement (with the model fit indictors of $\chi 2$= 73.185, p <.001; *CFI* = 0.902; *RMSEA* = 0.091, *SRMR* = 0.037).

In a second study, Williford et al. (2013) examined children's engagement and their literacy skills (receptive and expressive vocabulary, phonological awareness, and print knowledge). Participants included 605 children from Head Start and community-based classrooms. During winter, the Individual Classroom Assessment Scoring System (inCLASS) measured children's engagement with teachers, peers, and tasks. The results demonstrated that children's positive engagement associated with the significant achievement of expressive vocabulary with b = 2.26, *SE* = 0.85, p = .01, and effect size = .07. Children's negative engagement was associated with significantly smaller gains in print knowledge.

Williford et al. (2013) found that children's engagement was not only related to their current learning achievement, but also predicted their later school achievement, confirming findings from a number of longitudinal studies (Hughes et al., 2008; Hughes & Kwok, 2007; Ladd & Dinella, 2009). Ladd and Dinella's (2009) longitutinal study found that young children's engagement predicted their later school achievement. Their study recruited 383

children when they entered kindergarten. At the beginning of the study, teachers rated students' engagement level using five items from the Teaching Rating Scale of School Adjustment (e.g., uses classroom materials responsibly), and five items from the Devereux Elementary School Behavior Rating Scale (e.g., breaks classroom rules). The researchers assessed each child's reading and math achievement from the first through the eighth grade. The results showed that the composite score of reading and math from the first to eighth grade showed moderate stability (*rs* ranged from .62 to .83, $M = .74$). Using a path analysis, they found that children's early engagement was a significant predictor ($p < .01$) of children's positive changes in achievement.

Hughes et al. (2008) conducted a three-year longitudinal study involving 671 academically at-risk children who entered this study at first grade. This study assessed teacher-student relationships, child engagement, and math and reading achievement each year. The authors defined engagement as effort, attention, persistence, and cooperative participation in learning and used a 10-item engagment scale. The Big Five Inventory and the Social Competence Scale were combined to create the scale items. A structural equation model approach tested the hypothesis that teacher-child relationships at Year 1 predicted student engagement at Year 3 after controlling students' earlier engagement level, and earlier engagement predicted math achievement at Year 3 after controlling earlier math achievement. This hypothesis was confirmed by the established model. It showed the math model had an adequate fit with $\chi^2 = 236.34$ ($SD = 14.34$), $p < .001$, $CFI = .96$ ($SD = .003$), $RMSEA = .08$ ($SD = .003$), and the $SRMR = .06$ ($SD = .002$). It was also hypothesized that teacher-child relationships at Year 1 predicted student engagement at Year 3 after controlling students' earlier engagement

level. Earlier engagement predicted reading achievement at Year 3 after controlling earlier reading achievement. The model for reading achievement indicated a good fit model with χ^2 = 218.46 (*SD* = 14.34), $p < .001$, *CFI* = .96 (*SD* = .003), *RMSEA* = .07 (*SD* = .003), and the *SRMR* = .06 (*SD* = .004).

Hughes and Kwok (2007) conducted a comparable 2-year longitudinal study using the same scale as Hughes et al.'s (2008) study to assess first graders' engagement. Results from the structural equation model showed that children's classroom engagement mediated the positive associations between teacher-student relationships and children's academic achievement, and between parent-student relationships and children's academic achievement in the subsequent year.

Direct and Indirect Associations Between Engagement and Achievement Using SEM

Some studies employed a structural equation model (SEM) to create complex models to examine the mechanism of children's engagement and their school achievement. SEM enables the investigator to measure direct and indirect effects among variables and analyzes several regression equations simultaneously (Karimimalayer & Anuar, 2012). It examines the associations more accurately by testing direct and indirect relationships. For instance, in Ponitz et al. (2009)'s and Guo et al. (2015)'s studies, the researchers identified a direct association between children's engagement and their school achievement. Ponitz et al. (2009)'s study investigated the extent to which kindergartners' classroom behavioral engagement mediated the association between classroom quality and children's reading performance. Participants included 171 kindergarteners from 36 rural classrooms. The Observed Child Engagement Scale (Rimm-

Kaufman, 2005) was used to rate the children's engagement behaviors: engagement, attention, self-reliance, compliance, and disruptive behavior. Two subscales of letter-word identification and sound awareness from the Woodcock-Johnson III measured children's reading achievement. The structural equation model (SEM) analysis revealed that engaged children improved more in reading achievement from the fall to spring (β = .16) than those who were less engaged.

Guo et al. (2015) examined the relationship between children's behavioral engagement and reading achievement. Data was extracted from The National Institute of Child Health and Human Development's study of early childcare and youth development. The engagement and reading achievement was assessed 1,160 children between preschool and fifth grade. Researchers employed the Classroom Observation System (COS) to examine children's behavioral engagement in the first, third, and fifth grade. Assessment of children's reading skills was through letter-word identification, picture vocabulary, and passage comprehension from the scale of the Woodcock-Johnson Test of Achievement-R (WJ-R) in their preschool, first, third, and fifth grade. A structural equation model (SEM) hypothesized the following associations: children's reading achievement in preschool would predicte their behavioral engagement in 1st grade, which would then predict their engagment in third and fifth grade. In addition, the reading acheivement in first, third, and fifth grades would correlate with children's engagement in the corresponding grade. The model fit indicators showed that these associations existed as predicted (χ^2 = 337.95, p < .001, *TLI* = .93, *CFI* = .96, *RMSEA* = .08).

The indirect association between children's engagement and their learning achievement was also evident in Portilla et al.'s (2014) longitudinal study. The authors analyzed the data

collected from 338 kindergarten children. Teachers and parents reported children's engagement using two different versions of the school engagement subscale from the Heath and Behavior Questionnaires (HBQ) (Armstrong & Goldstein, 2003) during the fall of kindergarten, the spring of kindergarten, and first grade spring. Teachers and parents also reported children's math and reading abilities using the academic competence subscale from the HBQ at first grade spring. The nested path analysis signified that children's academic competence in first grade was positively associated with their school engagement in kindergarten spring with $B = .29$, $p < .001$. The results also demonstrated that children's inattention to learning activities influenced their academic achievement through school engagement with $B = -.13$, $\beta = -.06$, $p < .01$.

Engagement and ChildCare Quality

Various researchers have measured children's engagement as an indicator of effective interventions and high quality programs (McWilliam et al., 1985; Raspa et al., 2001; Ridley et al., 2000). Early in 1985, McWilliam et al. investigated the efficacy of intervention efforts using behavior engagement as an outcome measure. One setting used traditional programs or programmed instruction teaching methods, while the other setting employed nontraditional programs, such as incidential teaching designed to produce consistently high levels of engagement. Thirty-five preschoolers who participated in either a traditional or nontraditional program were involved in this study. The results showed that children in the nontraditional program were more engaged ($M = 91.97$) than children in the traditional programs ($M = 74.20$).

Moreover, Raspa et al. (2001) examined the relationships between childcare quality and children's engagement behavior. Researchers observed 78 toddlers from two licensing levels (A

and AA) to assess their engagement level using the Engagement Check II scale, which was a modification of the Planned Activity Check (Risley & Cataldo, 1973). Four individual engagement categories were observed: sophisticated engagement (persistence, symbolic, encoded, and constructive behaviors), differentiated engagement (differentiated behaviors), focused engagement (focused attention behaviors), and unsophisticated engagement (undifferentiated, casual attention, nonengaged behaviors). Six other measures evaluated program quality: Infant/Toddler Environment Rating Scale (Harms, Cryer, & Clifford, 2006), Early Childhood Environment Rating Scale-Revised (Harms, Clifford, & Cryer, 2005), Caregiver Interaction Scale (Arnett, 1989), Teaching Styles Rating Scale (McWilliam, Scarborough, Bagby, & Sweeney, 1998), group size, and child-teacher ratio. The results demonstrated that all quality measures, except group size, were positively associated with children's unsophisticated engagement.

Engagement and Curriculum Quality

As a result of research findings, engagement has become an important indicator of curriculum quality in early childcare programs worldwide. In the state of Tennessee, the Revised Tennessee Early Learning Developmental Standards (Birth-48 months) issued by the Tennessee Department of Education in 2013 encourages teachers to provide children self-selected activities to support their curiosity and engage them in play (Tennessee Department of Education, 2013). Children's engagement is undergoing global examination, for example in Singapore where the government focus is on expanding childcare settings. Children's engagement level is treated as an indicator of childcare programs quality. The government provides different amount of funding

to the programs based on the quality. In Hong Kong in 2006, the Education Bureau (HKSAR) issued the *Guide to Pre-primary Curriculum*, which considers children's engagement pivotal to learning effectiveness. The guide emphasizes that caregivers should provide materials based on children's interests to stimulate children's play (The Curriculum Development Council, 2006). In South Australia, the South Australia Curriculum, Standards and Accountability (SACSA) Framework for the Early Years Band describes children's outcomes as that "which describe what will be observed or inferred through a student's engagement with the curriculum scope" (Government of South Australia, 1999, p. 27).

Summary for Engagement

From the literature discussed above, the relationships between children's engagement and academic achievement is well established. However, research indicates a low level of engagement in US schools (Skinner et al., 2008). Therefore, it is necessary to do further research on student engagement, especially for young children. As shown in numerous studies, children's engagement in their early years can predict their later school achievement (Guo et al., 2015; Ponita et al., 2009; Portilla et al., 2014; Williford et al., 2013).

Given the importance of children's active engagement, interventions should be developed to enhance young children's engagement. However, in order to make the intervention programs successful, we need to determine what factors influence early childhood engagement in learning and how those factors influence each other. This study explored a number of factors that may influence children's engagement.

Teacher-Child Interaction

Definition of Teacher-Child Interaction

Teacher-child interaction is a critical element that contributes to children's engagement (Papadopoulou & Gregoriadis, 2016; Ponitz et al., 2009; Williford et al., 2013). The most recent studies have examined teacher-child interaction at the classroom level using the scale of the Classroom Assessment Scoring System (CLASS) (Aydogan et al., 2015; Bailey et al., 2016; Cadima et al., 2015; Merritt, Wanless, Rimm-Kaufman, Cameron, & Peugh, 2012; Pianta et al., 2005; Rimm-Kaufman et al., 2009) which included teachers' emotional support, organizational support, and instructional support. To fit the aims of the present study, the definition of teacher-child interaction incorporates the teachers' perception of their interaction with an individual child in their daily activites. There were four aspects of interaction: child behavior, communication, teacher engagement, and teacher skills in maintaining the child's engagement (Almqvist, 2006).

Classroom-level Interaction

Teacher-child interaction is a strong indicator of a positive classroom climate in early childhood, which influenced children's engagement (Papadopoulou & Gregoriadis, 2016; Ponitz et al., 2009; Williford et al., 2013). Researchers have confirmed a positive relationship between teacher-child interactions and children's engagement at the classroom level for children with disabilities (Casey, McWilliam, & Sims, 2012; Mahoney & Wheeden, 1999; Sjoman et al., 2016) and for children without disabilities (Aydogan et al., 2015; Bailey et al. 2016; Ponitz et al., 2009; Sjoman et al., 2016). This same relationship has been confirmed with preschoolers (Bailey et al., 2016; Casey et al., 2012; Sjoman et al., 2016), kindergarteners, (Aydogan et al., 2015; Mahoney,

& Wheeden, 1999; Ponitz et al., 2009) and older children, such as 5th graders, (Rimm-Kaufman et al., 2014).

In addition to fifth graders, Rimm-Kaufman et al. (2009) investigated the direction and extent of the influence of teacher-child interactions on kindergarteners' behavioral engagement. Participants in the study included 171 kindergarteners from 36 rural classrooms and one teacher from each classroom. Using the Observed Child Engagement Scale (Rimm-Kaufman, 2005), teachers rated each child's engagement behaviors based on three observations during the year and a teacher-report rating scale at the end of the year. The findings showed that the quality of teacher-child interaction promoted children's behavioral engagement, which led to an increase in children's learning achievement.

In Aydogan et al.'s (2015) study, researchers used an observational tool to assess the interaction of 45 kindergarten teachers with their children who were 60 to 72 months old. In this study, they averaged the ratings of engagement scores in each classroom across the deliberately designed activities. The results demonstrated that teachers' interactions with the children, instructional and emotional, predicted children's engagement in learning.

In addition, Bailey et al.'s (2016) study supported the positive association between teacher-child interaction at the classroom level and preschoolers' engagement. In this study, participants included 312 three-, four-, and five-year-old children. Classroom teachers rated the children's engagement levels using a questionaire that included three subscales: positive/engaged, independent/motivated, and prosocial/connected. The Classroom Assessment Scoring System (CLASS) measured the components of emotional and organizational support of

teacher-child interaction (Pianta et al., 2005) through an outside observer. The findings showed that while teacher-child interactions were indirectly associated with preschoolers' engagement, children's emotional regulation was significantly associated with children's engagment through the teachers providing positive emotional and organizational support.

The studies discussed above, as well as others (Casey et al., 2012; Rimm-Kaufman et al., 2014; Ponitz et al., 2009) that examined the influence of teacher-child interaction on children's engagement, focused on teacher classroom-level interaction with all children, rather than interaction with individual children. Few studies examined teachers' individual level interaction with children (Casey et al., 2012; Mahoney & Wheeden, 1999; Sjoman et al., 2016).

Individual-level Interaction

Few studies have examinined the association between teacher-child interactions and children's engagement at the individual level, and those studies concentrated on children with disabilities (Casey et al., 2012; Mahoney & Wheeden, 1999; Sjoman et al., 2016). Mahoney and Wheeden (1999) recruited 49 teacher-child dyads coming from 30 early childhood special education classrooms. Nineteen of the classrooms had two teachers that participated in the study. The study involved children, ranging from 17 to 71 months of age who had a variety of disabilities. Each participating teacher selected one child from the classroom to form the teacher-child dyad. Three items of the Child Behavior Rating, including persistence, attention to activity, and involvement, measured the engagement level when the child was alone. Four additional items, including initiation activity, compliance/cooperation, initiation teacher, and affect, assessed the child's engagement level when interacting with the teacher. A 7-item observational

rating scale was used to assess the interactive styles of the teachers. The results showed that teachers' individual interaction styles, including performance orientation (achievement orientation + directiveness + praise) and child orientation (participation + enjoyment + supportiveness + responsiveness), explained a significant amount of variance in children's engagement. Specifically, teachers' performance orientations were negatively associated with children's initiation and positively associated with children's social involvement. Teachers' orientation positively associated with children's initiation.

Casey et al.'s (2012) study found that incidental teaching, one of the three types of teacher interactions (incidental teaching, nonelaborative response, and nonresponsive directives), predicted the amount of time children with disabilities spent in sophisticated engagement, such as persistence, symbolic, encoding, and constructive behaviors. This study included 61 preschoolers with disabilities from 31 early childhood classrooms and their classroom teachers. The Engagement Quality and Incidental Teaching for Improved Education (E-Qual-ITIE) was used to assess the children's engagment. This observational scale used momentary time sampling to record children's engagement for two 15-minute sessions. The teachers' interactions or incidental teaching used the same observational scale of E-Qual-ITIE at the individual level. Findings noted that children who received more incidental teaching showed more sophisticated engagement than children who received less incidental teaching.

In an international study, Sjoman et al. (2016) examined interaction as a mediator between the behaviors of children with and without disabilities and their engagement. The participants included 663 children from 18 to 71 months of age from a Swedish preschool. The

Child Engagement Questionaire (CEQ) (McWilliam, 1991), which is a teacher-reported engagement scale, assessed the children's engagement level. A factor analysis of the engagement scale found two factors of children's engagement: core engagement and developmental engagement. Using their experience with each child in preschool, teachers rated the teacher-child social interactions using a questionnaire. The results indicated that positive interactions with the child contributed to the child's engagement. Specifically, both children's core engagement (r = .55, $p < .001$), and children's developmental engagement (r = .50, $p < .001$) significantly associated with teachers' responsiveness.

Factors Influencing Teacher-Child Interaction

The teacher factor. In 2007, Maxwell and colleagues reviewed seven major studies of early childhood education, which examined the predictors of classroom quality and children's outcomes. The results indicated that teachers' education level and educational major were not indicators of a high quality classroom and did not predict children's outcomes. However, other studies have found that teachers' education level and teaching experience contributed to classroom quality. For instance, King, Pierro, Li, Porterfield, and Rucker (2016) examined 766 infant and toddler classrooms using the Infant Toddler Environment Rating Scale-Revised (ITERS-R) and teachers' education levels and teaching experience. The results demonstrated that teachers' education levels were significantly and positively associated with the scores on classroom organization and interaction with the children, and teachers' teaching experiences were significantly and positively related to their helping children use language and interact with the teacher.

The child factor. Teacher-child interaction is an important indicator of classroom climate (Ponitz et al., 2009), and teachers' interaction quality varies depending on individual children's characteristics. For instance, the quality of teachers' interaction with older children was higher than with younger children (Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000). Teachers interacted more with children with learning difficulties (Roorda, Koomen, Spilt, & Oort, 2011) or children with less self-control (Rimm-Kaufman et al., 2009), because children with less self-control were more likely to receive teacher-initiated interactions to correct their behavior (Rudasill & Rimm-Kaufman, 2009). Additionally, Rimm-Kaufman, and Pianta (2000) found that teacher-child interaction was bidirectional. Children's characteristics (e.g., self-control) influenced the frequency of teacher-child interactions.

Summary for Teacher-Child Interaction

In order to examine the contributions of teacher-child interactions on children's engagement more accurately, examining the individual level of interaction between the teacher and the child without disabilities is critical. This current study individually assessed the quality of each teacher-child dyad interaction to identify the association between the teacher's interaction and the children's engagement. In addition, children's characteristics (self-control) and teachers' characteristics (teacher's years of teaching experience and education level) were important factors predicting the quality of teachers' interaction with the children examined in the current study.

Teacher-Child Relationship

Definition of the Teacher-Child Relationship

Some researchers described the teacher-child relationship based on attachment theory. For example, Howes and Matheson (1992) described teacher-child relationship as secure, avoidant, or resistant/ambivalent. Lynch and Cicchetti (1992) identified five types of teacher-child relationships when considering children's emotional quality and psychological proximity-seeking: optimal, deprived, disengaged, confused, and average. Pianta et al. (1994) characterized the teacher-child relationship as six clusters based on the degree and emotional quality of involvement between teacher and child: dependent, positively involved, dysfunctional, functional/average, angry/dependent, and uninvolved. The current study adopted Pianta and his colleagues' conception of teacher-child relationships and considered the different levels of teacher-child relationship quality, including teacher-child closeness and conflict aspects.

Teacher-Child Relationships and Engagement

It has been well established that the quality of teacher-child relationships has a significant positive influence on children's engagement in their early years. The results from several longitudinal studies revealed that teacher-child closeness predicted children's later engagement (Hughes & Kwok, 2007; Hughes et al., 2008; Portilla et al., 2014). Portilla et al. (2014) examined the dynamic interplay between teacher-child relationships and engagement in kindergarten and first grade. This longitudinal study included 338 kindergarteners with a mean age of 5.31 years from 29 classrooms. The researchers collected data at three intervals (kindergarten fall, kindergarten spring, and first-grade spring). The results demonstrated that

children who experienced greater closeness with their teachers in kindergarten showed more engagement across kindergarten and first grade. Children who were closer to their teachers in kindergarten had better self-control and demonstrated more academic competence in first grade.

A few international studies reported that the quality of the teacher-child relationship was positively associated with children's engagement (Archambaul et al., 2013; Cadima et al., 2015; Papadopoulou & Gregoriadis, 2016). In Papadopoulou and Gregoriadis's (2016) study, participants included 232 preschool children and 39 kindergarten teachers from Greece. Rating of the perceptions of teacher-child relationships came from interviews with the children that focused on three areas: warmth, conflict, and autonomy. Teachers reported children's engagement in learning activities using the Teacher-Rated Effortful Engagement (TREE) scale. The findings showed that, although the correlations between conflict with teachers and children's engagement was not high, the relationship was significantly correlated. Children who had more warmth from their teachers showed higher engagement levels.

In addition, Roorda et al. (2011) conducted a meta-analysis about the influence of the teacher-child relationships on students' engagement. This analysis included 99 studies involving 129,423 participants, ranging from preschool to high school. The results showed that the effect size for both the positive relationships (closeness) and engagement ($r = .39$, $p < .01$) and negative relationships (conflict) and engagement ($r = -.32$, $p < .01$) were medium to large.

Factors Influencing the Teacher-Child Relationship

The teacher factor. From Roorda et al.'s (2011) meta-analysis, the literature indicated a positive influence of teacher-student relationships on children's engagement and children's

achievement during preschool through high school. This study revealed that when teachers had more years of teaching experience, the strength of the relationship with their students was stronger. It also revealed that teachers' years of teaching experience was positively related to children's achievement (β = .386, p = .032).

The child factor. Self-control is a major factor affecting children's relationships with their teachers. Numerous studies revealed an important association between children's self-control skills and a positive relationship with the teacher (Cadima et al., 2015; Cadima, Verschueren, Leal, & Guedes, 2016; Palermo, Hanish, Martin, Fabes, & Reiser, 2007; Portilla et al., 2014; Rudasill, 2011).

Most of these studies used the Student-Teacher Relationship Scale (STRS) (Cadima et al., 2015; Cadima et al., 2016; Hughes & Kwok, 2007; Hughes et al., 2008; Portilla et al., 2014), which consists of two subscales—closeness and conflict—to assess the quality of the teacher-child relationship. However, the associations between children's self-control and their relationships with the teachers revealed by different studies were inconsistent. For instance, Cadima et al. (2015) examined children's engagement across kindergarten and first grade as well as the contributions of children's self-control and teacher-child relationships. The sample for this study was 145 children, and data was gathered in kindergarten and first grade. Researchers assessed children's self-control through two drawing tasks. The Student-Teacher Relationship Scale (STRS) was used to assess the closeness and conflict in the teacher-child relationship. Kindergarten teachers used the STRS to assess the quality of the teacher-child relationship. The results showed that closeness did not have a significant relationship with the child's self-control,

while conflict had a significant negative relationship with the child's self-control skills (r = -.13, p < .05).

On the other hand, a different conclusion about the influence of teacher-child closeness and conflict on children's self-control occurred in one of Cadima et al.'s (2016) later studies. This study investigated the associations between children's self-control and teacher-child relationships. The study involved 206 young children with a mean age of 4 years and 11 months who were at risk for poverty and social exclusion. The Head-Toes-Knees-Shoulders (HTKS) (Ponitz et al., 2009) task assessed the children's self-control at the beginning and at the end of the school year. The teachers reported their perceptions of their relationship with each child using the Student-Teacher Relationship Scale (STRS) in the middle of the school year. The results showed that children's self-control assessed both at the beginning (r = .25, p < .05) and the end of the school year (r = .27, p < .01) was significantly related to teacher-child closeness. However, teacher-child conflict was not significantly associated with child-control at either the beginning or the end of the school year.

In another study, teacher-child relationships (both closeness and conflict) were significantly associated with children's self-control (Portilla et al., 2014). This study used a structural equation modeling approach to demonstrate an association between teacher-child relationships and engagement. It also examined the relationship between the quality of the teacher-child relationship and children's self-control across kindergarten and first grade to predict children's academic achievement in first grade. Participants included 338 kindergarten children with a mean age of 5.31 years. Teachers reported the quality of teacher-child

relationships using the Student-Teacher Relationship Scale (STRS) (Pianta, 2001) at three time points: kindergarten fall, kindergarten spring, and first grade spring. Parents and teachers rated the quality of children's self-control during the same three points of time. The results showed that teacher-child closeness was negatively related to children's self-control only at the end of first grade (B = -.02, β = -.11, p < .05). Teacher-child conflict was positively related to children's self-control in kindergarten fall (B = .15, β = .60, p < .001), kindergarten spring (B = -.10, β = -.42, p < .001), and first grade (B = -.15, β = -.47, p < .001).

Summary for Teacher-Child Relationship

From the review above, it can be seen that the teacher-child relationship has an association with children's engagement (Cadima et al., 2015; Cadima et al., 2016; Palermo et al., 2007; Portilla et al., 2014; Rudasill, 2011). Regarding the associations between the teacher-child relationship and the children's self-control, researchers have reached different conclusions. Cadima et al.'s (2016) study found that teacher-child closeness was significantly associated with children's self-control, but conflict was not related to children's self-control (Cadima et al., 2016). However, a similar study came to a different conclusion, that teacher-child closeness was not significantly associated with self-control of kindergarteners and first graders, while teacher-child conflict was negatively related to the children's self-control (Cadima et al., 2015). Therefore, in the current study, it is necessary to examine the factors of teacher-child relationships and the degree of contribution of children's engagement. Further, we need to investigate the relationship between teacher-child closeness and preschoolers' self-control, and between conflict and preschoolers' self-control.

Self-Control

Definition of Self-Control

Although extant research supports the influence of children's self-control on their classroom engagement and learning outcomes (Brock et al., 2009; Cadima et al., 2015; Graziano, Garb, Ros, Hart, & Garcia, 2016; Portilla et al., 2014; Rimm-Kaufman et al., 2009; Williford et al., 2013), the definition and specific components of self-control are still debatable (Hofmann, Schmeichel, & Baddeley, 2012; McClelland & Tominey, 2014; Singer & Bashir, 1999; Yildiz, Kara, Tanribuyurdu, & Gonen, 2014). Singer and Bashir (1999) described executive functions and self-control to demonstrate the distinction between the two concepts. They subsumed self-control under the concept of executive function. However, many other researchers included executive function as part of self-control (Hofmann et al., 2012; McClelland, Ponitz, Messersmith, & Tominey, 2010; McClelland & Tominey, 2014; Yildiz et al., 2014). Self-control is the conscious control of thoughts, feelings, and behaviors, including the ability to think and to plan before acting. McClelland & Tominey 2014) stated that executive function is the key component of self-control, and includes three cognitive components: attentional or cognitive flexibility, working memory, and inhibitory control. Attentional or cognitive flexibility is the ability to focus on a task, to ignore distractions, and to switch attention to another task. Working memory is the ability of processing information mentally. Young children use working memory to remember rules and instructions. Inhibitory control is the ability to stop an unwanted impulse and to replace it with desired behavior. Thus, self-control can be the integration of the three skills

into behavior. These skills help children manage their behaviors, and persist in difficult tasks (McClelland & Tominey, 2014).

Humphrey (1982) considered self-control as self-regulation and defined it as having cognitive (e.g., the child sticks to what she or he is doing until finished, even when the task is lengthy and unpleasant) and behavioral components (e.g., the child disrupts others when they are engaged in activities). Cognitive self-control describes the extent to which children can control their own thinking when working on learning activities. On the other hand, behavior self-control describes the extent to which children can control their interpersonal behaviors when they work with others. This concept of self-control, including behavior and cognitive behavior, is used in the current study.

Self-Control and Engagement

Children who can better control their behaviors and emotions are more engaged during their classroom activities (Brock et al., 2009; Drake, Belsky, & Fearon, 2014; Searle et al., 2013; Sjöman et al., 2016; Williford et al., 2013). As children grow in their abilities to control their behaviors and emotions, their engagement levels are also enhanced. Self-control contributes to children's school achievement. Some researchers reported that children's self-control in their early life influenced their engagement level in subsequent situations and learnings throughout their lives (Cadima et al., 2015; Portilla et al., 2014). This relationship can be seen in the following structural equation modeling (SEM) studies.

Drake et al. (2014) built a model of the mediational influence of children's self-control between attachment and their school engagement. The data was derived from the National

Institute of Child Health and Human Development (NICHD) study of early childcare and youth development. The involved participants were 1,149 children with attachment data at 15 months, and 1,140 children with attachment data at 36 months. The researchers measured children's self-control using the self-control subscale of the Social Skills Rating System (Gresham & Elliott, 1990) repeatedly through primary school. Measuring children's school engagement required using the Classroom Observation System (NICHD Early Childcare Research Network, 2006), which assessed the degree of classroom engagement for each child at Grades 1, 3, and 5. The results from the path analysis showed that the mediational effect of children's self-control existed. The indirect effect of the child's 15-month attachment on fifth grade engagement through self-control was significant with $B = .46$, $z = 2.35$, $p = .017$. The indirect effect of children's 36-month attachment on fifth grade engagement through self-control was also significant with $B = .69$, $z = 3.23$, $p < .001$. Thus, children's self-control was not only associated with their current engagement level, but also related to their engagement in later school learning activities.

Williford et al. (2013) examined the way in which children's engagement predicted their self-regulation during their preschool years. Participants included 341 preschool children, observed with the Individualized Classroom Assessment Scoring System (inCLASS) (Downer et al., 2010) to determine children's engagement with teachers, peers, and tasks. The task orientation subscale of the Teacher-Child Rating Scale (Hightower et al., 1986) rated children's behavior and cognitive regulation. Teachers completed the Emotion Regulation Checklist (Shields, Dickstein, Seifer, Giusti, Magee, & Spritz, 2001) to assess their perceptions of

children's emotional regulation. The pencil tap and toy sort tasks from the Preschool Self-Regulation Assessment (Smith-Donald, Raver, Hayes, & Richardson, 2007) assessed each child's executive functioning and compliance. Several models examined how well children's engagement with teachers, peers, and tasks predicted their self-regulation development during the preschool year. The results showed that children's engagement with tasks and activities was positively associated with gains in task orientation (b = 0.31, SE = .02, p = .014; effect size = .11). Negative classroom engagement was negatively associated with gains in task orientation (b = -0.59, SE = .21, p = .005; effect size = .12). Positive engagement with teachers was associated with greater gains in compliance/executive control during their preschool year (b = 0.27, SE = .10, p = .007; effect size = .17). Children who were more actively engaged with tasks gained more in their emotional regulation during their preschool year (b = 0.12, SE = .06, p = .039; effect size = .12). Children who were more positively engaged reduced their dysregulation (b = -0.67, SE = .29, p = .022; effect size = .21).

Cadima et al. (2015) investigated the contribution of children's self-control to their engagement level during their transition to school. The sample consisted of 145 children assessed from kindergarten through first grade. The Teacher Rating Scale of School Adjustment (TRSSA) (Birch & Ladd, 1997) measured children's behavioral engagement as reported by teachers at the end of kindergarten and first grade. Another observational engagement scale was used to assess children's behavioral engagement at the end of first grade. Two drawing tasks indicated children's self-control/regulation, which was indicated by children's inhibitory control. (Kochanska, Murray, & Coy, 1997). Multilevel path analysis showed that children's inhibitory

control (β = .21, *SE* = .08, $p < .001$) directly contributed to children's observed behavioral engagement at the end of kindergarten. When examining the teacher-report of children's engagement data. The model showed children's inhibitory control (β = .24, *SE* = .09, $p = .008$) directly contributed to behavioral engagement at the end of kindergarten, which, along with teacher-child closeness, and peer-teacher conflict, was associated with teacher-reported children's engagement in first grade (β = .54, *SE* = .07, $p < .001$).

Likewise, Portilla et al. (2014) examined children's self-regulation as indicated by inattention and impulsive behaviors as one of the predictors of children's engagement. Parents and teachers completed the school engagement subscale from the MacArthur Health and Behavior Questionnaire (HBQ) (Armstrong & Goldstein, 2003) in the fall of kindergarten, spring of kindergarten, and spring of first grade. Parents and teachers also reported children's inattention and impulsive behaviors at all three points using the inattention and impulsive subscales from the HBQ. The results showed that children's school engagement was negatively associated with their inattention and impulsivity at kindergarten in fall (*B* = -.04, β = -.36, $p < .001$) and first grade (*B* = -.05, β = -.45, $p < .001$). Children who showed more inattention and impulsivity in kindergarten demonstrated less engagement by the end of first grade (*B* = -.27, β = -.19, $p < .01$). This study also identified the indirect effect between inattention and impulsivity and academic achievement through children's engagement (*B* = -.04, β = -.04, $p < .10$). Children's self-control influenced their engagement, which in turn affected their academic achievement.

Factors Influencing Children's Self-Control

The parent factor. Children can inherit characteristics from their parents genetically. Gesell (1980-1991) believed that the action of genes directly decided children's development (Crain, 2011). This perspective suggested that children's ability to control their behavior (self-control) was inherited from their parents prior to birth. However, other researchers posited that parental characteristics affected children's self-control after they were born. Cadima et al. (2015) found that the mothers' education level was positively associated with children's self-control, which was indicated by children's inhibitory control.

The teacher factor. Another environmental factor identified by researchers as influencing children's self-control in classrooms was the quality of the teacher-child interaction. Humphrey (1982) divided the conceptualization of children's self-control into their cognitive/personal behavior and behavior/interpersonal behavior. This study found that children's behavior was associated with the quality of teacher interaction. Sjöman et al. (2016) also examined teacher-child social interaction as mediating the relationship between children's externalized behavior difficulties and their engagement in preschool. The Strength and Difficulties Questionnaire (SDQ) measured the externalized behaviors of 666 children, which included the subscales of emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior (Goodman, 1997). Classroom teachers completed this questionnaire of social interaction, and results showed that teacher responsiveness mediated the relationship between children's hyperactivity and their engagement. Further research also found that children's self-control indicated by effortful control (Rudasill, 2011), inhibitory

control (Cadima et al., 2015), behavioral self-control (Merritt et al., 2012) and executive function (Yildiz et al., 2014) related to teacher-child interaction quality.

Summary for Self-Control

The influence of the children's self-control on the children's engagement was found in numerous studies, self-control is a factor that influences children's engagement (Brock et al., 2009; Drake et al., 2014; Searle et al., 2013; Sjöman et al., 2016; Williford et al., 2013). To further examine the contribution of children's self-control, the model for the current study examined the direct and indirect associations among the variables of teacher-child relationship, teacher-child interaction, and children's self-control.

Physical Environment

Definition of Physical Environment

The classroom physical environment, along with the social environment and the temporal environment, make up the three components of early childhood environments frequently discussed in early childhood research literature. Physical environment includes the size, density, privacy, well-defined activity settings, modified open-plan space, and a variety of technical design features (Moore, 2010). Teachers have control over many aspects of their classroom's physical environment and can organize it by selectively designing spaces, furnishings, and materials to maximize children's learning opportunities and engagement.

Classroom Quality and Children's Development

A variety of studies have related classroom quality to children's achievement (Abreu-Lima, Leal, Cadima, & Gamelas, 2013; Hassan, Hemdan, Mohamed, & Marzouk, 2016;

Mashburn, 2008); however, the studies used scales that assessed the overall classroom quality, including physical environment as only one component. For instance, Abreu-Lima et al. (2013) analyzed the relationships between preschool classroom quality including physical environment and children's developmental outcomes. The participants were 215 four- and five-year-old children from 60 classrooms in Portugal. The Early Childhood Environmental Rating Scale-Revised (ECERS-R) (Harms et al., 2005) was used to assess classroom quality, while other measures examined children's literacy, math, and behavioral outcomes. The results demonstrated that the classroom quality indexed by ECERS-R scores predicted children's literacy and behaviors skills.

Physical Environment and Children's Development

Some studies examined the influence of only the physical environment on children's academic achievement, noting a positive relationship between these constructs (Mashburn, 2008; Maxwell, 2007; Read, Sugawara, & Brandt, 1999; Tanner, 2000; 2008).

Part of Mashburn (2008)'s study examined the association between the classroom physical environment and children's development of academic, language, and literacy skills. Participants included 540 preschoolers. Two subscales measured the physical environment: space and furnishings from the Early Childhood Environment Rating Scale-Revised (ECERS-R) (Harms et al., 2005) and learning environment from the Assessment Profile (Abbott-Shim & Sibley, 1998). Two subscales of the Woodcock-Johnson-III Test of Achievement (Woodcock & Johnson, 1990) were used to evaluate children's academic achievement. The Peabody Picture Vocabulary Test-III and the expressive language subtest of the Oral and Written Language

Scales gauged children's language skills, while the Story and Print (Zill & Resnick, 1998) assessed literacy skills. The results demonstrated that the classroom physical environment was not associated with children's development of academic, language, and literacy skills. However, it was found that the physical environment significantly moderated the association between family income and children's academic achievement, as well as the relationship between race/ethnicity and literacy development. Children from more impoverished homes who were in lower quality physical environment classrooms had lower academic skills than did poor children in higher quality physical environment classrooms ($B = 2.42$, $p < .01$). Higher literacy skills were evident among non-White children in higher quality physical environment classrooms than they were among White children ($B = 0.47$, $p < .05$).

Maxwell (2007) assessed the physical environment's role in the development of cognitive and social competency in young children. Seventy-nine children with a mean age of 52.7 months participated in this study. The Classroom Rating Scale assessed the children's physical environment by examining social spaces, boundaries, privacy, personalization, complexity, scale, and adjacency. Researchers measured the children's cognitive competency using the McCarthy's Scale of Children's Abilities (McCarthy, 1972), and assessed social competency using the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (Harter & Pike, 1984). The linear regression model in this study showed that three-year-old children in classrooms with higher physical environment scores had higher cognitive competency ($b =$

- 23.62, $p < .005$). Children in the classrooms rated as higher on complimentary areas, support spaces, access to large motor development play, and personal care had higher social competency scores ($b = - 1.54$, $p < .02$). This study did not find this relationship for four-year-old children.

Two of Tanner's (2000, 2008) studies focused on elementary students. In Tanner's 2000 study, the School Design and Planning Laboratory (SD&PL) assessed the schools' physical environment, and children's academic achievement was assessed by the Iowa Test of Basic Skills (ITBS) (Hoover, Dunbar, & Frisbie, 2003). Participants were from 44 elementary schools. Among the 39 design patterns from the SD&PL, seven patterns were significantly correlated with the ITBS scores. They were: a) context (the school and grounds are compatible with the surroundings) ($r = 0.62$, $p = .05$); b) outdoor rooms (enough like a classroom, but with added beauties of nature) ($r = 0.75$, $p = .02$); c) pathways (allow freedom movement among structure) ($r = 0.79$, $p = .01$); d) outdoor space (places which are defined) ($r = 0.55$, $p = 0.05$); e) technology for students (spaces with computers, etc.) ($r = 0.65$, $p = .01$); f) technology for teachers (computers, etc.) ($r = 0.65$, $p = .01$); and g) overall impression (student friendly and teacher friendly) ($r = 0.65$, $p = .01$). A multiple regression analysis determined which variables predicted children's ITBS scores the best. The results showed that the four best predictors were pathways, positive outdoor spaces, computers for teachers, and overall impression. The adjusted *R2* was 0.86 with $p < .05$.

In Tanner's 2008 study, the researchers examined the relationships between physical environment and third grade students' academic achievement. The participants included 1,916 third graders from 24 elementary schools. The Design Appraisal Scale for Elementary Schools,

featuring four components—movement and circulation classifications, large group meeting places, day lighting and views, and instructional neighborhoods—assessed the physical environment. The Iowa Tests of Basic Skills (ITBS) (Hoover et al., 2003) was used to examine students' academic achievement levels. The results from structural equation modeling analysis revealed that the four components of physical environment were positively associated with students' academic achievement. This could be seen in the model modification. Before adding the four components of physical environment, the R^2 was .472. After adding the four components (movement and circulation classifications, large group meeting places, day lighting and views, and instructional neighborhoods) independently to the model, the R^2 increased to .541(movement and circulation), .490 (large group meeting places), .497(day lighting and views), and .503 (instructional neighborhoods).Read et al.'s (1999) research examined the impact of space and color in the preschool classroom on children's cooperative behavior by conducting an experimental study. Thirty preschoolers (3 years, 9 months to 5 years, 7 months), divided into eight groups, participated in the study. The preschoolers underwent four treatment conditions. Condition 1: undifferentiated ceiling height and wall color (a 9 foot ceiling with neutral color walls); condition 2: differentiated ceiling height (a portion of the ceiling reduced from 9 feet to 5 feet, 6 inches with the neutral color walls); condition 3: differentiated wall color (a 9 foot ceiling with a bright color east wall); and condition 4: differentiated ceiling height and wall color (a portion of the ceiling reduced to 5 feet, 6 inches ceiling with bright red color east wall). Researchers videotaped and coded the children's behaviors using the Oregon Preschool Test of Interpersonal Cooperation (OPTIC) (Paulson, 1974), rating five levels of cooperation behaviors:

cooperation (5 points), active interaction (4 points), parallel play (3 points), watching (2 points), minimal interaction (1 point), and obstructive interaction (0 point). The post hoc test showed that children's cooperative behaviors in condition 2 were significantly higher than were those in conditions 1 and 4. The cooperative behavior from condition 1 to 2 was higher, but slightly lower from condition 2 to 3 with the same trend from condition 3 to 4. These results demonstrated that children's cooperative behavior scores in either classrooms with ceilings having different heights or classrooms with the walls having different colors were higher than those in either classroom with the ceilings having the same height or classroom with the walls having the same color.

Physical Environment and Engagement

Little research has examined the impact of only the physical environment on children's engagement. Although some found that childcare quality related to children's engagement, the studies used scales that examined the overall quality of the classroom (Ridley et al., 2000; Raspa, McWilliam, & Ridley, 2001). For instance, Ridley et al. (2000) investigated the relationship between childcare quality and toddlers' engagement behaviors. The participants included 58 toddler and preschool classrooms. The Infant/Toddler Environment Scale (ITERS) (Harms et al.,, 2006) and the Early Childhood Environment Rating Scale-Revised (ECERS-R) (Harms et al., 2005) examined childcare quality. Researchers observed and coded children's engagement using the Engagement Check II (Risley & Cataldo, 1973). The results demonstrated that global classroom quality had an association with children's engagement. Raspa et al. (2001) conducted a similar study, using the same measure as Ridley et al. (2000) to examine classroom quality and children's engagement. The participants were 78 toddlers from 17 childcare centers. Findings

demonstrated a positive relationship between classroom global quality and children's engagement.

Summary for Physical Environment

In many childcare centers, researchers use classroom environment to measure an indicator of childcare quality. Children in higher quality childcare programs have greater developmental outcomes. These studies used the global environment measures tools to assess the childcare quality, which included physical environment as one component. Few studies focused on the influence of the independent aspect of physical environment on children's developmental achievement.

In addition, little research has found an association between the influence of physical environment and children's engagement. As discussed above, two studies examined the association between children's engagement and childcare quality using the ECERS-R. It is a global measure of classroom quality, which did not examine the independent effect of physical environment. Therefore, it was necessary to explore the influence of physical environment on children's classroom engagement level in the current study.

Chapter Summary

Based on the literature review in this chapter, the factors included in the current study as potential contributors to children's engagement are: teacher-child interactions, teacher-child relationships, children's self-control, and the physical environment. Most studies examined teacher-child interaction at the classroom-level (Aydogan et al., 2015; Casey et al., 2012; Ponitz et al., 2009; Rimm-Kaufman et al., 2009; Rimm-Kaufman et al., 2014), and did not assess the

quality of teacher-child interaction with individual children. The current study employed an individual level scale to assess the teacher interaction level with each child. Researchers measuring the two components of teacher-child relationships (closeness and conflict) have not reached the same conclusions (Cadima et al., 2015; Cadima et al., 2016; Palermo et al., 2007; Portilla et al., 2014; Rudasill, 2011). For instance, Cadima et al. (2016) found that teacher-child closeness was significantly associated with children's self-control, but conflict was not related to children's self-control. However, in Cadima et al.'s 2015 study, the researchers produced a different conclusion that teacher-child closeness was not significantly associated with the self-control of kindergarteners and first graders, while conflict was negatively related to the children's self-control. Therefore, the current study examined the influence of the two components on children's engagement separately. A teacher-report scale assessed each child's self-control level. Few researchers examined the impact of physical environment on children's engagement. In the current study, the researcher evaluated the physical environment as an independent variable to explore its influence on children's engagement.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study is to demonstrate whether and how teacher-child interactions, teacher-child relationships, children's self-control, parents' education levels, teachers' teaching experience and education levels, and the classroom physical environment associate with children's engagement level. The specific research questions formulated in Chapter 1 are restated here:

RQ1: Is the level of preschoolers'engagement in classroom learning activities directly associated with their self-control or mediated through teacher-child interaction quality?

RQ2: Is the level of preschoolers' engagement in classroom learning activities directly associated with the teacher-child relationship or mediated through children's self-control?

RQ3: Is the level of preschoolers' engagement associated with the quality of classroom physical environment?

RQ4: Are fathers' and mothers' education levels associated with the level of preschoolers' engagement through children's self-control?

RQ5: Are teachers' years of teaching experiences associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ6: Are teachers' levels of education associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ7: Are teachers' years of teaching experience and levels of education associated with the level of preschoolers' engagement through the quality of the classroom physical environment?

This chapter discusses the research methodology used to conduct this study, which includes the research design, population and sample, sampling procedures, instrumentation, data collection procedures, data screening, and data analysis.

Research Design

The study employed structural equation modeling (SEM) to build theoretical models. SEM is a general statistical modeling technique that combines factor analysis, regression, and path analysis (Hox & Bechger, 1998). The structural equation model (SEM) statistical method has many advantages over other approaches and enables the researcher to measure direct and indirect effects among the variables. This method can analyze several regression equations simultaneously (Karimimalayer & Anuar, 2012). The original model as shown in Figure 2 involves five variables: engagement (CEQ), teacher-child relationship (TCREL), children's self-control (CSC), teacher-child interaction (TCINT), and classroom physical environment (CPERS). This model addressed Research Questions 1-3.

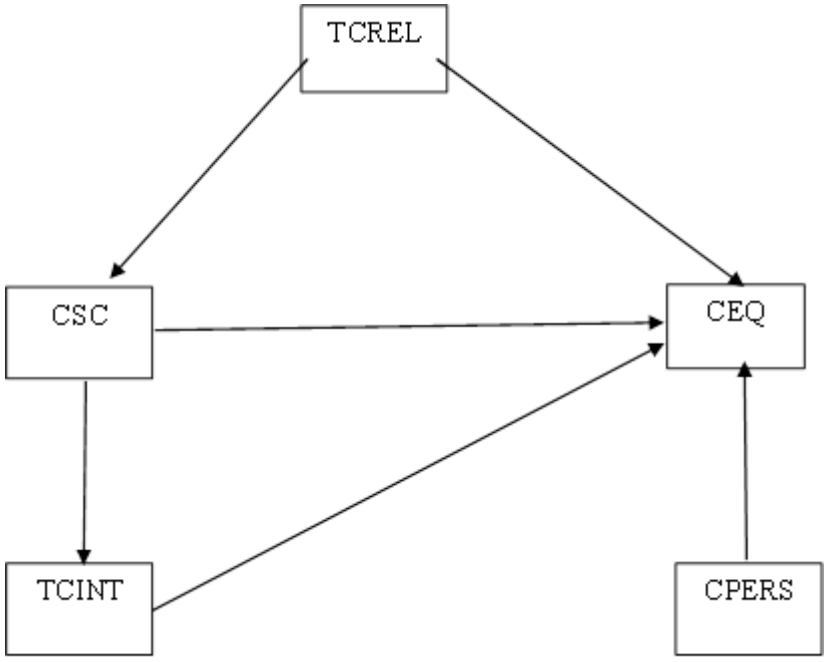

Figure 2. Model 1. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

The researcher added four covariates to Model 1 as shown in Figure 3: teachers' years of teaching experience (TysEx), teachers' education level (Tedu), fathers' education level (Faedu) and mothers' education level (Maedu). This model addressed Research Questions 4-7.

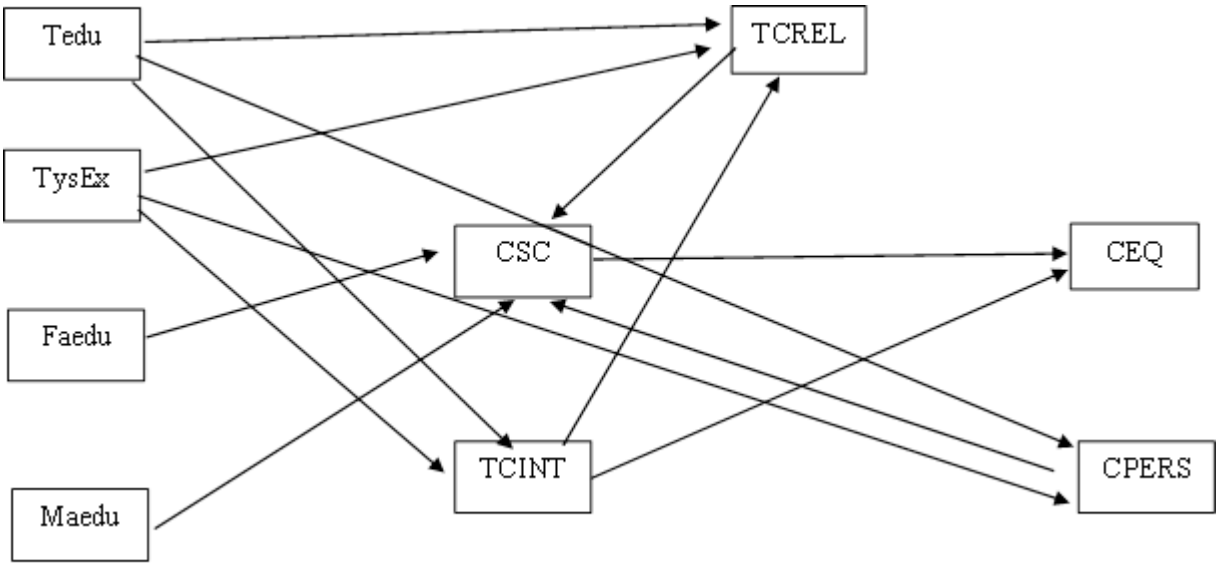

Figure 3. Model 2. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience, Faedu = fathers' education level, Maedu = mothers' education level.

Population and Sample

Creswell (2015) stated, "Population is a group of individuals who have the same characteristics" (p. 140). In this study, the population consisted of 3- to 5-year-old preschoolers. "Sample is a subgroup of the target population that the researcher plans to study for generalizing about the target population" (Creswell, 2015, p. 141). In this study, the sample was 135 preschoolers from Head Start programs and a university childcare center in East Tennessee.

Sampling Procedures

Power Analysis

To predict the sample size needed for this study, the researcher conducted a power analysis using a G*Power 3.1.9.2 statistical program. Children's engagement was the dependent variable (outcome) with nine predictors contributing to that engagement level. The predictors included children's self-control, two subscales of teacher-child relationships (closeness and conflict), teacher-child interactions, classroom physical environment, head teachers' education level, head teachers' years of teaching experience, mothers' education level, and fathers' education level. Faul, Erdfelder, Lang, and Buchner (2007) recommended using a moderate effect size of .15, alpha-level of .05, and power estimate of .80 for a correlation study.

The result from the power analysis as shown in Figure 4 suggested that the minimum sample size for this study was 114. The X-Y plot for a range of value calculated the power of the actual sample size. Figure 4 shows the power analysis results with the number of predictors at nine, the effect sizes ranging from .15 to .45, and power estimate ranging from .60 to .95.

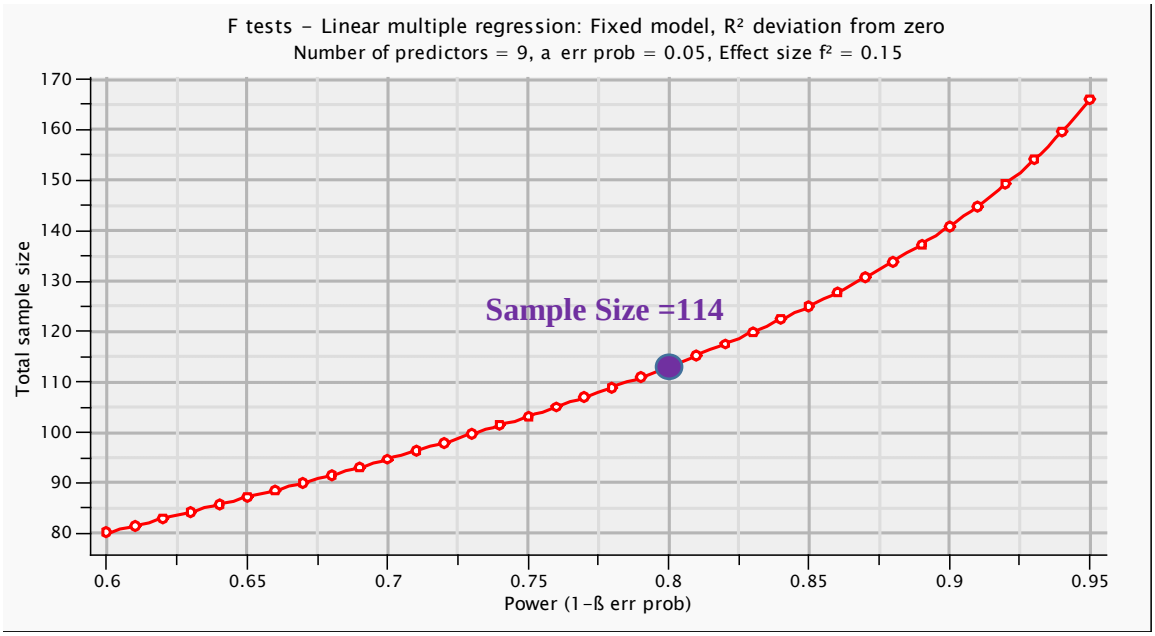

Figure 4. Sample size with effect size and powers.

Sample Participants

Following study approval from the Institutional Review Board (IRB) of East Tennessee State University on January 29, 2018 recruitment of teachers began. The Head Start manager sent the invitations to 25 preschool teachers asking if they would like to participate in the study, along with the approved teacher consent forms (Appendix A) and the Teacher Information Survey (TIS) (Appendix B) in early February 2018. Two teachers agreed to participate in the study during the first contact. Two weeks later, a second invitation from the researcher (Appendix C) with all the same information was sent to the 23 nonresponsive teachers, and seven teachers agreed to participate.

Using the snowball sampling approach that asks study participants to tell acquaintances about the study, two more Head Start teachers agreed to participate in the study. Two teachers

were dropped from the study. One teacher had family issues, while the other teacher did not receive enough parental consent forms. The final count included nine teachers from Head Start programs involved in the study.

The director of the university childcare center sent invitations to the program's nine preschool teachers in early February 2018. Three teachers agreed to participate. Two weeks later, the researcher attended their preschool department meeting, presented information about the study, and gained four additional participants for a total of seven. However, one teacher did not receive enough parental consent forms and was dropped from the study. Therefore, six teachers from the university childcare center and nine from Head Start participated in this study for a total of 15 teachers participating in the study.

After returning their completed teacher consent forms and Teacher Information Surveys (TIS), classroom teachers gave out parental consent forms (Appendix D). The parents had one to two weeks to read the information about the study and make a decision about whether their child could participate. The parents returned the signed consent forms to the classroom teachers, and the researcher collected the signed permission forms from the teachers. Among the children whose parents gave permission to participate in the study, eight children in each classroom were randomly selected for participation. Teachers who did not receive eight parental consent forms were eliminated from the study.

Of the parents contacted, 154 returned parental consented forms to allow their children to participate in the study. From those children, 135 were chosen to participate in the study. Among the 135 children, 103 were randomly chosen from 13 classrooms (7 to 8 from each classroom).

The rest of the 32 children were from those two Head Start classrooms whose parents gave the permissions. Fifteen teachers participated in the study. Based on the actual sample size, the power analysis was recomputed. For the 135 preschooler participants, the actual effect size was .15 with an alpha-level of .05, and power estimate of .88. The actual power (.88) is higher than the estimated (.80). This information is in Figure 5 below.

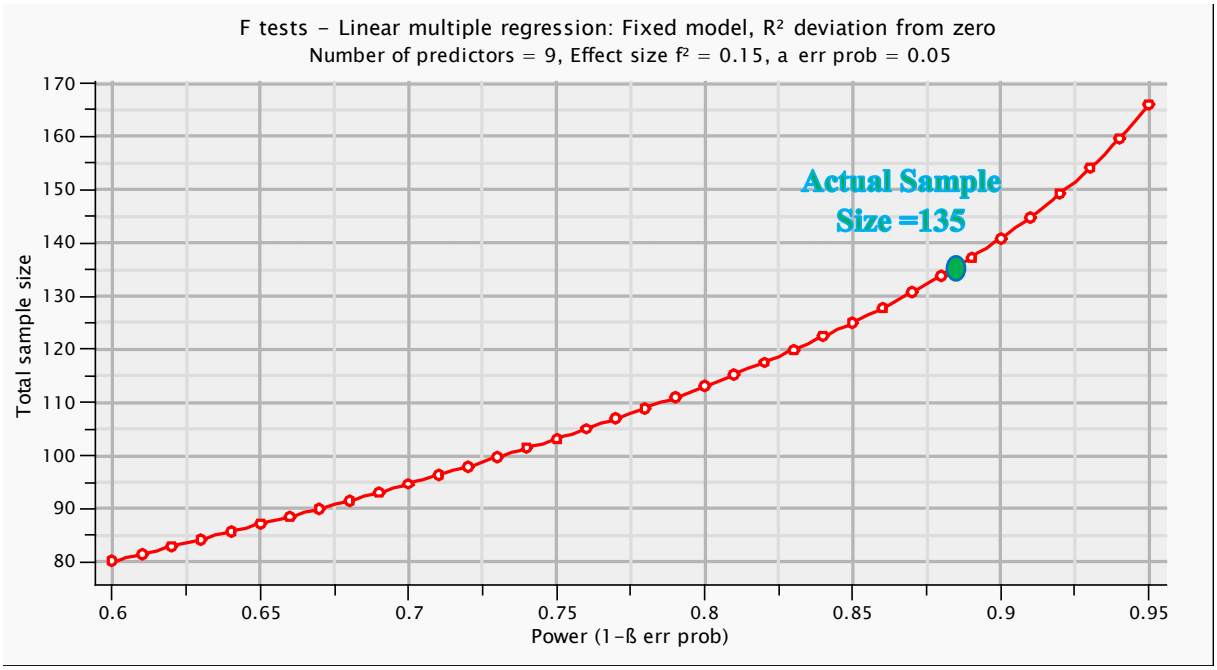

Figure 5. Actual sample size with effect size and powers.

Instrumentation

This study consists of seven measurements with ten variables: engagement, teacher-child interaction, teacher-child relationships, the classroom physical environment, children's self-control, mothers' and fathers' education level, and teachers' education levels and years of teaching experiences. There were two subscales from the teacher-child relationship scale, closeness and conflict, which were treated as separate predictors of children's engagement in the

analysis. Teachers' education levels and years of teaching experience were collected from the Teacher Information Survey (TIS) and were treated as separate factors contributing to the dependent variable (engagement). Fathers' and mothers' education levels were two other factors examined to determine children's engagement. This information was collected from the Parent Information Survey (PIS) (Appendix E). Classroom teachers completed questionnaires to assess children's engagement, teacher-child interactions, and teacher-child relationships on each child in their classrooms.

Engagement

The Child Engagement Questionnaire (CEQ) (McWilliam, 1991) (Appendix F) was used to measure the preschoolers' engagement levels for each child. In this questionnaire, teachers rated children's engagement level from free-recall impressions of children's classroom behaviors with peers, adults, and materials. The CEQ consists of 32 items that rate children's global engagement. The four-point Likert scale is used to rate the child's engagement using the following indicators: *not at all typical, somewhat typical, typical, and very typical*. On the questionnaire, the scale developer specified "*typical*" should mean the child spends quite a lot of time in this activity (McWilliam, 1991, p. 1). For each item, examples further clarify what it intends to measure. For example, item 1 states "watches or listens to adults." Examples include *when the teacher moves around the classroom, talking to the child, the child watches him or her*. The CEQ consists of four child engagement factors: competence, persistence, undifferentiated behavior, and attention (McWilliam & Scarborough, 2003). These four factors explain 62.1% of

the variance (McWilliam, Snyder, & Lawson, 1993). The generalizability coefficient of CEQ was .84, and the alpha coefficient for internal consistency of CEQ was .96 (de Kruif et al., 1999).

Teacher-Child Interaction

The teacher-child interaction questionnaire (TCINT) was originally developed by Granlund and Olsson in 1998 (Appendix G). Almqvist (2006) employed this questionnaire to assess the interaction between the teacher and the child as well as between the child and a peer. This questionnaire consists of 36 items, covering four interaction dyads: between other children and the child, between the child and other children, between child and teacher, and between teacher and child. This study only used the interaction dyad between teacher and child (e.g., I respond to the child's communication) that has 10 items. This questionnaire used a five-point Likert scale: *seldom, fairly seldom, 50% of the time, fairly often* and *often.*

Almqvist's (2006) study found the reliability of the teacher's perception of their interaction with the child ranged from .86 to .87, and the reliability of the teacher's perception of the child's interaction with the peers was .96. The reliability of the child's perception of their interaction with the teacher ranged from .77 to .84, and the reliability of the child's perception of their interaction with their peers ranged from .69 to .76. Another study reported the reliability of the 15 items measuring the teacher's interaction to the child and the peers' interaction scores ranged from .77 to .92 (Sjoman et al., 2016). In Sjoman's et al. (2016) study, the 10 items measured teachers' perception of their interaction with the children. Almqvist (2006) found the 10 items had four indexes through using factor analysis: child behavior, communication, teacher engagement, and teacher skills in maintaining the child's engagement.

Teacher-Child Relationship

Pianta (2001) developed the Student-Teacher Relationship Scale (STRS) (Appendix H) to assess teachers' perceptions of the quality of their relationships with each child and for teachers to report their conflict and closeness with the child. The original 28-item scale consisted of three subscales: closeness, conflict, and dependency. Pianta's (2001) study showed that the conflict and closeness subscales reliability was $\alpha = .86$ and .92, but the dependency subscale was low with $\alpha = .64$. The results from the factor analysis for the STRS validity showed that the conflict and closeness subscale had eigenvalue 8.63 and 3.73, but eigenvalue of the dependency subscale validity was only 1.79 (Pianta, 2001). Several studies recommended using the two-subscales of STRS, conflict and closeness, to measure the teacher-child relationships (Cadima et al., 2015; Portilla et al., 2014; Zhang, 2010). The seven conflict items measured three constructs of antagonism, disharmony, and conflict. The eight closeness items measured three constructs: warmth, affection, and open communication. Teachers rated each item using a 5-point scale ranging from 1 (*definitely does not apply*) to 5 (*definitely applies*). The current study also used both the conflict and closeness of subscales of STRS.

Children's Self-Control

The Teacher's Self-Control Rating Scale (TSCRS) (Humphrey, 1982) (Appendix I) measures children's self-control. TSCRS is a 15-item scale describing children's cognitive and personal components of self-control. Teachers rated children's behavior based on a 5-point Likert scale from 1 (never) to 5 (very often). The scale includes two subscales of self-control: cognitive/personal self-control (10 items, e.g., *sticks to what she or he is doing, even lengthy*

unpleasant tasks until finished) and behavioral/interpersonal self-control (5 items, e.g., *disrupts others when they are doing things*). The scores of the five items for the behavioral/interpersonal self-control were reverse coded in order for higher scores to indicate children's higher self-control levels. Humphrey (1982) conducted a factor analysis to analyze the principal components of the TSCRS, which resulted in two factors, cognitive/personal self-control and behavioral/interpersonal self-control, with the eigenvalues > 1 and the item loadings ≥ .48. This study also reported the test-retest total reliability of the TSCRS was .94, with the cognitive/personal at .93 and the behavioral/Interpersonal at .88.

Kendall and Wilcox (1979) developed the Self-Control Rating Scale (SCRS). It is a 33-item questionnaire, rated by the teacher on a 7-point Likert scale. The test-retest reliability was .94. These values indicated that the SCRS is a reliable rating scale for assessing children's self-control. In Reynolds and Stark's (1986) study, the researchers used the Self-Control Rating Scale (SCRS) and the Teacher's Self-Control Rating Scale (TSCRS) to conduct a multimethod examination of children's self-control. The results showed that the correlation between the TSCRS and the SCRS rated by the classroom teachers was .88. It suggested that the TSCRS was a valid scale to assess children's self-control level.

Physical Environment

In the current study, the Children's Physical Environments Rating Scale (CPERS) (Appendix J) was used to examine the quality of the physical environment in each classroom (Moore & Sugiyama, 2007). CPERS has four parts: a) *planning* focuses on the overall planning of the center including its size and capacity; b) *building as a whole* explores the environmental

quality of the building, its overall organization, image, and circulation; c) *indoor activity spaces* assesses spaces including home bases and activity area; and d) *outdoor spaces* evaluates the outdoor activity areas around the building and surrounding conditions. Each part of the scale consists of several subscales, totaling 14 subscales in the whole scale. Each subscale comprises a number of items of environmental attributes that contribute to the overall quality of the facility in the center.

CPERS has shown to be a reliable and valid measure in several studies (Moore & Sugiyama, 2007; Moore, Sugiyama, & Donnell, 2003). The inter-rater reliability of the CPERS was found to be an average value of 84%. This percentage indicates that CPERS is a reliable scale for assessing physical environment as compared to the other environment scales; e.g., ITERS at 78% and the revised ECERS-R at 71% (Moore & Sugiyama, 2007). The test-retest reliability of the CPERS was 91%. Experts from architecture, education, and research examined the content and construct validity of the CPERS, which showed high agreement (Moore & Sugiyama, 2007).

To determine the quality of the subscale of planning (Part A), the rater assesses each item using a 5-point scale (0-4) ranging from *not met* (0) to *fully met* (4). For each item, the rater decides whether the childcare center met that criterion, and then evaluates how well the center meets each item, scoring it on a continuum between *not met* at all (0) and *fully met* (4). Some items inquire about the existence of particular spaces in the center, in which case the raters indicates from *no* it doesn't exist (0), *ahared* with other functions (2), or *yes* it exists and is

purposefully designed for that activity (4). Some items might not apply to certain classrooms depending on children's age groups. In this case, the rater checks *not applicable* for the item.

The *building as a whole* and *indoor activity space* of the CPERS were used to assess the preschool classroom physical environment in this study. It included 10 subscales: image and scale (subscale 2); circulation (subscale 3); common core and shared facilities (subscale 4); indoor environmental quality (subscale 5); safety and security (subscale 6); modified open-plan space (subscale 7); home bases (subscale 8); quiet activity areas (subscale 9); physical activity areas (subscale 10); and messy activity areas (subscale 11). The 10 subscales measured indoor physical environment quality. These scales fit the purpose of this study because children's engagement, teacher-child interaction, teacher-child relationships, and children's self-control are only assessed within the classroom.

The two raters used the classrooms that were not part of the study to reach a 95% reliability. Both evaluated 7 of 15 classrooms (47%) involved in the study to obtain actual reliability for this assessment.

Parent Information Survey

Parents who gave permission for their children to participate in the study completed a short survey, the Parent Information Survey (PIS). The parents received the survey attached to the parental consent form when they picked up or dropped off their children. Each parent or guardian provided four pieces of information: child's age, child's gender, fathers' education level, and mothers' education level.

Teacher Information Survey

Each classroom teacher completed the Teacher Information Survey (TIS), which included the lead teacher's sex, degree, and years of teaching experience. The preschool teachers received the survey as part of the study recruitment package. The teachers who agreed to participate in the study returned the completed TIS to the researcher.

Data Collection Procedures

Data collection began in early February of 2018 and was completed in mid-April of 2018. The researchers collected the Parent Information Survey (PIS) when parents returned it with the parental consent form allowing their child to participate. In February, teachers received the children's engagement, teacher-child relationships, teacher-child interactions, and children's self-control questionnaires with the direction for completing the scales. The teachers completed the questionnaires for each of the randomly selected children in their classrooms within one month. In April 2018, the researcher visited each involved classroom to assess the physical environment and retrieve the completed questionnaires.

Data Screening

Before analyzing the data in SEM, the researcher screened the original data for potential problems (Kline, 2011) in order to obtain more reliable and valid results. The researcher randomly selected 20% of the questionnaires and asked a peer to double-check the entry correctness. This random selection yielded 27 out of 135 child cases, including 2,727 items out of total 13,635 items. The percentage of data entered correctly was determined. Because the Mplus program uses the full information maximum-likelihood (FIML) estimate, which is robust

to the normality (Diamantopoulos, Siguaw, & Siguaw, 2000), normality checking was not required.

Outliers. Regression analysis is a statistical technique used to estimate a linear relationship between two variables. SEM is a special case of regression analysis. It is highly sensitive to outliers because outliers can overstate the coefficient of determination (R^2), which can lead to false conclusions about the model (Walfish, 2006). However, there is no exact definition for extreme outliers. The common rule for discovering outliers is that their scores tend to be more than three standard deviations beyond the mean (Kline, 2011). The researcher used the SPSS statistical program to detect and delete outliers and treated them as missing data.

Missing data. The proportion of missing data directly affects the quality of statistical inference. Addressing missing data involved a two-step process. First, Little's (1988) missing completely at random (MCRA) test examined whether the missing data was dependent on other variables in the data set. In other words, if the missing data is unrelated to any other variable in the data set, then the data loss pattern was missing completely at random (MCRA). The null hypothesis for the MCRA test was that if the test had a significant value greater than .05, the null hypotheses failed to be rejected meaning that any missing data were completely random (Little, 1988). After determining that the data missing was completely random, the full information maximum-likelihood (FIML) estimate predicts the value for the missing data. FIML is the most widely used method for estimating when there is missing data in SEM. It is a more complex statistical procedure to deal with missing data than the conventional approaches (e. g., listwise

deletion and pairwise deletion). The MCRA was proposed to be conducted in the SPSS statistic program measured the MCRA, while the Mplus program assessed the FIML.

Collinearity. Collinearity occurs when there are two or more independent variables highly intercorrelated. If high intercorrelations occur, it means that although the variables have different labels and items, the variables are measuring the same concept. This may happen especially when multiple scales measure the same construct (Garson, 2012). Two values, tolerance and variance inflation factor (VIF) were used to determine collinearity. When the tolerance value is less than .20 or the VIF value is above 4.0, collinearity exists (Garson, 2012). If this occurs, an investigator can standardize the data to remove the collinearity. If standardizing the data does not work, one measure will be retained for the analysis and the other variable will be removed. Since there are many predictors of children's engagement in this study, the collinearity detection was conducted in the SPSS statistical program.

Linearity. Linearity is an approach for modeling the relationships between a dependent variable and one or more independent variables. It is easy to detect linearity by looking at the scatterplots (Kline, 2011). If non-linear relationships among variables are present, log transformation or polynomial regression can transform the data to fit the model.

Reliability of Children's Physical Environment Rating Scale (CPERS)

A doctoral student majoring in early childhood education was trained to assess the classroom physical environment using this scale. The primary researcher and this doctoral student used the classrooms that were not part of the study to reach a 95% reliability. Then, they chose 7 out of 15 (47%) classrooms to measure for reliability between February and April, 2018.

The two raters made simultaneous but independent assessments of seven classrooms' indoor and outdoor space, and the overall environment of the center.

The calculation for reliability was the degree of agreement for each item between the two raters. Regarding agreement, exact agreement and agreement within one point counted as agreement as demonstrated in some studies that used CPERS in their research (Clifford et al., 1989; Harms, Clifford & Cryer, 2005). In the current study, both types of agreement were calculated.

Data Analysis

Descriptive Statistics

Descriptive statistics summarize the overall trends or tendencies of data that provides an understanding of the variations in scores' variations and compares the scores to others. The current study employed two types of descriptive statistics to analyze the data: central tendency and variability (Creswell, 2015). For the central tendency, the mean score (mean = *M*) described the average value for each variable. For variability, the square root of the variance (standard deviation = *SD*) demonstrated the dispersion or spread of the scores. The SPSS statistical program calculated all the descriptive statistics.

Data Analysis by ANOVA test

An ANOVA was used to examine if there were differences between the independent and dependent variables based on programs and children's gender. This study examined the differences in children's engagement level, teacher-child interaction, teacher-child relationship,

children's self-control, and classroom physical environment between the Head Start vs university childcare programs and between boys and girls with a series of ANOVAs.

Bivariate Correlation Analysis

Bivariate correlations examine the associations among variables. An effect size $r = \pm .30$ indicates a weak correlation, $r = \pm .50$ demonstrates a moderate correlation, and $r = \pm .70$ signifies a strong correlation (Rumsey, 2011). The SPSS statistical program examined these bivariate correlations.

Confirmatory Factor Analysis of Teacher-Child Relationship Items

From the review in Chapter 2, it can be seen that studies reached different conclusions about the impact of the two subscales of teacher-child relationships on child's behaviors (Cadima et al., 2015; Cadima et al., 2016). Therefore, the current study researcher used confirmatory factor analysis (CFA) to evaluate the validity of the teacher-child relationship scale to confirm the two factors for further analysis.

To assess model fit for the factor analysis of this scale, the study examined four fit indices: χ^2 statistic, root mean square error of approximation (RMSEA), standardized root square mean residual (SRMR), and the comparative fit index (CFI). Chi-square indicates the distance between the expected and observed covariance matrices. The smaller the chi-square , the better the model fits. Values of nonsignificance at .05 indicate good fit models. RMSEA values ranging from 0 to 1 are related to residuals in the model. A smaller RMSEA value indicates a better model fit. RMSEA values close to .06 or below indicate a good fit, between .06 and .08 suggests an acceptable fit, and higher than .10 implies an unacceptable fit. A value of .08 or less for the

SRMR is an adequate fit. CFI is the discrepancy function adjusted for sample size, ranging from 0 to 1. A larger value indicates a better model fit. The acceptable model fit is the value of CFI at 0.90 or greater (Hu & Bentler, 1999).

Structural Equation Modeling Test

The data about preschoolers were gathered from teachers in their classrooms. Two models examined the data. Figure 6 graphically displays the original model with five variables: Engagement, teacher-child relationship, children's self-control, teacher-child interaction, and classroom physical environment. The model in Figure 6 addressed the first three research questions:

RQ1: Is the level of preschoolers'engagement in classroom learning activities directly associated with their self-control or mediated through teacher-child interaction quality?

RQ2: Is the level of preschoolers' engagement in classroom learning activities directly associated with the teacher-child relationship or mediated through children's self-control?

RQ3: Is the level of preschoolers' engagement associated with the quality of classroom physical environment?

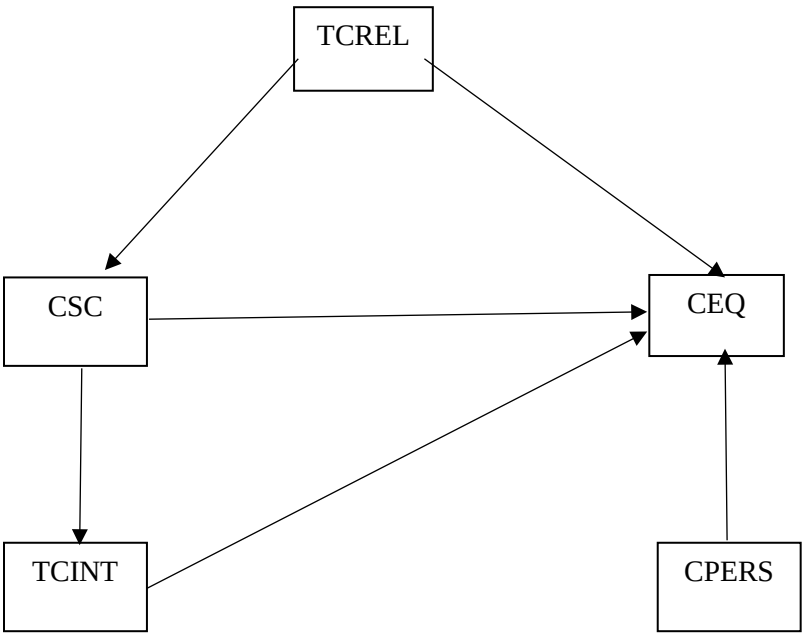

Figure 6. Basic model with five variables. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

To examine the effects of subscales of teacher-child relationship on children's engagement level, the researcher split the variable of teacher-child relationships into the subscales of closeness and conflict of teacher-child relationships as shown in Figure 7.

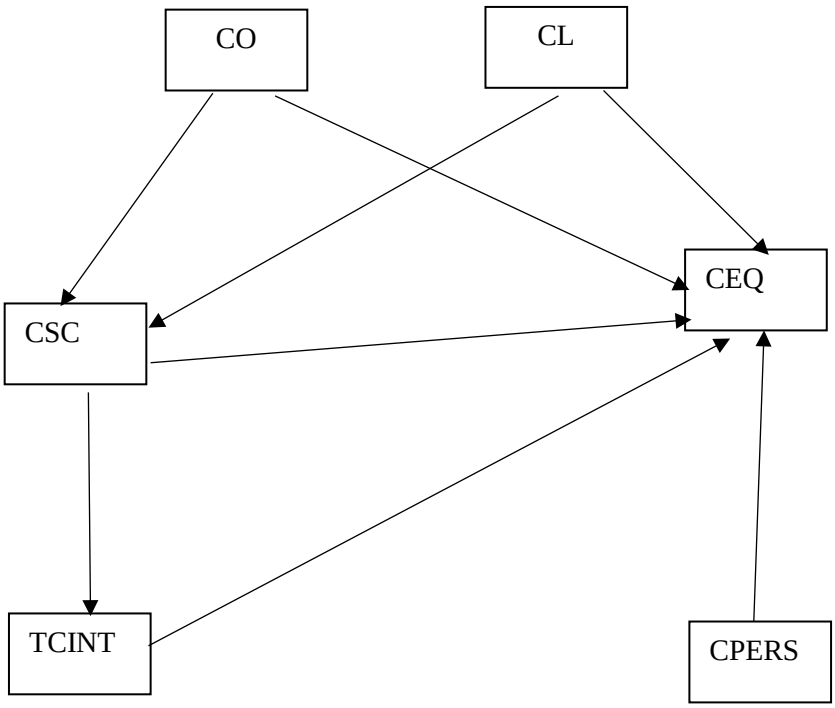

Figure 7. Basic model with closeness/conflict added. CEQ = children's engagement, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment, CO = conflict of teacher-child relationship, CL = closeness of teacher-child relationship.

Model 2 as shown in Figure 8 is the model after adding the covariates: teachers' years of teaching experience (TysEx), teachers' education level (Tedu), fathers' education level (Faedu), and mothers' education level (Maedu). This model addressed research questions 4-7:

> RQ4: Are fathers' and mothers' education levels associated with the level of preschoolers' engagement through children's self-control?

RQ5: Are teachers' years of teaching experiences associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ6: Are teachers' levels of education associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ7: Are teachers' years of teaching experience and levels of education associated with the level of preschoolers' engagement through the quality of the classroom physical environment?

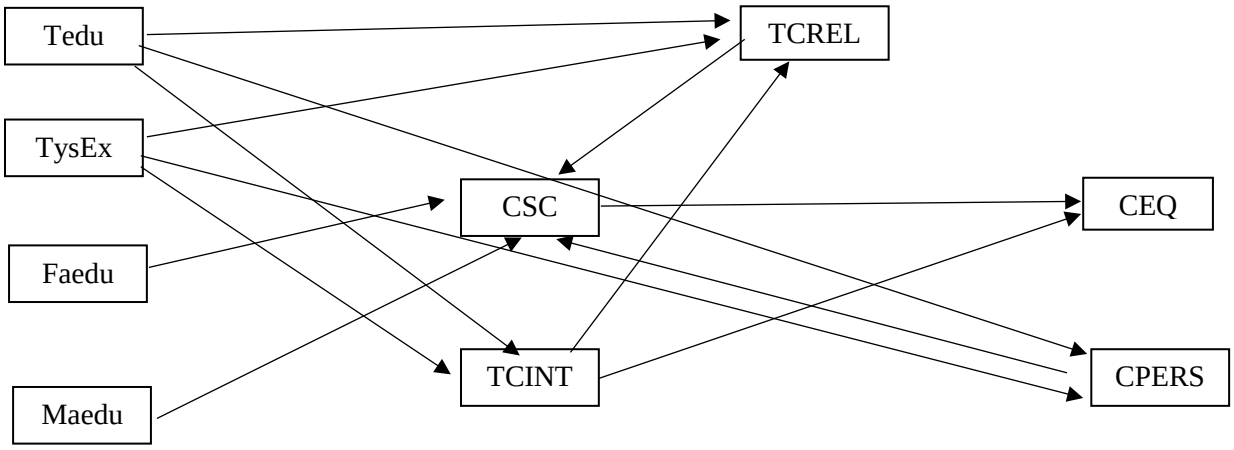

Figure 8. Model 2. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience, Faedu = fathers' education level, Maedu = mothers' education level.

The Mplus program was used to run the structural equation models (SEM). Based on the modification indices found from this analysis, changes were made in order to fit the data. To assess model fit, the study considered four fit indices: χ^2 statistic, root mean square error of approximation (RMSEA), standardized root square mean residual (SRMR), and the comparative fit index (CFI). Chi-square indicated the distance between the expected and observed covariance matrices. The smaller the value, the better the model. Values of nonsignificance at .05 indicated good fit models. RMSEA values ranging from 0 to 1 related to residuals in the model. A smaller RMSEA value indicated a better model fit. When RMSEA values were close to .06 or below, it indicated a good fit, between .06 and .08 suggested an acceptable fit, and higher than .10 implied an unacceptable fit. A value of .08 or less for the SRMR was an adequate fit. CFI was the discrepancy function adjusted for sample size, ranging from 0 to 1. A larger value indicated a better model fit. The acceptable model fit for CFI is 0.90 or higher (Hu & Bentler, 1999).

Chapter Summary

This chapter presented the research approach used to analyze the data. In the data screening, outliers, missing data, collinearity, and linearity were examined. ANOVA test and bivariate correlations analysis aided in analyzing the data. Structural equation modeling (SEM) explored the factors that affected children's engagment level. These factors included: teacher-child interactions, teacher-child relationships, children's self-control, classroom physical environment, parents' education level, teachers' education level, and years of teaching experiences.

CHAPTER 4

RESULTS

The purpose of this study was to demonstrate whether and how teacher-child interactions, teacher-child relationships, children's self-control, fathers' and mothers' education levels, years of teachers' teaching experience and education levels, and classroom physical environment were associated with children's engagement level. This chapter presents the results from preliminary data analysis, validity and reliability of measures, demographic information, and the descriptive and inferential analyses.

Preliminary Data Analysis

As indicated in Chapter 3, data screening procedures were used to eliminate potential problems prior to analysis. First, another doctoral student majoring in early childhood education conducted data entry checking. Twenty percent of the data was randomly selected, yielding 27 of 135 child cases and including 2,727 items out of total 13,635 items. The percentage of data entered correctly was 99.82 % (5 errors among 2727 items). This demonstrated a high data entry reliability. The researcher then screened for outliers, missing data, collinearity, and linearity with the corresponding statistical strategies used to fix the potential problems before analyzing the data in the SEM.

Outliers

Children's engagement (CEQ). Descriptive statistics detected the outliers for CEQ. The box and whisker plot (Figure 8) shows two outliers for the CEQ test (M = 3.06, SD = .56) (Table 1). Based on the rule for outliers (Kline, 2011), scores of more than three standard deviations

beyond the mean were outliers, so any CEQ value beyond the range of 1.36 to 4.74 was an outlier. The two values in the box and whisker plot (Figure 9) were within range, not considered outliers, and used for the data analysis.

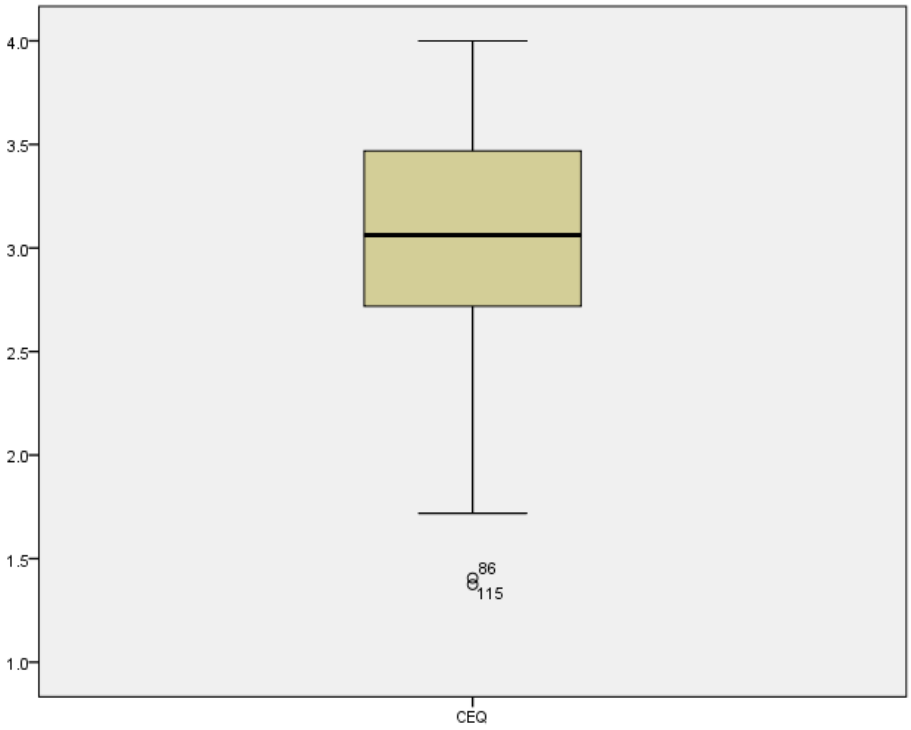

Figure 9. Box and whisker plot for CEQ outliers. CEQ = children's engagement.

Children's self-Control (CSC). Descriptive statistics detected the outliers for CSC. CSC had *M* = 3.51 and *SD* = .79 (Table 1). Based on the rule for outliers (Kline, 2011), scores of more than three standard deviations beyond the mean were outliers, so any CSC value beyond the range of 1.14 to 5.88 was an outlier. Given the *Min* = 1.57, *Max* = 5.00, all the values were in the range of 1.14 to 5.88. There were no outliers for children's self-control (CSC) as the box and whisker plot (Figure 10) shows below.

Table 1

Descriptive Statistics on the Variables

	N	*Min*	*Max*	*Mean*	*SD*
AGE (M)	135	41	71	54.93	7.50
CEQ	135	1.38	4.00	3.06	.56
CSC	135	1.57	5.00	3.51	.79
TCINT	135	3.60	5.00	4.51	.34
TCREL	135	2.20	5.00	4.30	.62
CPERS	135	2.70	3.32	3.05	.17

Note. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

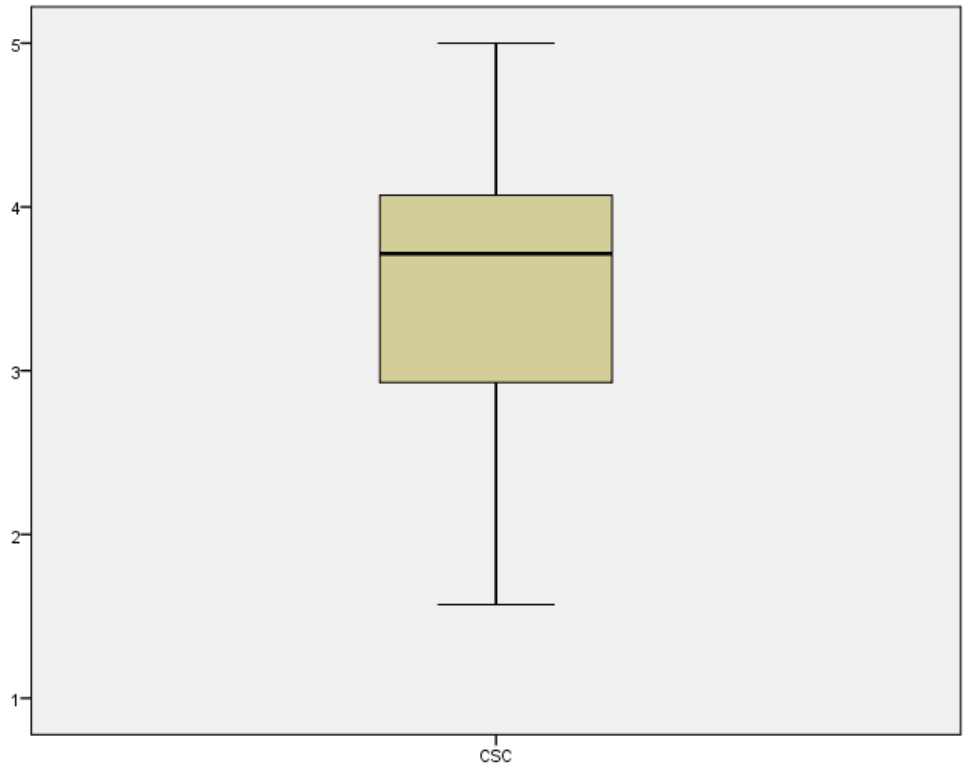

*Figure 10.*Box and whisker plot for CSC outliers. CSC = children's self-control.

Teacher-Child interaction (TCINT). Descriptive statistics detected the outliers for TCINT. TCINT had *M* = 4.51 and *SD* = .34 (Table 1). Based on the rule for outliers (Kline, 2011), scores of more than three standard deviations beyond the mean were outliers, so any CSC value beyond the range of 3.49 to 5.53 was an outlier. Given the *Min* = 3.60, *Max* = 5.00, all the values were in the range of 3.49 to 5.53. There were no outliers for teacher-child interaction (TCINT) as the box and whisker plot (Figure 11) shows below.

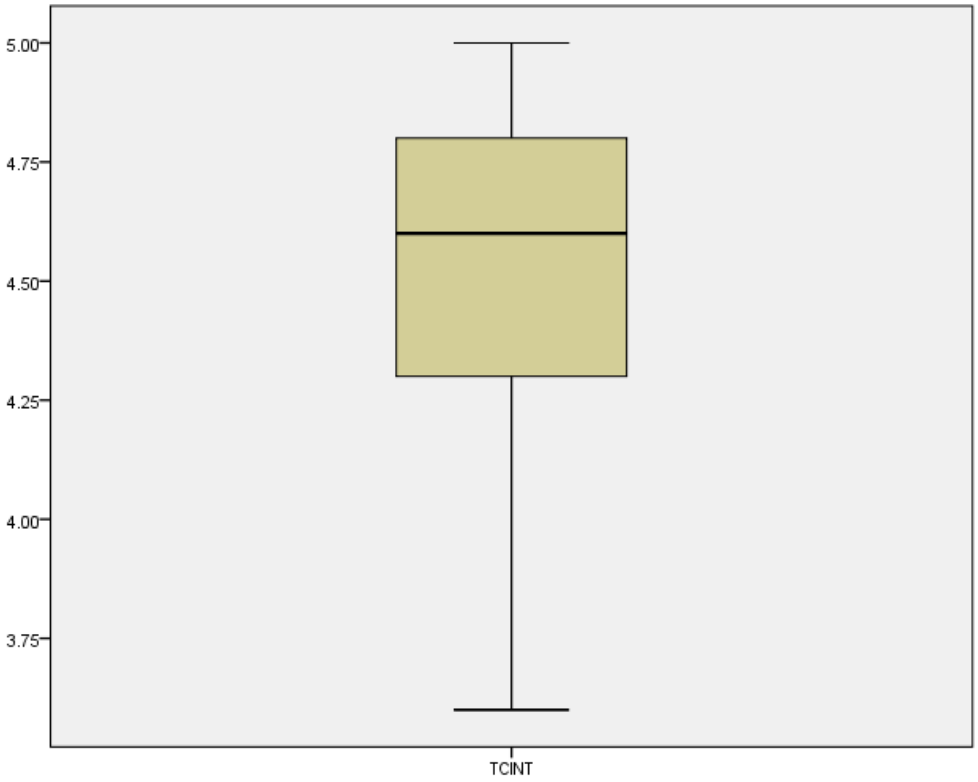

Figure 11. Box and whisker plot for TCINT outliers. TCINT = teacher-child interaction.

Teacher-Child Relationship (TCREL). Descriptive statistics detected the outliers for TCREL. The box and whisker plot (Figure 12) shows five outliers for the TCREL (teacher-child relationship) test (*M* = 4.30, *SD* = .62 in Table 1). Based on the rule for the outlier (Kline, 2011),

any TCREL values beyond the range of 2.44 to 6.16 were outliers. Two of the five values in the box and whisker plot were beyond the range, thus they were outliers.

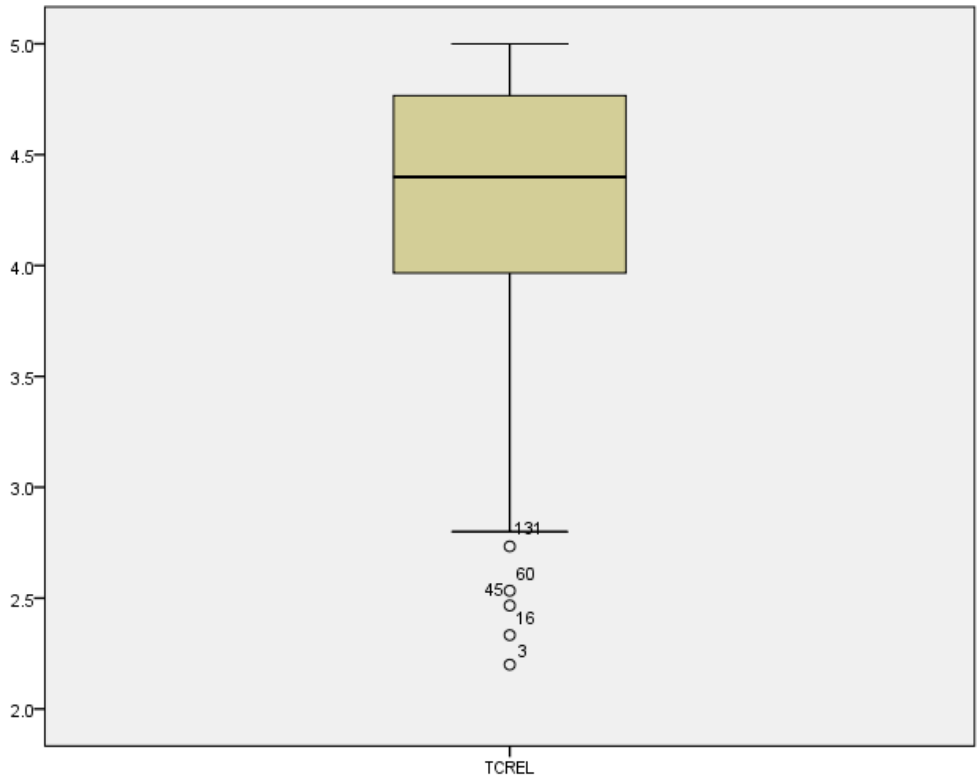

Figure 12. Box and whisker plot for TCREL outliers. TCREL = teacher-child relationship.

Classroom Physical Environment (CPERS). Descriptive statistics detected the outliers for CPERS. CPERS had *M* = 3.05 and *SD* = .17 (Table 1). Based on the rule for outliers (Kline, 2011), scores of more than three standard deviations beyond the mean were outliers, so any CPERS value beyond the range of 2.54 to 3.56 was an outlier. Given the *Min* = 2.70, *Max* = 3.32, all the values were in the range of 2.54 to 3.56. There were no outliers for the CPERS (classroom physical environment) as the box and whisker plot (Figure 13) shows below.

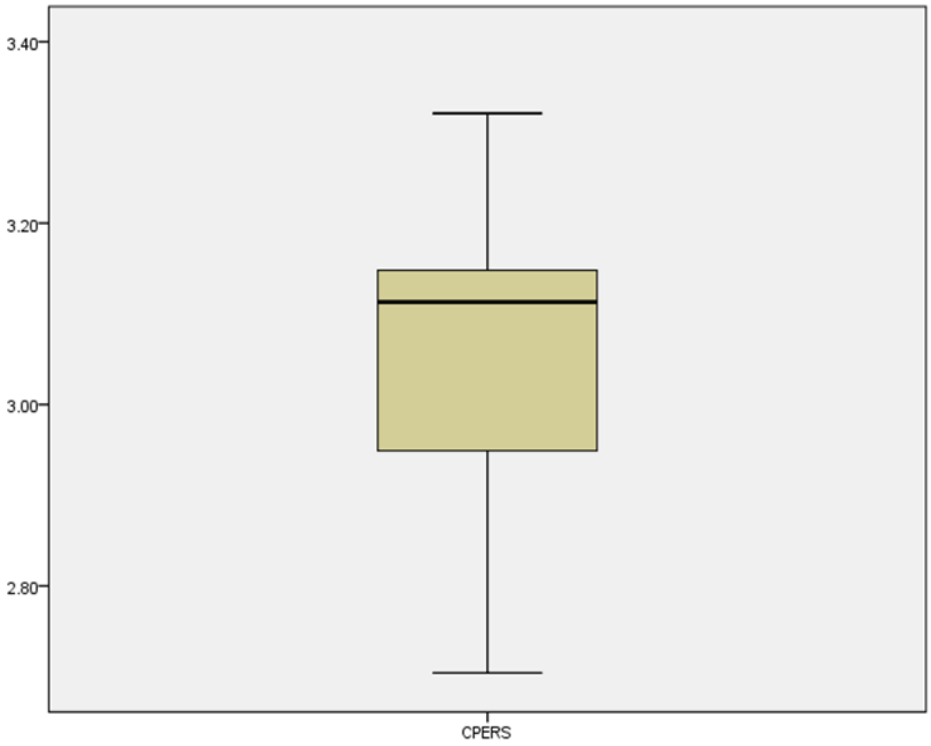

Figure 13. Box and whisker plot for CPERS outliers. CPERS= classroom physical environment.

Missing Data

After collecting data from participating teachers, the researcher checked each item on the scales for missing data and contacted teachers that omitted information. However, only one form showed missing data from the parents' information survey, and it was not possible to ask the parents to supply the information. The two outliers from the teacher-child relationship scale were treated as missing data, creating a percentage of 0.14% [3/ (16 × 135)] × 100. While there was no clear cutoff regarding an acceptable percentage of missing data for statistical inference, Schafer (1999) noted a missing proposition of 5% or less was insignificant. Bennett (2001) suggested that statistical analysis was likely biased if there were more than 10% missing data. Given these recommendations, it was not necessary to use the Little's MCAR test to determine if the missing

data was randomly missing (MCAR). The full information maximum-likelihood (FIML) estimated the data in the Mplus program. FIML is robust to the data missing completely at random (MCAR) and missing at random (MAR). FIML can produce unbiased parameter estimates and standard errors under MAR and MCAR (Newsom, 2017).

Collinearity

A linear regression in SPSS examined the collinearity. The results are in Table 2 below. The CEQ was the dependent variable, the children's self-control (with the tolerance value .61 and the VIF value 1.64), teacher-child interaction (with the tolerance value .61 and VIF value 1.65), teacher-child relationship (with the tolerance value .49 and the VIF value 2.05), and classroom physical environment (with the tolerance value .86 and the VIF value 1.17) formed the independent variables. All tolerance values ranged from .49 to .86, which were higher than .20, and the VIF values ranged from 1.17 to 2.05, which were below 4. When the tolerance value is less than .20 or VIF value is above 4.0, there is collinearity. These findings indicated that no collinearity was in the dataset.

Table 2

Collinearity Checking Result

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*Sig.*	Collinearity Statistics	
	B	*Std. Error*	*Beta*			*Tolerance*	*VIF*
Constant	-2.522	.617		-4.086	< .000		
CSC	.247	.050	.348	4.941	< .000	.61	1.64
TCINT	.873	.116	.532	7.533	< .000	.61	1.65
TCREL	.013	.072	.014	.178	.859	.49	2.05
CPERS	.239	.192	.074	1.243	.216	.86	1.17

Note. Dependent variable: CEQ. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

Linearity

A scatterplot checked for linearity in a R statistical program. The five variables (CEQ: children's engagement, TCREL: teacher-child relationships, TCINT: teacher-child interactions, CSC: children's self-control, CPERS: classroom physical environment) underwent scatterplot checking. As Figure 14 shows, there were no non-linear relationships among the variables.

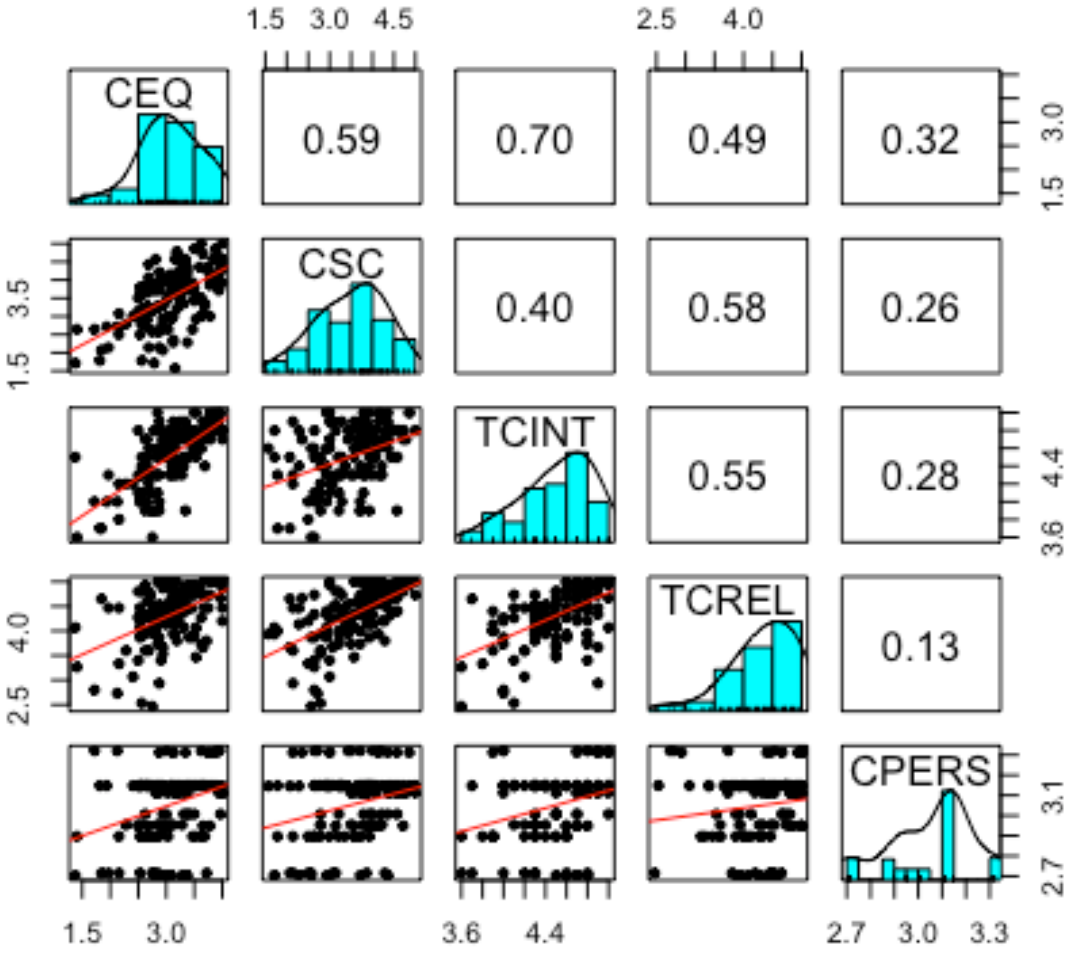

Figure 14. Scatterplot for linearity. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

Reliability of Children's Physical Environment Rating Scale (CPERS)

The results obtained from assessing 7 out of 15 classrooms (47%) by the two raters demonstrated good observational reliability when using this scale. As seen from Table 3, the percentage of cases in which the primary rater and the secondary rater had exact agreement ranged from 66.07% to 97.62% with total agreement of 80.99%. The percentage of cases in which the primary rater and the secondary rater agreed within one point ranged from 90.48% to 100% with total agreement of 95.89%.

Table 3

Reliability for CPERS

Subscales	Inter-rater Reliability	
	Exact agreement (%)	Agreement within 1 point (%)
Subscale 2	78.57	97.62
Subscale 3	64.29	100
Subscale 4	91.67	95.19
Subscale 5	66.07	94.64
Subscale 6	97.62	97.62
Subscale 7	59.52	90.48
Subscale 8	94.64	98.21
Subscale 9	80.61	93.88
Subscale 10	89.01	96.70
Subscale 11	87.91	94.51
Total CPERS	80.99	95.89

Note. $N = 7$. CPERS = Children's Physical Environments Rating Scale.

Demographic Descriptive Statistics

Children Participants

Children's and parents' demographic information was obtained from a survey handed out with the parental consent form. When the parents agreed for their child to participate, they completed the survey and returned it to the classroom teacher with the completed parental consent form. The Parent Information Survey (PIS) included the child's gender, age (in months), father's education level and mother's education level (rated as PhD., JD, EdD, or MD = 5, Masters = 4, Bachelors = 3, Associates = 2.5, high school = 2, middle school or lower = 1). Tables 4 displays the demographic information for children's parents. Eighty-eight children (48 male, 40 female) participated from a Head Start program with a *M* = 55.83 months and *SD* = 7.11, while the rest of the 47 children participants (29 male, 18 female) were from the university childcare center with a *M* = 53.49 months and *SD* = 7.99. Most of the parents whose children were in the Head Start program had a high school degree (80.68% of the mothers had high school degree; 79.55% of the fathers had the high school degree). A majority of the parents whose children were in the university childcare center had a university or advanced degree (68.09% of the mothers had a PhD., JD., EdD., or MD, Masters, or Bachelor's degree, and 67.39% of the fathers had PhD., JD., EdD., or MD, Masters, or Bachelor's degrees). Two of the classrooms in the university childcare center included children from Head Start programs, considered separately (mothers with a percentage of 29.79% had a high school degree, and fathers with a percentage of 30.43 % had a high school degree).

Table 4

Demographic Information for Parents

	Head Start (*n* = 88)		University Childcare Center (*n* = 47)	
Mother's Education	Frequency	Percentage (%)	Frequency	Percentage (%)
PhD., JD., EdD., MD	1	1.13	10	21.28
Masters	1	1.13	13	27.66
Bachelors	4	4.55	9	19.15
Associates	5	5.68	1	2.13
High school	71	80.68	14	29.79
Middle school or lower	6	6.82	0	0
Father's Education				
PhD., JD., EdD., or MD	1	1.13	10	21.74
Masters	2	2.27	10	21.74
Bachelors	4	4.55	11	23.91
Associates	2	2.27	0	0
High school	70	79.55	14	30.43
Middle school or lower	9	10.23	1	2.17

Teacher Participants

The teacher information was obtained from a survey given out with the teacher consent form. When the teachers agreed to participate, they filled out the Teacher Information Survey

(TIS) attached to the teacher consent form. This Teacher Information Survey (TIS) included gender, education level (coded the same way as the parents' education level), and years of teaching experience. Fifteen female teachers participated in the study, nine from a Head Start program and six from the university childcare center. All of the teacher participants were female. As indicated in Table 5, all teachers had at least an associate's degree, and most had a bachelor's degree. Teachers' years of teaching experience in the university childcare center ranged from 15 to 36 years. The teachers from the Head Start program had teaching experience that ranged from 5 to 30 years.

Table 5

Demographic Information for Teacher Participants

	Head Start		University Childcare Center	
	Male (*n*= 0), Female (*n* = 9)		Male (*n* = 0), Female (*n*= 6)	
Education Level	Frequency	Percentage (%)	Frequency	Percentage (%)
PhD, JD, EdD, or MD	0	0	0	0
Masters	1	11.11	1	16.67
Bachelors	5	55.56	4	66.67
Associates	3	33.33	1	16.67
High school	0	0	0	0
Middle school or lower	0	0	0	0
Years of Teaching Experience				

Table 5 continued

1-5 years	1	11.12	0	0
6-10 years	3	33.33	0	0
11-20 years	2	22.22	2	33.33
21 years or over	3	33.33	4	66.67

Data Analysis on the Variables Based on Programs

To prepare the data for analysis, the scores of the items for the CSC behavioral/interpersonal self-control and the TCREL items for conflict of teacher-child relationships were reverse coded. Therefore, children having higher scores on the children's self-control scale meant they had better self-control skills. Children having higher scores on the teacher-child relationship scale meant they had more positive relationships with teachers. The researcher examined the scores of children's engagement levels, children's self-control level, teacher-child interaction, teacher-child relationship, and classroom physical environment scores from the two programs (Head Start and university childcare center) using a one-way ANOVA. As shown in Table 6, engagement levels of children from the university (M = 3.12, SD = .54) childcare center were a little higher than were those for children from the Head Start program (M = 3.04, SD = .57), but the differences were not significant (F = .905, p = .648). Children's self-control levels from the university (M = 3.43, SD = .81) childcare center were a little lower than were children from the Head Start program (M = 3.55, SD = .78), but the differences were not significant with F = .830, p = .737. Teacher-child interaction scores from the university childcare

center (*M* = 4.50, *SD* = .36) were a little lower than the scores from the Head Start program (*M* = 4.51, *SD* = .33), and the differences were significant with *F* = 1.782, *p* = .049. Teacher-child relationships from the university childcare center (*M* = 4.19, *SD* = .58) were a little lower than with children from the Head Start program (*M* = 4.35, *SD* = .63), but the differences were not significant with *F* = 1.511, *p* = .060. Classroom physical environment scores of the university childcare center (*M* = 3.05, *SD* = .12) and the Head Start program (*M* = 3.05, *SD* = .21) with *F* = 1.912, *p* = .189 were very similar.

Table 6

Differences in Variables Based on Programs

	Head Start		University Childcare Center			
	Mean (*SD*)	Min (*Max*)	Mean (*SD*)	Min (*Max*)	*F*	*Sig.*
Engagement	3.04 (.57)	1.38 (3.97)	3.12 (.54)	1.41 (4.00)	.905	.648
Child's self-control	3.55 (.78)	1.71(5.00)	3.43 (.81)	1.57 (5.00)	.830	.737
Teacher-child interaction	4.51(.33)	3.60(5.00)	4.50(.36)	3.6(5.00)	1.782	.049*
Teacher-child relationship	4.35 (.63)	2.20 (5.00)	4.19 (.58)	2.53 (5.00)	1.511	.060
Classroom physical environment	3.05 (.21)	2.70 (3.32)	3.05 (.12)	2.90 (3.15)	1.912	.189

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Data Analysis on the Variables Based on Child Gender

The researcher examined children's engagement levels, children's self-control level, teacher-child interactions, teacher-child relationships, and classroom physical environment based on gender using a one-way ANOVA, as shown in Table 7. The engagement levels of male children (M = 2.92, SD = .56) were lower than those of female children (M = 3.26, SD = .51), but the differences were not significant with F = .967, p = .547. Male children's self-control levels (M = 3.33, SD = .79) were lower than those of female children (M = 3.75, SD = .73), but the differences were not significant with F = .797, p = .782. The interaction level between the teachers and male children (M = 4.44, SD = .36) was somewhat lower than was the interaction between the teachers and female children (M = 4.60, SD = .30), but the differences were not significant with F = 1.625, p = .082. The relationship between the teachers and female children (M = 4.50, SD = .36) was higher than was the relationship between the teachers and male children (M = 4.14, SD = .69), but the differences were not significant with F = 1.078, p = .376.

Table 7

Differences in Variables Based on Child Gender

	Male (***n***=77)		Female (***n***=58)			
	Mean (*SD*)	Min (*Max*)	Mean (*SD*)	Min (*Max*)	*F*	*Sig.*
Engagement	2.92 (.56)	1.38 (4.00)	3.26 (.51)	2.16 (4.00)	.967	.547
Children's self-control	3.33 (.79)	1.71 (5.00)	3.75 (.73)	1.57 (5.00)	.797	.782
Teacher-child interaction	4.44 (.36)	3.60 (5.00)	4.60 (.30)	3.90 (5.00)	1.625	.082

Table 7 continued

Teacher-child relationship	4.14 (.69)	2.20 (5.00)	4.50 (.43)	3.40 (5.00)	1.078	.376

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Bivariate Correlations

To examine the correlations among the variables, the study employed bivariate correlations to analyze the data. The results in Table 8 show that children's gender significantly related to several variables:

1) Gender was significantly related to their engagement level with $r = .301$, $p = .01$ with female children having higher engagement level than male children;
2) Gender was significantly related to children's self-control skills with $r = .263$, $p = .01$ with female children having higher self-control scores than male children;
3) Gender was significantly related to the teachers' interaction with children at $r = .234$, $p = .01$ with teachers having more positive interactions with female children than male children;
4) Gender was significantly related to their relationships with teachers at $r = .266$, $p = .01$ with teachers having more positive relationships with female children than male children.

The closeness subscale was not significantly related to gender, but the subscale of conflict was significantly associated with children's gender with the females having fewer conflict relationships with their teachers than did the male children.

Children's age did not significantly associate with any other variables. Mothers' education level was significantly positively associated with children's engagement level with r = .258, p = .01. However, fathers' education levels did not have a significant relationship with their child's engagement.

Children's engagement significantly related to children's self-control (r = .585, p < .001), teacher-child interaction (r = .700, p < .001), and teacher-child relationship (r = .490, p < .001). In addition, children's engagement also significantly associated with the subscale of closeness (r = .584, p < .001) and conflict (r = .370, p < .001). This suggests that children with higher self-control skills, children having more positive relationships with the teachers, and children having higher quality interactions with their teachers were more engaged in their learning. Children's self-control was significantly related to the quality of teacher-child interactions with r = .395, p < .001, teacher-child relationships with r = .576, p < .001 (closeness r = .340, p < .001; conflict r = .603, p < .001), and classroom physical environment with r = .255, p = .003. This signifies that children having high quality interactions and positive relationships with teachers had better self-control behaviors. Children in classrooms with a high quality of physical environment had higher scores of self-control skills.

Children having high quality interactions with the teachers also had positive relationships with the teachers (r = .552, p < .001) (closeness r = .626, p < .001; conflict r = .408, p < .001). Classroom physical environment had a significant relationship with the quality of teacher-child interactions (r = .285, p = .001). However, teachers' education levels had a significantly negative relationship with the quality of teacher-child interaction (r = -.450, p < .001). This indicates that

teachers with higher education levels may not have better interactions with the children. In addition, the results showed that teachers' education levels had significantly negative relationships with children's engagement levels.

Children in classrooms with higher quality of physical environment were more engaged ($r = .316$, $p < .001$). Children had higher self-control skills ($r = .255$, $p = .003$) in classrooms with higher quality of physical environment. Children had higher scores of teacher-child interaction ($r = .285$, $p = .001$) in classrooms with higher quality of physical environment. However, teachers' education levels had significantly negative relationships with the quality of classroom physical environment ($r = -.285$, $p = .001$). Teachers' years of teaching experiences was not significantly related to any other variables.

Table 8

Bivariate Correlation among the Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. PROTY	1	-.069	-.141	.627***	.584***	.068	-.072	-.025	.042	-.195*	-.173*	.126	.512***	.015
		.427	.104	.000	.000	.431	.406	.773	.630	.023	.046	.145	.000	.867
2. CGender		1	.067	-.067	-.085	.301***	.263**	.236**	.160	.294***	.267**	-.166	-.073	.067
			.442	.443	.330	.000	.002	.006	.064	.001	.002	.055	.397	.440
3. CAge			1	-.102	-.076	.077	.145	-.039	.033	.046	.068	.108	-.034	.096
				.241	.385	.372	.094	.655	.703	.594	.435	.213	.699	.269
4. Maedu				1	.707***	.258**	.064	.261**	.192*	-.097	-.007	-.084	.325***	.144
					.000	.002	.462	.002	.025	.264	.934	.334	.000	.095
5. FaedF					1	.137	-.074	.158	.064	-.190*	-.144	-.149	.343***	.138
						.113	.392	.068	.463	.028	.101	.086	.000	.112
6. CEQ						1	.585***	.700***	.584***	.370***	.490***	-.242**	.009	.316***
							.000	.000	.000	.000	.000	.005	.922	.000
7. CSC							1	.395***	.340***	.603***	.576***	-.061	-.005	.255**
								.000	.000	.000	.000	.483	.952	.003
8. TCINT								1	.626***	.408***	.552***	-.450***	.019	.285***
									.000	.000	.000	.000	.825	.001
9. TCCL									1	.396***	.721***	-.195*	.071	.048
										.000	.000	.024	.415	.578
10. TCCO										1	.890***	-.109	-.207*	.098
											.000	.209	.016	.261
11. TCREL											1	-.183*	-.188*	.132
												.035	.030	.129
12. Tedu												1	.045	-.285***
													.607	.001

13. TysEx	1	-.058 .501
14. CPERS		1

Note. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Confirmatory Factor Analysis (CFA) on Teacher-Child Relationship

The teacher-child relationship data underwent confirmatory factor analysis (CFA) with results indicating that the model with two factors (closeness and conflict) from the scale fit the data well with $\chi^2 = 167.61$, $df = 89$, $p < .001$, $CFI = .92$, $RMSEA = 0.08$, $SRMR = .06$. The model fit indices were good except that the RMSEA value was a little higher than .06, but it was still in the acceptable range (between .06 and .08 suggests an acceptable fit). Figure 15 shows the model for the scale of teacher-child relationship.

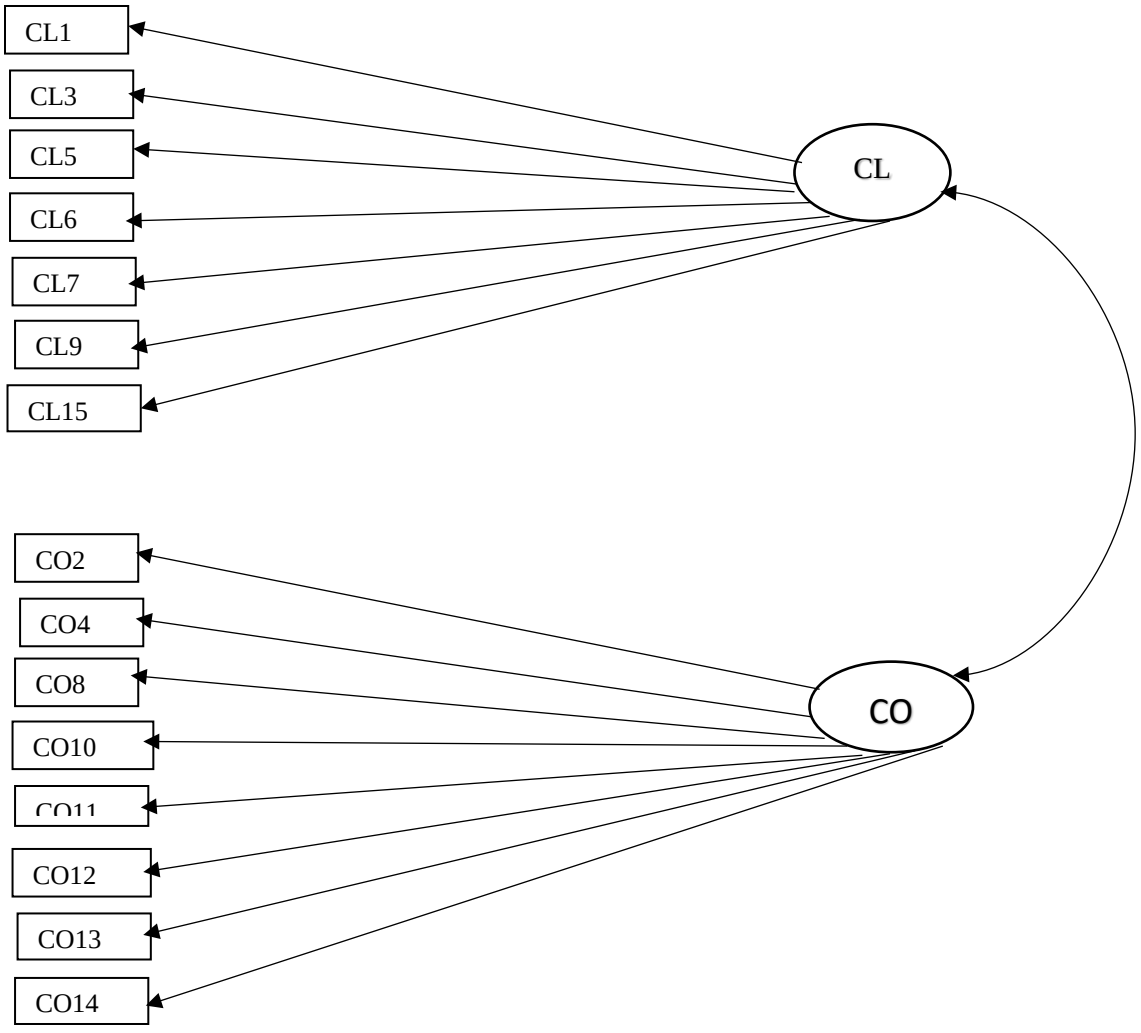

Figure 15. Confirmatory factor analysis model for teacher-child relationship scale. CO = Conflict. CL = Closeness.

Based on the modification suggestions from Mplus output, the researcher added a correlation between item CL7 (*This child spontaneously shares information about himself/herself.*) and CL15 (*This child openly shares his/her feelings and experiences with me*), which improved the model fit with χ^2 = 140.21, *df* = 88, *p* = .003, *CFI* = .950, *RMSEA* = 0.066, *SRMR* = .058. Figure 16 shows the model after correlating CL7 and CL15.

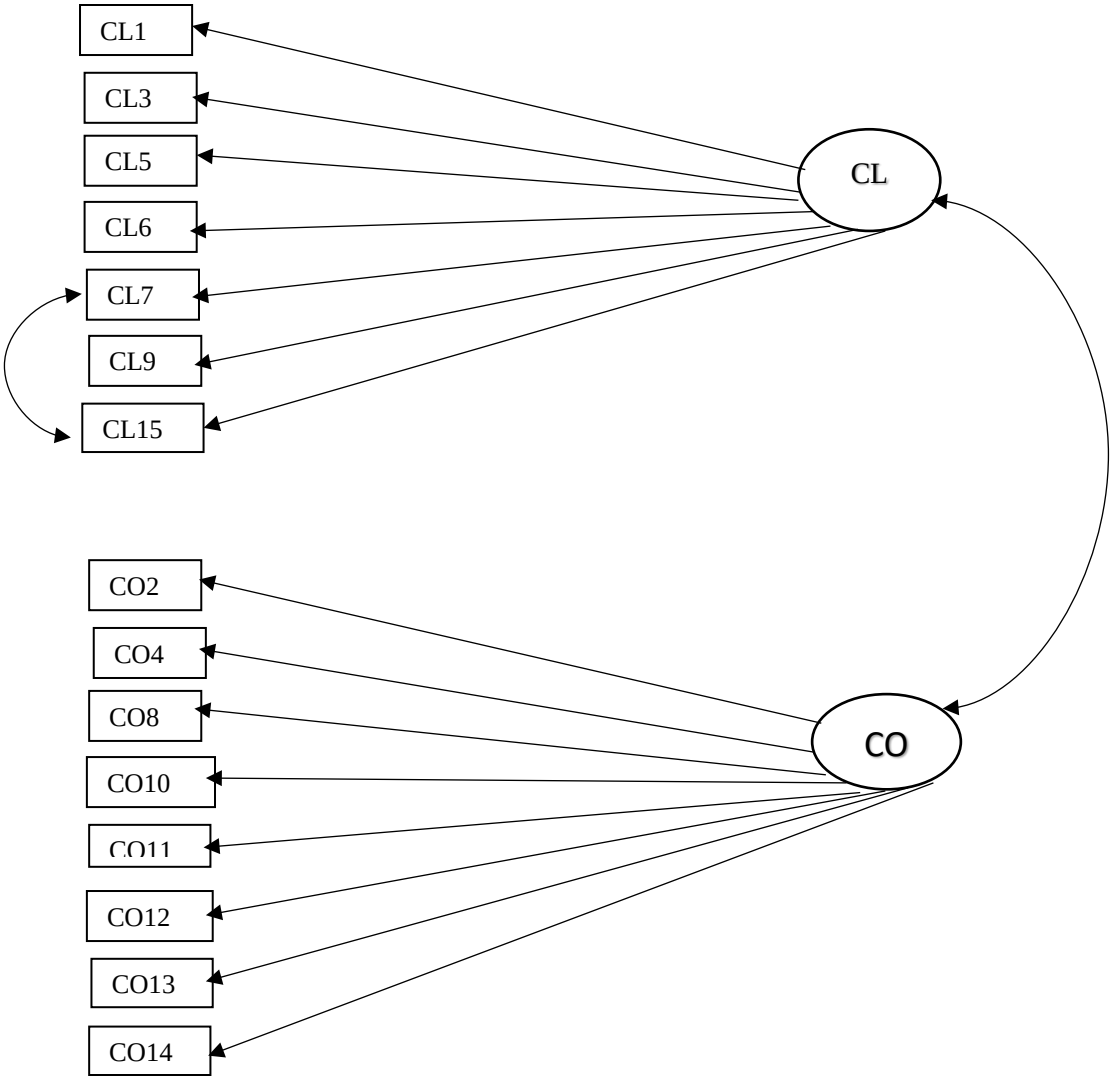

Figure 16. Confirmatory factor analysis model for teacher-child relationship scale (after modification). CO = conflict. CL = closeness.

Structural Equation Modeling Analysis without Covariates

Mplus version 6.12 was used to conduct structural equation modeling using an MLR estimator to examine the model fit. Model 1 addressed research questions 1-3:

RQ1: Is the level of preschoolers'engagement in classroom learning activities directly associated with their self-control or mediated through teacher-child interaction quality?

RQ2: Is the level of preschoolers' engagement in classroom learning activities directly associated with the teacher-child relationship or mediated through children's self-control?

RQ3: Is the level of preschoolers' engagement associated with the quality of classroom physical environment?

Results indicated that the original model (Figure 17) did not fit well with $\chi^2 = 23.50$, $df = 3$, $p < .001$, $CFI = .85$, $RMSEA = .23$, $SRMR = .13$. Table 9 presents a summary of the model results.

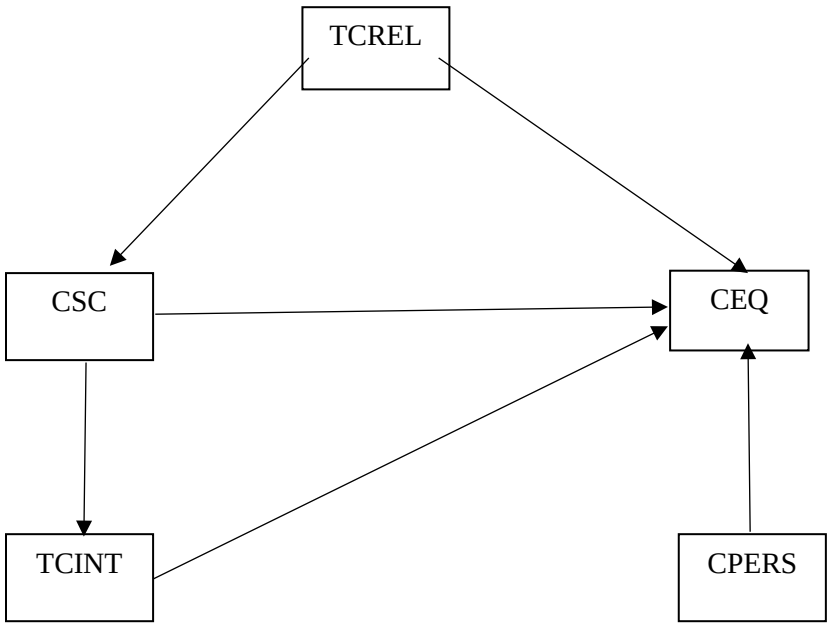

Figure 17. Original model 1. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

Table 9

Model Results for Model 1

	Estimate	SE	Est./SE	Two-Tailed *p*-value
CSC on TCREL	.58	.07	7.99	< .001***
CEQ on TCREL	-.03	.11	-.23	.815
CSC	.37	.08	4.73	< .001***
TCINT	.55	.05	12.02	< .001***
CPERS	.09	.06	1.40	.162
TCINT on CSC	.36	.11	3.40	.001***

Note. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Based on the model modification suggestions from Mplus output, the direct associations between CEQ and CPERS, between CEQ and TCREL, and between CSC and TCINT were removed from the model. The direct associations between TCINT and TCREL and between CPERS and CSC were added to the model. The modified model 1 (Figure 18) indicated good fit indices with $\chi^2 = 1.14$, $df = 4$, $p = .887$, $CFI = 1.00$, $RMSEA = 0.00$, $SRMR = .02$. Table 10 presents a summary of the model results.

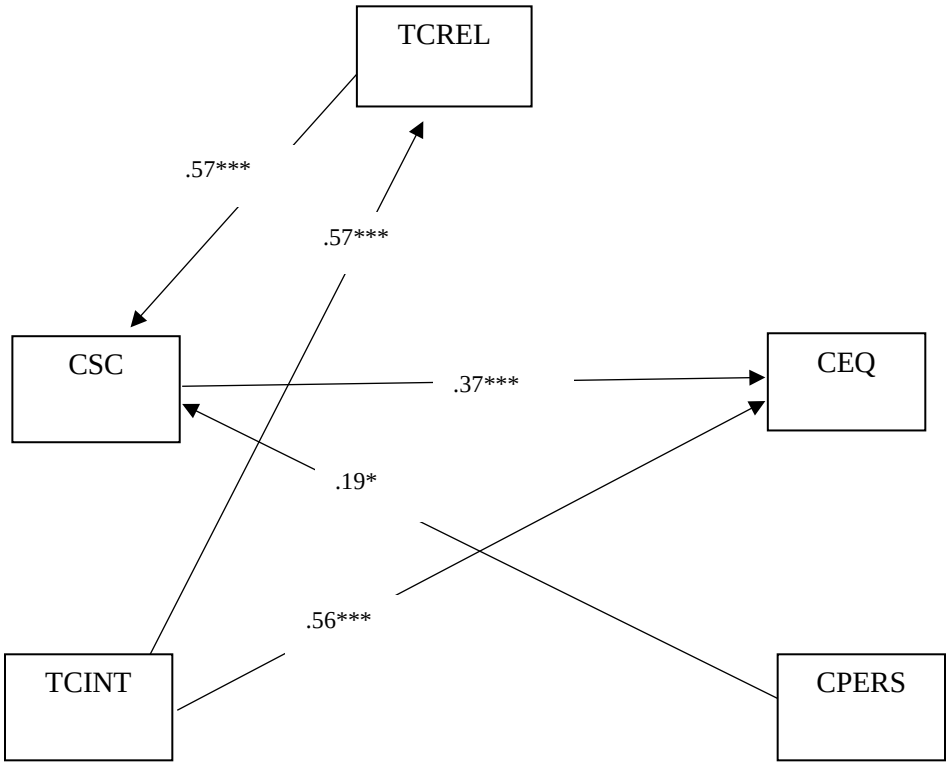

Figure 18. Modified model 1. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

Table 10

Modified Model 1 Results

	Estimate	SE	Est./ SE	***p***-value
Direct Effects				
TCREL on TCINT	.57	.08	7.36	< .001***
CSC on TCREL	.57	.07	8.53	< .001***
CPERS	.19	.09	2.21	.027*

Table 10 continued

CEQ on CSC	.37	.07	5.19	< .001***
TCINT	.56	.06	9.69	< .001***
Indirect Effects				
TCINT to CSC through RE	.75	.17	4.52	< .001***
CPERS to CEQ through CSC	.23	.12	1.91	.057
TCREL to CEQ through CSC	.20	.04	4.56	< .001***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment.

The results demonstrated that the level of engagement of preschoolers in classroom learning activities was directly associated with children's self-control with $\beta = .37$, $p < .001$. The level of engagement of preschoolers in classroom learning activities did not have direct association with teacher-child relationships, but teacher-child relationship had an indirect association with children's engagement through children's self-control with $\beta = .20$, $p < .001$. The effect of engagement of preschoolers was not directly associated with the classroom physical environment. The indirect association between preschoolers' engagement and classroom physical environment through children's self-control was not identified in this model ($\beta = .23$, $p = .057$). It was also found that teacher-child interaction was indirectly associated with children's self-control, mediated by teacher-child's relationship with $\beta = .75$, $p < .001$.

To examine the effects of two subscales of teacher-child relationships on children's engagement further, closeness and conflict replaced the teacher-child relationship in the original model 1 (Figure 17) to build model 1a as shown in Figure 19. The results indicated that the model fit indices were not acceptable for the goodness of fit with $\chi^2 = 37.29$, $df = 4$, $p = .001$, *CFI* = .79, *RMSEA* = .25, *SRMR* = .15. Table 11 presents a summary of the model results.

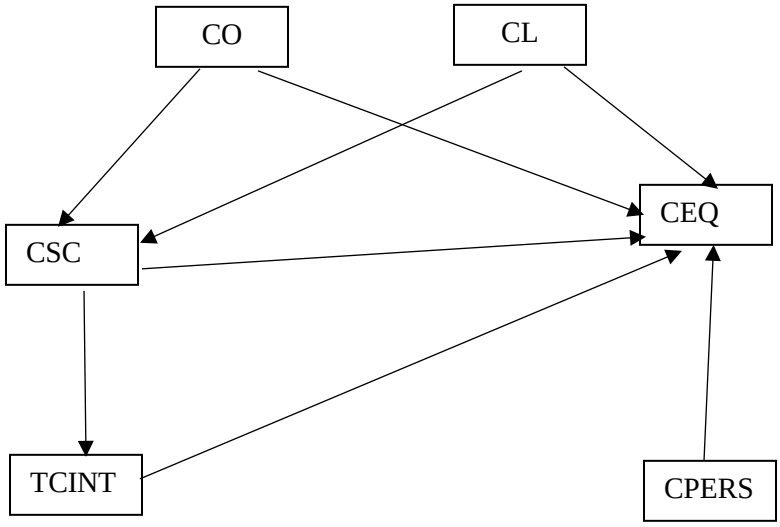

Figure 19. Original model with split RE (Model 1a). CEQ = children's engagement, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment, CO = conflict of teacher-child relationship, CL = closeness of teacher-child relationship.

Table 11

Model Results for Model 1a

	Estimate	SE	Est./ SE	*p*-value
CSC on CO	.56	.10	6.16	< .001***
CL	.12	.08	1.48	.138
TCINT on CSC	.40	.11	3.74	< .001***
CEQ on CL	.25	.09	2.84	.005**
CO	-.16	.08	-2.12	.034*
SC	.43	.08	5.49	< .001***
INTER	.45	.07	7.00	< .001***
CPERS	.10	.07	1.47	.142

Note. CEQ = children's engagement, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment, CO = conflict of teacher-child relationship, CL = closeness of teacher-child relationship.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Based on the modification suggestions from Mplus output and the table, the researcher removed the relationship between children's self-control and teacher-child's interaction, children's self-control and teacher-child closeness, and the relationship between child's engagement and classroom physical environment from the model. The researcher added the relationship between classroom physical environment and children's self-control, between teacher-child interaction and teacher-child closeness, and between teacher-child's interaction and teacher-child conflict to the model. The results suggested that the model as shown in Figure 20 was improved with $\chi^2 = 10.54$, $df = 6$, $p = .104$, *CFI* = .977, *RMSEA* = .075, *SRMR* = .064. The

model indices showed good fit. The RMSEA was a little higher, but still in the range of acceptable fit (between .06 and .08 suggests an acceptable fit). Table 12 presents a summary of the model results.

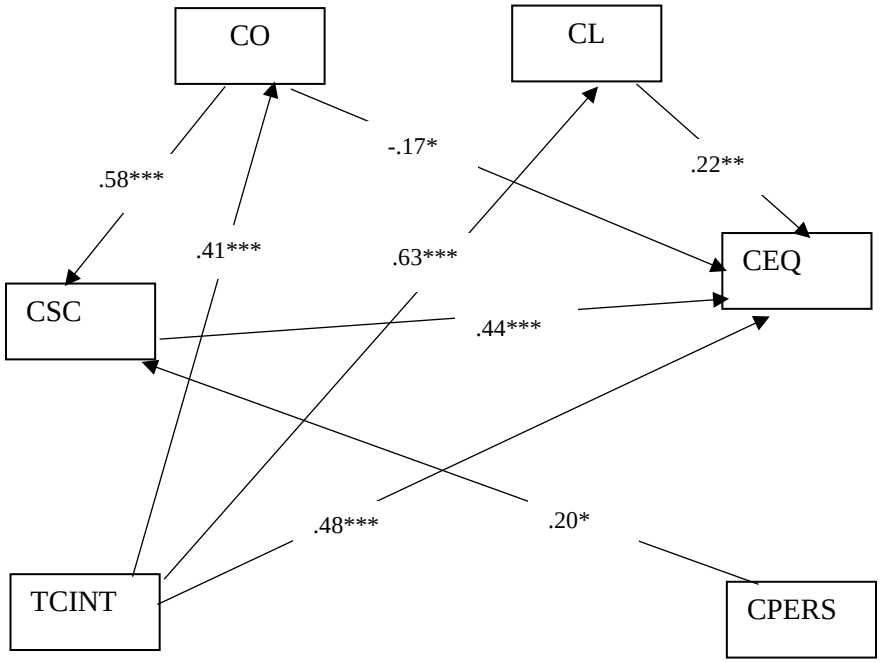

Figure 20. Modified model with split RE (modified Model 1a). CEQ = children's engagement, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment, CO = conflict of teacher-child relationship, CL = closeness of teacher-child relationship.

Table 12

Model Results for Modified Model 1a

	Estimate	S.E.	Est./ S.E.	*p*-value
Direct Effects				
CSC on CO	.58	.07	7.95	< .001***

Table 12 continued

CPERS	.20	.08	2.41	.016*
CEQ on CL	.22	.07	3.00	.003**
CO	-.17	.072	-2.29	.022*
CSC	.44	.09	5.10	< .001***
TCINT	.48	.06	7.81	< .001***
CL on TCINT	.63	.09	7.30	< .001***
CO on TCINT	.41	.10	4.11	< .001***
Indirect Effects				
TCINT to CSC through CO	.24	.08	3.02	.003**
TCINT to CEQ through CL	.14	.06	2.49	.013**
TCINT to CEQ through CO	-.07	.03	-2.21	.027**
TCINT to CEQ through SC CO	.11	.03	3.59	< .001***
CPERS to CEQ through CSC	.09	.05	1.96	.050*
CO to CEQ through CSC	.26	.05	5.48	< .001***

Note. CEQ=children's engagement, CSC=child's self-control, TCINT=teacher-child interaction, CPERS=classroom physical environment, CO = conflict of teacher-child relationship, CL = closeness of teacher-child relationship.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

In the original model 1, the model fit demonstrated that teacher-child relationships had no association with children's engagement level. After two subscales of teacher-child relationships, closeness and conflict, replaced the overall score of the teacher-child relationship, it showed that closeness was significantly associated with children's engagement level ($\beta = .22$, $p = .003$).

Conflict was significantly negatively associated with children's engagement level (β = -.17, p = .022). Other relationships existing in the original model 1 also occurred in this model.

Compared to the established modified model 1 with teacher-child relationship as a whole scale, this model separated the two subscales of teacher-child relationships (closeness and conflict). The results showed that teacher-child interaction had direct (β = .48, p < .001) and indirect association with child's engagement level through both closeness (β = .14, p = .013) and conflict (β = - .07, p = .027). The indirect effects of classroom physical environment on children's engagement through children's self-control still existed (β = .09, p = .050). Teacher-child interaction affected children's self-control through the conflict subscale of teacher-child relationships (β = .24, p = .003). Teacher-child interaction affected child's engagement levels through the closeness subscale of teacher-child relationship (β = .14, p = .013), and the conflict subscale of teacher-child relationships (β = - .07, p = .027). The conflict subscale of teacher-child relationship affected the child's engagement level through children's self-control (β = .26, p < .001).

Structural Equation Modeling with Covariates

The researcher added the four covariates—teachers' education level, years of teaching experiences, fathers' education level, and mothers' education level—to modified model 1, already established to be a good fit, to build model 2 as shown in Figure 21. This model was proposed to address research questions 4-7.

> RQ4: Are fathers' and mothers' education levels associated with the level of preschoolers' engagement through children's self-control?

RQ5: Are teachers' years of teaching experiences associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ6: Are teachers' levels of education associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ7: Are teachers' years of teaching experience and levels of education associated with the level of preschoolers' engagement through the quality of the classroom physical environment?

After running the model in Mplus version 6.12, the model indices showed that the model fit well with $\chi^2 = 25.56$, $df = 17$, $p = .083$, $CFI = .950$, $RMSEA = .061$, $SRMR = .070$. Table 13 presents a summary of the model results.

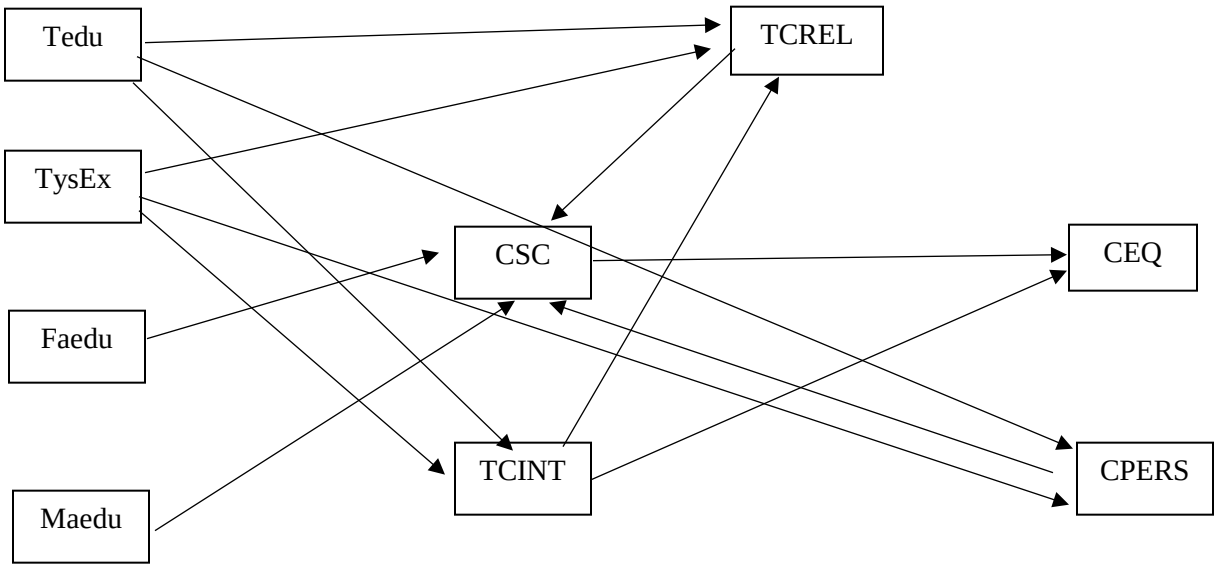

Figure 21. Original model 2 with covariates. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience, Faedu = fathers' education level, Maedu = mothers' education level.

Table 13

Standardized Model Results for Original Model 2 with Covariates

	Estimate	SE	Est./ SE	*p*-value
CSC on TCREL	.56	.07	8.61	< .001***
CPERS	.19	.10	2.04	.041*
Maedu	.11	.05	2.39	.017*
Faedu	-.11	.06	-1.78	.076
CEQ on CSC	.36	.07	5.18	< .001***
TCINT	.56	.05	10.98	< .001***

Table 13 continued

TCINT on Tedu	-.45	.13	-3.38	.001***
TysEx	.04	.15	.26	.792
TCREL on TCINT	.62	.09	6.67	< .001***
Tedu	.11	.10	1.11	.267
TysEx	-.17	.06	-2.77	.006**
CPERS on Tedu	-.28	.14	-2.10	.036*
TysEx	-.05	.22	-.22	.826

Note. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = children's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience, Faedu = fathers' education level, Maedu = mothers' education level.

* $p < .05$, ** $p < .01$, *** $p < .001$.

From the table above, it can be seen that, although the model fit well, not all of the associations were significant. Therefore, the researcher removed the relationships between children's self-control and fathers' education level, between years of teaching experiences and classroom physical environment, between years of teaching experiences and teacher-child interaction, between teacher-child relationship and teachers' education level from the model as indicated in Figure 22. The model fit indices showed that it was a good fit model with $\chi^2 = 6.74$, $df = 12$, $p = .874$, $CFI = 1.000$, $RMSEA = .000$, $SRMR = .057$. However, the Mplus output showed an indication of model nonidentification and suggested that model parameter estimates (e.g., model indices, parameter estimates) might not be trustworthy. This was mostly due to

having more parameters than the number of clusters (15 classrooms). Therefore, the model was dropped, because it could not address research questions 4-7 through the built structural equation model. Table 14 presents a summary of the model results.

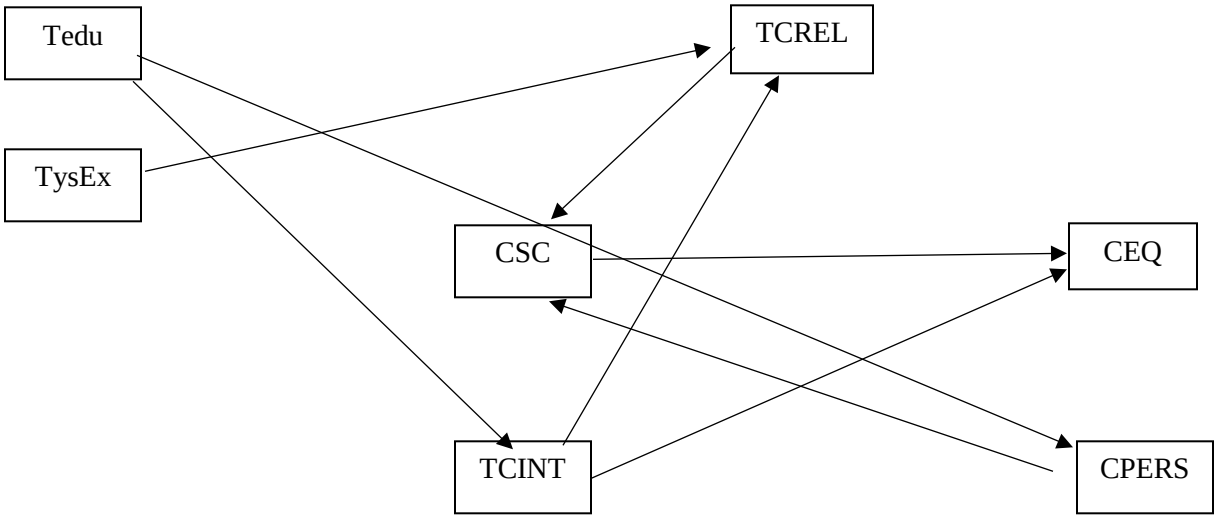

Figure 22. Modified model 2 with covariates. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience.

Table 14

Modified Results for Modified Model 2 with Covariates

	Estimate	SE	Est./SE	***p*** value
CSC on TCREL	.57	.06	8.88	< .001***
CPERS	.19	.10	1.93	.053
CEQ on CSC	.37	.07	5.34	< .001***

Table 14 continued

TCINT	.56	.05	11.01	< .001***
TCINT on Tedu	-.45	.13	-3.41	.001***
TCREL on TCINT	.57	.07	8.72	< .001***
TysEx	-.17	.07	-2.49	.013*
CPERS on Tedu	-.29	.13	-2.14	.023*

Note. CEQ = children's engagement, TCREL = teacher-child relationship, CSC = child's self-control, TCINT = teacher-child interaction, CPERS = classroom physical environment. Tedu = teacher education level, TysEx = teachers' years of teaching experience.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Chapter Summary

The chapter discussed the findings from descriptive statistics, ANOVA tests, bivariate correlation analysis, confirmatory factor analysis, and structural equation modeling (SEM). The structural equation model addressed research questions 1-3:

RQ1: Is the level of preschoolers'engagement in classroom learning activities directly associated with their self-control or mediated through teacher-child interaction quality?

RQ2: Is the level of preschoolers' engagement in classroom learning activities directly associated with the teacher-child relationship or mediated through children's self-control?

RQ3: Is the level of preschoolers' engagement associated with the quality of classroom physical environment?

From the findings, it can be seen that the level of preschoolers' active engagement in classroom learning activities was directly positively associated with their self-control. However, the level of preschoolers' active engagement in classroom learning activities did not have an indirect positive association with the children's self-control through teacher-child interaction. The level of preschoolers' active engagement in classroom learning activities did not directly associate with teacher-child relationships, but the level of engagement of preschoolers in classroom learning activities revealed an indirect association with teacher-child relationships as a mediator of children's self-control. The classroom physical environment was not directly associated with the level of preschoolers' engagement, but there was an indirect positive relationship between the level of preschoolers' engagement and classroom physical environment, mediated by the children's self-control.

However, due to the model nonidentification, the proposed model could not address research questions 4-7:

RQ4: Are fathers' and mothers' education levels associated with the level of preschoolers' engagement through children's self-control?

RQ5: Are teachers' years of teaching experiences associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ6: Are teachers' levels of education associated with the level of preschoolers' engagement in the classroom through the teacher-child relationship or teacher-child interaction?

RQ7: Are teachers' years of teaching experience and levels of education associated with the level of preschoolers' engagement through the quality of the classroom physical environment?

CHAPTER 5

DISCUSSION

Chapter 5 presents a summary of the study and findings, and discusses the way in which these findings contribute to the literature. It also provides some implications for teacher education based on the findings. Further, the section discusses the limitations of the study and offers some emerging directions for future research.

Summary of the Study

The purpose of this study was to demonstrate whether and how teacher-child interactions, teacher-child relationships, children's self-control, classroom physical environment, parents' education levels, and teachers' teaching experience and education levels affected children's engagement levels.

Study participants totaled 135 preschoolers and 15 preschool classroom teachers. Nine of the teachers were from a Head Start program, while six were from a university childcare center. To collect parents' and children's demographic information, parents received a Parent Information Survey (PIS) attached to the parental consent form. When the parents agreed for their child to participate in the study, they signed the parental consent form and filled out the Parents Information Survey (PIS), which included their child's age and gender and the father's and mother's education level. To collect teachers' demographic information, teachers received a Teacher Information Survey (TIS) attached to their consent form sent by the researcher. When the teachers agreed to participate in the study, they signed the teacher consent form and filled out the Teacher Information Survey (TIS), which included the head teacher's gender, educational

degree, and years of teaching experience. In addition, teachers completed the following questionnaires on children's behaviors: Children Engagement Questionnaire (CEQ), Teacher-Child Interaction Questionnaires (TCINT), the Teacher's Self-Control Rating Scale (TSCRS), and the Student-Teacher Relationship Scale (STRS). The researcher assessed the classroom's physical environment using the Children's Physical Environments Rating Scale (CPERS).

Before analysis, the researcher screened the data for outliers, missing data, collinearity, and linearity. Having established the parameters, the data analysis included:

1) Calculating the reliability of the Children's Physical Environments Rating Scale (CPERS) to obtain the inter-rater reliability;
2) Analyzing the demographic information through descriptive statistics;
3) Examining correlations among the variables with bivariate correlation;
4) Conducting confirmatory factor analysis (CFA) on the teacher-child relationship scale to examine the validity of the scale;
5) Analyzing the data through structural equation model (SEM) to determine the goodness of the model fit.

Appendix K presents a summary of the findings related to the research questions.

Discussion of Findings

This section offers the primary findings on the research questions and secondary findings derived from the study.

Primary Finding 1

The higher levels of preschoolers' active engagement in classroom learning activities was directly associated with the children's better self-control. However, the level of preschoolers' active engagement in classroom learning activities did not have an indirect positive association with the children's self-control through teacher-child interaction.

The finding was consistent with many other studies that examined the relationship between children's self-control and their engagement levels. Some studies found that children who had better control of their behaviors and emotions were more engaged during their classroom learning activities (Brock et al., 2009; Drake et al., 2014; Searle et al., 2013; Sjoman et al., 2016; Williford et al., 2013). As children grow in their abilities to control their behaviors and emotions, their engagement levels in learning activities are also enhanced.

Some of the literature investigated the mediational relationships between children's self-control and their engagement. Drake et al. (2014) conducted a path analysis of the mediational influence of children's self-control between attachment and their school engagement. The results demonstrated that the mediational effect of children's self-control existed, and the indirect effect of the children's early attachment to their later engagement through self-control was significant. Portilla et al. (2014) examined children's self-control as one of the predictors of children's engagement. The results showed that when children had higher inattention and impulsivity scores (self-control), their school engagement decreased. The results identified the indirect effect between children's self-control and academic achievement through children's engagement. The current study did not identify the indirect association between children's engagement and their

self-control through teacher-child interaction. This study identified a statistically significant medium effect size of correlation between children's self-control and teacher-child interaction through the bivariate correlation test ($r = .395$, $p < .01$).

Primary Finding 2

The level of preschoolers' active engagement in classroom learning activities did not have a direct association with teacher-child relationships, but the level of engagement of preschoolers in classroom learning activities revealed an indirect association with teacher-child relationships as a mediator of children's self-control. When separating the two subscales of teacher-child relationships (closeness and conflict), teacher-child closeness was directly associated with children's engagement levels and teacher-child conflict both directly and indirectly associated with children's engagement through their self-control.

A variety of other studies established the association between teacher-child relationships and children's engagment, revealing that teacher-child closeness predicted children's later engagement (Hughes & Kwok, 2007; Hughes et al., 2008; Portilla et al., 2014). Portilla et al. (2014) examined the dynamic interplay between teacher-child relationships and engagement. These results demonstrated that children who experienced greater closeness with their teachers in kindergarten also showed more engagement in learning activities across kindergarten and first grade. The current study also found a direct association between teacher-child closeness and children's engagement. In Papadopoulou and Gregoriadis' (2016) study, the findings showed that the correlation between conflict with teachers and children's engagement was positively correlated, which the current study confirmed.

In the current study, teacher-child conflict was reverse coded. It was found that teacher-child conflict was positively associated with children's self-control. This finding was consistent with Portilla et al.'s (2014) study. Portilla et al. (2014) found that teacher-child conflict positively related to children's self-control. However, their finding was contrary to some other studies. For instance, Cardima et al. (2016) investigated the predictors of children's self-control, treating teacher-child relationships as a major factor. The results showed that children's self-control was significantly related to teacher-child closeness, but teacher-child conflict was not significantly associated with children's self-control.

Primary Finding 3

The classroom physical environment did not directly predict the level of preschoolers' engagement, but there was an indirect positive relationship between the level of preschoolers' engagement and quality of the classroom physical environment, mediated by the children's self-control.

Other studies have examined the association between the classroom physical environment and children's development. For example, Mashburn's (2008) study, in part, examined the association between the classroom physical environment and children's development of academic, language, and literacy skills. The results demonstrated that the classroom's physical environment did not associate with children's development of academic, language, or literacy skills. However, the physical environment of the classroom significantly moderated the association between family income and children's academic achievement as well as the relationship between race/ethnicity and literacy development.

The current study did not establish a direct positive association between the classroom's physical environment and children's engagement level. However, findings did establish a mediation role in the classroom physical environment. Although the quality of the classroom physical environment did not directly influence children's engagement, it affected children's self-control, which, in turn, affected children's engagement.

Secondary Finding 1

Teacher-child interaction had an indirect association with children's self-control through mediation of teacher-child relationship and through mediation of teacher-child conflict.

The secondary findings were not in the original research questions, but derived from the modified model 1 as shown in Figure 18 and modified model 1a as shown in Figure 20. The result showed that children with less self-control skills had higher conflict with the teachers. When children had conflicts with their teachers, they had less interaction with their learning. Therefore, as indicated in this study, teacher-child interaction directly influenced children's engagement level.

Extant literature clearly established the positive association between teacher-child relationships and children's self-control (Cardima et al., 2015; Cardima et al., 2016; Portilla et al., 2014). Cardima et al. (2016) discovered that children's self-control significantly related to teacher-child closeness in a positive way, but teacher-child conflict did not significantly associate with children's self-control. On the other hand, Portilla et al. (2014) found that both teacher-child closeness and teacher-child conflict significantly related to children's self-control. The finding in the current study is consistent with the literature.

However, few studies explored the mediation role of the teacher-child relationship on children's self-control. The current study found that teacher-child relationships mediated the relationship between teacher-child interaction and children's self-control. Teachers and children could improve their relationships through interaction. Once children feel close to their teachers and have less conflict, they feel safe to explore the learning activities and control their behavior and cognition.

Secondary Finding 2

Mothers' education level was significantly associated with children's engagement levels, while fathers' education level did not have a significant relationship with their children's engagement level.

The role of parents in children's development has been well established. Cadima et al. (2015) found that mothers' education positively associated with children's self-control. Ferreira et al. (2018) discovered that both mothers' and fathers' engagement in children's learning activities predicted their children's self-control. However, evidence from this study also demonstrated that fathers played a much more important role in parenting children than did mothers. Baker, Kainz, and Reynolds (2018) revealed that fathers' parenting was a more consistent mediator of links between poverty and children's achievement than was mothers' parenting.

However, the current study found that mothers played a much more important role in children's engagement in their learning activities than did the fathers. Interestingly, Zhao, Trivette, and Dunlap (2018)'s study on the difference in creativity between American and

Chinese children found that fathers' education had a significant influence on young children's creative fluency. On the other hand, the mothers' education level had no significant association with children's creativity. This finding signified that parenting had important influences on children's development. While fathers and mothers may have different interaction styles or different foci when involving children in learning activities, it suggests that both fathers and mothers should aid their children's education and help develop the whole child.

Secondary Finding 3

Teachers' education levels had a statistically significant negative relationship with children's engagement levels, and teachers' years of teaching experiences had no significant relationship with any other variable.

Some studies found that teachers' education levels and teaching experience positively contributed to higher classroom quality. For instance, King et al. (2016) demonstrated that teachers' education levels were significantly associated with the scores from classroom organization and interaction with the children, and that teachers' teaching experiences were significantly positively related to their behaviors in helping children use language and interaction with the teacher. Roorda et al.'s (2011) meta-analysis study indicated the influence of teacher-student relationships on engagement and achievement for children from preschool to high school. It revealed that when teachers had more years of teaching experience, the strength of the relationship with their students was stronger. It also revealed that teachers' years of teaching experience positively related to children's achievement.

In 2007, Maxwell and colleagues reviewed seven major studies of early childhood education, all of which examined the predictors of classroom quality and children's outcomes. The results indicated that teachers' education level were not indicators of high quality classrooms and did not predict children's outcomes. In the current study, the results were consistent with these findings. Teachers' years of teaching experience did not have significant relationships with children's engagement level, the quality of teacher-child interaction, teacher-child relationships or children's self-control. In addition, teachers' education levels had a significantly negative relationship with children's engagement levels. This finding supported many other studies. For instance, researchers found little evidence that current training and professional development activities were consistently associated with children's outcomes (Early et al., 2007; Pianta, La Paro, Payne, Cox, & Bradley, 2002). In addition, taking more course credits, earning an advanced education degree, or attending workshops did not necessarily lead to improved children's outcomes (Clifford, Early, & Hills, 1999; Hart, Stroot, Yinger, & Smith, 2005).

Implications for Teacher Education

The findings from this study suggest that teacher-child relationships influence children's self-control, which, in turn, affects children's engagement levels. Although the classroom physical environment does not directly affect children's engagement levels, teachers working in classrooms with a higher quality of physical environment had a higher quality of interaction with children as identified through the bivariate correlation test. This positive interaction improves children's engagement levels in their learning activities. Children in classrooms with a higher

quality of physical environment can control their behaviors and become more engaged in their learning activities. In this researcher's experience, teachers in the current early childhood classrooms who emphasize the importance of the physical environment on children's learning carefully and intentionally arrange the furnishings in the classrooms and select quality learning materials for children. Children in a more constructive classroom with appropriate learning materials might spend more time playing in a developmentally appropriate manner and have more engagement with their learning.

In early childhood classrooms, children that have secure attachments with caregivers feel safe to interact with peers and play with the learning materials. In the current study, although teacher-child relationship was not directly associated with children's engagement levels, the teacher-child relationship affected the children's self-control, which, in turn, affected their engagement levels. Teacher-child relationships also play a meditative role between children's self-control and teacher-child interaction. Children with positive relationships with teachers more likely trust the environment caregivers create for them and share their experiences with teachers or peers. With this positive relationship, children know the expectations of their teachers and are more likely to follow classroom rules. In order to enhance children's engagement levels, classroom teachers can start building secure attachments with children and develop positive relationships with them. Once children trust their teachers and are willing to interact with them, they are more likely to control their behavior and become more engaged with learning.

In the current study, one finding showed that the conflict subscale of teacher-child relationships had a negative relationship with children's engagement. However, as a proverb

says, only the “crying baby gets milk.” In some early childhood classrooms, only when children misbehave or have problems do they get attention or interaction from the teacher. Some other studies found that teachers had more interactions with children with less self-control (Rimm-Kaufman et al., 2009), because children with less self-control were more likely to receive teacher-initiated interactions to correct their behaviors (Rudasill & Rimm-Kaufman, 2009).

The findings from this study about teacher education along with the findings from other studies are of interest. The current study found that teachers’ education levels had a significantly negative relationship with children’s engagement level, and teachers’ years of teaching experience had no significant relationship with any other variable, which agreed with findings from many other studies. There is little evidence that taking more course credits, gaining an advanced education degree, or attending workshops improve child outcomes (Clifford et al., 1999; Early et al., 2007; Har et al., 2005; Pianta et al., 2002). For instance, Early et al.’s (2007) review synthesized several studies and found an association between teachers’ education and children’s outcome, but the direction was negative. In other words, more teacher education was associated with less positive outcomes for children. Incidentally, in this regard, the prevailing view posits that education courses lack rigor and true content (National Council on Teacher Quality, 2004).

Early et al. (2007) demonstrated that policies which only focused on increasing teachers’ education may not improve classroom quality or enhance children’s academic outcomes. Instead, teachers’ interaction with children in their learning activities was more likely to improve children’s engagement in early childhood education. Regarding the findings from the current

study, this researcher thinks we should reconsider the approach we use for early childhood university training. We emphasize delivering information or materials to teachers for their training in the current early childhood education field; however, we should consider improving the quality of the content we deliver to teacher candidates, how much information they can assimilate, and how well they can apply the information to the classroom when working with children. These three elements—deliver, assimilate, and apply—should be a consistent loop in the process instead of separate elements. This loop works for developing both pre-service and in-service teachers. In addition, as the National Council on Teacher Quality (2004) demonstrated, many current education courses lack rigor and true content.

An efficient professional development program should consider the three consistent elements as a whole and guarantee the quality of implementation for each step when designing any efficient course for pre-service teachers. The loop should not have a definite end; rather, the end of each loop should mean another advanced exploratory beginning when working with diverse children. Teachers' knowledge of children and practices should be wider and deeper on the issues of children's development when they have more experience in working with children.

Limitations of this Study

This study employed a structural equation modeling (SEM) approach to analyze the data. SEM is an advanced correlation study (Cresswell, 2015) with more advantages, such as linear regression, than other correlation approaches. The SEM approach enables researchers to measure direct and indirect effects among variables; in other words, multiple dependent variables can exist with several regression equations analyzed simultaneously (Karimimalayer & Anuar,

2012). However, it has some disadvantages. One of the disadvantages is that it can only assess the predictor associations among the variables, but cannot examine the causal relationships, which require an experimental study.

The researcher randomly selected eight preschoolers from each classroom whose parents gave permission for participation in the study. However, the small number of children from each classroom probably does not represent all the characteristics of the children in all classrooms. Additionally, a sample size may fail to answer research questions adequately (Creswell, 2015). To improve the sample representation and the rigor of the study, randomly choosing a larger sample of children from each classroom and having a much bigger sample size would enhance the quality of this study.

To obtain reliable data, two raters reached a 95% reliability using the classrooms that were not part of the study. Therefore, the data for the classroom physical environment were more reliable. However, only the head teacher from each classroom rated children's engagement, self-control, teacher-child interactions, and teacher-child relationships. It was difficult to find another staff member familiar with the children. Therefore, children in different classrooms might have the same degree of behaviors, but different scores since different teachers rated them.

Future Research

Future research should address the limitations of this study. First, this study employed structural equation modeling (SEM) examining the associations among the dependent variable (children's engagement) and several independent variables (teacher-child interaction, teacher-child relationship, children's self-control, and the classroom physical environment). It was not

able to examine the causal relationships among the variables. In the future, an experimental study could be able to investigate the causal relationships among these variables. In the experimental study, researchers could manipulate one or more variables to examine which of the independent variables (teacher-child relationships, teacher-child interaction, and children's self-control) caused changes in the dependent variables (children's engagement). If causal relationships exist, further corresponding intervention could improve children's engagement levels in their learning activities.

Second, the well-established model in Figure 18 which was a good fit model interpreted the data collected from the 135 preschoolers and 15 preschool classroom teachers. Because of the small sample size, this model may not be generalizable to the population, and may require further exploration using a larger sample size to confirm. This is necessary and meaningful for exploring young children's engagement. Once the model has confirmation, early childhood educators can use the model as a framework for training and teachers' professional development.

Third, the head teacher from each classroom completed the questionnaires on teacher-child interaction, teacher-child relationship, children's self-control, and children's engagement for the 135 preschoolers. This methodological approach may not reflect the children's performance comprehensively or unbiasedly since it was not able to involve more staff, which would produce more reliable data for these variables. In the future, more reliable data on the children's behavior could be gathered from at least two caregivers who know the children well, and the average scores could be used for data analysis.

Concluding Statements

The purpose of this study was to demonstrate whether and how teacher-child interactions, teacher-child relationships, children's self-control, fathers' and mothers' education levels, years of teachers' teaching experience and education levels, and classroom physical environment were associated with children's engagement level. Due to the nonidentification of the model, this study was not able to address the associations of the four covariates (mothers' education levels, fathers' education levels, teachers' education levels, and teachers' years of teaching experience) with children's engagement. This study was able to address the associations of the four variables (teacher-child interactions, teacher-child relationships, children's self-control, and the classroom physical environment) with children's engagement.

The findings from the current study demonstrated that preschoolers' active engagement was associated with children's self-control. Preschoolers' engagement was indirectly associated with the teacher-child relationship through the mediator of children's self-control. Preschoolers' engagement was indirectly associated with the classroom physical environment through the mediator of children's self-control. Teacher-child interaction had an indirect association with children's self-control mediated by the teacher-child relationship. Mothers' education level was significantly associated with children's engagement level, while fathers' education level did not have a significant relationship with their child's engagement level. Teachers' education levels had a significant negative relationship with children's engagement level. Based on the findings, implications for teacher education were discussed, resulting in the proposal of a three-element (deliver, assimilate, and apply) model for university training to pre-service teachers in early

childhood education. Limitations were addressed through conducting further experimental studies, increasing sample size, and obtaining reliability for all the questionnaires on children's behaviors.

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APPENDICES

Appendix A
Teacher Consent Form

Title of Research Study: Contributors toward Preschoolers' Engagement: Teacher-Child Interaction, Teacher-Child Relationship, Child's Self-Control, and Classroom Physical Environment

Principal Investigator: Hongxia Zhao
zhaoh1@etsu.edu
423-268-7435
East Tennessee State University

TEACHER CONSENT FORM

This Teacher Consent Form explains a research study that will be conducted in your classroom by an East Tennessee State University doctoral student. The university Institutional Review Board requires your permission to participate in the study. The following information will help you decide whether you agree to participate or not.

Purpose: Engagement is especially important for children in their early years, because children's engagement in their early years predicts their later school achievement (Ladd & Dinella, 2009). The purpose of this research study is to examine variety of factors that contribute preschoolers' engagement in their learning activities. The factors examined in this study are: teacher-child interaction, teacher-child relationship, child's self-control, and classroom physical environment.

Procedures: If you agree to participate in this study, please fill out the Teacher Information Survey which attached to this Teach Consent Form. I will collect it one week later since the time I send to you. After I get your permission, I will send you the Parental Consent Forms to distribute them to children in your classroom. After getting parents' permission, I will randomly select up to 8 participants from the children whose parents gave permission. You will be asked to complete the scales: Children's Engagement Questionnaire (CEQ), Teachers' Perception of their Interaction with the Child, the Student-Teacher Relationship Scale (STRS), and the Teacher's Self-Control Rating Scale (TSCRS) about each of the 8 selected children based on your experiences about these children. It will take you about 1 hour to complete these scales for the 8 selected children. After you complete the scales, I will come and learn more about the physical environment of your classroom for about 15 minutes through using the Children's Physical Environments Rating Scale (CPERS) and pick up the scales you complete.

Alternative Procedures/Treatments: If you elect not to participate this study, you do not need to do anything.

Possible Risks/Discomforts: There are no anticipated risks to you when participating this study.

Possible Benefits: You may understand the selected children better through completing the scales about them. Based on the understanding, you may be able to make more appropriate decisions of helping children learn. In addition, this study will examine the factors and how these factors influence preschoolers' engagement. The findings may be used for future intervention studies about how to improve preschoolers' engagement.

VERSION 01/25/2018 PARTICIPANT INITIALS_____

Approved by ETSU Campus IRB / Approval Date: January 29, 2018 / Expiration Date: January 28, 2019

Compensation: Each teacher participant will get a $15 gift card as a token after completing the scales for the 8 children selected from your class. When I go to your classroom collecting the completed scales, the gift card will be given to you.

This study intends to examine the factors and the pathways of influencing preschoolers' engagement in learning. The findings can be used for future intervention studies about how to improve preschoolers' engagement.

Voluntary Participation: Your participation in this research project is voluntary. ***You may choose not to participate.*** If you decide to participate in this research study, you can change your mind and quit at any time. You may quit by calling the Principle Investigator Hongxia Zhao (423-268-7435) or the dissertation chair Dr. Carol Trivette (828-514-6077).

Contact for Questions: If you have any questions or concerns about participating the study at any time, you may call the Principle Investigator Hongxia Zhao (423-268-7435) or the dissertation chair Dr. Carol Trivette (828-514-6077).You may also call the Chairperson of the ETSU Institutional Review Board at 423.439.6054 for any questions you may have about your rights as a research participant. If you have any questions or concerns about the research and want to talk to someone independent of the research team or you can't reach the study staff, you may call an IRB Coordinator at 423.439.6055 or 423.439.6002.

Confidentiality: For the confidentiality, I will use the key code to assign you a number, so your real ID information will not be used for the data entry. Every attempt will be made to see that your study results are kept confidential. A copy of the records from this study will be stored in the Early Childhood Department office locked cabinet (Warf-Pickle Hall 209) for at least 6 years after the end of this research. The results of this study may be published and/or presented at meetings without naming you as a participant. Although your rights and privacy will be maintained, the ETSU IRB and the research team have access to the study records.
By signing below, I confirm that I have read and understand this Teacher Permission Document. I agree to take part in this research study and will complete the attached Teacher Information Survey.

_____	_____
Name of the Child Care Center	Date
_____	_____
Signature of the Classroom Teacher	Date
_____	_____
Printed Name of the Classroom Teacher	Date

VERSION 01/25/2018 PARTICIPANT INITIALS_____

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Appendix B
Teacher Informtion Survey (TIS)

Teacher Information Survey

Name of the childcare center you work in:_____

Your name:_____

If you agree to participant this study, please provide the following information.

1. Your gender: ○ Male ○ Female

2. Your educational level:

○ PhD (EdD or MD) ○ Master ○ Bachelor ○ High school ○ Middle school or lower

3. How many years of teaching experience do you have in childcare centers?

_____

Appendix C
Invitation Email

Dear Ms.XXX,

I am Hongxia Zhao, a doctoral student in Early Childhood Education Department at ETSU, and is recruiting participants for my dissertation study entitled "*Contributors toward preschoolers' engagement: Teacher-child interaction, teacher-child relationship, child's self-control, and classroom physical environment*" chaired by Dr. Carol Trivette. It has been approved by ETSU IRB and I am inviting you to participate in my study.

I understand you are very busy with your daily work. For this study, if you agree to participate, I **just select 8 children** from your classroom and ask you to **complete some questionnaires** about these 8 children. As compensation, each participant teacher will **get a $15 gift card** when completing these questionnaires.

The attached are the Teacher Consent Form and Teacher Information Survey, **could you please let me know your decision about whether you are willing to participate?** My email address: zhaoh1@etsu.edu and cell phone number: 423-268-7435.

Your participation will be **a big contribution** to my research study. I really appreciate your help!! Thank you for considering supporting my research.

Sincerely,
Hongxia Zhao,
Doctoral fellow
Early Childhood Education
East Tennessee State University

Appendix D
Parental Consent Form

Title of Research Study: Contributors toward Preschoolers' Engagement: Teacher-Child Interaction, Teacher-Child Relationship, Child's Self-Control, and Classroom Physical Environment

Principal Investigator: Hongxia Zhao
zhaoh1@etsu.edu
423-268-7435
East Tennessee State University

PARENTAL CONSENT FORM

This form explains a study that will happen in your child's classroom. The study will be led by Hongxia Zhao. She is a doctoral student at East Tennessee State University. You must give us your permission for your child to be included in the study. The following information will help you decide if you want to let your child be in the study.

Purpose: This study will examine what things impact how much children are involved in their learning. Teachers will answer questions about their contact with each child and each child's self-control. The classroom setting will also be studied.

Procedures: If you agree to let your child be in the study, you will sign this form. You also will be asked to complete 4 questions on Parents Information Survey. It will take you about 5 minutes to complete it. You will then put these two forms in the envelope you received. You will give this envelope with the forms to your child's teacher.

After you return the consent form and survey back, we will randomly pick 8 children from the classroom. If your child is not selected, then he/she will not be in the study. The survey you completed will not be used.

If your child is selected to be in the study, the classroom teacher will complete 4 questionaires about your child's behaviors and his/her learning. Ms. Zhao will go to the classroom and see the physical environment of your child's classroom for about 15 minutes. Your child will not be asked any questions. The teacher will answer the surveys about your child. Your child will NOT be directly interviewed or observed in the study.

Other Procedures or Distress: The teacher will not complete the survey if your child is not in the study. Your child will still be in all classroom activities.

Likely Risks/Discomforts: There are likely no risks to you and your child in this study.

Likely Benefits: There are no direct benefits for you or your child. But, teachers may understand children better through this study. The teacher may be able to better help your child learn. The findings may be used in other studies about ways to help children improve their learning.

Voluntary Participation: You decide if your child can be in this study. *You and your child may choose not to be in the study*. Even if your child is in this study, you can change your mind. You can quit at any time. If you do not want your child to be in the study or you quit the study, the benefits with you and your child will not change. Call Ms. Zhao at 423-268-7435 or Dr. Trivette at 828-514-6077, if you want to leave the study.

VERSION 01/25/2018 PARTICIPANT INITIALS_____

Approved by ETSU Campus IRB / Approval Date: January 29, 2018 / Expiration Date: January 28, 2019

Contact with Questions: If you have questions about being in the study, you may call Ms. Zhao or Dr. Trivette. You may call the Chair of ETSU Institional Review Board if you have questions about your rights as a member at 423-439-6054.

The IRB Coordinators are not part of this study. If you have questions about the study, call an IRB Coordinator. If you cannot reach the study staff, call an IRB Coordinator. Their phone numbers are 423-439-6055 or 423-439-6002.

Your Privacy: For the privacy, I will give you and your child a number. You and your child's real names will not be on the surveys. A copy of the surveys will be stored in the Early Childhood Department office. They will be in a locked drawer (Warf-Pickle Hall 209) for 6 years after the end of this study.

When I sign below, I confirm that I have read and understand this information. I agree to let my child be in this study. I will complete the attached Parent Information Survey.

Classroom teacher's name	Date
Your Child's name	Date
Signature of Parent/Guardian	Date
Printed Name of Parent/Guardian	Date

Approved by ETSU Campus IRB / Approval Date: January 29, 2018 / Expiration Date: January 28, 2019

Appendix E
Parental Information Survey (PIS)

Parents Information Survey

Child name:_____

If you agree that your child can participant this study, please provide the following information.

1. Your child's gender: ◯ Male ◯ Female

2. Your child's data birth: _____Month/Date/Year

3. Mother's educational level:

◯ PhD (EdD or MD) ◯ Master ◯ Bachelor ◯ High school ◯ Middle school or lower

4. Father's educational level:

◯ PhD (EdD or MD) ◯ Master ◯ Bachelor ◯ High school ◯ Middle school or lower

Appendix F

Children's Engagement Questionnaire

Name of the Childcare Center: _____

Child's name: _____Date birth: _____MM/DD/YY

Child's gender: Boy_____Girl_____

Today's date: _____

Please rate how this child usually spends his or her time. "**Typical**" here should mean that the child spends quite a lot of time in this activity. The examples are only given to help understand the meaning of the items. Even though the example might not always be relevant for this child, please answer all the questions, even if you are not sure.

		Not at all typical	Somewhat typical	Typical	Very typical
1	**Watches or listens to adults.** *Example: When the teacher moves around the classroom, talking to the child, the child watches him or her.*				
2	**Play with adults who try to play with him or her.** *Example: When an adult in the classroom, someone the child knows well, begins to play with the child, the child joins in.*				
3	**Tries to get adults to do things.** *Example: The child tries to get the teacher to give him or her a toy.*				
4	**Tries to get other children to do things.** *Example: The child keeps asking another child to play on the swings.*				
5	**Plays with toys.** *Example: When the child is near toys, he or she plays with them.*				
6	**Tries to complete things, even if it takes a long time to finish.** *Example: The child who knows how to put together simple jigsaw puzzles, sticks with it until it is completed.*				
7	**Plays with objects in a simple manner (i.e., repetitive, unchanging)** *Example: The child bangs the toy car over and over again on the highchair tray.*				
8	**Talks about things that happened in the past or in the future.** *Example: The child refers to an event that happened the day before. This only refers to events 24 hours or more in the past or in the future.*				
9	**Tries out new ways of playing with objects.**				

	Example: The child already knows how to roll a ball; now he tries to sit on it.				
10	**Plays appropriately for his or her developmental level.** *Example: The child who does most things at the 2-year-old level plays with objects and people at the 2-year-old level.*				
11	**Tries to get toys to work.** *Example: The child works at turning the jack-in-the-box handle to get the clown to pop out.*				
12	**Watches or listens to other children.** *Example: When other children are playing, the child follows their movements with his eye-gaze.*				
13	**Plays with other children.** *Example: When other children are nearby, the child joins in what they are doing.*				
14	**Stays busy.** *Example: When no adult is playing with the child, he or she finds something to do.*				
15	**Uses repetitive vocalizations.** *Example: The child says, "Ba-ba-ba-ba."*				
16	**Tries out new ways of communicating or uses new language.** *Example: The child practices using new words he or she has heard.*				
17	**Seems constantly aware of what's going on around him or her.** *Example: The child looks at the source of noises and at moving objects and people.*				
18	**Solves problems quickly.** *Example: When the toy falls behind the furniture, the child rapidly finds a way to retrieve it.*				
19	**Plays with adults**. *Example: When adults are nearby, the child talks to them or approaches them.*				
20	**Figures out how things work, without asking for help.** *Example: When the child opens a present, he or she tries to play with the unfamiliar toy without adult help.*				
21	**Uses understandable language or sign language.** *Example: The child uses words someone other than the parents understand.*				
22	**Pretends to be things or other people** *Example: The child creeps on the floor and says, "Meeow."*				
23	**Plays with objects the way they were intended to be played with.**				

	Example: The child bangs blocks with a toy hammer rather than chewing it.				
24	**Continues repetitive movements to make sounds with an objects.** *Example: When the child discovers that the toy rattle, he or she makes it rattle again.*				
25	**Concentrates hard a lot of time.** *Example: When coloring, the child leans over the paper, keeps his or her eyes on the task, and appears to be thinking about coloring.*				
26	**Chooses difficult things to do.** *Example: The child goes to the toys that require a little effort.*				
27	**Plays with other children who try to play with him or her.** *Example: When another child approaches, the child will talk to or play with him or her.*				
28	**Does what's expected (for this child), considering the time of day, place, or activity.** *Example: The child puts clothes on in the morning, uses the toilet appropriately, plays on the see-saw during outside play.*				
29	**Notices changes in people, objects, and the environment as a whole.** *Example: The child communicates, "where's the TV?" when it is moved.*				
30	**Pretends objects are something else.** *Example: The child pretends a box is a car or uses an oblong block as a baby bottle.*				
31	**Explores objects or places.** *Example: The child turns objects over, looking inside.*				
32	**Tries to get adults to repeat things.** *Example: When the adult has done something the child likes, the child begs for more.*				

(McWilliam, 1991)

Appendix G

Teacher's Experience of Interaction with The Child

*Please **tick** the option that you think best describes the statement on the left. **Only one option** per statement is possible.*

Statement	Seldom	Fairly seldom	50/50	Fairly often	often
1. I respond to the child's communication.					
2. I understand what the child means.					
3. I use language that is appropriate for our interaction.					
4. I comment or show interest on what the child is doing.					
5. I can direct the child's attention to a common focus.					
6. I know how to keep the child's attention on what we are doing together.					
7. I decide the content of the interaction (what we are communicating about).					
8. I engage in activities and use materials suitable for the child's age, developmental level and interest.					
9. I adapt my communication to the child's pace/level.					
10. I know what kind of situations motivate the child to interact and can create such situations if necessary.					

Granlund and Olsson (1998)

Appendix H

Teacher-child Relationship Scale – Short Form

Please reflect on the degree to which each of the following statements currently applies to your relationship with this child. Using the scale below, ***circle the appropriate number*** *for each item.*

Definitely does not apply 1	Not really 2	Neutral, not sure 3	Applies somewhat 4	Definitely applies 5

1.	I share an affectionate, warm relationship with this child.	1	2	3	4	5
2.	This child and I always seem to be struggling with each other.	1	2	3	4	5
3.	If upset, this child will seek comfort from me.	1	2	3	4	5
4.	This child is uncomfortable with physical affection or touch from me.	1	2	3	4	5
5.	This child values his/her relationship with me.	1	2	3	4	5
6.	When I praise this child, he/she beams with pride.	1	2	3	4	5
7.	This child spontaneously shares information about himself/herself.	1	2	3	4	5
8.	This child easily becomes angry with me.	1	2	3	4	5
9.	It is easy to be in tune with what this child is feeling.	1	2	3	4	5
10.	This child remains angry or is resistant after being disciplined.	1	2	3	4	5
11.	Dealing with this child drains my energy	1	2	3	4	5
12.	When this child is in a bad mood, I know we're in for a long and difficult day.	1	2	3	4	5
13.	This child's feelings toward me can be unpredictable or can change suddenly.	1	2	3	4	5
14.	This child is sneaky or manipulative with me.	1	2	3	4	5
15.	This child openly shares his/her feelings and experiences with me.	1	2	3	4	5

Appendix I
Self-Control Rating Scales

Please reflect on the degree to which each of the following statements currently applies to this child. Using the scale below, circle the appropriate number for each item ***from 1 (not at all) to 5 (very well).***

1. Sticks to what she or he is doing, even lengthy unpleasant tasks until finished.	1	2	3	4	5
2. Works toward goals	1	2	3	4	5
3. Is frustrated and/or gives up on difficult tasks.	1	2	3	4	5
4. Pays attention to what she or he is doing.	1	2	3	4	5
5. Plans ahead what to do before acting.	1	2	3	4	5
6. Is distracted from work or responsibilities.	1	2	3	4	5
7. Makes careless mistakes because he or she rushes through work.	1	2	3	4	5
8. Anticipates the consequences of his/her actions.	1	2	3	4	5
9. Knows when she or he is misbehaving without being told.	1	2	3	4	5
10. Has to have things right away.	1	2	3	4	5
11. Gets into arguments and/or fights with other children.	1	2	3	4	5
12. Talks out of turn.	1	2	3	4	5
13. Disrupts others when they are doing things.	1	2	3	4	5
14. Has trouble keeping promises to improve behavior.	1	2	3	4	5

Humphrey (1982)

Appendix J
Children's Physical Environment Rating Scale (CPERS)

THE CHILDREN'S PHYSICAL ENVIRONMENTS RATING SCALE

BACKGROUND INFORMATION FOR CENTER BEING ASSESSED

Name of Child Care Center

Name of the Classroom

Name of the Classroom Teacher

PART B: BUILDING AS A WHOLE

The subscales in Part B apply to the building as a whole, not any individual spaces, but the building considered holistically. They are used to assess the major functions and overall qualities of the building as a setting for early childhood development, care and education.

SUBSCALE 2. IMAGE AND SCALE

The ***image and scale*** of the building should be inviting to children:

- It should be of a child-friendly scale and look and feel like a pleasant place to be.
- The quality of "home" is a good way to think about the image and scale of the best early childhood centers.
- The image should include familiar home-like features, e.g., rather than looking like an institutional building, it should have low windows with small windowpanes, friendly entryways and natural materials.

		Not Met				Fully Met
2.1	The exterior of the center appears non-institutional and welcoming (e.g., single story, pitched roofs, verandas, use of wood, brick and stone not concrete blocks or large expanses of glass, etc).	0	1	2	3	4
2.2	Children can see some indoor children's activity areas from outside before entering the center (e.g., windows between inside and outside along the entrance path, etc).	0	1	2	3	4
2.3	The scale of the interior appears small and cozy (e.g., low ceilings, low hanging lights, low windows that children can see, low openings between adjoining spaces, etc).	0	1	2	3	4
2.4	The interior finishes appear welcoming and natural (e.g., use of carpet, warm colors, soft lighting, curtains, etc).	0	1	2	3	4
2.5	Furniture is child height (e.g., bookcases, display shelves, tables, chairs, etc).	0	1	2	3	4
2.6	Toilets, basins and mirrors used by children are child-height.	0	1	2	3	4

Subscale 2 Sum		Number of Items		Subscale 2 Score
	÷	6	=	_ . _ _

SUBSCALE 3. CIRCULATION

Circulation refers to main traffic routes throughout the building, both between different parts of the building and among the activity spaces used by children (e.g., between the entrance, activity areas, eating areas, sleeping area, etc).

- There should be clear and well-defined circulation connecting but not crossing through or interfering with children's activities.
- It should allow staff and children to "overlook" areas or give a "preview" of activities.

		Not Met				Fully Met	NA
3.1	When entering the center, children can easily identify the circulation paths to the main indoor activity areas.	0	1	2	3	4	
3.2	Children can easily identify circulation paths within activity areas.	0	1	2	3	4	
3.3	Circulation paths within activity areas do not interfere with children's activities.	0	1	2	3	4	
3.4	While moving between activities, children can see into or "preview" other activities before engaging in them (e.g., at least partial visibility into activity spaces, no high barriers, etc).	0	1	2	3	4	
3.5	Doors that are intended to be used by children are easy to open (e.g., low handle height and lightweight, etc).	0	1	2	3	4	☐
3.6	Circulation paths inside the center are able to accommodate wheelchairs, prams and persons on crutches (e.g., wide enough, flat, gently sloped, etc).	0	1	2	3	4	

Subscale 3 Sum ÷ **Number of Items Answered** = **Subscale 3 Score**

☐ ÷ ☐ = ☐ . ☐☐

SUBSCALE 4. COMMON CORE OF SHARED FACILITIES

The ***common core*** typically includes the following shared facilities within the building: administration office, reception, seating area, staff lounge room, staff workroom, meeting/conference room, staff/adults' bathroom, laundry, kitchen, multipurpose active play area (gym), maybe a book and toy lending library, and storage.

Ideally, these should be centrally located in the building and grouped together into one location.

- Please answer the following in terms of both the ***existence*** and the ***quality*** of the spaces.
- Score "**0**" if the space does not exist.
- Maximum points "**4**" should be awarded *only* if the function exists in a ***well-defined space***. A *well-defined space* is an architecturally articulated space that has adequate room for the function and that is not infringed on by other tasks.

		Not Met				Fully Met
4.1	The center has an administration office, with adequate space and storage, where the director and other supporting staff are grouped together.	0	1	2	3	4
4.2	The center has a reception/waiting area with seating and adequate space or storage for several strollers or prams.	0	1	2	3	4
4.3	The center has a staff lounge, where staff can have informal breaks or lunches, share information and store personal belongings.	0	1	2	3	4
4.4	The center has one or more rooms allocated for small meetings, teacher preparation, and/or parent-teacher conferences.	0	1	2	3	4
4.5	The center has staff/adult bathrooms, which are also accessible for disabled people.	0	1	2	3	4
4.6	The center has a separate lockable laundry room.	0	1	2	3	4
4.7	The center has a kitchen, which is visually connected to children's activity areas.	0	1	2	3	4
4.8	The center has an indoor multipurpose active playroom or gym, with enough space to accommodate slides, tunnels, space for ball play or to ride small push toys.	0	1	2	3	4
4.9	The center has a space allocated as a book and toy lending library.	0	1	2	3	4

Sum of 4.1 to 4.9 = Subtotal A

ⓘ Now answer the following in terms of the ***arrangement*** of the above spaces.

		Not Met				Fully Met
4.10	The above facilities are grouped together into one location in the building.	0	1	2	3	4
4.11	The above facilities are separate from children's activity areas so that they are not accessible to children (e.g., separate area, doors, barriers, etc).	0	1	2	3	4
4.12	The above facilities are located near the center of the building, easily accessible for all staff.	0	1	2	3	4

Sum of 4.10 to 4.12 = Subtotal B

[ ]

Now calculate the total score for Subscale 4:

Subtotal A **Subtotal B** **Subscale 4 Score**

([ ] + [ ]) ÷ [12] = [_ . _ _]

SUBSCALE 5. INDOOR ENVIRONMENTAL QUALITY

A comfortable and healthy indoor environment including appropriate temperature, lighting, and air quality is an important component of any early childhood facility.

		Not Met				Fully Met	NA
5.1	The temperature of the indoor environment can be manipulated by staff to keep it at a pleasant level (e.g., fans, windows, or air conditioning). (Ask the director if necessary.)	0	1	2	3	4	
5.2	Children's spaces have a plenty of natural light.	0	1	2	3	4	
5.3	The artificial lighting at the center provides sufficient light for children's areas (e.g., no dark or low visual areas, etc) and can be adjusted by staff.	0	1	2	3	4	
5.4	The area(s) children sleep in can be darkened to an appropriate light level so children can sleep or rest. (Ask the director if necessary.)	0	1	2	3	4	☐
5.5	To dampen undesirable sound transfer, the interior is covered with soft materials (e.g., carpet, curtains, acoustic ceiling tiles, textured walls hangings, etc).	0	1	2	3	4	
5.6	Exterior windows throughout the center are fitted with fly screens (e.g., children's areas, kitchen, office, etc).	0	1	2	3	4	
5.7	The center is designed to supply a plenty of fresh air (e.g., effective cross-ventilation, high ceiling vents, aligned doors and windows, etc).	0	1	2	3	4	
5.8	Bathrooms and kitchens have both natural and mechanical ventilation (e.g., windows that open, exhaust fans, etc).	0	1	2	3	4	

Subscale 5 Sum ☐ ÷ **Number of Items Answered** ☐ = **Subscale 5 Score** ☐ . ☐☐

SUBSCALE 6. SAFETY AND SECURITY

A center should take measures to ensure that all areas are:

- free from preventable accidents
- secure for the children, staff and visitors
- kept in accordance with health and hygiene standards

		Not Met				Fully Met	NA
6.1	Entrances have a security measure to prevent intruders from entering (e.g., locked gate or door with intercom release, etc).	0	1	2	3	4	
6.2	Entrance(s) to the center and/or building are within view of an office (eg, at least the building door within view of an office, and perhaps the gate to the site).	0	1	2	3	4	
6.3	Staircases are not accessible to unaccompanied children (e.g., childproof self-locking barriers, etc).	0	1	2	3	4	☐
6.4	Indoor stairs and ramps are safe for children (e.g., child-height handrails, easy gradient, etc).	0	1	2	3	4	☐
6.5	In children's spaces, people are able to see a child behind doors before opening them (e.g., door with glass panes, etc).	0	1	2	3	4	
6.6	Children are protected from hot equipment and moving parts (e.g., stoves, hot water heaters, fans, etc) by being out of reach or by doors, fences, etc.	0	1	2	3	4	

Subscale 6 Sum		Number of Items Answered		Subscale 6 Score
☐	÷	☐	=	__ . __

PART C: CHILDREN'S INDOOR SPACES

The subscales in Part C apply to the spaces were children spend most of their time while in the building. These spaces include *home bases* and *activity areas*.

As defined in Subscale 1, ***modules*** are functionally separate units within the building serving most of children's developmental and functional needs (e.g., several different developmentally oriented activity areas plus eating and sleeping areas, toilets, etc). The difference between 'rooms' and 'modules' is this: The center may have an infants room, a toddler room and a preschooler room, each just for play activities, and then a separate shared area for eating, sleeping, toilets, etc. Taken together this would constitute <u>one</u> module. Alternatively, the center might have an area for infants with play areas, eating, sleeping, nappy changing, etc. all self-contained in that area, and a separate self-contained area for toddlers with all the things toddlers need, and a third similar self-contained area with everything preschoolers need from play areas to eating and toilets. This would constitute <u>three</u> modules. Modules are also called houses, wings, or pods. The above diagram illustrates two modules.

In the case of preschool childcare, two or more modules may serve different age groups of children (one for infants and toddlers, one for older preschool children, etc). Alternatively, each module might have infants, toddlers and older preschoolers such that the modules are simply different clusters of children so as to break down what otherwise would seem a very large building into two or more pods or houses.

Special instruction:

If the center is *not* subdivided into modules, all the scales in this part should be used only *once*. However, if the center is subdivided into modules, then each module needs to be assessed separately in the five subscales in Part C: modified open-plan space, home base, quiet activity areas, physical activity areas and messy activity areas. In this case, the score of each subscale is an average of the scores for each module.

NOTE: If there are several modules in the building, please assess each module separately.

Copy Part C (pp. 27 - 35) and use each copy to assess one module.

This is a copy for Module _____, which is or might be called the _____ module.

SUBSCALE 7. MODIFIED OPEN-PLAN SPACE

Modified open-plan space is flexibly planned children's activity spaces consisting of a mixture of semi-open areas interconnected with smaller, partially enclosed spaces to accommodate children individually, in small groups, or in larger groups and to facilitate children moving freely from one activity to another.

It is in contrast to totally closed-plan space where each activity is in a separate enclosed room, and to totally open-plan space where there are few or no dividers between children's different activities.

Note: For items 7.1-7.3, if the space is primarily open in plan with no differentiation between subspaces, items 7.1-7.3 should be marked very low as not met.

If there is more than one module in the building, it is necessary to assess each module separately.

This is a copy for Module _____, which is or might be called the _____ module.

		Not Met				Fully Met	NA
7.1	Children's activity areas are partially enclosed to provide protection from visual and noise distractions (e.g., partitions, half walls, bookcases, storage and shelves, etc).	0	1	2	3	4	
7.2	Children's activity areas can be easily modified to change activities from week to week (e.g., few or no permanent walls, but partitions or furnishings are easily moved).	0	1	2	3	4	
7.3	Children in one activity area can see other activities within the same module (e.g., low or no walls/partitions, low windows or other openings if there are walls, low furnishings, etc).	0	1	2	3	4	
7.4	Spaces for noisy activities (e.g., gross-motor play, dramatic play, music) are separated from spaces for quiet activities (e.g., reading). (Does not apply to infants' modules.)	0	1	2	3	4	☐
7.5	Spaces for messy activities (e.g., arts and crafts, water play) are separated from spaces for clean activities (e.g., reading, computers). (Does not apply to infants' modules.)	0	1	2	3	4	☐
7.6	Indoor children's spaces are spatially and visually connected with outdoor play areas.	0	1	2	3	4	

Subscale 7 Sum ÷ **Number of Items Answered** = **Subscale 7 Score**

	÷		=	__ . __ __

SUBSCALE 8. HOME BASES

A ***home base*** is space or adjoining spaces for the more functional care-giving activities of the center such as:

- leaving personal belongings
- eating and snacking
- going to the toilets
- diaper changing (for infants)
- napping

As a ***home base***, the spaces for these activities would be grouped in adjacent and interconnecting spaces. The home base should be welcoming and home-like, the anchor point of the day, and of the house or room – the welcoming place where the child begins and ends the day.

ⓘ Please answer the following questions in terms of the ***existence*** and ***quality*** of the spaces.

ⓘ Score "**0**" if the space does not exit.

ⓘ Maximum points "**4**" should be awarded only if the function exists in a ***well-defined space***. A *well-defined space* is an architecturally articulated space, which has adequate room for the function and is not infringed on by other tasks.

If there is more than one module in the center, it is necessary to assess each module separately.

This is a copy for Module _____, which is or might be called the _____ module.

		Not Met				Fully Met	NA
8.1	The center (or module being evaluated) has a well-defined area for individual lockers or cubbies for each child's personal belongings.	0	1	2	3	4	
8.2	The center or module has an area clearly intended for eating (eg, a cluster of tables) used predominantly for lunch and snacks (OK if used for other activities at other times).	0	1	2	3	4	
8.3	The center or module has a quiet sleeping area separate from children's play areas (so it can be used for napping at any time during the day).	0	1	2	3	4	
8.4	If the center or module serves infants and younger toddlers, it has a diapering area from which staff can see activity areas.	0	1	2	3	4	☐
8.5	If the center or module serves toddlers or children in the process of becoming toilet-trained, it has toilets that are not closed or isolated but that are visually and spatially connected to other indoor children's activity areas.	0	1	2	3	4	☐
8.6	If the center or module serves toddlers or children already toilet-trained, it has a toilet area that is closed and architecturally separated from other indoor children's activity areas (eg, by walls, not by distance).	0	1	2	3	4	☐

Sum of 8.1 to 8.6 = Subtotal A

ⓘ Please answer the following in terms of the ***arrangement*** of the above spaces.

		Not Met				Fully Met
8.7	The above facilities are grouped together into one location.	0	1	2	3	4
8.8	The above facilities are adjacent and visually connected to children's indoor spaces.	0	1	2	3	4

Sum of 8.7 and 8.8 = Subtotal B

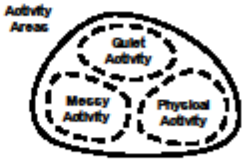
Now calculate the total score for Subscale 8:

Subtotal A		Subtotal B		Number of Items Answered		Subscale 8 Score
(	+	)	÷		=	__ . __

Subscales 9-11. Activity Areas

For each module, assess the activity areas – first whether they are shared or not, and second their qualities. To begin, study the below definitions:

Activity areas are indoor spaces for different developmentally oriented play activities. They are the "primary activity spaces" for the developmental needs of the children. To be considered an activity area, it must be dedicated to the activity and there must be sufficient space for 2-5 children plus 1 teacher to be involved.



The activity areas for children may be divided into three types:

9. Quiet Activity Areas
- Reading
- Small toy (fine motor) play
- Computers

10. Physical Activity Areas
- Physical (gross motor) play
- Music
- Dramatic/fantasy play

11. Messy Activity Areas
- Arts and crafts
- Water play
- Science and nature

The following three subscales evaluate areas for each of these activities. For each activity area, there are two sets of questions: The first asks about the *existence* of an identifiable area for the activity – is there a well-defined area dedicated to that type of activity? The second assesses its *properties* – the quality of the area for the activity.

ⓘ In doing the ratings, look at and rate only those activity areas that have sufficient space for 4-5 children and 1 adult. If a particular activity area is not well defined or is too small to accommodate 4-5 children and 1 adult, score "**0**" in the first set of questions in each activity area (see example below).

ⓘ If an activity area is shared between two or more *activities* (e.g., reading at one time and toy play at another) or between two or more *age groups* (e.g., infants and toddlers at different times), then circle "**2 (Shared)**" in the first set of questions for each activity area.

ⓘ If the centre does not have an area for some of the below activities, score "**0**" in the first set of questions, and check "**NA**" in the second set (e.g., in the example below, if the centre does not have a computer area for children, score "0" for 9.11 and 9.12, then check "NA" for 9.13 and 9.14, i.e., if it does not have a given area, you cannot evaluate how well or poorly it is designed!). Only use NA if the center does not cater for that age-group of children:

	Computer Area	No		Shared		Yes	NA
9.11	The center (or module being evaluated) has a computer area for toddlers.	0		2		4	☐
9.12	The center or module has a computer area for preschoolers.	0		2		4	☐

		Not Met				Fully Met	NA
9.13	The computer area is spatially separated from other (non-shared) activity areas (e.g., different floor and ceiling levels, partially enclosed).	0	1	2	3	4	☐
9.14	The computer area has appropriate furnishings and storage (e.g., desks, chairs, display shelves, storage for equipment, etc).	0	1	2	3	4	☐

ⓘ If the centre or module does not serve infants, tick "**NA**" beside the "Infants" questions in the first set of questions. Likewise if a module only serves older preschoolers, tick "**NA**" beside the "Toddlers" questions, and fill out another copy of pp 31-33 for the module that serves "Preschoolers."

ⓘ When assessing the different spaces in the facility, it is important to focus on the environmental qualities of each *space* and whether each is designed to facilitate the particular activity. Do not be influenced by the teacher, the children, or the amount of toys, just by the interior design of the space.

Subscale 9. Quiet Activity Areas

If there are several modules in the center, assess each module separately. Make copies of pp 31-33 of the scale and use them for each separate module.

This is a copy for Module ____.

Reading Area		**No**		**Shared**		**Yes**	**NA**
9.1	The center (or module being evaluated) has a designated reading area for toddlers (e.g., an identifiable reading area with books close at hands, etc).	0		2		4	☐
9.2	The center or module has a designated reading area for preschoolers.	0		2		4	☐

		Not Met				**Fully Met**	**NA**
9.3	The reading area is separated spatially and acoustically from other (non-shared) activity areas (e.g., partially enclosed by partitions, furniture, etc, maybe different floor and ceiling levels, etc).	0	1	2	3	4	☐
9.4	The reading area is cozy and comfortable (e.g., soft sitting areas, beanbags, cushions, etc).	0	1	2	3	4	☐
9.5	The reading area has appropriate furnishings and storage (e.g., couch, easily accessible shelves, etc).	0	1	2	3	4	☐

Manipulative (Fine Motor) Play Area		**No**		**Shared**		**Yes**	**NA**
9.6	The center (or module being evaluated) has a manipulative play area for infants (e.g., blocks, small cars and trucks, manipulation toys, etc).	0		2		4	☐
9.7	The center or module has a manipulative play area for toddlers.	0		2		4	☐
9.8	The center or module has a manipulative play area for preschoolers (e.g., advanced puzzles, Lego, etc).	0		2		4	☐

		Not Met				**Fully Met**	**NA**
9.9	The manipulative play area is spatially separated from other (non-shared) activity areas (e.g., different floor and ceiling levels, partially enclosed, etc).	0	1	2	3	4	☐
9.10	The manipulative play area has appropriate furnishings and storage (e.g., flat child-height work surfaces, shelves, display racks, etc).	0	1	2	3	4	☐

Computer Area		**No**		**Shared**		**Yes**	**NA**
9.11	The center (or module being evaluated) has a computer area for toddlers.	0		2		4	☐
9.12	The center or module has a computer area for preschoolers.	0		2		4	☐

		Not Met				**Fully Met**	**NA**
9.13	The computer area is spatially separated from other (non-shared) activity areas (e.g., different floor and ceiling levels, partially enclosed).	0	1	2	3	4	☐
9.14	The computer area has appropriate furnishings and storage (e.g., desks, chairs, display shelves, storage for equipment, etc).	0	1	2	3	4	☐

Subscale 10. Physical Activity Areas

If there are several modules in the center, it is necessary to assess each module separately.

This is a copy for Module _____.

Physical (Gross Motor) Play Area	No		Shared		Yes	NA
10.1 The center (or module being evaluated) has an indoor physical play area for infants (e.g., large toys, crawling levels, etc).	0		2		4	☐
10.2 The center or module has an indoor physical play area for toddlers.	0		2		4	☐
10.3 The center or module has an indoor physical play area for preschoolers.	0		2		4	☐

	Not Met				Fully Met	NA
10.4 The physical play area is spatially separated from other (non-shared) activity areas.	0	1	2	3	4	☐
10.5 The physical play area is appropriate for a range of gross-motor physical activities (eg, hard surfaces for ball play, storage, display racks, maybe climbing equipment, etc).	0	1	2	3	4	☐

Music Area	No		Shared		Yes	NA
10.6 The center or module has a music area for toddlers.	0		2		4	☐
10.7 The center or module has a music area for preschoolers.	0		2		4	☐

	Not Met				Fully Met	NA
10.8 The music area is separated spatially and acoustically from other (non-shared) activity areas (e.g., partitions, partial acoustic panels, partial walls, heavy curtains, etc).	0	1	2	3	4	☐
10.9 The music area has appropriate furnishings and storage (e.g., open display shelves for instruments, etc).	0	1	2	3	4	☐

Dramatic/Fantasy Play Area	No		Shared		Yes	NA
10.10 The center (or module being evaluated) has a dramatic/fantasy play area for toddlers (e.g., playhouse, stages, etc).	0		2		4	☐
10.11 The center or module has a dramatic/fantasy play area for preschoolers.	0		2		4	☐

	Not Met				Fully Met	NA
10.12 The dramatic/fantasy play area is spatially separated from other (non-shared) activity areas.	0	1	2	3	4	☐
10.13 The dramatic/fantasy play area has appropriate furnishings and storage (e.g., play house, stages, mirrors, display shelves for props, storage for dress-up clothes, etc).	0	1	2	3	4	☐

Subscale 11. Messy Activity Areas

If there are several modules in the center, it is necessary to assess each module separately.

This is a copy for Module _____.

Arts and Crafts Studio		**No**		**Shared**		**Yes**	**NA**
11.1	The center (or module being evaluated) has an arts and crafts area for toddlers.	0		2		4	☐
11.2	The center or module has an arts and crafts area for preschoolers.	0		2		4	☐

		Not Met				**Fully Met**	**NA**
11.3	The arts and crafts area is spatially separated from other (non-shared) activity areas (e.g., the area partially enclosed by supply storage, furnishings, etc).	0	1	2	3	4	☐
11.4	The arts and crafts area has appropriate furnishings and storage (e.g., easels, tables, working wall, dedicated sink with water, easily cleaned floor, open shelves, etc).	0	1	2	3	4	☐

Water Play Area		**No**		**Shared**		**Yes**	**NA**
11.5	The center (or module being evaluated) has an indoor water play area for toddlers.	0		2		4	☐
11.6	The center or module has an indoor water play area for preschoolers.	0		2		4	☐

		Not Met				**Fully Met**	**NA**
11.7	The indoor water play area is spatially separated from other (non-shared) activity areas.	0	1	2	3	4	☐
11.8	The indoor water play area has appropriate furnishings and storage (e.g., a sink with water, easily cleaned floor, tables, storage, and possibly sand, etc).	0	1	2	3	4	☐

Science and Nature Area		**No**		**Shared**		**Yes**	**NA**
11.9	The center (or module being evaluated) has a science and nature area for toddlers (e.g., area for pets, plants, specimen, etc).	0		2		4	☐
11.10	The center or module has a science and nature area for preschoolers.	0		2		4	☐

		Not Met				**Fully Met**	**NA**
11.11	The science and nature area is spatially separated from other (non-shared) activity areas.	0	1	2	3	4	☐
11.12	The science and nature area has lots of natural light.	0	1	2	3	4	☐
11.13	The science and nature area has appropriate furnishings and storage (e.g., a sink with water, racks, cabinets, or shelves, provision for keeping pets and plants, display walls, small indoor garden, etc).	0	1	2	3	4	☐

When you have completed the assessment of all the activity spaces in the center, calculate the score for each of the above three subscales. For the "Number of Items Answered," be sure to count all of the items in the above three subscales that were not marked as "NA/not applicable":

Subscale 9 Sum		Number of Items Answered		Subscale 9 Score
☐	÷	☐	=	__ . __

Subscale 10 Sum		Number of Items Answered		Subscale 10 Score
☐	÷	☐	=	__ . __

Subscale 11 Sum		Number of Items Answered		Subscale 11 Score
☐	÷	☐	=	__ . __

Appendix K

Summary of the Findings Regarding the Research Questions

Research questions	Hypotheses	Findings
Question1: Is the level of engagement of preschoolers in classroom learning activities associated with their self-control directly or mediated through teacher-child interaction quality?	The level of engagement of preschoolers in classroom learning activities is associated with their self-control directly and mediated through teacher-child interaction quality.	The level of engagement of preschoolers in classroom learning activities is directly associated with their self-control. But the level of engagement of preschoolers in classroom learning activities did not have indirectly association with child's self-control through teacher-child interaction.
Question 2: Is the level of engagement of preschoolers in classroom learning activities associated with teacher-child relationship directly or	The level of engagement of preschoolers in classroom learning activities is associated with teacher-child relationship directly and mediated through child's self-control.	The level of engagement of preschoolers in classroom learning activities was not directly associated with teacher-child relationship, while the level of engagement of preschoolers in classroom learning activities was

Appendix K continued mediated through child's self-control?		found the indirectly association with teacher-child relationship through mediator of child's self-control. When separating the two subscales of teacher-child relationship (closeness and conflict), teacher-child closeness was found directly associated with children's engagement level, and teacher-child conflict was found both directly and indirectly associated with child's engagement through child's self-control.
Question 3: Is the effect of engagement of preschoolers predicted by classroom physical environment?	The effect of engagement of preschoolers is predicted by classroom physical environment.	The effect of engagement of preschoolers was not directly predicted by classroom physical environment. But the indirect relationships were found between

Appendix K continued		the two variables and mediated by child's self-control.
Question 4: Is the effect of father and mother's education level on the level of engagement of preschoolers mediated through child's self-control?	The effect of father and mother' s education level on the level of engagement of preschoolers is mediated through child's self-control.	The model which was supposed to address this question was nonidentified. Therefore, it was not be able to address in this study.
Question 5: Is the effect of teachers' years of teaching experience on the level of engagement of preschoolers in the classroom mediated through teacher-child relationship or teacher-child interaction?	The effect of teachers' years of teaching experience on the level of engagement of preschoolers in the classroom is mediated through teacher-child relationship or teacher-child interaction.	The model which was supposed to address this question was nonidentified. Therefore, it was not be able to address in this study.
Question 6: Is the effect of teachers' education level on the level of engagement of	The effect of teachers' education level on the level of engagement of preschoolers in the	The model which was supposed to address this question was nonidentified. Therefore, it was

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preschoolers in the classroom mediated through teacher-child relationship or teacher-child interaction?	classroom mediated through teacher-child relationship or teacher-child interaction.	not be able to address in this study.
Question 7: Is the effect of teachers' years of teaching experience and education level on the level of engagement of preschoolers mediated through the quality of classroom physical environment?	The effect of teachers' years of teaching experience and education level on the level of engagement of preschoolers is mediated through the quality of classroom physical environment.	The model which was supposed to address this question was nonidentified Therefore, it was not be able to address in this study.

VITA

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