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Teacher–child relationships and academic achievement: A multilevel propensity score model approach ☆

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ABSTRACT

A robust body of research finds positive cross-sectional and longitudinal associations between teacher–child relationships and children's academic achievement in elementary school. Estimating the causal effect of teacher–child relationships on children's academic achievement, however, is challenged by selection bias at the individual and school level. To address these issues, we used two multilevel propensity score matching approaches to estimate the effect of high-quality teacher–child relationships in kindergarten on math and reading achievement during children's transition to first grade. Multi-informant data were collected on 324 low-income, Black and Hispanic students, and 112 kindergarten and first-grade teachers. Results revealed significant effects of high-quality teacher–child relationships in kindergarten on math achievement in first grade. No significant effects of teacher–child relationships were detected for reading achievement. Implications for intervention development and public policy are discussed.

1. Introduction

A robust body of research has identified associations between high-quality teacher–child relationships—characterized by high levels of closeness and low levels of conflict—and children's academic achievement in elementary school (Birch & Ladd, 1997; Hamre & Pianta, 2001; O'Connor & McCartney, 2007; Pianta & Stuhlman, 2004; Rudasill, 2011). Additional studies find that high-quality teacher–child relationships may promote academic resilience among lower-income, racial/ethnic minority children at-risk for poor achievement (Crosnoe et al., 2010; Murray & Zvoch, 2011). This formative work suggests that interventions designed to boost academic achievement in lower-income urban schools should consider targeting teacher–child relationship quality. Research, however, has yet to use multilevel models to infer causal impacts of high-quality teacher–child relationships on academic achievement within this high-risk population of students and schools. To address this need, we used multilevel propensity score models to estimate the effects of high-quality teacher–child relationships in kindergarten on standardized measures of student math and reading achievement in first grade in 22 urban elementary schools. We hypothesized significant effects of high-quality teacher–child relationships on math and reading achievement.

1.1. Teacher–child relationships and academic achievement during the transition to school

Teacher–child relationships are bidirectional, interpersonal exchanges that take place in proximal (e.g., the interpersonal interaction) and distal systems (e.g., the classroom context) (Bronfenbrenner & Morris, 1998; Pianta, 1999). Conceptual studies,

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based in attachment theory, propose that children who experience these high-quality relationships are able to rely on teachers as a secure base and a resource for actively exploring the school environment (Howes, Phillipsen, & Peisner-Feinberg, 2000; Hughes, Cavell, & Wilson, 2001). Thus, high-quality teacher–child relationships may boost students' learning by creating a supportive environment in which children are motivated to actively and appropriately engage in the classroom (Ladd & Burgess, 1999).

Recent studies have found that the protective effect of teacher–child relationships on academic achievement may be stronger for lower-income and racial/ethnic minority students, compared to more affluent, White students (Maldonado-Carreño & Votruba-Drzal, 2011; Wu, Hughes, & Kwok, 2010). However, children of lower socioeconomic status tend to be at higher-risk for low-quality relationships with teachers (Pianta & Stuhlman, 2004). In addition, past research has found that White children are likely to have closer relationships with teachers than Black children (Ladd, Birch, & Buhs, 1999). Improving urban schools is of special interest to policymakers interested in shifting resources to close academic achievement gaps (Jacob & Ludwig, 2009). As such, it may be important for future studies of teacher–child relationships to focus attention on lower-income urban schools and students (Jacob & Ludwig, 2009; Murray & Zvoch, 2011).

Theorists argue the transition to elementary school marks a key period for children's development and subsequent achievement (Alexander, Entwisle, Blyth, & McAdoo, 1988). Indeed, early formal schooling experiences are influential in predicting children's highly stable achievement trajectories across childhood and adolescence (Entwisle, Alexander, & Olson, 2005). The transition from kindergarten to first grade appears to be a particularly critical developmental stage for children, due to growing emphasis on emerging literacy and numeracy skills and higher academic expectations (Alexander et al., 1988; Entwisle et al., 2005). This transition is likely to be especially important for children attending lower-income urban schools, as children who enter school with high levels of socioeconomic risk may experience less optimal relationships with their teachers (Jerome, Hamre, & Pianta, 2009).

1.2. Inferring causality between teacher–child relationships and academic achievement

Although the research base linking teacher–child relationships and academic achievement is quite robust (e.g., Roorda, Koomen, Spilt, & Oort, 2011), studies seeking to identify causal effects of teacher–child relationships are limited. Much of the research examining teacher–child relationships and achievement has been nonexperimental (Maldonado-Carreño & Votruba-Drzal, 2011). In general, a central issue in nonexperimental studies is the identification of comparable individuals (e.g., students) to remove selection bias.

Existing studies typically use a number of demographic variables to control for between-child differences that may influence selection into high-quality teacher–child relationships and subsequent academic achievement (e.g., Hughes, 2011; Hughes, Luo, Kwok, & Loyd, 2008; Ladd et al., 1999). Regression analysis attempts to address selection bias by including potential confounding covariates, theoretically and empirically associated with the outcome, in a linear model. However, for regression models to yield causal estimates, they must include all confounding covariates and must be specified correctly. In practice, regression methods that require linearity and additivity may not be appropriate when the model includes a large number of covariates. Because they use prediction equations, regression models extrapolate over portions of the covariate space where there are no data (Gelman & Hill, 2007; Hill, 2011; Hill, Waldfogel, Brooks-Gunn, & Han, 2005). As such, regression models may over or underestimate effects by making comparisons in sections of the covariate space where there is no clear counterfactual for either group.

In addition, although controlling for confounding covariates in a regression is a good first step in limiting selection bias in studies of teacher–child relationships, it is possible that previous analyses omitted a number of important characteristics, such as child sociability, behavior, and intelligence, likely related to both teacher–child relationships and academic achievement. Complicating interpretation is the fact that relations between teacher–child relationships and achievement may actually reflect rater effects if teacher-reported measures were collected (Maldonado-Carreño & Votruba-Drzal, 2011). For example, because teachers are more likely to have high-quality relationships with children who are behaviorally regulated, they may perceive those children to have higher levels of academic skills than less behaviorally regulated children (O'Connor & McCartney, 2007; Rudasill, Reio, Stipanovic, & Taylor, 2010).

Recent studies on teacher–child relationships have begun to address the issue of confounding factors (Ly, Zhou, Chu, & Chen, 2012; Spilt, Hughes, Wu, & Kwok, 2012). Notably, controlling for initial levels of achievement, Maldonado-Carreño and Votruba-Drzal (2011) examined within-child associations in teacher–child relationships and achievement to limit the threat of selection bias and compare effects from teacher-reported and standardized achievement outcomes. Using data from the NICHD Study of Early Child Care and Youth Development from kindergarten to fifth grade, they found no significant associations between teacher–child relationship quality in kindergarten and standardized achievement scores later in elementary school (e.g., first, third, and fifth grades). However, they did detect significant positive relations between teacher–child relationships and teacher-reports of students' academic achievement. Results are notable because many of the previous studies that found significant associations between teacher–child relationships and standardized student achievement failed to control for initial levels of achievement when predicting later outcomes (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Pianta, 1997; Pianta & Stuhlman, 2004). It is important to continue to build upon this research using a range of methods that may help address the problem posed by selection when estimating effects of teacher–child relationships on academic achievement.

It may also be important for future studies to account for systematic differences in teacher–child relationships and academic achievement that exist across schools (Kelcey, 2009; Kim & Seltzer, 2007; Singer & Willett, 1998). Ecological theories suggest that teacher–child relationship quality is likely to differ across schools (Bronfenbrenner & Morris, 1998), as are the processes by which students select into high-quality teacher–child relationships (Kim & Seltzer, 2007). For example, Hong and Raudenbush (2006) encountered such between-school variation in their study estimating the effect of kindergarten retention on achievement.