# Interactional Quality in Middle Schools: Latent Profiles and their Associations with Teacher, Classroom, and School Compositional Factors

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**Abstract**

High quality teacher-student interactions are critical for the healthy social-emotional, behavioral, and academic development of middle school students. However, few studies have explored patterns of teacher-student interactions in middle school classrooms or the relation between teacher-, classroom-, and school-level factors and patterns of interaction. The current study employed latent profile analyses (LPA) to identify patterns of teacher-student interactional quality in a sample of 334 teachers from 41 schools serving middle school students within the Mid-Atlantic region of the U.S. Three distinct profiles of teacher-student interactional quality were identified, characteristic of higher, lower, and intermediate quality, and were differentially related to teacher, classroom, and school characteristics. Compared to classrooms with lower interactional quality, classrooms with "higher" or "intermediate" profiles were more likely to be taught by early career teachers, to have higher rates of observed student cooperation, and to be in schools in rural fringe areas. Classrooms with lower interactional quality were more likely to have larger student-to-teacher ratios and higher rates of student disruptive behaviors than classrooms with intermediate interactional quality and to be in schools with a higher percentage of out-of-school suspensions than classrooms with higher interactional quality. These findings suggest that interventions at the teacher, classroom, and school levels, such as consultation to support teachers' effective classroom management, alternatives to out-of-school suspensions, and smaller student-to-teacher ratios may promote positive teacher-student interactions.

## Interactional Quality in Middle Schools: Latent Profiles and their Associations with Teacher, Classroom, and School Compositional Factors

When interactions between teachers and students are characterized by high levels of emotional and instructional support, classroom organization, and student engagement, they create a classroom context that facilitates the social-emotional and academic development of its students (Hamre & Pianta, 2001). Several studies have highlighted the role of high quality teacher-student interactions in improving children's social-emotional and academic outcomes (Curby et al., 2009; Mashburn et al., 2008; Pianta et al., 2008), but few studies have focused on middle school settings within the U.S. (Allen et al., 2013; Halpin & Kieffer, 2015; Virtanen et al., 2018). Middle schools represent an important developmental context for early adolescents, who experience multiple physiological and psychosocial changes (e.g., puberty, searching for identity) that can prove destabilizing without adequate supports like positive teacher-student relationships (Davis, 2003; Eccles & Roeser, 2011). Likewise, research investigating the quality of teacher-student interactions is essential to understand how teachers can foster their students' developmental and academic success.

An increasing number of studies have employed latent profile approaches to examine patterns of teacher-student interactions, with "higher quality" interactions characterized by higher levels of dimensions of emotional support, classroom organization, and instructional support, in middle school settings (Allen et al., 2013; Halpin & Kieffer, 2015; Virtanen et al., 2018). These studies indicated four latent profiles comprised of varying levels of these dimensions (Halpin & Kieffer, 2015; Virtanen et al., 2018). However, scant research has examined the associations between these profiles and teacher-, classroom-level, and school-level covariates (Hu et al., 2016; LoCasale Crouch et al., 2007; Virtanen et al., 2019). Additionally, no

studies to date have explored the associations between the latent profiles and covariates related to student behaviors, school demographics, prior academic achievement, and disciplinary outcomes. Understanding middle school interactional profiles and their correlates could inform educational policies and interventions designed to promote individual (e.g., collegial connectedness, self-efficacy) and contextual characteristics (e.g., higher student-to-teacher ratios, restorative practices) conducive to positive teacher-student interactions. To address these gaps, the current study examined the profiles of teacher-student interactional quality for a sample of middle school teachers in the mid-Atlantic region of the U.S. and associations between these profiles and a broad set of teacher, classroom, and school compositional factors.

**Schools as a Key Developmental Context during Early Adolescence**

Schools are a key context for youth development (Eccles & Roeser, 2011; Osher et al, 2014). Bronfenbrenner and Morris's (2006) process-person-context-time model, which posits that youth develop within complex, sociocultural contexts with distinct norms, beliefs, and characteristics that influence growth and learning processes, provides a helpful framework for illustrating their developmental importance. Within this framework, schools function as a microsystem, a sociocultural context nested within broader ecological systems (e.g., an educational system, norms of a particular culture). Through proximal processes within the microsystem, such as interactions between teachers and students, a youth's individual characteristics and characteristics of those within the context (e.g., teacher) reciprocally interact over time to produce developmental outcomes (Bronfenbrenner & Morris, 2006). Aspects of students' classroom and school context may affect the nature of these interactions, and likewise serve a role in shaping their development.

Without supportive contexts such as classrooms and schools, early adolescents' biological and psychosocial changes can prove destabilizing and make adolescents vulnerable to persistent academic, behavioral, and social difficulties (Dawes et al., 2020). Early adolescent students experience multiple developmental transitions as they undergo physiological maturation associated with puberty, as well as changes in abilities, interests, identities, and relationships with both teachers and peers (Eccles & Roeser, 2011; Vollet et al., 2017). Early adolescent students also identify diminished levels of school engagement and connections with teachers (Davis, 2003; Wang et al., 2013), indicating a heightened developmental risk. A teacher's ability to foster supportive relationships via positive interactions with their middle school students likewise has important implications for youth development.

**Teaching Through Interactions and Measuring Interactional Quality**

The Teaching Through Interactions framework (TTI; Hamre et al., 2013), derived from both human attachment and ecological systems theories (Bronfenbrenner & Morris, 2006), presents the patterns of teacher-student interactions within a classroom context as a significant proximal process that facilitates students' academic and social-emotional development. Specifically, it posits that effective teaching, which maximizes student developmental gains via classroom practice, is driven by teacher-student interactions that demonstrate high levels of emotional support, classroom organization, and instructional support (Hamre et al., 2013).

A robust body of educational and psychological literature (e.g., attachment, self-determination, and developmental theories) supports the social-emotional and instructional importance of the TTI's three broad domains of teacher-student interactions. With respect to emotional support, youth develop a sense of security and agency in navigating the world when adults provide a safe, responsive, and consistent relational environment (Bowlby, 1969).

Furthermore, when adults support youth's need for positive relatedness, competence, and autonomy, they are most motivated to learn (Connell & Wellborn, 1991). Well-organized classroom contexts characterized by consistent routines for behavior, structured time use, and positive classroom management strategies (Emmer & Stough, 2001) allow students to employ essential self-regulatory and executive functioning skills that promote learning (Ponitz et al., 2009).

Scaffolded instruction that builds simpler skills into more complex ones (Skibbe et al., 2004), incorporates students' background and real-world examples (Bransford et al., 2000), and provides immediate, specific, and corrective feedback (Good & Brophy, 2008), is most conducive to students' learning and development. Collectively, when teachers provide these supports, their students display behavioral engagement in academic tasks and higher academic achievement (Virtanen et al., 2015).

Past studies using the *Classroom Assessment Scoring System* (*CLASS,* which is derived from the TTI framework; Pianta et al., 2012) have found significant associations between the measure's dimensions of Classroom Organization and Instructional Support and student engagement in seventh through ninth grade classrooms in Finland (Virtanen et al., 2015). Only a select few studies (e.g., Allen et al., 2013; Braun et al., 2019; Halpin & Kieffer, 2015) have employed this observational measure among middle school teachers in the U.S.

**Profiles of Teacher-Student Interactional Quality**

Teacher-student interactional quality is a multifaceted construct, and its component dimensions occur simultaneously within the classroom setting. Latent profile analysis (LPA), a person-centered approach applied by previous CLASS researchers (Halpin & Kieffer, 2015; Hoang et al., 2019; Hu et al., 2016; Salminen et al. 2012; Virtanen et al., 2019), identifies

subgroups of teachers with similar patterns of interactional quality dimensions. In doing so, LPA permits a nuanced examination of the way interactional quality dimensions relate within each profile and in comparison to other profiles (e.g., subgroups with higher or relatively lower dimension scores; Collins & Lanza, 2010; LoCasale-Crouch et al., 2007). Documenting the presence of distinct patterns of teacher-student interactional quality across a range of measures and samples may inform classroom interventions that promote teacher practices that are most conducive to student learning and development (Halpin & Kieffer, 2015). For example, profiles indicating global and profile-specific strengths and weaknesses in interactional quality may be used to inform professional development supports targeting interactional quality dimensions. Targeted interventions to support high-quality teacher-student interactions can thereby enhance student learning and development.

Prior CLASS research using LPA indicated three to four profiles among kindergarten classrooms in Vietnam (Hoang et al., 2019), China (Hu et al., 2016), and Finland (Salminen et al., 2012) and four profiles in secondary schools in Norway and the U.S. (Halpin & Kieffer, 2015; Virtanen et al., 2018). In Norway, secondary school profiles included sixth grade teachers who scored (a) high in all dimensions; (b) low in Emotional and Instructional support, but high in Classroom Organization; (c) high in Regard for Adolescents' Perspectives; and (d) low in all dimensions (Virtanen et al., 2018). Similarly, the U.S. study showed discernible inter-profile differences (more than 1 point mean score differences) in the Classroom Organization and Organizational Support CLASS-S domains of the CLASS-S, the *Classroom Assessment Scoring System-Secondary* (Allen et al, 2013), for sixth to eighth grade English Language Arts teachers. Additional research is needed to replicate this approach, including a more precise detailing of

inter-profile differences in teacher-student interactional quality for a sample of educators within the U.S. who teach a variety of subjects (Halpin & Kieffer, 2015).

**Teacher Characteristics**

Research demonstrates that certain teacher characteristics, such as self-efficacy and years of experience, relate to interactional quality as measured by the CLASS-S. For example, in Finnish classrooms, both classroom management self-efficacy and years of teaching experience were positively associated with Organizational Support (Virtanen et al., 2018). Additionally, in 58 U.S. classrooms, years of overall teaching experience was associated with higher levels of observed Emotional Support and Classroom Organization (Braun et al., 2019). There is likewise reason to believe that teachers' years of experience in their current school may also be associated with higher levels of interactional quality, as teachers accrue context-specific relational trust and pedagogical skills within their school communities over time. However, no studies to date have explicitly investigated the association between teachers' years of experience at their current school and interactional quality. The current study uniquely investigates teachers' years of experience in their current school, operationalized as early career status (0–3 years of experience at current school; Sullivan et al., 2019), and teacher self-efficacy in relation to interactional quality profiles.

Scant research has investigated the relation between teacher affiliation and teachers' interactions with students, although researchers posit that teachers who engage in supportive and collaborative relationships with colleagues may have a greater capacity to display supportive behaviors in their relationships with students (Jennings & Greenberg, 2009). Unsatisfactory teacher-teacher relationships, conversely, contribute to lower levels of teacher job satisfaction and commitment to students (Lee et al., 2011; Van Maele & Van Houtte, 2011), attitudes which

may diminish the quality of teacher-student interactions via less supportive teacher behaviors (Klusmann et al., 2008). Toward this end, the current study explored the association between teacher affiliation and interactional quality profiles.

**Classroom Characteristics**

Previous studies exploring the associations between class size and interactional quality have yielded mixed results. For example, smaller class size was associated with higher Emotional Support in one study (Virtanen et al., 2018), whereas larger class size was associated with higher Emotional Support and Student Engagement in another (Malmberg et al., 2010). In comparison to class size, student-to-teacher ratio may provide a more precise index of the sustained time and attention teachers can devote to individual students and more directly relate to interactional quality. Smaller student-to-teacher ratios within early childhood classrooms are associated with greater cognitive and achievement gains and contribute to classroom quality (Barnett et al., 2003; Bowne et al., 2017). Less research has investigated these connections within middle schools. Understanding the connection between student-to-teacher ratio and the quality of their interactions with teachers is vital for early adolescent students, who are developmentally vulnerable without supportive relationships with adults (Dawes et al., 2020).

Student behaviors are an integral part of interactions within a classroom (Hattie, 2009). In their prosocial classroom model, Jennings and Greenberg (2009) asserted that classrooms with a more relational classroom climate include teacher modeling of social-emotional competencies such as emotion regulation, problem-solving, and effective communication skills to prevent conflict with students and, when it does occur, de-escalate it so that it does not disrupt the learning environment. Strong teacher-student relationships have likewise been linked with lower rates of student disruptive behaviors and higher levels of academic engagement (Duong et al.,

2019; Quin, 2016), characteristics that in turn contribute to a more productive and positive classroom environment. Further empirical research is needed to investigate student behaviors (e.g., cooperative vs. disruptive) in relation to teacher-student interactional quality.

**School Compositional Factors**

As noted above, contextual characteristics exert an impact on the social processes that youth experience and play a part in shaping interactions between teachers and students. Past interactional quality studies have examined associations between profiles of teacher-student interactional quality and a limited set of compositional factors in early childhood settings but, to our knowledge, no such studies have been conducted in middle schools. Regarding school contextual factors, warm and responsive teacher-student relationships may be more difficult in schools with a larger student enrollment (Van Maele & Van Houtte, 2011). Additionally, in schools where teachers are aware of and expect higher levels of academic performance, teachers may engage their students in a more supportive and encouraging manner (De Boer et al., 2018) and in turn, higher achievement may lead to positive student engagement with teachers (Jerome et al., 2009). This reciprocal dynamic may enhance interactional quality dyadically and for the broader classroom.

For schools with higher percentages of socioeconomically disadvantaged and Black and Latinx students, interactional quality may also suffer for student populations who more frequently encounter educators with negative stereotypes, lower expectations, and lower levels of trust in them (Goddard et al., 2009; Sorhagen, 2013; Thys & Van Houtte, 2016). Prior research in early childhood settings demonstrated that the proportion of non-Caucasian students and student poverty negatively related to classroom interactional quality profiles (LoCasale-Crouch et al., 2007). Relatedly, establishing and maintaining trusting relationships between teachers and

students may be especially difficult in school climates marked by punitive and exclusionary disciplinary practices, such as higher rates of out-of-school suspensions and expulsions (Gregory et al., 2011).

Regional context may also play a role in shaping teacher-student interactions. Different regions (e.g., suburban, urban, rural) within the U.S. demonstrate different contextual challenges and strengths related to economic, demographic, political, or cultural resources (van der Pers & Helms-Lorenz, 2019). Such challenges may exert relational stress on teachers and students within urban and rural school contexts, as these school communities more commonly experience under-resourcing, teacher turnover, and lower levels of prior student achievement (Bryan et al., 2020; Jacob, 2007; Lamkin, 2006) due to multiple systemic conditions (e.g., lack of economic opportunities, federal underfunding, greater work demands). For example, a study conducted in China demonstrated that classrooms in lower quality profiles were more likely located in rural towns and villages characterized by lower socioeconomic status and that received less funding from the government (Hu et al., 2016). Conversely, urban and rural communities may possess key relational strengths, such as a strong community identity, resilience, and deep social connections (Bryan et al., 2020; McShane & Smarick, 2018), which may provide a strong foundation for positive teacher-student interactions.

**Present Study**

As noted above, positive teacher-student interactions play a vital role in the healthy development of youth, particularly during middle school, and a latent profile approach has emerged as a helpful method to illustrate patterns of these interactions for teacher samples. More research is needed using a large sample of middle school teachers in the U.S. and including an examination of the relations between interactional quality profiles and teacher, classroom, and

school characteristics. Such understanding will help inform policies and school-based efforts that target malleable factors in the promotion of high-quality teacher-student interactions. This study sought to fill this research gap by investigating the following questions:

**Research Question 1**: What profiles of teacher-student interactional quality emerge from the 12 dimension scores and one student-level dimension (Student Engagement) of the CLASS-S?

**Hypothesis 1:** Past research has demonstrated three to four profiles of interactional quality (Halpin & Kieffer, 2015; Hoang et al., 2019; Virtanen et al., 2018). We likewise anticipated three to four profiles, with one profile similarly reflecting higher ratings in all domains, one reflecting lower ratings, and one to two reflecting intermediate ratings.

**Research Question 2**: How do teacher characteristics (i.e., early career status, teacher self-efficacy, and teacher affiliation) relate to interactional quality profiles?

**Hypothesis 2:** Based on previous research, we expected that profiles characterized by higher levels of teacher-student interactional quality would be negatively associated with early career status (Braun et al., 2019; Virtanen et al., 2018) and positively associated with teacher self-efficacy (Virtanen et al., 2018) and teacher affiliation (Jennings & Greenberg, 2009).

**Research Question 3:** How do classroom characteristics (i.e., student-to-teacher ratio and disruptive and cooperative student behaviors) relate to interactional quality profiles?

**Hypothesis 3:** We hypothesized that profiles reflecting higher interactional quality would be negatively associated with student-to-teacher ratio (Bowne et al., 2017) and disruptive student behaviors (Quin, 2016), and positively associated with cooperative student behaviors (Duong et al., 2019).

**Research Question 4:** How do school compositional factors (i.e., school size, percentage of socioeconomically disadvantaged students, regional designation, reading achievement, percentage of Black and Latinx students, and percentage of out-of-school suspensions) relate to interactional quality profiles?

**Hypothesis 4:** Previous research suggests likely negative associations between higher levels of interactional quality and school size (Van Maele & Van Houtte, 2011), percentage of disadvantaged students (Hu et al., 2016; Sorhagen, 2013), urban or rural school designation (Jacob, 2007; Lamkin, 2006), percentage of Black and Latinx students (Goddard et al., 2009), and out-of-school suspension rates (Gregory et al., 2011). We anticipated that profiles reflecting higher levels of interactional quality would be associated with higher rates of reading achievement (Jerome et al., 2009).

## Method

### Participants

Participants were 334 teachers from 41 schools serving middle school students in four districts within two U.S. Mid-Atlantic states during the 2015–16 through 2018–19 academic years. These teachers were part of a larger-scale study ($N = 342$) investigating the impacts of a professional development and coaching model to promote culturally responsive classroom practices for a randomized sample of teachers (Bradshaw et al., 2018); all teachers whose classrooms were observed by researchers were included in the present study ($N = 334$). The resulting sample of teacher participants were predominantly White (47.9%) or Black/African American (35.9%), female (71.9%), 20–40 years of age (49.5%), and had 0–3 years of teaching experience (51.2%). Most teachers were sixth (35.9%) or seventh grade teachers (29.3%) who taught one of four main subjects (i.e., 20%–25% of these teachers taught Language Arts,

Science, Math, or Social Studies). Their average classroom size was equal to 22.9 students (*SD* = 4.6); the average student-to-teacher ratio was 19.9 students per teacher (*SD* = 5.8). Their schools had an average enrollment of 691.7 students (*SD* = 323.3); schools were racially and ethnically diverse (i.e., 60.1% of students were Black, 19.4% were White, 13.4% were Latinx, and 2.4% were Asian) and were in large urban (63.4%), large suburban (31.7%), and rural fringe (4.9%) regions. Approximately 54.5% (*SD* = 18.3%) of students in these schools received free and reduced-price meals, 14.7% (*SD* = 6.5%) received special education services, and 3.86% (*SD* = 6.7%) were eligible for the Limited English Proficient (LEP) programming. See Table 1 for a more detailed description of teachers' characteristics and Table 2 for information about classroom and school-level factors of focus.

## Measures

### *Teacher-Student Interactional Quality*

The Classroom Assessment Scoring System (CLASS; Pianta et al., 2012) captures interactional quality via 12 dimensions within three broad domains—Emotional Support, Classroom Organization, and Instructional Support. These domains cover distinct but interrelated features of teacher-student interactions in a classroom context (Hamre et al., 2013). Additionally, student engagement serves as a single dimension that assesses the degree to which students are involved in learning activities within the classroom. The Classroom Assessment Scoring System-Secondary (CLASS-S; Allen et al., 2013) is an adapted version of the CLASS observation system (Pianta et al., 2012) used in sixth through twelfth grade classrooms to more precisely capture key social and instructional processes to engage students in these settings (CLASS-S; Pianta et al., 2012). These modifications include the Regard for Adolescent Perspectives dimension, which includes items tailored to adolescent perspective-taking, as well as added

dimensions (e.g., Analysis & Problem Solving, Instructional Dialogue) that assess more developmentally advanced aspects of student learning and engagement. Researchers have increasingly applied and validated the CLASS-S to investigate teacher-student interactional quality in middle school settings (Allen et al., 2013; Braun et al., 2019; Malmberg et al., 2010; Virtanen et al., 2015).

The *Emotional Support* domain measures the strength of the relationship between teachers and students and includes the Positive Climate, Teacher Sensitivity, and Regard for Adolescent Perspectives dimensions. These dimensions emphasize the key relational processes through which teachers' words and actions establish a positive tone, create a positive learning environment, and make connections with and remain responsive to students' perspectives and experiences. The *Classroom Organization* domain measures a teacher's management of different aspects of the classroom environment. The Negative Climate, Behavior Management, and Productivity dimensions within this domain illustrate how teachers maintain an appropriate tone and manage student time, attention, and behavior in a manner that maximizes engagement in the learning process. The *Instructional Support* domain measures the instructional practices essential for student concept development and practice and includes the Instructional Learning Formats, Content Understanding, Analysis and Problem-Solving, Quality of Feedback, and Instructional Dialogue dimensions. These subdomains highlight how teachers engage students via learning structures, approaches, and feedback that facilitates and deepens their learning. Additionally, the *Student Engagement* dimension assesses the overall engagement level of students in the classroom and was included in this study, although it is not part of the 3 domain scores.

Observers rated each of the above dimensions on a 1–7 scale, with scores of 1–2 falling with the *low* range, 3–5 within the *middle* range, and 6–7 within the *high* range (Pianta et al.,

2012). Consistent with past CLASS research studies, dimension scores across three classroom observations for each teacher were averaged (Hu et al, 2016; Virtanen et al., 2018). Composites were computed for the Emotional Support, Classroom Organization, and Instructional Support domains by adding up respective dimension scores. Reliabilities for the three main CLASS-S domains for a secondary school sample (Grades 6–12) demonstrated good internal consistency for the scales at the item level (.83 for Emotional Support, .82 for Organizational Support, and .90 for Instructional Support; Virtanen et al., 2018), with intraclass correlations (i.e., ICCs measuring interrater reliability) within the good to excellent range (.64–.78; Allen et al., 2013). In the present study, ICCs were .60 for Emotional Support, .63 for Classroom Organization, .61 for Instructional Support, and .66 for Student Engagement.

### *Teacher Characteristics*

Teachers completed online surveys at the beginning of their study participation that included a demographic questionnaire and scales to measure their behavior management self-efficacy and affiliation with other teachers. Teachers rated items accordingly on a 6-point Likert scale from 1 (*strongly disagree*) to 6 (*strongly agree*). Responses to all items were averaged for each scale. We have summarized these measures and demographic data below.

**Teacher Affiliation**. We utilized the teacher affiliation scale from the Organizational Health Inventory (OHI; Hoy & Tarter, 1997) to assess the quality of interpersonal relationships between staff members within a building (6 items; e.g., “Teachers in this school like each other”; $\alpha = .83$). Higher scores indicate that teachers reported higher levels of affiliation.

**Behavior Management Self-Efficacy**. To measure teachers’ ability to handle students with behavior problems, we used an efficacy scale from Hoy and Woolfolk (1993; 5 items; e.g., “I can manage almost any student behavior problem”; $\alpha = .86$). We decided to use this more

focused measure rather than one that assesses general teaching efficacy given past literature that indicates that disruptive and/or challenging student behavior serves as an impediment to positive teacher-student interactions (Quin, 2016). Higher scores indicate that teachers felt more self-efficacious in managing disruptive student behavior.

**Teacher Demographics**. We collected demographic information from teachers, including their race/ethnicity, age, gender, grade level, subject taught, and years of experience at their current school. Although most of these data were used for descriptive purposes, we analyzed years at school as a proxy for teaching experience and as a predictor of teacher-student interactional quality. For these analyses, we dichotomized this variable, such that early career teacher status (years at school $\leq 3$) was coded 1 whereas 4 or more years at school was coded 0.

### *Classroom Characteristics*

The Assessing School Settings: Interactions of Students and Teachers (ASSIST; Rusby et al., 2001, 2011) classroom observational measure assesses social processes within the classroom. It includes event-based tallies and global ratings of teacher and student behavior. Consistent with the prosocial classroom model (Jennings & Greenberg, 2009), we conceived of ratings of student behaviors as a salient feature of each classroom's unique relational climate. For the current analyses, we utilized global ratings of *Student Cooperation* (7 items; e.g., "Students consistently follow rules appropriate to settings" and "Students cooperate;" $\alpha = .96$; ICC = .71) and *Socially Disruptive Behaviors* (7 items; e.g., "Students are irritable or sarcastic toward the teacher" and "Students physically harass and/or bully others;" $\alpha = .73$; ICC = .73). Observers rated items on a 0–4 point Likert-type scale, which ranged from *never* to *almost continuously*. Observers conducted three cycles of observations and scores were averaged across items and cycles to calculate scales. Higher scores on *Student Cooperation* and *Socially Disruptive Behavio*rs

indicated, respectively, higher levels of cooperative or disruptive behaviors. Observers recorded other classroom characteristics in the first 3 min of the observation, including student-to-teacher ratio, which was also analyzed in the current study.

### *School Compositional Factors*

School compositional factors were compiled from publicly available databases collected by state departments of education for the academic year that preceded each school's study involvement. Variables of interest included total enrollment, the percentage of students receiving free and reduced-price meals, percentage of student proficiency in reading standardized tests, percentage of Black and Latinx students, percentage of out-of-school student suspensions, and school regional designation (i.e., large urban vs. large suburban vs. rural fringe). School regional designation was determined via each school's "locale" classification on the National Center for Education Statistics database (NCES, 2020). All the rural schools in our sample were categorized as rural "fringe" schools, which indicates a more densely populated region than rural "remote" or "distant" schools according to the NCES classification system.

## Procedure

Schools voluntarily participated in the broader study to promote cultural responsivity via professional development and coaching. The research team engaged principals of each participating school district in face-to-face meetings. These principals were subsequently asked to sign commitment letters, allowing research team members to recruit teachers for the study at their school. Research team members visited each participating school and solicited written consent to participate in the research study from all eligible teachers (i.e., core subject teachers in Grades 6–8, but prioritizing Grades 6–7). Approximately 71% of eligible teachers consented to

participate. The subsample used in this study included participants who were eligible to receive coaching because they taught core instruction courses.

Prior to data collection, research staff informed observers that they were collecting data related to teachers' classroom practices in secondary classroom settings. These observers were unaware of the purpose of the study or the schools,' and thus of teachers,' assignment to either the intervention or control condition. For the current study, we used baseline data from this randomized control trial which were collected prior to random assignment to condition. Observations were conducted for 98.83% ($n$ = 334) of eligible consented teachers. The project coordinator scheduled observation dates within a 1–2 week period within each data collection cycle.

### *Teacher Self-Report Survey*

Teachers completed self-report surveys at the start of their study participation (i.e., fall of each academic year) that consisted of a demographic questionnaire and scales to measure their behavior management efficacy and affiliation with other teachers. These surveys were completed via a secure online survey system, with teachers earning a $10 gift card for survey completion. Overall, 87.43% of eligible teachers who consented to participate completed the self-report survey.

### *Classroom Observation Training*

Observers external to the schools were hired by the research team and trained to conduct classroom observations using the CLASS-S (Allen et al., 2013) and the ASSIST (Rusby et al., 2001, 2011). Training in both the CLASS-S and ASSIST entailed initial didactic sessions where trainers provided observers with CLASS-S and ASSIST manuals with descriptions of observation codes on domains and scales of each measure, classroom procedures for each, and

step-by-step data collection procedures. For both measures, observers engaged in practice and then the establishment of interobserver agreement or reliability.

**ASSIST.** After participating in initial ASSIST training sessions led by research team members, observers visited nonproject schools to complete in-person training practice and engaged in calibration sessions where interobserver agreement with an expert coder was sought. During this process, expert observers were paired with observer trainees for simultaneous data coding and achievement of interobserver reliability during three classroom observations. Observers calibrated their scores, conducting additional observations, if necessary, until they achieved a criterion of 80% agreement, a standard considered acceptable within behavioral research (McHugh, 2012; Page & Iwata, 1986). During active data collection, all observers were engaged in an on-site recalibration session to ensure reliability persisted. This required additional joint observations with expert observers and recently trained observers. For this study, interobserver agreement during recalibration for the ASSIST was 87.25%.

**CLASS-S.** The CLASS-S training and reliability followed the procedures outlined by the developers of the CLASS (Pianta et al., 2012). The research team hired observers who were trained by Teachstone instructors (i.e., didactic and in-person training sessions); Teachstone provides training, technical assistance, and certification to support use of the CLASS. Coding practice was conducted using videos available from Teachstone. Observers had to demonstrate 80% reliability, a threshold required by the CLASS-S manual, on video coding within three testing windows (Pianta et al., 2012).

### *Classroom Observations*

**ASSIST.** Observers conducted three classroom observations using the ASSIST on separate dates and times. ASSIST observations took, on average, 25–30 min each. Observers

took approximately 3 min to acclimate to the classroom and document the class subject, number of teachers and students present, and the number of White students from their perception. Subsequently, observers spent 15 min conducting live tallies of classroom behaviors. Observers then would leave the classroom and immediately complete global rating items during the remaining time. Observers conducted three cycles (i.e., on at least two separate days) of ASSIST observations and teachers' dimension scores were averaged across these cycles. Observations of each classroom were conducted by the same observer.

**CLASS-S.** Observers conducted three classroom observations using the CLASS-S on at least two separate dates and times. Each CLASS observation lasted up to 30 min; observers spent 15 min taking notes within each classroom and subsequently spent 10–15 min recording scores for the 12 dimensions. Observers conducted three observation cycles overall; the classroom and teachers' dimension scores were averaged across these cycles.

## Analyses

To examine Research Question 1, we used LPA (Hagenaars & McCutcheon, 2002; Muthén & Muthén, 1997–2017), conducted in M*plus* 8.1, to identify latent profiles of teacher-student interactional quality using 12 CLASS-S dimension scores. LPA is a type of latent class analysis that employs continuous data to generate "unobservable" profiles based on similarities in response patterns across multiple continuous indicators. In the LPA model-building process, a series of models with increasing numbers of latent profiles are specified, and multiple criteria are considered to determine the model (i.e., number of profiles) that best fits the data. Models are built one latent profile at a time, assessing model fit after each profile's addition. In this study, we specified models such that indicator means were freely estimated and variances were constrained to be equal across profiles, with no within-profile indicator covariances. We used a

Huber-White sandwich estimator to adjust standard errors to account for clustering of teachers and classrooms within schools (Muthén & Muthén, 1997–2017; Pas et al., 2015). This estimator is robust to non-normality or non-independence of observations (Muthén & Muthén, 1997–2017).

Consistent with current recommendations in the literature, each model was evaluated using a combination of statistical and substantive criteria (Masyn, 2013; Muthén, 2003; Nylund-Gibson & Choi, 2018). Four information criteria (IC), the Vuong Lo Mendel Rubin likelihood ratio test (VLMR-LRT; Vuong, 1989), Bayes Factor (BF), and correct model probability (cmP) were used to evaluate the fit of each profile solution. The ICs included the Bayesian Information Criterion (BIC; Schwartz, 1978), the sample size adjusted BIC (ABIC; Scolve, 1987), the approximate weight of equivalence (AWE; Banfield & Raftery, 1993), and the constant Akaike information criterion (CAIC; Bozdogan, 1987). For each IC, lower values or diminishing returns (i.e., an elbow after which only small decreases occur for each additional profile) indicate superior model fit (Nylund et al., 2007; Nylund-Gibson & Choi, 2018). The VLMR-LRT examines the fit of a given profile model ($k$) with a solution with one fewer profile ($k - 1$), such that a significant $p$-value indicates improvement in model fit with the additional latent profile (Nylund et al., 2007). Thus, a nonsignificant VLMR-LRT indicates that the additional profile does not improve model fit (Nylung-Gibson & Choi, 2018). BF values between 1–3 suggest *weak* support, between 3–10 offer *moderate* support, and greater than 10 offer *strong* support for the current model (Nylund-Gibson & Choi, 2018; Wasserman, 1997). Larger cmP values indicate greater likelihood of the model being correct out of all models tested (Masyn, 2013).

Fit indices may offer support for more than one candidate model when specifying latent profile models (Nylund-Gibson & Choi, 2018). When more than one model is supported,

parsimony, interpretability, how models relate to one another, proportions of emerging profiles, and results of auxiliary variable analyses inform final model selection (Masyn, 2013; Nylund et al., 2007; Nylund-Gibson & Choi, 2018). Solutions with relatively large (i.e., greater than 5%–8% of participants) and relatively equal profile sizes indicate greater model stability (Muthén, 2004; Nylund-Gibson & Choi, 2018). Finally, the accuracy of classification of individuals into emerging latent profiles are evaluated via relative entropy, with values above .80 and closer to 1.00 indicating superior classification precision (Masyn, 2013).

The size of a study's sample may impact model estimation and performance of statistical fit indices (Nylund et al., 2007). Although there are "no concrete guidelines for sample size" for LPA models, previous research indicates that most common fit indices function adequately in samples ranging from 300 to 1000 participants (Nylund-Gibson & Choi, 2018, p. 451). Additionally, the BIC, which simulation studies have found to be superior to other commonly used fit indices (Nylund et al., 2007; Nylund-Gibson & Masyn, 2016), can detect the correct number of classes within even smaller samples ($n$ = 200; Nylund et al., 2007). Thus, this study's sample of 334 classrooms is likely sufficient for the analyses. Moreover, our sample size is comfortably within the range of sample sizes from prior research investigating CLASS profiles (Halpin & Kieffer, 2015; Hoang et al., 2019; Hu et al., 2016; Salminen et al. 2012; Virtanen et al., 2019).

After deciding on the number of profiles, we examined Research Questions 2–4 via specification of a conditional LPA model that included covariates to examine the associations between teacher-student interactional quality profiles and teacher characteristics, classroom characteristics, and school compositional factors (Clark & Muthén, 2009; Nylund-Gibson & Masyn, 2016). The teacher, classroom, and school covariates were included in the model using a

three-step procedure to prevent shifting in identified latent profiles that can occur when new variables are included in the model (Asparouhov & Muthén, 2013; Nylund-Gibson & Choi, 2018; Vermunt, 2010). The measurement parameters (e.g., indicator means and variances) of the best-fitting latent profile model were fixed while accounting for classification error (see Nylund-Gibson & Choi, 2018, and Nylund-Gibson et al., 2014, for further information and example M*plus* syntax). This model specification employs a multinomial logistic regression, wherein the covariates are regressed onto the latent class variable. We examined whether the distribution of teacher characteristics (i.e., early career teacher status, affiliation, behavioral management self-efficacy), classroom characteristics (i.e., student disruptive behavior, student cooperation), and school compositional characteristics of interest (i.e., student enrollment, percentage of Black and Latinx students, percentage of students receiving free or reduced-priced meals, percentage of students proficient in reading, percentage of out-of-school suspensions, and regional designation as urban or rural fringe as opposed to suburban) significantly varied across interactional quality profiles. A Huber-White sandwich estimator was again used to account for the nested nature of covariate data (Muthén & Muthén, 1997–2017). *P*-values, logit values, and odds ratios were used to assess the statistical and practical significance of these associations.

None of this study's participants had missing CLASS-S observational data; however, data were missing at variable rates from the teacher, classroom, and school covariates. Teacher self-report variables, particularly measures of teacher affiliation and behavior management self-efficacy, had the most missing data (6.3% missing for years of experience to 15.9% missing for behavior management self-efficacy). A Little's MCAR test indicated that teacher demographic data for these cases were missing at random, $\chi^2 = 6.28$, $p = .28$. ASSIST classroom observational data were missing for fewer than 1% of the sample, and public data regarding school

characteristics were unavailable for 3.6% of the sample. Thus, full information maximum likelihood (FIML) estimation was used to specify the multinomial logistic regression during the third step of the three-step method to account for missing data (e.g., Sterba, 2016).

## Results

### Profiles of Teacher-Student Interactional Quality

We assessed the fit of a series of LPA models with as many as six latent profiles using 12 dimensions of the CLASS-S in 334 classrooms. Data screening conducted prior to LPA analyses indicated no major violations of univariate normality for the 12 CLASS-S LPA indicators (Kline, 2011). Skewness ranged from -1.44 (Negative Climate) to 0.56 (Analysis and Problem Solving), whereas kurtosis ranged from -0.62 (Behavior Management Self-Efficacy) to 2.32 (Negative Climate).

Table 3 provides fit statistics for each model. The BIC, ABIC, and CAIC continued to decrease with each additional profile included in the model, with the AWE having the lowest value at the four-profile solution. A scree plot of values for each of the BIC, ABIC, CAIC, and AWE (see Figure 1) demonstrated diminishing returns (i.e., an "elbow") following the 3-profile solution for each IC, providing support for the 3-profile solution over the 2-profile solution and indicating minimal improvements in fit in subsequent profile models (Nylund-Gibson & Choi, 2018). Considering the VLMR-LRT, the *p*-value was statistically significant for the 2-profile solution, indicating a significant improvement in model fit over a 1-profile model. The *p*-value was not statistically significant for the 3-profile model, indicating that the addition of the third profile did not significantly improve model fit; the LMRT was also nonsignificant for the 4- to 6-profile solutions. The BF provided weak support for all models and the cmP indicated support for a 6-profile solution.

As is common when identifying latent profile solutions, the fit criteria offered support for differing candidate solutions (i.e., 2-, 3-, 4-, or 6- profiles). Thus, we next considered proportions of emerging profiles, interpretability, parsimony, and results of auxiliary analyses to inform our choice of the final model (Nylund-Gibson & Choi, 2018). Although the 4-profile model demonstrated improved IC values in comparison to the 3-profile model and the lowest AWE, this solution included an unreliably small percentage (i.e., 6%) of middle school classrooms and thus was not examined further. The 6-profile solution evidenced similar weaknesses in proportions of identified profiles. The size of the profiles identified in the remaining models under consideration (i.e., 2- or 3-profiles) was sufficient. Additionally, each of the 2- and 3-profile solutions were interpretable, with the additional profile identified in the 3-profile solution being conceptually distinct (see Figure 2 and Supplementary Figure S1). Moreover, when examining the relation of the latent profile variable to teacher, classroom, and school covariates (discussed in more detail below; See Table 4 and Supplementary Table S1), meaningful differences in the patterns of effects emerged across the three profiles, offering additional support for the 3-profile solution. Although the 2-profile solution is more parsimonious and supported by the VLMR-LRT, the 3-profile solution is supported by the IC, is conceptually interpretable with the third profile meaningfully extending the 2-profile solution, and contains sufficiently robust class proportions (i.e., 25%, 31%, and 44%). Recent simulation research has also supported the superiority of the BIC in class enumeration (Nylund-Gibson & Masyn, 2016). Therefore, we selected the 3-profile solution as the final model, supporting Hypothesis 1. Estimated entropy indicated that classrooms were well-classified by this solution (.90).

Also in line with Hypothesis 1, one of our profiles demonstrated higher ratings relative to other profiles in all domains (except Negative Climate), one demonstrated relatively lower

ratings, and the third demonstrated intermediate levels of interactional quality. Figure 2 illustrates each profile's estimated mean CLASS-S subdomain scores. The smallest profile, comprised of 25% of classrooms, included classrooms, on average, with high CLASS-S mean scores across the Classroom Organization subdomains and Student Engagement, and demonstrated middle-to-high scores of Emotional Support and Instructional Support. We refer to this profile as having "higher" teacher-student interactional quality relative to the other profiles. Conversely, the second largest profile comprised of 31% of classrooms was characterized by CLASS-S subdomain scores that fell primarily within the low-middle range and were descriptively lower than the means of the other two profiles. This profile included low-to-middle quality Instructional Support as well as middle-quality Emotional Support, Classroom Organization, and Student Engagement scores. We refer to this profile as having "lower" teacher-student interactional quality relative to the other profiles. Finally, the third and largest profile, characterizing 44% of classrooms, was comprised of middle-high scores of interactional quality. It is characterized by Emotional and Instructional Support scores that fall within the middle-quality range and high-quality Classroom Organization and Student Engagement scores. We refer to this profile as having "intermediate" teacher-student interactional quality relative to other profiles. Interestingly, all three profiles demonstrated similarly high ratings on the Negative Climate dimension, signifying that, on average, teachers in each profile did not engage in actions that fostered a negative classroom climate. All profiles also demonstrated the lowest average scores for the Analysis and Problem Solving dimension.

**Associations Between Interactional Quality Profiles and Covariates**

To facilitate the comparison across latent profiles and covariate relationships, Table 4 illustrates the results of this analysis using either the "higher" or "lower" interactional quality

profile as the comparison group. Negative logit values and odds ratios below 1 indicated that for a given covariate, classrooms were more likely to be categorized in the teacher-student interactional quality reference profile than the comparison profile when associations were significant ($p < .05$). We found several statistically significant associations between teacher characteristics, classroom characteristics, and school compositional factors and teacher-student interactional quality profiles. Below, results are discussed in sequence for each covariate type.

### *Teacher Characteristics*

Hypothesis 2 was not supported by our findings. Results showed that classrooms taught by early career teachers were less likely to be characterized by the "lower" (odds ratio [OR] = 0.31) than the "higher" student-teacher interactional quality profile. In other words, classrooms taught by early career teachers were more than 3 times more likely (i.e., 1/0.31 = 3.23) to be characterized as having the "higher" (versus "lower") interactional quality profile. Early career teachers were also 3.75 times (OR = 3.75) more likely to be in the "intermediate" quality profile than the "lower" quality profile. The odds that teachers were observed demonstrating "intermediate" interactional quality compared to "higher" interactional quality was 1.81 times higher for teachers reporting greater teacher affiliation (i.e., 1 point higher on the Likert scale). No significant differences were observed in teachers' behavior management self-efficacy across profiles or for teacher affiliation among other profiles.

### *Classroom Characteristics*

Hypothesis 3 was largely supported by our findings. Classrooms with larger student-to-teacher ratios were more likely to be characterized by the "lower" quality profile than the "higher" or "intermediate" quality profiles. For every one-unit increase in student-to-teacher ratio, the odds of a classroom being in the "lower" quality profile was 1.10 times greater than

being in the "higher" quality profile and the odds of being in the "intermediate" quality profile were 0.93 times lower than being in the "lower" quality profile. Classrooms with higher student cooperation were more likely to be in the "higher" quality profile compared to the "intermediate" and "lower" quality profiles, such that for every one-unit increase in student cooperation score, classrooms were 100 (i.e., 1/0.01 where 0.01 is OR for "lower" quality) times more likely to be in the "higher" than "lower" quality profile and 6.67 times (i.e., 1/0.15 where 0.15 is OR for "intermediate") more likely to be in the "higher" than "intermediate" quality profile. Classrooms with higher student cooperation scores were also 17.67 times more likely to be in the "intermediate" than the "lower" profile. Similarly, classrooms with higher rates of student disruptive behaviors were 7.69 times (i.e., 1/0.13 where 0.13 is OR for "intermediate") more likely to be characterized by the "lower" than the "intermediate" interactional quality profile.

***School Compositional Factors***

With respect to school compositional factors, Hypothesis 4 was largely unsupported by our findings. Only regional designation and percentage of students receiving out-of-school suspensions were significantly associated with teacher-student interactional quality profiles. Relative to classrooms in suburban schools, classrooms in rural fringe schools were 50 times (i.e., 1/0.02 where 0.02 is the OR for "lower") more likely to be characterized by the "higher" teacher-student interactional quality profile than the "lower" quality profile and 8.33 times (i.e., 1/0.12 where 0.12 is the OR for "intermediate") more likely to be in the "higher" than the "intermediate" quality profile. Similarly, relative to classrooms in suburban schools, classrooms in rural fringe schools were 7.12 times more likely to be in the "intermediate" interactional quality profile than the "lower" interactional quality profile. Finally, for every one-unit increase in percentage of out-of-school suspensions, classrooms were 1.10 times more likely to be in the

"lower" quality profile than the "higher" quality profile. All other school compositional characteristics did not significantly vary across teacher-student interactional quality profiles.

## Discussion

The current study aimed to identify latent profiles of teacher-student interactional quality and determine the teacher characteristics, classroom characteristics, and school compositional factors related to these profiles using self-report and observational data for a large sample of middle school classrooms. Three LPA profiles, characterized by classrooms with teacher-student interactional quality that was comparatively lower, intermediate, and higher across domains of Emotional Support, Classroom Organization, Organizational Support, and Student Engagement, were identified. Our three-profile solution supported Hypothesis 1 and aligned with findings of a previous CLASS study using a latent profile analysis that found three profiles (Hoang et al., 2019), but diverged slightly from the other CLASS studies that identified 4 interactional quality profiles (Halpin & Kieffer, 2015; Hu et al., 2016; Salminen et al., 2012; Virtanen et al., 2019). All profiles displayed relatively higher mean scores in their Classroom Organization domains and Student Engagement dimension and lower mean scores in their Emotional Support and Instructional Support domains. Competencies associated with more advanced levels of Emotional and Instructional Support domains, such as Regard for Adolescent Perspectives, Analysis and Problem Solving, Quality of Feedback, and Instructional Dialogue, served as areas in relative need of improvement for teachers across profiles. These interactional strengths and weaknesses align with those found in previous studies that employed the CLASS-S within a U.S. secondary teacher sample (Grades ranging from 6 to 12; Allen et al., 2013; Halpin & Kieffer, 2015).

Addressing Research Questions 2–4, results revealed multiple associations between profiles and teacher, classroom, and school compositional factors. Namely, classrooms characterized by the "higher" and the "intermediate" quality profiles were more likely to be taught by early career teachers, to have higher rates of student cooperation, and to be in rural-fringe schools than were classrooms with "lower" teacher-student interactional quality. Compared to classrooms with "intermediate" interactional quality, classrooms with "higher" interactional quality were also more likely to have higher rates of student cooperation and to be in rural-fringe schools. Conversely, classrooms characterized by the "lower" interactional quality profile were more likely to have higher student-to-teacher ratios compared to all other classrooms, higher rates of student disruptive behaviors compared to classrooms in the "intermediate" quality profile, and a greater percentage of out-of-school suspensions compared to classrooms in the "higher" quality profile. Below, we expand on findings at each (teacher, classroom, school) level.

**Teacher Characteristics in Relation to Interactional Quality Profiles**

Findings showed that only early career status and teacher affiliation were related to interactional quality profiles; however, both were associated in a different direction than hypothesized (Hypothesis 2). Considering past studies, we expected that teachers with less experience may be less effective (Braun et al., 2019; Sullivan et al., 2019; Virtanen et al., 2018) or just as effective (Graham et al., 2020), but not more effective, in the classroom than more veteran teachers with respect to interactional quality. It is possible that our sample of "early career" teachers added a fresh set of knowledge and skills conducive to more supportive teacher-student interactions than more experienced teachers within these contexts. More research is needed to confirm or replicate this finding, especially considering that our conceptualization of

early career status as it applies to teachers' years of experience at their current school is unique in the research literature.

Our finding related to teacher affiliation was also contrary to expectations based on literature that illustrates the social-emotional importance of positive and collegial relationships for teachers (Jennings & Greenberg, 2009; Lee et al., 2011; Van Maele & Van Houtte, 2011). Perhaps our measure of teacher affiliation, which mostly included items pertaining to how teachers feel about their colleagues, was less attuned to teachers' relational sentiments towards their students. Whatever the interpretation, future investigation would help edify the relation between teacher affiliation and teacher-student interactional quality.

No significant differences were observed in teachers' behavior management self-efficacy across profiles. This result runs counter to a previous study using the CLASS-S, which found a positive association between classroom management efficacy and interactional quality (Virtanen et al., 2018). It also runs counter to a robust literature base that documents the importance of teachers' behavior management efficacy on numerous social-emotional processes within the classroom, such as effective classroom management strategies, close, sensitive, and responsive relationship practices with students, and teacher well-being (Dicke et al., 2014; Guo et al., 2012). Likewise, since the state of the literature investigating relations between interactional quality and teacher characteristics is still nascent, the relations between this construct and aspects of teacher-student interactions in particular warrants further study.

**Classroom Characteristics in Relation to Interactional Quality Profiles**

Results demonstrated that the classroom characteristics we investigated related to interactional quality profiles in the hypothesized directions (Hypothesis 3). Classrooms with incrementally higher interactional quality profiles (i.e., "higher" in comparison to "intermediate,"

"intermediate" in comparison to "lower") were characterized by higher rates of cooperative student behaviors, whereas classrooms with higher rates of student disruptive behaviors were more likely to be characterized by the "lower" (in comparison to "intermediate") interactional quality profile. The associations between both types of student behaviors, in comparison to other covariates, and interactional quality were particularly strong. These findings also support the connection within the teacher-student relationship literature between lower rates of student disruptive behaviors and/or problem behaviors (e.g., externalizing behaviors such as acting out or aggression) and stronger teacher-student relationships (Duong et al., 2019; Jerome et al., 2009; Quin, 2016). More frequent student disruptions and difficult behaviors may contribute to more frequent teacher-student conflict, which in turn may reduce teachers' capacity to provide adequate emotional and instructional support and organize the classroom effectively. Conversely, when students engage in cooperative and on-task behaviors, teachers may be able to devote more time and energy to such tasks.

It is also important to note, however, that because these data are cross-sectional, we cannot determine if students' cooperative behaviors contributed to higher teacher-student interactions or the reverse. Our study's purpose was to illustrate classroom conditions associated with higher levels of interactional quality, and these findings inform how to promote these conditions via teacher actions. Teachers, through their demonstration of social and emotional competence, play an instrumental role in proactively establishing a prosocial classroom context conducive to student cooperation and that prevents and/or defuses disruptions (Jennings & Greenberg, 2009). Longitudinal research which documents the reciprocal influence of student behavior and positive teacher-student interactions over time is needed.

Larger student-to-teacher ratios were more likely to be characterized by the "lower" quality profile than the "higher" or "intermediate" quality profiles. This finding aligns with existing literature that has found an association between smaller class size and higher Emotional Support in sixth grade classrooms (Virtanen et al., 2018), as well as studies that have detailed the connections between teacher-child ratio and classroom quality within early childhood educational settings (Barnett et al., 2003; Bowne et al., 2017). The supportive teacher-student interactions fostered by classrooms with smaller student-to-teacher ratios may have a special preventive role in middle school settings, especially considering the developmental vulnerability that students face as they experience multiple physiological and psychosocial transitions during early adolescence (Eccles & Roeser, 2011; Vollet et al., 2017). Further validation of the role of smaller student-to-teacher ratios in enriching teacher-student interactions may also inform school and district-level policies related to optimal conditions to maximize student achievement.

**School Compositional Factors in Relation to Interactional Quality Profiles**

Of the school compositional factors examined, only out-of-school suspension rate was associated with interactional quality profiles in the direction we hypothesized (Hypothesis 4). Specifically, in schools with higher suspension rates, classrooms were more likely to be in the "lower" quality profile than the "higher" quality profile. This finding supports a growing literature that posits that teacher-student relationships may suffer in school contexts characterized by more punitive and exclusionary disciplinary practices (Gregory et al., 2011). To foster a whole-school relational climate conducive to classroom-level positive teacher-student interactions, school staff may consider practices and policies to reduce suspensions.

Rural fringe schools were more likely to be characterized by the "higher" teacher-student interactional quality profile than the "intermediate" or "lower" quality profiles. Thus, the positive

association between rural fringe regional designation and higher interactional quality profiles ran counter to Hypothesis 4. This finding contrasts with previous research that has identified numerous contextual challenges confronting rural schools (Lamkin, 2006) that may adversely impact teacher-student interactions. Perhaps, in accordance with Bronfenbrenner and Morris's (2006) socioecological framework, specific features of the rural fringe school context positively impact the formative processes associated with interactional quality. Rural school settings are often institutions that connect generations of residents to a community and in which residents and educators take pride (McShane & Smarick, 2018). It is possible that such pride and connection to the community manifest in more trusting teacher-student relationships. Given the small sample size of rural fringe classrooms within our study, more research is necessary to investigate the relation between other rural school contexts and teacher-student interactions.

Contrary to our hypothesis, the other school compositional factors we examined (i.e, school size, percentage of socioeconomically disadvantaged students, percentage of Black and Latinx students, and past reading achievements) were not significantly associated with interactional quality profiles. Especially surprising is that percentage of socioeconomically disadvantaged students and interactional quality profiles were not associated, given the findings reported by Hu et al. (2016) and LoCasale-Crouch (2007) whereby higher proportions of student poverty and other contextual markers of socioeconomic disadvantage in early childhood settings were associated with lower quality CLASS profiles. It was also surprising that compositional factors like school size, percentages of Black and Latinx students, and student reading proficiency did not significantly relate to profiles of interactional quality profiles, as past research suggests they may relate to teacher-student interactions (Goddard et al., 2009; Jerome et al., 2009; Van Maele & Van Houtte, 2011). Larger school sizes, lower rates of students who

meet academic standards, and higher rates of students who experience sociocultural marginalization (i.e., Black and Latinx students), are typically factors that adversely impact a school's relational climate.

**Limitations and Future Directions**

Despite this study's numerous strengths, especially its inclusion of 334 teachers across 41 schools and use of multiple data sources (e.g., self-reports, classroom observational measures, school-level data), certain limitations merit consideration. The data were cross-sectional in nature and represent a snapshot in time of interactional quality and various associated factors. Given the dynamic nature of educational contexts in which classroom and broader school conditions change over time, longitudinal data collection of teacher characteristics, classroom, and school characteristics could better account for these conditions and their relations to teacher-student interactions over time. Additionally, we investigated myriad variables in relation to interactional quality, but such correlational data cannot be justifiably used to support causal inferences between these variables and interactional quality.

Furthermore, in detailing the complex and multi-directional interactional processes that transpire within a classroom (Jennings & Greenberg, 2009), the teacher and classroom characteristics we found to be significant (i.e., student cooperative behaviors, student disruptive behaviors, and early career status) in relation to our interactional quality profiles can only tell us so much. There remain unanswered questions regarding whether and how student cooperative behaviors or disruptions set the tone for higher interactional quality or are the result of interactions, as well as how reciprocal influences emerge over time. We still have much to learn about how characteristics of teachers (e.g., levels of burnout, their professional supports) and their students influence each other (e.g., how social identities like race, gender, and age impact

interactional processes). To adequately answer these important questions, a more process-based methodology and collection of more data related to teachers' and students' experiences and social identities (e.g., racial/ethnic identity) is needed. Future research might explore aspects of these experiences, such as teacher burnout and professional support, and student-teacher congruity in social identities, and how these factors impact teacher-student interactions.

Our study's sampling of rural schools presents another limitation. Our finding that classrooms within rural fringe schools are more likely characterized as having "higher" interactional quality should be considered cautiously. In comparison to the number of urban ($n$ = 26) and suburban ($n$ = 13) schools sampled, the number of rural fringe ($n$ = 2) schools was notably small. It is possible that our rural school sample included an unintentional over-selection of schools comprised of "higher" interactional quality classrooms when compared to schools with other regional designations. A larger and more representative sample of rural fringe schools is needed to determine the connection between this regional designation and interactional quality. Our findings may also differ among rural "distant" or "remote" schools, which are located a greater distance from urban areas than rural "fringe" schools (NCES, 2020). Including rural schools with "distant" or "remote" classifications would enrich future related research.

**Conclusions and Implications for School Psychologists**

This study investigated middle school interactional quality profiles and their correlates for the purpose of informing educational policies and interventions designed to foster positive teacher-student interactions. Our findings suggest novel opportunities for school psychologists to leverage their expertise to do so. School psychologists, with a diverse skillset that includes collecting data to identify student and teacher strengths and needs, implementation of evidence-based interventions to increase student engagement, and consultative skills that address

stakeholders' social-emotional and behavioral needs, are well positioned to promote interactional quality (National Association of School Psychologists [NASP], 2020). To promote interactional quality within their school contexts, school psychologists may consider providing teachers consultation to ensure effective implementation of class-wide behavior management strategies to manage disruptive behaviors while maximizing cooperative student behaviors (Shernoff et al., 2017). We found that teachers belonging to different profiles may have different starting points with respect to skill levels, suggesting the importance of differentiating interventions to optimize teachers' skill development. Given school psychologists' competencies in data collection, data-based decision making, and intervention selection and implementation, they may serve a role performing classroom observations using the CLASS-S, identifying culturally and developmentally appropriate evidence-based interventions to enhance interactional quality, and implementing them within schools and districts (NASP, 2020); the profiles found in our study suggest potential targets for intervention. As one example, the MyTeachingPartner-Secondary (MTP-S) coaching model utilizes the CLASS-S as a basis for observational data, feedback, intervention suggestions, and progress monitoring, to drive teacher knowledge and skill development in bolstering teacher-student interactions (Allen et al., 2013; Gregory et al., 2017) using a scaffolded and individualized approach. MTP-S has also been found to be effective in promoting positive peer interactions, student behavioral engagement, and raising academic achievement (Allen et al., 2013; Gregory et al., 2017).

Interventions to increase teachers' Regard for Adolescent Perspectives, a relative weakness of our study's teacher population, may include strategies to increase content relevance and provide students with opportunities for leadership and autonomy, which are the knowledge and skills embedded within that subdomain (Pianta et al., 2012). School or district-level training

or policies may likewise seek to increase teachers' use of culturally relevant and inquiry-based (Aronson & Laughter, 2016; Pedaste et al., 2015) approaches to promote growth in this CLASS-S subdomain. However, interventions to promote Classroom Organization subdomains (i.e., Negative Climate, Behavior Management, Productivity), which serve as relative strengths for our sample's teachers, would not meet their most pressing interactional quality needs.

Lastly, the use of a strengths-based assessment, which includes an environmental scan of the supportive resources and developmental assets within the school environment, may serve well for the purposes of leveraging a school's compositional strengths (Jimerson et al., 2004). School psychologists may advocate for class-wide and school-wide practices or policies, such as restorative practices (as an alternative to out-of-school suspensions) or smaller student-to-teacher ratios, that foster a school climate conducive to supportive teacher-student interactions. When school psychologists have a more precise understanding of the relational strengths that contribute to higher interactional quality, perhaps they can cultivate these strengths in other school settings.

## References

Allen, J., Gregory, A., Mikami, A., Lun, J., Hamre, B., & Pianta, R. (2013). Observations of effective teacher-student interactions in secondary school classrooms: Predicting student achievement with the classroom assessment scoring system-secondary. *School Psychology Review*, *42*(1), 76–98. https://doi.org/10.1080/02796015.2013.12087492

Aronson, B., & Laughter, J. (2016). The theory and practice of culturally relevant education: A synthesis of research across content areas. *Review of Educational Research*, *86*(1), 163–206. https://doi.org/10.3102/0034654315582066

Asparouhov, T., & Muthén, B. (2014). Auxiliary variables in mixture modeling: Three-step approaches using M plus. *Structural Equation Modeling*, *21*(3), 329–341. https://doi.org/10.1080/10705511.2014.915181

Banfield, J. D., & Raftery, A. E. (1993). Model-based Gaussian and non-Gaussian clustering. *Biometrics, 49,* 803–821. https://dx.doi.org/10.2307/2532201

Barnett, W. S., Hustedt, J. T., Robin, K. B., & Schulman, K. L. (2003). *The state of preschool: 2003 preschool yearbook*. The National Association for Early Education Research.

Bowlby, J. (1969). *Attachment and loss*: vol. 1. *Attachment*. Basic Books.

Bowne, J. B., Magnuson, K. A., Schindler, H. S., Duncan, G. J., & Yoshikawa, H. (2017). A meta-analysis of class sizes and ratios in early childhood education programs: Are thresholds of quality associated with greater impacts on cognitive, achievement, and socioemotional outcomes? *Educational Evaluation and Policy Analysis*, *39*(3), 407–428. https://doi.org/10.3102/0162373716689489

Bozdogan, H. (1987). Model selection and Akaike's information criterion (AIC): The general

theory and its analytical extensions. *Psychometrika, 52,* 345–370. https://doi.org/10.1007/bf02294361

Bradshaw, C. P., Pas, E. T., Bottiani, J. H., Debnam, K. J., Reinke, W. M., Herman, K. C., & Rosenberg, M. S. (2018). Promoting cultural responsivity and student engagement through double check coaching of classroom teachers: An efficacy study. *School Psychology Review*, *47*(2), 118–134. https://doi.org/10.17105/SPR-2017-0119.V47-2

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school, expanded edition.* National Academies Press.

Braun, S. S., Roeser, R. W., Mashburn, A. J., & Skinner, E. (2019). Middle school teachers' mindfulness, occupational health and well-being, and the quality of teacher-student interactions. *Mindfulness*, *10*(2), 245–255. https://doi.org/10.1007/s12671-018-0968-2

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology, Vol. 1: Theoretical models of human development* (6th ed., pp. 793–828). Wiley.

Bryan, J., Williams, J. M., & Griffin, D. (2020). Fostering educational resilience and opportunities in urban schools through equity-focused school–family–community partnerships. *Professional School Counseling*, *23*(1 part 2), 1–14. https://doi.org /10.1177/2156759X19899179

Clark, S. L., & Muthén, B. (2009). *Relating latent class analysis results to variables not included in the analysis*. http://www.statmodel.com/download/relatinglca.pdf

Collins, L. M., & Lanza, S. T. (2009). *Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences* (Vol. 718). John Wiley & Sons.

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. R. Gunnar & L. A. Sroufe (Eds.), *Self process and development: The Minnesota symposia on child development* (Vol. 23, pp. 43–77). Erlbaum.

Curby, T. W., Rimm-Kaufman, S. E., & Ponitz, C. C. (2009). Teacher-child interactions and children's achievement trajectories across kindergarten and first grade. *Journal of Educational Psychology*, *101*(4), 912–925. https://doi.org/10.1037/a0016647

Davis, H. A. (2003). Conceptualizing the role and influence of student-teacher relationships on children's social and cognitive development. *Educational Psychologist*, *38*(4), 207–234. https://doi.org/10.1207/S15326985EP3804_2

Dawes, M., Farmer, T., Hamm, J., Lee, D., Norwalk, K., Sterrett, B., & Lambert, K. (2020). Creating supportive contexts for early adolescents during the first year of middle school: Impact of a developmentally responsive multi-component intervention. *Journal of Youth and Adolescence*, *49*(7), 1–17. https://doi.org/10.1007/s10964-019-01156-2

De Boer, H., Timmermans, A. C., & Van Der Werf, M. P. (2018). The effects of teacher expectation interventions on teachers' expectations and student achievement: narrative review and meta-analysis. *Educational Research and Evaluation*, *24*(3-5), 180–200. https://doi.org/10.1080/13803611.2018.1550834

Dicke, T., Parker, P. D., Marsh, H. W., Kunter, M., Schmeck, A., & Leutner, D. (2014). Self-efficacy in classroom management, classroom disturbances, and emotional exhaustion: A moderated mediation analysis of teacher candidates. *Journal of Educational Psychology, 106*(2), 569–583. https://doi.org /10.1037/a0035504

Duong, M. T., Pullmann, M. D., Buntain-Ricklefs, J., Lee, K., Benjamin, K. S., Nguyen, L., &

Cook, C. R. (2019). Brief teacher training improves student behavior and student–teacher relationships in middle school. *School Psychology*, *34*(2), 212–221. https://doi.org/10.1037/spq0000296

Eccles, J. S., & Roeser, R. W. (2011) Schools as developmental contexts during adolescence. *Journal of Research on Adolescence, 21*, 225–241. https://doi.org/10.1111/j.1532-7795.2010.00725.x

Emmer, E. T., & Stough, L. M. (2001). Classroom management: A critical part of educational psychology, with implications for teacher education. *Educational Psychologist*, *36*(2), 103–112. https://doi.org/10.1207/S15326985EP3602_5

Goddard, R. D., Salloum, S. J., & Berebitsky, D. (2009). Trust as a mediator of the relationship between poverty, racial composition, and academic achievement. *Educational Administration Quarterly*, *45*, 292–311. https://doi.org/10.1177/0013161X08330503

Good, T. L., & Brophy, J. E. (2008). *Looking in classrooms* (10th ed.). Pearson Allyn & Bacon.

Graham, L. J., White, S. L., Cologon, K., & Pianta, R. C. (2020). Do teachers' years of experience make a difference in the quality of teaching? *Teaching and Teacher Education*, *96*, 103190.

Gregory, A., Cornell, D., & Fan, X. (2011). The relationship of school structure and support to suspension rates for black and white high school students. *American Educational Research Journal, 48*, 904–934. https://doi.org/10.3102/0002831211398531

Gregory, A., Ruzek, E., Hafen, C. A., Mikami, A. Y., Allen, J. P., & Pianta, R. C. (2017). My Teaching Partner-Secondary: A video-based coaching model. *Theory into Practice*, *56*(1), 38–45. https://doi.org/10.1080/00405841.2016.1260402

Guo, Y., Connor, C. M., Yang, Y., Roehrig, A. D., & Morrison, F. J. (2012). The effects of teacher qualifications, teacher self-efficacy and classroom practices on fifth graders' reading outcomes. *The Elementary School Journal, 113*, 3–24. https://doi.org/10.1086/665816

Hagenaars, J. A., & McCutcheon, A. L. (Eds.). (2002). *Applied latent class analysis*. Cambridge University Press.

Halpin, P. F., & Kieffer, M. J. (2015). Describing profiles of instructional practice: A new approach to analyzing classroom observation data. *Educational Researcher*, *44*(5), 263–277. https://doi.org/10.3102/0013189X15590804

Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development*, *72*(2), 625–638. https://doi.org/10.1111/1467-8624.00301

Hamre, B. K., Pianta, R. C., Downer, J. T., DeCoster, J., Mashburn, A. J., Jones, S. M., Brown, J. L., Cappella, E., Atkins, M., Rivers, S. E., Brackett, M. A., Hamagami, A. (2013). Teaching through interactions: Testing a developmental framework of teacher effectiveness in over 4,000 classrooms. *The Elementary School Journal*, *113*(4), 461–487. https://doi.org/10.1086/669616

Hattie, J. (2009). *Visible learning. A synthesis of 800 meta-analyses relating to achievement*. Routledge.

Hoang, N., Holopainen, L., & Siekkinen, M. (2019). Classroom quality profiles and associations with children's classroom engagement in Vietnamese kindergartens. *Learning Environments Research*, *22*(2), 193–208. https://doi.org/10.1007/s10984-018-9273-1

Hoy, W. K. , & Tarter, C. J. (1997). *The road to open and healthy schools: The handbook for*

*change*. Thousand Oaks, CA: Corwin.

Hoy, W. K., & Woolfolk A. E., (1993). Teachers' sense of efficacy and the organizational health of schools. *The Elementary School Journal, 93*(4), 355–372. https://doi.org /10.1086/461729

Hu, B. Y., Fan, X., LoCasale-Crouch, J., Chen, L., & Yang, N. (2016). Profiles of teacher-child interactions in Chinese kindergarten classrooms and the associated teacher and program features. *Early Childhood Research Quarterly*, *37*, 58–68. https://doi.org/10.1016/j.ecresq.2016.04.002

Jacob, B. A. (2007). The challenges of staffing urban schools with effective teachers. *The Future of Children*, 129–153. https://doi.org/10.1353/foc.2007.0005

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, *79*(1), 491–525. https://doi.org/10.3102/0034654308325693

Jerome, E. M., Hamre, B. K., & Pianta, R. C. (2009). Teacher-child relationships from kindergarten to sixth grade: Early childhood predictors of teacher-perceived conflict and closeness. *Social Development, 18*, 915–945. https://doi.org/10.1111/j.1467-9507.2008.00508.x

Jimerson, S. R., Sharkey, J. D., Nyborg, V., & Furlong, M. J. (2004). Strength-based assessment and school psychology: A summary and synthesis. *The California School Psychologist*, *9*(1), 9–19. https://doi.org/10.1007/BF03340903

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). The Guilford Press.

Klusmann, U., Kunter, M., Trautwein, U., Lüdtke, O., & Baumert, J. (2008). Teachers'

occupational well-being and quality of instruction: The important role of self-regulatory patterns. *Journal of Educational Psychology, 100*(3), 702–715. https://doi.org/10.1037/0022-0663.100.3.702

Lamkin, M. L. (2006). Challenges and changes faced by rural superintendents. *Rural Educator*, *28*(1), 17–24. https://doi.org/10.35608/ruraled.v28i1.486

Lee, J. C. K., Zhang, Z., & Yin, H. (2011). A multilevel analysis of the impact of a professional learning community, faculty trust in colleagues and collective efficacy on teacher commitment to students. *Teaching and Teacher Education*, *27*(5), 820–830. https://doi.org/10.1016/j.tate.2011.01.006

LoCasale-Crouch, J., Konold, T., Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D., & Barbarin, O. (2007). Observed classroom quality profiles in state-funded pre-kindergarten programs and associations with teacher, program, and classroom characteristics. *Early Childhood Research Quarterly*, *22*(1), 3–17. https://doi.org/10.1016/j.ecresq.2006.05.001

Malmberg, L. E., Hagger, H., Burn, K., Mutton, T., & Colls, H. (2010). Observed classroom quality during teacher education and two years of professional practice. *Journal of Educational Psychology*, *102*(4), 916–932. https://doi.org/10.1037/a0020920

Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., Burchinal, M., Early, D. M., & Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development*, *79*(3), 732–749. https://doi.org/10.1111/j.1467-8624.2008.01154.x

Masyn, K. E. (2013). Latent class analysis and finite mixture modeling. In T. D. Little (Ed.), *The*

*Oxford handbook of quantitative methods* (pp. 551–611). Oxford University Press.

McHugh, M. L. (2012). Interrater reliability: the kappa statistic. *Biochemia medica*, *22*(3), 276-282. https://www.biochemia-medica.com/en/journal/22/3/10.11613/BM.2012.031

McShane, M. Q., & Smarick, A. (2018). *No longer forgotten: The triumphs and struggles of rural education in America*. Rowman & Littlefield Publishers, Inc.

Muthén, B. (2003). Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran (2003). *Psychological Methods, 8*, 369–377. https://doi.org/10.1037/1082-989X.8.3.369

Muthén, B. O. (2004). Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In D. Kaplan (Ed.), *The SAGE handbook of quantitative methodology for the social sciences* (pp. 345–368). Sage.

Muthén, L. K., & Muthén, B. O. (1997–2017). *Mplus user's guide*. Muthén and Muthén.

National Association of School Psychologists (2020). *NASP 2020 Domains of Practice.* NASP 2020 Professional Standards Adopted. https://www.nasponline.org/standards-and-certification/nasp-2020-professional-standards-adopted/nasp-2020-domains-of-practice

National Center for Education Statistics. (2020). *School directory information for the 2019-2020 school year.* U.S. Department of Education, National Center for Education Statistics. https://nces.ed.gov/ccd/schoolmap/

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling*, *14*(4), 535–569. https://doi.org/10.1080/10705510701575396

Nylund-Gibson, K., & Choi, A. Y. (2018). Ten frequently asked questions about latent class analysis. *Translational Issues in Psychological Science, 4*(4), 440. https://doi.org/10.1037/tps0000176

Nylund-Gibson, K., Grimm, R., Quirk, M., & Furlong, M. (2014). A latent transition mixture model using the three-step specification. *Structural Equation Modeling, 21,* 439–454. http://dx.doi.org/10.1080/10705511.2014.915375

Nylund-Gibson, K., & Masyn, K. E. (2016). Covariates and Mixture Modeling: Results of a Simulation Study Exploring the Impact of Misspecified Effects on Class Enumeration. *Structural Equation Modeling, 23*(6), 782–797. https://doi.org/10.1080/10705511.2016.1221313

Osher, D., Kendziora, K., Spier, E., & Garibaldi, M. L. (2014). School influences on child and youth development. In *Defining prevention science* (pp. 151–169). https://doi.org/10.1007/978-1-4899-7424-2_7

Page, T. J., & Iwata, B. A. (1986). Interobserver agreement: History, theory, and current methods. In A. D. Poling & R. W. Fuqua (Eds.), *Research methods in applied behavior analysis: Issues and advances* (pp. 99–126). Plenum.

Pas, E. T., Cash, A. H., O'Brennan, L., Debnam, K. J., & Bradshaw, C. P. (2015). Profiles of classroom behavior in high schools: Associations with teacher behavior management strategies and classroom composition. *Journal of School Psychology, 53,* 137–148. https://doi.org/10.1016/j.jsp.2014.12.005

Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T., Manoli, C.

C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Pianta, R.C., Hamre, B., & Mintz, S. L. (2012). *The CLASS-Secondary manual.* University of Virginia.

Pianta, R. C., Mashburn, A. J., Downer, J. T., Hamre, B. K., & Justice, L. (2008). Effects of web-mediated professional development resources on teacher-child interactions in pre-kindergarten classrooms. *Early Childhood Research Quarterly*, *23*(4), 431–451. https://doi.org/10.1016/j.ecresq.2008.02.001

Ponitz, C. C., Rimm-Kaufman, S. E., Brock, L. L., & Nathanson, L. (2009). Early adjustment, gender differences, and classroom organizational climate in first grade. *The Elementary School Journal*, *110*(2), 142–162. https://doi.org/10.1086/605470

Quin, D. (2016). Longitudinal and contextual associations between teacher-student relationships and student engagement: A systematic review. *Review of Educational Research*, *87*(2), 345–387. https://doi.org/10.3102/0034654316669434

Rusby, J. C., Crowley, R., Sprague, J., & Biglan, A. (2011). Observations of the middle school environment: The context for student behavior beyond the classroom. *Psychology in the Schools*, *48*(4), 400–415. https://doi.org/10.1002/pits.20562

Rusby, J. C., Taylor, T. K., & Milchak, C. (2001). *Assessing school settings: Interactions of students and teachers*. Oregon Research Institute.

Salminen, J., Lerkkanen, M.-K., Poikkeus, A.-M., Pakarinen, E., Siekkinen, M., Hannikainen, M., et al. (2012). Observed classroom quality profiles of kindergarten classrooms in Finland. *Early Education & Development, 23*(5), 654–677.

https://doi.org/10.1080/10409289.2011.574267

Schwartz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics*, *6*, 461–464. https://dx.doi.org/10.1214/aos/1176344136

Sclove, S. L. (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika, 52*(3), 333–343. https://doi.org/10.1007/bf02294360

Shernoff, E. S., Bearman, S. K., & Kratochwill, T. R. (2017). Training the next generation of school psychologists to deliver evidence-based mental health practices: Current challenges and future directions. *School Psychology Review*, *46*(2), 219–232. https://doi.org/10.17105/SPR-2015-0118.V46.2

Skibbe, L., Behnke, M., & Justice, L. M. (2004). Parental scaffolding of children's phonological awareness skills: Interactions between mothers and their preschoolers with language difficulties. *Communication Disorders Quarterly*, *25*(4), 189–203. https://doi.org/10.1177/15257401040250040401

Sorhagen, N. S. (2013). Early teacher expectations disproportionately affect poor children's high school performance. *Journal of Educational Psychology*, *105*(2), 465–477. https://doi.org /10.1037/a0031754

Spurk, D., Hirschi, A., Wang, M., Valero, D., & Kauffled, S. (2020). Latent profile analysis: A review and "how to" guide of its application within vocational behavior research. *Journal of Vocational Behavior, 120*, 103445. https://doi.org/10.1016/j.jvb.2020.103445

Sterba, S. K. (2016). Cautions on the use of multiple imputation when selecting between latent categorical versus continuous models for psychological constructs. *Journal of Clinical Child & Adolescent Psychology, 45*(2), 167–175. https://doi.org/10.1080/15374416.2014.958839

Sullivan, A., Johnson, B., & Simons, M. (Eds.). (2019). *Attracting and keeping the best teachers: Issues and opportunities* (Vol. 16). Springer.

Thys, S., & Van Houtte, M. (2016). Ethnic composition of the primary school and educational choice: Does the culture of teacher expectations matter? *Teaching and Teacher Education, 59*, 383–391. https://doi.org/10.1016/j.tate.2016.06.011

Van Maele, D., & Van Houtte, M. (2011). The role of teacher and faculty trust in forming teachers' job satisfaction: Do years of experience make a difference? *Teaching and Teacher Education*, *28*(6), 879–889. https://doi.org/10.1016/j.tate.2012.04.001

van der Pers, M., & Helms-Lorenz, M. (2019) Regional school context and teacher characteristics explaining differences in effective teaching behaviour of beginning teachers in the Netherlands. *School Effectiveness and School Improvement, 30*(2), 231–254. https://doi.org/10.1080/09243453.2019.1592203

Vermunt, J. K. (2010). Latent class modeling with covariates: Two improved three-step approaches. *Political Analysis, 18,* 450–469. https://doi.org/10.1093/pan/mpq025

Virtanen, T. E., Lerkkanen, M. K., Poikkeus, A. M., & Kuorelahti, M. (2015). The relationship between classroom quality and students' engagement in secondary school. *Educational Psychology*, *35*(8), 963–983. https://doi.org/10.1080/01443410.2013.822961

Virtanen, T. E., Pakarinen, E., Lerkkanen, M. K., Poikkeus, A. M., Siekkinen, M., & Nurmi, J. E. (2018). A validation study of Classroom Assessment Scoring System-Secondary in the Finnish school context. *The Journal of Early Adolescence*, *38*(6), 849–880. https://doi.org/10.1177/0272431617699944

Virtanen, T. E., Vaaland, G. S., & Ertesvåg, S. K. (2019). Associations between observed patterns of classroom interactions and teacher wellbeing in lower secondary

school. *Teaching and Teacher Education*, *77*, 240–252. https://doi.org/10.1016/j.tate.2018.10.013

Vollet, J. W., Kindermann, T. A., & Skinner, E. A. (2017). In peer matters, teachers matter: Peer group influences on students' engagement depend on teacher involvement. *Journal of Educational Psychology*, *109*(5), 635–652. https://doi.org/10.1037/edu0000172

Vuong, Q. H. (1989). Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica, 57*, 307–333. https://doi.org/10.2307/1912557

Wang, M.-T., Brinkworth, M., & Eccles, J. (2013). Moderating effects of teacher-student relationship in adolescent trajectories of emotional and behavioral adjustment. *Developmental Psychology, 49*(4), 690–705. https://doi.org/10.1037/a0027916

Wasserman, L. (1997). *Bayesian model selection and model averaging*. Presented at Mathematical Psychology Symposium "Methods for Model Selection," Bloomington, IN.

**Table 1**

*Teacher Demographic Characteristics (N = 334)*

| Characteristic | *N* | *%* |
|---|---|---|
| Gender | | |
| Female | 240 | 71.9 |
| Male | 77 | 23.1 |
| Race or Ethnicity | | |
| Asian/Pacific Islander | 12 | 3.6 |
| Black/African American | 120 | 35.9 |
| Native American/American Indian | 1 | 0.3 |
| White | 160 | 47.9 |
| Latinx | 3 | 0.9 |
| Other | 19 | 5.7 |
| Age | | |
| 20-30 years | 82 | 24.6 |
| 31-40 years | 83 | 24.9 |
| 41-50 years | 66 | 19.8 |
| 51-60 years | 40 | 12 |
| 60+ years | 15 | 4.5 |
| Years at current school | | |
| 0-3 years | 171 | 51.2 |
| 4 or more years | 142 | 42.5 |
| Unknown | 21 | 6.3 |
| Subject area taught | | |
| Language arts | 83 | 24.9 |
| Math | 84 | 23.1 |
| Science | 81 | 24.3 |
| Social studies | 77 | 23.1 |
| Other | 6 | 1.8 |
| Grade taught | | |
| 6th grade | 120 | 35.9 |
| 7th grade | 98 | 29.3 |
| 8th grade | 23 | 6.9 |
| Mixed | 90 | 26.9 |
| Unknown | 6 | 1.8 |

**Table 2**

*Descriptive Statistics for Classroom and School Variables*

| Classroom Characteristics ($N$ = 334) | *M* | *SD* |
|---|---|---|
| Teacher affiliation with other teachers | 3.8 | 0.7 |
| Teacher behavior management self-efficacy | 3.5 | 0.8 |
| Student-to-teacher ratio | 19.9 | 5.8 |
| ASSIST global scales | | |
| Student cooperation | 2.7 | 0.7 |
| Student socially disruptive behaviors | 0.5 | 0.4 |
| CLASS-S | | |
| Emotional support | 13.2 | 2.3 |
| Positive climate | 4.8 | 0.9 |
| Teacher Sensitivity | 4.8 | 0.9 |
| Regard for adolescent perspectives | 3.6 | 1.0 |
| Classroom organization | 16.8 | 2.3 |
| Negative climate (R) | 6.5 | 0.6 |
| Behavior management | 5.2 | 1.0 |
| Productivity | 5.1 | 1.0 |
| Instructional support | 18.3 | 4.4 |
| Instructional learning formats | 4.3 | 0.9 |
| Content understanding | 4.0 | 1.0 |
| Analysis and problem solving | 2.9 | 1.1 |
| Quality of feedback | 3.7 | 1.1 |
| Instructional dialogue | 3.4 | 1.1 |
| Student engagement | 4.9 | 1.0 |
| **School Characteristics ($N$ = 41)** | ***M*** | ***SD*** |
| Total enrollment | 691.7 | 323.3 |
| % Black and Latinx students | 73.5 | 27.0 |
| % Students receiving FARMS | 54.5 | 18.3 |
| % Students meeting grade level reading expectations | 26.7 | 13.2 |
| % Suspension† | 13.7 | 11.7 |
| | *N* | *%* |
| Urban designation | 26 | 63.4 |
| Suburban designation | 13 | 31.7 |
| Rural-fringe designation | 2 | 4.8 |

*Note.* ASSIST = Assessing School Settings: Interactions of Students and Teachers. CLASS-S = Classroom Assessment Scoring System - Secondary. FARMS = Free and reduced-priced meals. The means for ASSIST global scales were on a scale of 0–4. The response range for CLASS-S was 1–7. †The suspension variable is calculated by dividing the total number of suspension events by total student enrollment.

**Table 3**

*Fit Statistics for Latent Profile Analysis of Teacher-Student Interactional Quality*

| Number of classes | npar | Log likelihood | BIC | ABIC | CAIC | AWE | VLMR-LRT *p* | Entropy | BF | cmP | Class Prevalence |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24 | -5445.09 | 11029.60 | 10953.51 | 11053.64 | 11241.10 | - | - | <.001 | <.001 | 1 |
| 2 | 37 | -4664.94 | 9544.89 | 9427.53 | 9581.89 | 9870.91 | **.014** | .92 | <.001 | <.001 | .41, .59 |
| 3 | 50 | -4403.17 | **9096.90** | **8938.30** | **9146.90** | 9537.46 | .120 | .90 | <.001 | <.001 | .25, .31, .44 |
| 4 | 63 | -4299.77 | 8965.64 | 8765.79 | 9028.64 | **9520.74** | .372 | .91 | <.001 | <.001 | .06, .23, .34, .37 |
| 5 | 76 | -4216.05 | 8873.75 | 8632.67 | 8949.75 | 9543.40 | .266 | .91 | <.001 | <.001 | .06, .08, .23, .31, .32 |
| 6 | 89 | -4165.70 | 8848.59 | 8566.27 | 8937.59 | 9632.78 | .740 | .89 | <.001 | **1.00** | .06, .09, .13, .16, .28, .29 |

*Note*. npar = number of parameters. BIC = Bayesian Information Criterion. ABIC = sample size adjusted BIC. CAIC = constant Akaike information criterion. AWE = approximate weight of equivalence. VLMR-LRT *p* = *p*-value of Vuong Lo Mendel Rubin likelihood ratio test. BF = bayes factor. cmP = correct model probability. Bolded values indicate preferred model for a given fit index.

**Table 4**

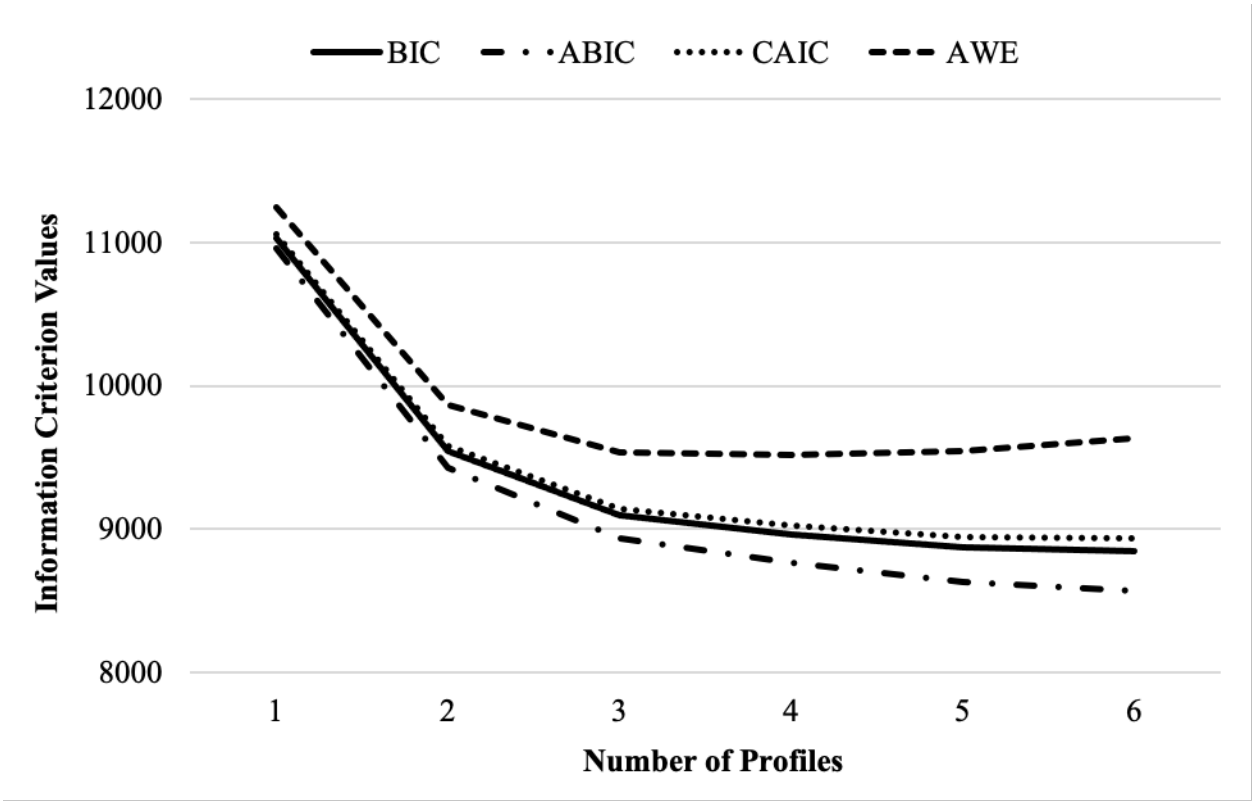
*Results of Multinomial Logistic Regression for the 3-Profile Model with Teacher Characteristics, Classroom Characteristics, and School Compositional Factors as Predictors*

| | Reference Profile | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Higher Interactional Quality | | | | Lower Interactional Quality | | | |
| Class/Effect | Logit | *p*-value | Odds Ratio | OR [95% CI] | Logit | *p*-value | Odds Ratio | OR [95% CI] |
| *Lower* | | | | | | | | |
| 0-3 years at School | -1.17 | **.042** | 0.31 | [0.10, 0.96] | | | | |
| Teacher Affiliation | 0.75 | .145 | 2.11 | [0.77, 5.78] | | | | |
| Teacher Efficacy | -0.22 | .523 | 0.80 | [0.41, 1.58] | | | | |
| Student-to-teacher Ratio | 0.09 | **.011** | 1.10 | [1.02, 1.18] | | | | |
| Student Cooperation | -4.80 | **<.001** | 0.01 | [0.002, 0.04] | | | | |
| Student Socially Disruptive Behaviors | 1.66 | .232 | 5.25 | [0.35, 79.97] | | | | |
| Enrollment | 0.00 | .565 | 1.00 | [1.00, 1.00] | | | | |
| % Students FARM | -0.06 | .098 | 0.94 | [0.88, 1.01] | | | | |
| Urban School | -0.15 | .896 | 0.86 | [0.09, 8.54] | | | | |
| Rural Fringe School | -4.09 | **<.001** | 0.02 | [0.002, 0.15] | | | | |
| % Proficient in Reading | -0.04 | .421 | 0.96 | [0.86, 1.06] | | | | |
| % Minoritized Students | 0.00 | .945 | 1.00 | [0.96, 1.04] | | | | |
| % Out-of-School Suspensions | 0.09 | **.041** | 1.10 | [1.00, 1.20] | | | | |
| *Intermediate* | | | | | | | | |
| 0-3 years at School | 0.15 | .668 | 1.16 | [0.59, 2.31] | 1.32 | **.002** | 3.75 | [1.66, 8.47] |
| Teacher Affiliation | 0.60 | **.013** | 1.81 | [1.14, 2.90] | -0.15 | .761 | 0.86 | [0.32, 2.31] |
| Teacher Efficacy | -0.21 | .537 | 0.81 | [0.42, 1.58] | 0.01 | .963 | 1.01 | [0.63, 1.63] |
| Student-to-teacher Ratio | 0.02 | .472 | 1.02 | [0.97, 1.08] | -0.07 | **.021** | 0.93 | [0.88, 0.99] |
| Student Cooperation | -1.93 | **<.001** | 0.15 | [0.05, 0.42] | 2.87 | **<.001** | 17.67 | [5.51, 56.68] |
| Student Socially Disruptive Behaviors | -0.38 | .712 | 0.68 | [0.09, 5.24] | -2.04 | **.019** | 0.13 | [0.02, 0.72] |
| Enrollment | 0.00 | .137 | 1.00 | [1.00, 1.00] | 0.00 | .840 | 1.00 | [1.00, 1.00] |
| % Students FARM | -0.03 | .330 | 0.97 | [0.92, 1.03] | 0.03 | .118 | 1.03 | [0.99, 1.07] |
| Urban School | -0.29 | .694 | 0.75 | [0.18, 3.12] | -0.13 | .857 | 0.88 | [0.21, 3.69] |
| Rural Fringe School | -2.13 | **<.001** | 0.12 | [0.04, 0.36] | 1.96 | **.030** | 7.12 | [1.21, 41.98] |
| % Proficient in Reading | -0.05 | .194 | 0.95 | [0.88, 1.03] | -0.01 | .873 | 0.99 | [0.92, 1.08] |
| % Minoritized Students | -0.01 | .656 | 0.99 | [0.96, 1.03] | -0.01 | .604 | 0.99 | [0.97, 1.02] |
| % Out-of-School Suspensions | 0.04 | .172 | 1.04 | [0.99, 1.09] | -0.06 | .076 | 0.95 | [0.89, 1.01] |

*Note.* FARM - Free & Reduced Meals. Bolded values indicate $p < .05$

**Figure 1**

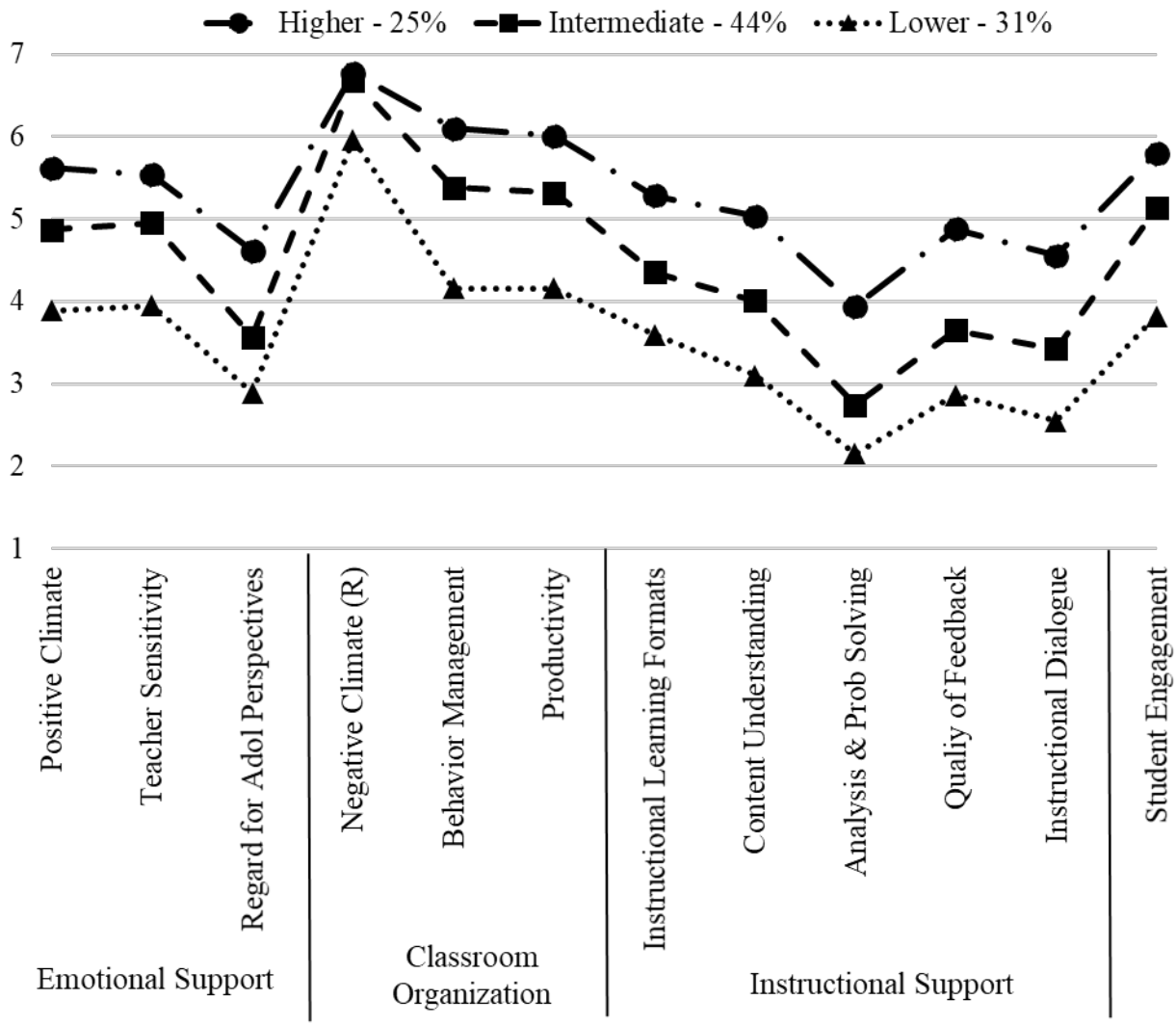
*Scree plot of BIC, ABIC, CAIC, and AWE values for LPA Models with 1-6 Latent Profiles*




*Note.* BIC = Bayesian Information Criterion. ABIC = sample size adjusted BIC. CAIC = constant Akaike information criterion. AWE = approximate weight of equivalence.

**Figure 2**

*Estimated Means of the Three-Profile Solution of Teacher-Student Interactional Quality*



Supplementary Tables and Figures

**Figure S1**

*Estimated Means of the Two-Profile Solution of Teacher-Student Interactional Quality*

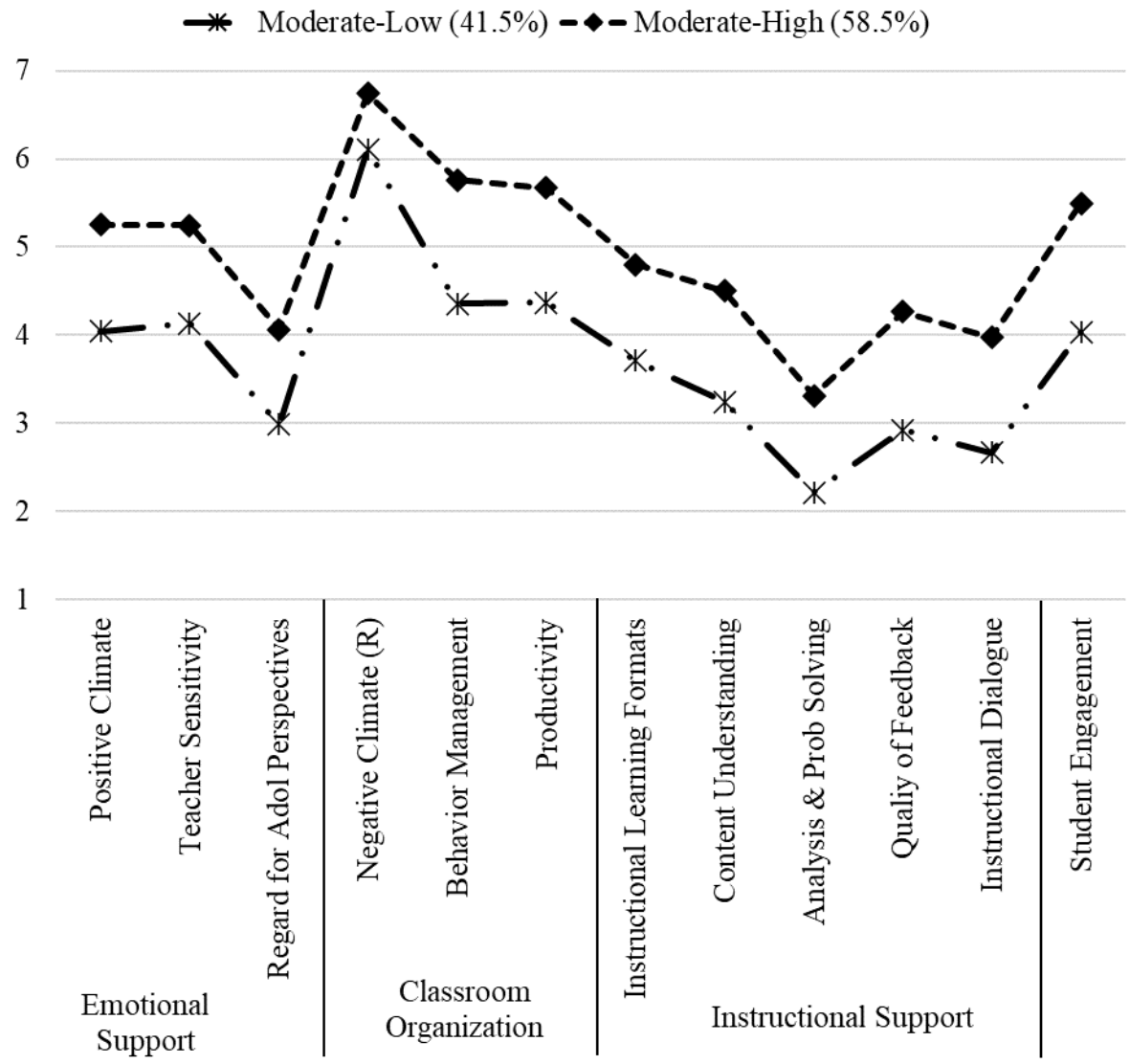



**Table S1**

*Results of Multinomial Logistic Regression for the 2-Profile Model with Teacher Characteristics, Classroom Characteristics, and School Compositional Factors as Predictors Using the Moderate-High Profile as the Reference Profile*

| Class/Effect | Logit | *p*-value | Odds Ratio | OR [95% CI] |
|---|---|---|---|---|
| *Moderate-Low* | | | | |
| 0-3 years at School | -1.20 | **.037** | 0.30 | [0.10, 0.93] |
| Teacher Affiliation | 0.69 | .186 | 2.00 | [0.72, 5.60] |
| Teacher Efficacy | -0.20 | .451 | 0.82 | [0.49, 1.37] |
| Student to Teacher Ratio | 0.10 | **.001** | 1.11 | [1.04, 1.17] |
| Student Cooperation | -3.41 | **<.001** | 0.03 | [0.01, 0.11] |
| Student Socially Disruptive Behaviors | 1.31 | .125 | 3.71 | [0.69, 19.84] |
| Enrollment | 0.00 | .666 | 1.00 | [1.00, 1.00] |
| % Students FARM | -0.03 | .174 | 0.97 | [0.93, 1.01] |
| Urban School | 0.36 | .667 | 1.43 | [0.28, 7.26] |
| Rural Fringe School | -2.73 | **<.001** | 0.07 | [0.02, 0.26] |
| % Proficient in Reading | 0.01 | .786 | 1.01 | [0.94, 1.09] |
| % Minoritized Students | 0.01 | .577 | 1.01 | [0.98, 1.03] |
| % Out of School Suspensions | 0.08 | **.023** | 1.08 | [1.01, 1.16] |

*Note.* FARM - Free & Reduced Meals. Bolded values indicate $p < .05$