

# Associations Between Student Behavior, Teacher Practice Delivery and Teacher Student Relationships: An Integrative Data Analytic Approach

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## Research Article

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## Abstract

This study used integrative data analysis (IDA) to examine student teacher relationship profiles within student problem behavior, teacher delivered practices, and teacher-student relationships, and the influence of profiles on distal outcomes in early childhood and early elementary classrooms with students with or at risk for EBD. Typically, samples from these two age groups are considered separately, however, we use IDA procedures such as data harmonization to identify measures from three separate federally funded studies spanning ages (3-8) to examine these phenomena across these developmental ranges. Using an exploratory approach to latent profile analysis (LPA) and including Conflict, Closeness, Teacher Delivery of Practices, Social Skills, and Problem Behavior scores as indicators, we found significant evidence for the existence of four student teacher relationship profiles among our sample of 196 student-teacher dyads observed across three different datasets. These dyads roughly corresponded to what we describe as four different teacher-student interaction profiles: 1) Responsive, 2) Unresponsive, 3) Difficult, and 4) Challenging. Nearly 80 percent of dyads fell into profiles 1 or 3, with the remaining dyads split between profiles 2 and 4. Further, we found that profile membership did predict significant differences on most of the same measures observed at Time 2, in the Spring. Findings from the present study provide evidence that teacher student relationships in early childhood and elementary school classrooms are multifaceted and that transactional processes inherent in these relationships influence some outcomes at the end of the school year.

## Introduction

In early childhood programs and elementary school classrooms, the working relationship between a teacher and student<sup>[1]</sup> is an important factor in the learning environment that contributes to student success, fostering positive academic and social-emotional competencies (Pianta et al., 2012). High-quality relationships with teachers may be particularly important for students with, or at risk of emotional and behavioral disorders (EBD). Students with or at risk for EBD, on average, can have strained relationships with their teachers, which may contribute to cycles of problem behavior and continued relationship strain (Sutherland & Oswald, 2005). To illustrate, teacher-student interactions remained negative with disruptive students a year after externalizing behaviors were identified (Henricsson & Rydell, 2004). As such, these students may have more to gain from high quality relationships with teachers compared to their peers (Belsky, 1997; McGrath & Bergen, 2015). Given that approximately 12% of students display chronic problem behavior (e.g., disruptive behavior, inappropriate emotional responses, and defiance; Forness et al., 2012), unpacking the multifaceted nature of teacher-student working relationships will help elucidate avenues for support and intervention efforts for a large population of students.

Teacher-student working relationships are complex and multidimensional. Prior work demonstrates three key elements may underlie this construct: 1) student behavior (e.g., disruptive behavior; social skills); 2) teacher delivery of practices; and 3) teacher child closeness and conflict (Baker et al., 2008; Nurmi, 2012; Split et al., 2012). Most studies to date have used a variable-centered approach to examine how these dimensions are associated with student outcomes (e.g., Hamre & Pianta, 2001; Pianta & Stuhlman, 2004; Saft & Pianta, 2001; Sutherland et al., 2008). However, limitations inherent in variable-centered methods constrain our understanding about how these dimensions operate in conjunction with one another and cannot account for the fact that the dimensions may be uniquely organized, within teacher-student dyads, into profiles. Thus, three important issues remain unanswered by studies using these variable-centered methods. First, there is variability between- and within-teachers in their ability to deliver evidence-based teaching practices with high fidelity (i.e., frequently and thoroughly). This variability suggests some teachers are less consistent than others in navigating students' needs with responsiveness and support. Features of the student teacher relationship as well as characteristics of the student may contribute to this variation. Second, teacher-child closeness and teacher-child conflict are distinct constructs and as such do not always "move together" (Pianta, 1992); thus, it is important to consider how these two constructs operate in combination. Third, although students with or at risk for EBD often face social challenges, there is heterogeneity in the social experiences and skills of these students (Farmer et al., 2021). It may be that student problem behavior and social skills considered together contribute to characteristic profiles of student teacher working relationships and further enhance our understanding of these critical interactions.

Person-centered approaches are uniquely equipped to examine how combinations of teacher and student characteristics and teaching practices shape the working relationships of teacher-student dyads and influence student outcomes. The purpose of

this study was to examine profiles of working relationships between teachers and students with or at risk for EBD; specifically, we assess profiles based on teacher delivery of practices, teacher-student relationship quality, and student behavior and social skills. We also assess associations between profiles and outcomes measured six to seven months later. We leverage integrative data analysis (IDA) and combine samples of early childhood and early elementary classrooms to address our research questions. We focus on this developmental range because the links between teacher-student relationships and behavior problems are stronger in early childhood programs and among younger elementary school children compared to older children (Lei et al., 2016). Further, IDA provides the opportunity to combine samples from these two age groups to examine potential commonalities in profile patterns.

## **Theoretical Framework**

We ground this investigation in the transactional model, which outlines that child development is a product of dynamic associations between characteristics of a child and factors in their environment. Importantly, this model notes that these interactive systems are bi-directional, and that feedback between the systems can modify future associations (Chow et al., 2018; Sameroff & Mackenzie, 2003). In this study, we suspect that rates of teacher delivered practices may be associated with features of student behavior (e.g., disruptive behavior; social skills) and teacher-child closeness and conflict. We also anticipate that associations between these factors may modify distal outcomes, based in part on the ongoing reciprocal influences of teachers and students upon each other (Sutherland & Oswald, 2005).

## **Student Externalizing Behavior**

Teachers have long reported struggling to meet the needs of students who exhibit chronic problem behaviors. Specifically, teachers report that educating students with externalizing problem behaviors is one of the most difficult aspects of their job (Bushaw & Gallup, 2008; Gettinger et al., 1999; Maag, 2004). Externalizing behaviors can include aggression, defiance, and emotional regulation challenges, and by nature are disruptive to classroom processes (Schlein et al., 2013); as a result, students displaying these behaviors are often exposed to lower rates of teacher support (Sutherland & Oswald, 2005). Prior work documents low rates of positive teacher attention and daily interactions for students with chronic problem behavior (e.g., Van Acker et al., 1996; Wehby et al., 1995). This includes decreased rates of practices shown to prevent and mitigate problem behavior such as teacher praise, opportunities to respond, reviewing rules, and precorrecting problem behaviors before they occur (Carr, Taylor, & Robinson, 1991; Chow et al., 2020; Shores, Gunter, & Jack, 1993; Walker et al., 1998; Wehby et al., 1998). To illustrate, Sutherland and Wehby's (2001) review documented that rates of opportunities to respond in classrooms for students with EBD were alarmingly low.

Student externalizing behavior is also shown to influence the quality of teacher-student relationships (Sutherland & Oswald, 2005). In the extant literature, the quality of teacher-student relationships is largely characterized as either close or conflictual (Spilt et al., 2012). Closeness represents the degree of warmth, affinity, and rapport, whereas conflict describes the extent of discord or hostility. Teachers and students with or at risk for EBD are likely to develop conflictual and negative relationships (Buyse et al., 2008). These relationship patterns are likely to be maintained across the year, driven in part via transactional processes; with conflict between teachers and students further exacerbating externalizing student behavior which maintains or magnifies conflictual relationships (Carr et al., 1991; O'Connor et al., 2011).

## **Student Social Skills**

Evidence indicates that behavioral challenges and poor social skills co-exist in young students (Reijntjes et al., 2010). Students displaying externalizing behavior are particularly susceptible to elevated rates of social difficulties with peers (Normand et al., 2010). These difficulties include peer rejection (Sturaro, et al., 2011), likelihood of being involved in bullying as a target or perpetrator (Reijntjes et al., 2011), lack of social status (Hymel, et al., 1990), and peer exclusion (Gazelle & Ladd, 2003) and victimization (Hawker & Boulton, 2000). However, it is important to note there is heterogeneity in the peer difficulties of students who exhibit externalizing behavior. To illustrate, prior work described social subtypes of students with or at risk for EBD. Subtypes included: 1) *popular aggressive* students, with high ratings of externalizing problems and average to high ratings of popularity in their classroom; 2) *passive* students with low to average ratings on externalizing problems and are typically shy-withdrawn with

low social skills scores; and 3) *low adaptive* students, with low ratings in externalizing problems, low status in classroom social hierarchies, and risk of social isolation (Farmer et al., 2021). Each subtype is associated with peer difficulties and implications for future problem behavior (Farmer et al., 2021).

Although prior work suggests externalizing behavior is associated with conflictual relationships and reductions in teacher delivery of practices, associations may differ when considered in combination with social skills. For example, teachers report high levels of closeness with children displaying high levels of prosocial behavior (Nurmi, 2012). Teachers are also generally more tolerant of social immaturity (i.e., social withdrawal, lack of self-confidence) than they are of defiance (i.e., fighting, inattentiveness; Algozzine, Ysseldyke, Christenson, & Thurlow, 1983; Sugawara & Cunningham, 1988). Thus, students' externalizing behavior and social skills may work together to shape teachers' relationships and practice use with students. To illustrate, teachers may experience reductions in conflictual relationships with students who display externalizing problems but who are also socially skilled (e.g., popular aggressive subtype); however, teachers may still deliver evidence-based practices with these students in an effort to improve behavioral outcomes.

## Present Study

The purpose of this study is to leverage integrative data analysis (IDA) to examine student teacher relationship profiles within student problem behavior, teacher delivered practices, and teacher-student relationships, and the influence of profiles on distal outcomes in early childhood and early elementary classrooms with students with or at risk for EBD. Typically, samples from these two age groups are considered separately, however, we use IDA procedures such as data harmonization to identify measures from three separate federally funded studies spanning ages (3-8) to examine these phenomena across these developmental ranges. The field is still identifying the combination of factors that may shape student teacher working relationships. For example, despite the status of a teacher's relationship with a student, a teacher may use evidence-based practices often in effort to increase the likelihood of better outcomes. Alternately, some teachers may use fewer and/or less extensive evidence-based practices with a student but have a close teacher-student relationship that may influence student outcomes. To this end, our research questions assess the multiple combinations of these factors in teacher-student working relationships. Our research questions were:

1. Are there distinct profiles of student teacher working relationships that show patterns of teacher delivered practices, conflict, closeness, externalizing behavior, and social skills at the beginning of the school year?
2. To what extent does profile memberships predict distal outcomes, including teacher delivered practices, conflict, closeness, externalizing behavior, and social skills at the end of the school year?

[1] We use the term *students* to refer to the current study population, however, we recognize that early childhood programs instruct young *children* not typically labeled as students. For consistency, we use *students* throughout.

## Method

### Sample

The present study includes teacher and student participants, from comparison conditions, who were part of three federally funded research studies testing an intervention designed to address the needs of young students who demonstrate persistent and intensive challenging behaviors in classroom settings (Sutherland et al., 2020; Sutherland et al., 2018; IES R305A180182). Teacher and student participants were recruited from early childhood programs and elementary schools in a Mid-Atlantic and a Southern state. All study activities were approved by the associated human participants protection boards.

### Teachers

Teachers were eligible to participate if they: (a) taught in early childhood or kindergarten to third grade classroom, (b) served at least one child identified as being at risk of EBD, and (c) consented to participate. The present study includes 100 predominantly female (97%) teachers (n = 84 early childhood teachers; n = 16 kindergarten - 3rd grade teachers). Forty-nine percent self-identified as African American/Black, 47% as White, 1% as Asian/Pacific Islander, and 3% as another race. Only three percent

identified as Hispanic/Latino. Most teachers had a bachelor's degree or higher (63%), and half reported having a teaching license (50%). Teachers ranged in age from 18 to 25 (9%), to over 55 (15%), with other teachers between the ages of 26 to 35 (21%), 36 and 45 (32%), 46 and 55 (21%) and 2% who preferred not to list their age. Teachers had an average of 12.01 years of teaching experience ( $SD = 10.06$ ). They were given \$100-\$400 for their participation (amount varied by study).

## **Students**

Teachers selected one to three focal students in their classrooms who exhibited externalizing problem behavior. Eligible students were: (a) enrolled in a participating teacher's classroom, (b) exhibited externalizing behaviors that interfered with participation in the classroom as indicated by systematic screening (Walker et al., 2014), and (c) had parent/guardian consent to participate. This study included 196 students who had data on all profile measures; 91 students were excluded from analysis because they were missing data on one or more profile measures. Student sample demographics included 68.9% African American/Black, 16.8% White, 11.7% other ethnicities, and 2.6 percent unreported. Five percent of students were Hispanic/Latino. Most participating students were male (66.8%).

## **Procedures, Measures and Data Harmonization**

Our overarching approach to harmonizing data sources across samples was to identify the subset of scale items (either identical or comparable) that was held in common between the three studies included in the study sample. All three studies used identical procedures for screening in eligible students, which we document below, and very similar processes were used for training observers for observational coding of student teacher interactions. We then used measurement models (such as multigroup confirmatory factor analysis) to further inspect the similarity of response patterns for all data collected via questionnaire.

### *Student Screening*

Across all three studies, screening began approximately one month after the start of school. Teachers nominated up to five students who engaged in externalizing problem behavior and caregiver consent was obtained. Then systematic screening for risk of EBDs took place using the Early Screening Project (in early childhood classrooms; Feil et al., 1995) and the SSBD (in kindergarten- 3rd grade classrooms; Walker et al., 2014). The ESP and SSBD are both multigate screening systems designed to identify students who are at risk of negative developmental outcomes associated with their behavior patterns. The first two stages (used given the scope of the intervention) combine teacher ratings of frequency and intensity of student adjustment problems in their classroom. Assessment of risk included raw scores and applying risk criteria to scores (see Walker et al., 2014 for scoring criteria for the SSBD and Feil et al., 1995 for the ESP). Students were screened for critical events ( $M=1.14$ ,  $SD=1.85$ ), aggressive behavior ( $M=19.43$ ,  $SD=6.52$ ), adaptive behavior ( $M=23.74$ ,  $SD=6.05$ ) and maladaptive behavior ( $M=28.06$ ,  $SD=7.57$ ). After screening, up to three students per classroom were selected to participate. Following screening, study measures were collected for time point 1 in October - December and again for time point 2 in April-June.

### *Student Behavior*

Student problem behavior and social skills were assessed with the Social Skills Improvement System-Rating Scales (SSIS-RS; Gresham & Elliott, 2007). The SSIS-RS is a 76-item teacher-report measure, evaluating social skills and problem behaviors in young students. The Social Skills scale consists of seven subscales including, communication, cooperation, assertion, responsibility, empathy, engagement, and self-control. The Problem Behaviors scale consists of five subscales including, externalizing, bullying, hyperactivity/inattention, internalizing, and Autism Spectrum. Teachers rate items on a four-point Likert scale (0 = Never to 3 = Almost always) indicating how frequently students exhibit behaviors; higher scores indicate more social skills or more problem behavior. For the current sample Cronbach's alphas were .97 and .95 for Social Skills and .92 and .94 for Problem Behavior at pretest and posttest, respectively. The present study used standardized scores (standardized by child age and gender). Given the exceptionally high number of items in the SSIS, and the fact that we did not have item-level scores for all three studies, we were unable to perform the same item-level measurement analysis with the SSIS that we do with the STRS below. But we did find consistently high reliability for SSIS subscales across all three samples.

### *Student Teacher Relationships*

The student teacher relationship scale short form (STRS; Pianta, 2001) was used to assess teacher's perceptions of their relationships with students. The 15-item measure assesses the degree of closeness and conflict a teacher perceives in their relationship with a given child. Teachers indicate their degree of agreement with statements such as "this child and I always seem to be struggling with each other" and "I share an affectionate, warm relationship with this child" on a five-point Likert scale (Definitely applies = 4 to Definitely does not apply = 0). For the current sample, internal consistency was acceptable with Cronbach's alpha equal to .81 for Closeness and .84 and .86 for Conflict at pretest and posttest, respectively.

### *Teacher Practice Delivery*

The thoroughness and frequency of teacher delivery of practices to the focal student or group in which the focal student was present was measured in early childhood classrooms with the BEST in CLASS Adherence and Competence Scale (BiCACS; Sutherland et al., 2014) and in the elementary school classrooms with the Treatment Integrity Instrument for Elementary School Classrooms (TIES; Sutherland et al., 2015). The BiCACS and TIES are observational measures in which raters assess teachers' extensiveness (i.e., adherence) and quality of delivery (i.e., competence) of evidence-based practices using a 7-point Likert-type scale. The thoroughness and frequency of teacher delivery of evidence-based practices was measured with the adherence dimension of the BiCACS and TIES. Anchors on the adherence scale range from not at all to very extensive. The BiCACS and TIES include items that represent key evidence-based instructional practices (e.g., Rules, Precorrection, Opportunities to Respond, Behavior Specific Praise, Instructive Feedback, Corrective Feedback; see Sutherland et al., 2014; 2015 for a detailed description of the measure). The present study included observations of teacher-delivered practices across 4 overlapping practices in the BiCACS and TIES. These included Rules, Praise, Opportunities to Respond, and Precorrection.

Reliability was assessed using secondary observers for approximately 20% of observations within each of the three studies. ICCs were computed for each item on each scale. Cicchetti (1994) indicated that ICCs less than .40 reflect "poor" agreement, ICCs from .40 to .59 represent "fair" agreement, ICCs from .60 to .74 represent "good" agreement, and ICCs of .75 and higher represent "excellent" agreement. Across all three studies the mean ICC for the adherence scale ranged from .74-.82, with all items reflecting "good" to "excellent" agreement.

### **Data Analysis**

**Confirmatory Factor Analysis and Measure Invariance Testing.** First, multigroup confirmatory factor analysis (CFA) was used to test the fit of the Closeness and Conflict scales from the STRS across the three samples and two timepoints. This approach, recommended by Brown (2014), allowed us to test the relative fit of models with increasing constraints, corresponding to configural, metric, and scalar invariance. When results indicated an item did not function equivalently between groups, we freed model constraints in order to reach partial scalar invariance for each of the scales across groups.

**Latent Profile Analysis.** We used latent profile analysis (LPA) to identify distinct subgroups, or clusters, within a larger population given a series of indicator variables (Lubke, 2018). We used an exploratory approach, testing models that assume a range of possible latent profiles (e.g., 1-profile model, 2-profile model, etc.) and then chose the model that demonstrated the best model fit as indicated by the fit statistics described below.

Five variables were used as indicators of the latent profiles we estimated: 1) teacher delivery of practices, 2) teacher-student closeness, 3) teacher-student conflict, 4) student social skills, and 5) student problem behavior. These indicators were the basis for determining the optimal number of subgroups to answer RQ 1. To answer RQ 2, several additional measures were used as distal outcomes to test the validity of the LPA solution, including time-2 (Spring) measures of all five indicator variables.

The LPA modeling approach we used was the parametric procedure outlined by Finch and French (2014) and implemented in *Mplus*. The fit statistics used to make the determination of the appropriate number of profiles included: the Bayesian Information Criterion (BIC; Schwarz, 1978), the sample size adjusted Bayesian Information Criterion (SABIC; Sclove, 1987), the Bootstrap Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000) the Lo-Mendell-Rubin Test (LMR; Lo et al., 2001), consistent AIC (CAIC; Bozdogan, 1987), Bayes factor (BF; Wagenmakers, 2007; Wasserman, 1997), approximate weight of evidence (AWE; Banfield & Raftery, 1993) and approximate correct model probability (cmP; Schwarz, 1978). To answer RQ 2, the optimal number of subgroups were taken from the previous step, and then distal outcomes described above were included following the

recommended process for modeling outcomes in an LPA outlined by Nylund-Gibson et al. (2019). This approach, referred to as the manual 3-step BCH process (Bakk et al., 2013; Bolck et al., 2004), involves using the posterior probabilities and modal class assignments from an unconditional model (without outcomes) to calculate classification errors for each participant, then including the inverse logits of those errors as weights in the eventual prediction model.

Several methodological issues were accounted for using the following approaches. To adjust for possible violations of the multivariate normality assumption, a robust maximum likelihood estimator ("MLR" in *Mplus*) was used. To assess model fit, the scaled Satorra-Bentler Chi-Square statistic (Satorra & Bentler, 2001) was used in favor of the traditional Chi-Square test. Standard errors were adjusted for clustering using the sandwich estimator (Huber, 1967; White, 1980) to account for the fact that students were clustered within teachers.

## Results

We present our results in three sections. First, we provide descriptive statistics for all indicators and distal outcomes, disaggregated by study, to examine the extent to which scores on all measures were similar across all studies. Greater similarity across samples suggests that data can be combined and generalizations about profiles can be made across all three groups. Second, we report on the measurement properties of the STRS, a scale for which we have item-level data for all three studies. Starting with a CFA model and then using measurement invariance testing to examine whether response patterns differed between studies, we then applied (or relaxed) model constraints to allow for consistent comparison. Finally, we report results of the LPA assessing the extent to which student teacher dyads may be constituted into latent groups based on our five indicator variables measured at the start of the school year, as well as the extent to which profile membership predicted distal outcomes.

### Descriptive Comparisons of Indicators and Distal Outcomes, by Sample

Table 1 includes descriptive statistics, including means, standard deviations, medians, maxima and minima for the five indicator variables and five distal outcomes. Closeness and Conflict scores shown here are factor scores predicted by our final multigroup CFA model that met the threshold of partial scalar invariance (see below). Scores for each sample were consistent across groups, suggesting that integrating samples could allow for inferences to be drawn about the larger sample.

Table 1 *Descriptive Statistics for the Sample, by Data Source*

	<b>Sample 1 (N=16)</b>	<b>Sample 2 (N=14)</b>	<b>Sample 3 (N=185)</b>	<b>Overall (N=215)</b>
<b>Closeness, Time 1</b>				
Mean (SD)	-0.18 (0.59)	0.24 (0.66)	0.00 (0.470)	0.00 (0.50)
Median [Min, Max]	-0.17 [-1.04, 0.85]	0.55 [-1.58, 0.85]	0.06 [-1.44, 0.78]	0.06 [-1.58, 0.85]
<b>Conflict, Time 1</b>				
Mean (SD)	0.72 (0.76)	0.27 (0.90)	0.00 (0.78)	0.07 (0.79)
Median [Min, Max]	0.72 [-0.60, 1.79]	-0.16 [-0.82, 2.03]	-0.02 [-1.40, 1.80]	0.03 [-1.40, 2.03]
<b>Adherence, Time 1</b>				
Mean (SD)	2.63 (0.55)	2.86 (0.71)	2.95 (0.94)	2.92 (0.91)
Median [Min, Max]	2.75 [2.00, 3.75]	2.63 [2.00, 4.75]	3.00 [1.00, 5.50]	3.00 [1.00, 5.50]
Missing	2 (12.5%)	0 (0%)	1 (0.5%)	3 (1.4%)
<b>Social Skills, Time 1</b>				
Mean (SD)	56.6 (17.2)	68.3 (24.8)	62.7 (18.3)	62.6 (18.8)
Median [Min, Max]	59.0 [23.0, 88.0]	77.5 [18.0, 90.0]	65.0 [11.0, 117]	65.0 [11.0, 117]
<b>Problem Beh., Time 1</b>				
Mean (SD)	39.3 (13.4)	33.7 (12.6)	30.3 (13.6)	31.2 (13.7)
Median [Min, Max]	40.0 [15.0, 65.0]	35.0 [17.0, 65.0]	29.0 [3.00, 71.0]	30.0 [3.00, 71.0]
<b>Closeness, Time 2</b>				
Mean (SD)	-0.06 (0.54)	0.36 (0.62)	0.00 (0.51)	0.02 (0.53)
Median [Min, Max]	-0.00 [-1.03, 1.00]	0.50 [-0.99, 0.99]	0.10 [-1.50, 0.71]	0.10 [-1.50, 1.00]
<b>Conflict, Time 2</b>				
Mean (SD)	0.52 (0.83)	-0.02 (0.95)	0.00 (0.86)	0.04 (0.87)
Median [Min, Max]	0.83 [-1.34, 1.69]	-0.11 [-1.29, 1.94]	-0.16 [-1.36, 1.95]	-0.116 [-1.36, 1.95]
<b>Adherence, Time2</b>				
Mean (SD)	2.09 (0.334)	2.46 (0.531)	3.04 (0.914)	2.94 (0.908)
Median [Min, Max]	2.00 [1.75, 2.75]	2.38 [1.75, 3.50]	3.00 [1.00, 6.00]	3.00 [1.00, 6.00]
Missing	2 (12.5%)	2 (14.3%)	8 (4.3%)	12 (5.6%)
<b>Social Skills, Time 1</b>				
Mean (SD)	65.8 (15.7)	80.6 (27.2)	70.1 (18.5)	70.4 (19.1)
Median [Min, Max]	65.5 [40.0, 104]	79.5 [38.0, 119]	71.0 [18.0, 123]	71.0 [18.0, 123]
<b>Problem Beh.,</b>				

Time 2				
Mean (SD)	39.4 (19.2)	31.4 (18.4)	28.9 (14.4)	29.8 (15.3)
Median [Min, Max]	34.5 [9.00, 70.0]	24.5 [9.00, 76.0]	28.0 [1.00, 72.0]	28.0 [1.00, 76.0]

Notes.

### Assessing Measurement Invariance of Closeness and Conflict Scales

To further investigate the consistency of measurement properties between samples, we used multigroup CFA to conduct a series of measurement invariance (MI) tests to investigate the extent to which the Closeness and Conflict scores from the STRS operated equivalently for students from the three samples. Given the discrepancy in sample size between the samples, we combined data from the elementary studies, and compared these scores to those collected in the preschool sample. MI was tested in a series of models representing configural, metric, and scalar invariance. The configural model constrained the latent variable structure to be equal for all groups, but allowed item weights, intercepts, and error variances to vary. The metric model constrained the item loadings between the two groups but allowed the intercepts and error variances to differ. Finally, the scalar model constrained both the item weights and intercepts, allowing only the error variances to differ. We used likelihood ratio tests to compare the relative fit of nested models.

Scalar measurement invariance was found between observations from Studies 1 and 2 and Study 3 at time 1. For the time 2 measures, partial scalar invariance was found after allowing the intercepts from STRS items 1, 3, 7, and 15 from the Closeness scale to be freely estimated for each study. After releasing these constraints, the scales functioned equivalently between Studies 1 and 2 and Study 3. We then predicted factor scores for both Conflict and Closeness at both time points using the partial scalar invariance model. See Table 2 for full MI test results.

Table 2 *Measurement Invariance Test Results and Fit Statistics for the STRS Scale*

Model	df	AIC	BIC	RMSEA	CFI	TLI	SRMR		Diff.	df Diff.	Pr(>)
<u>Time 1 (Fall)</u>											
Configural	178	9073.52	9383.61	0.10	0.84	0.81	0.07	371.32	–	–	–
Metric	191	9056.54	9322.81	0.10	0.84	0.83	0.08	380.32	9.00	13	0.77
Scalar	204	9050.64	9273.16	0.10	0.84	0.83	0.08	400.44	20.12	13	0.09
<u>Time 2 (Spring)</u>											
Configural	178	8668.70	8978.80	0.10	0.87	0.84	0.07	353.63			
Metric	191	8653.50	8919.80	0.09	0.87	0.85	0.08	364.43	10.81	13	0.627
Scalar	204	8664.30	8886.70	0.10	0.85	0.84	0.08	401.22	36.79	13	0.000

Notes.  $N = 650$  for all items. AIC = Akaike Information Criterion. BIC = (Schwarz's) Bayesian Information Criterion. CFI = Configural Fit Index. TLI = Tucker-Lewis Index. RMSEA = Root Mean Square Error of Approximation. SRMR = Standardized Root Mean Square Residual. STRS = Student Teacher Relationship Scale.

### Identifying Teacher-Student Dyad Profiles

To identify the appropriate number of latent profiles found in our data, we fit a series of models assuming from 1 to 10 profiles and compared fit statistics. All indicators were z-standardized prior to estimation to facilitate model convergence and consistent interpretation. Table 3 provides model fit statistics for 1-to-10 profile solutions. The preferred model indicated by each statistic is indicated in bold. We found the most support for a 4-profile solution, which was the best model according to the *BIC*, *BLRT*, *BF*, and *cMP* statistics. There was also some support for a 2-profile solution, which was the best model according to the *CAIC*, *AWE*, and *LMR* statistics. After examining both solutions carefully, we found them similar in terms of overall trends, but the 4-profile

solution offered additional nuance that would be valuable in connecting to theory and prior literature. Thus, we proceeded with interpreting the 4-profile solution.

Table 3 *Model Fit Statistics for Latent Profile Analysis, by Profile Solution*

No. Profiles	Params.	LL	BIC	SABIC	CAIC	AWE	LMR p	BLRT p	BF	cmP
1	10	-1176.082	2404.946	2373.267	2454.507	2459.507	–	–	–	0.000
2	16	-1107.714	2299.877	2249.191	<b>2379.178</b>	<b>2387.178</b>	<b>0.0138</b>	<.001	1.53E-23	0.000
3	22	-1084.579	2285.276	2215.582	2394.314	2405.314	0.0796	<.001	6.75E-04	0.317
4	28	-1067.978	<b>2283.742</b>	2195.041	2422.518	2436.518	0.228	<b>&lt;.001</b>	<b>0.46</b>	<b>0.682</b>
5	34	-1058.139	2295.734	2188.026	2464.246	2481.246	0.2266	0.051	401.82	0.002
6	40	-1051.361	2313.847	2187.13	2512.096	2532.096	0.3814	0.400	8,574.09	0.000
7	46	-1044.482	2331.757	2186.034	2559.744	2582.744	0.7502	0.600	7,746.53	0.000
8	52	-1035.977	2346.416	2181.685	2604.140	2630.140	0.2829	0.500	1,524.62	0.000
9	58	-1027.338	2360.806	2177.067	2648.268	2677.268	0.1237	0.700	1,332.75	0.000
10	64	-1019.166	2376.131	<b>2173.385</b>	2693.330	2725.330	0.8169	0.999	2,127.07	0.000

Notes. LL = Log Likelihood. BIC = Schwarz’s Bayesian Information Criterion. SABIC = Sample-Size Adjusted Bayesian Information Criterion. CAIC = Consistent AIC. AWE = Average Weight Extracted. VLMR-LRT = Lo-Mendell-Rubin Likelihood Ratio Test. BF = Bayes Factor. cmP = Cumulative Model Probability. Statistics in bold indicate the preferred profile solution based on the specified criterion.

### Further Articulating the 4-Profile Model

Next, we created a conditional means plot to visualize the relative shapes and levels of each profile. Conditional means, adjusting for the classification error for each student, were generated for the five indicators for all profiles. Figure 1 illustrates all profiles, along with the underlying distribution of scores in the background. Table 4 includes profile-specific conditional means and standard errors for all indicators. In our description below, for simplicity, we use the term “average” to describe conditional means that are near 0, “high” to describe means that are significantly above 0, and “low” to describe means that are significantly below 0. Importantly, however, given that this is an indicated sample of students at risk of EBD, these distinctions should be interpreted relative to this sample, and not to all students of this age group.

Table 4 *Profile-Specific Descriptive Statistics for LPA Indicators*

Variable	<i>M</i>	<i>SE</i>	<i>t</i>	<i>p</i>
<u>Latent Class 1 (n = 75).</u>				
Adherence	-0.06	0.14	-0.43	0.67
Closeness	0.33	0.06	5.17	<.001
Conflict	-0.50	0.17	-2.94	<.001
Problem Beh.	0.78	0.13	6.12	<.001
Social Skills	-0.45	0.15	-2.93	<.001
<u>Latent Class 2 (n = 20).</u>				
Adherence	0.61	0.25	2.40	0.02
Closeness	-0.40	0.13	-3.06	<.001
Conflict	-0.57	0.23	-2.50	0.01
Problem Beh.	-0.50	0.36	-1.38	0.17
Social Skills	-0.61	0.49	-1.24	0.21
<u>Latent Class 3 (n = 87).</u>				
Adherence	0.11	0.15	0.74	0.46
Closeness	-0.01	0.10	-0.12	0.91
Conflict	0.44	0.11	3.91	<.001
Problem Beh.	-0.31	0.22	-1.41	0.16
Social Skills	0.37	0.16	2.39	0.02
<u>Latent Class 4 (n = 14).</u>				
Adherence	-0.03	0.32	-0.09	0.93
Closeness	-0.95	0.16	-6.11	<.001
Conflict	1.31	0.16	8.07	<.001
Problem Beh.	-1.46	0.20	-7.17	<.001
Social Skills	1.00	0.24	4.15	<.001

Profile 1 (n = 75, 38% of sample) includes student teacher dyads characterized by average practice delivery adherence, high closeness, low conflict, high social skills, and low problem behavior. We call this Profile “Responsive.” Profile 2 (n = 20, 11% of sample) is characterized by high adherence, low closeness, low conflict, low social skills, and low problem behavior. We call this Profile “Unresponsive”. Profile 3 (n = 87, 44% of sample) is characterized by average adherence, average closeness, high conflict, low social skills, and high problem behavior. We call this Profile “Difficult”. Profile 4 (n = 14, 7% of sample) is characterized by average adherence, low closeness, high conflict, low social skills, and high problem behavior. We call this Profile “Challenging.”

### Student Teacher Profiles and Distal Outcomes

Next, we analyzed whether profile membership was associated with differential responses on distal outcomes measured in the Spring of the year, including Conflict, Closeness, Adherence, Social Skills, and Problem Behavior. Results of this analysis are in Table 5.

Table 5 *Estimated Profile Means and Differences in Distal Outcomes*

<u>Adherence, Time 2 (Spring).</u>							
Mean				S.E.			
Class 2				Class 1			
Class 3				Class 4			
$\chi^2$				$p$			
Overall	1.48	0.69	Class 1 vs. 2	0.12	0.73		
Class 2 vs. 3	0.02	0.88	Class 2 vs. 4	0.56	0.46		
Class 1 vs. 3	0.79	0.37	Class 1 vs. 4	0.39	0.53		
Class 3 vs. 4	1.09	0.30					
<u>Closeness, Time 2 (Spring).</u>							
Mean				S.E.			
Class 2				Class 1			
Class 3				Class 4			
$\chi^2$				$p$			
Overall	45.48	0.00	Class 1 vs. 2	18.15	0.00		
Class 2 vs. 3	2.88	0.09	Class 2 vs. 4	2.31	0.13		
Class 1 vs. 3	15.76	0.00	Class 1 vs. 4	28.20	0.00		
Class 3 vs. 4	9.78	0.00					
<u>Conflict, Time 2 (Spring).</u>							
Mean				S.E.			
Class 2				Class 1			
Class 3				Class 4			
$\chi^2$				$p$			
Overall	72.76	0.00	Class 1 vs. 2	0.26	0.61		
Class 2 vs. 3	17.60	0.00	Class 2 vs. 4	29.21	0.00		
Class 1 vs. 3	35.77	0.00	Class 1 vs. 4	45.79	0.00		
Class 3 vs. 4	4.69	0.03					
<u>Social Skills, Time 2 (Spring).</u>							
Mean				S.E.			
Class 2				Class 1			
Class 3				Class 4			
$\chi^2$				$p$			
Overall	72.25	0.00	Class 1 vs. 2	22.24	0.00		
Class 2 vs. 3	1.26	0.26	Class 2 vs. 4	0.06	0.80		
Class 1 vs. 3	47.44	0.00	Class 1 vs. 4	40.92	0.00		

Class 3	vs.	4	3.21	0.07					
<u>Problem Behavior, Time 2 (Spring)</u>									
			Mean	S.E.			Mean	S.E.	
Class 2			-0.67	0.20	Class 1		-0.53	0.11	
Class 3			0.45	0.11	Class 4		0.79	0.29	
			$\chi^2$	$p$			$\chi^2$	$p$	
Overall			54.75	0.00	Class 1 vs. 2		0.31	0.58	
Class 2	vs.	3	21.27	0.00	Class 2 vs. 4		17.13	0.00	
Class 1	vs.	3	35.19	0.00	Class 1 vs. 4		18.73	0.00	
Class 3	vs.	4	1.13	0.29					

**Adherence.** We did not identify any significant profile differences in adherence at Time 2. Estimated profile means ranged from 0.13 for the "Difficult" profile to -0.25 for the "Challenging" profile.

**Closeness.** We found several profile differences in Closeness scores at Time 2. Scores ranged from a low of -0.61 for the "Challenging" profile to a high of 0.33 for the "Responsive" profile. All profile differences were significant except for the difference between the "Unresponsive" profile and the "Difficult" profile ( $p = .09$ ), and the difference between the "Unresponsive" profile and the "Challenging" profile ( $p = .13$ ).

**Conflict.** We also found several profile differences in Conflict scores at Time 2. Scores ranged from a low of -0.59 for the "Unresponsive" profile to a high of 0.84 for the "Challenging" profile. All profile differences were significant except for the difference between the "Responsive" profile and the "Unresponsive" profile ( $p = .60$ ).

**Social Skills.** We found fewer profile differences in Social Skills scores at Time 2. Scores ranged from a low of -0.82 for the "Challenging" profile to a high of 0.80 for the "Responsive" profile. The only significant differences were found to be between the "Responsive" profile and all other profiles (all  $ps < .01$ ). None of the other comparisons were statistically significant.

**Problem Behavior.** For Problem Behavior, scores ranged from a low of -0.67 for the "Unresponsive" profile to a high of 0.79 for the "Challenging" profile. All profile differences were significant except for the difference between the "Responsive" profile and the "Unresponsive" profile ( $p = .58$ ) and the difference between the "Difficult" and the "Challenging" profile ( $p = .29$ ).

## Discussion

Using an exploratory approach to latent profile analysis and including Conflict, Closeness, Teacher Delivery of Practices, Social Skills, and Problem Behavior scores as indicators, we found significant evidence for the existence of four student teacher relationship profiles among our sample of 196 student-teacher dyads observed across three different datasets. These dyads roughly corresponded to what we describe as four different teacher-student interaction profiles: 1) Responsive, 2) Unresponsive, 3) Difficult, and 4) Challenging. Nearly 80 percent of dyads fell into profiles 1 or 3, with the remaining dyads split between profiles 2 and 4. We used descriptive comparisons, reliability statistics, and multiple group measurement invariance tests to confirm that the data from each of the three samples can be sufficiently harmonized and integrated into a single analysis. Further, we found that profile membership did predict significant differences on most of the same measures observed at Time 2, in the Spring.

This study advances previous work on student teacher relationships by employing profile analysis to examine how combinations of teacher and student characteristics and teaching practices may shape the relationship between teacher-student dyads and influence student outcomes. Previous work has employed variable-centered methods, which are limited in that they are often unable to account for the multifaceted nature of student teacher relationships. Further, modeling teacher student working relationships as multidimensional profiles allows us to better understand within teacher variability; this is important as prior work

demonstrates variability within teachers in their ability to navigate each student's needs with the same degree of responsiveness and support (e.g., Nurmi, 2012).

### **Teacher-Student Working Relationship Profiles**

Our findings revealed that the majority of teacher-student working relationships were characterized by two profiles. Approximately 38% of the sample included teacher-student dyads that fell into the "Responsive" profile, and were characterized by average practice delivery adherence, high closeness, low conflict, high social skills, and low problem behavior. Dyads in this profile may have experienced overall positive teacher-student working relationships. It is important to note that students in this sample were eligible for participation only if they met thresholds for externalizing problem behavior (Feil et al., 1995; Walker et al., 2014). This profile suggests that even for students who are above average in externalizing problem behavior (compared to their peers), positive teacher-student working relationships still occur for several dyads. Interestingly, this was the only profile in which students displayed high levels of social skills. It may be that student social skills serve as a proponent of positive teacher-student relationships in samples of students with or at risk for EBD. However, the plurality of dyads (44%) fell into the "Difficult" profile and were characterized by average adherence, average closeness, high conflict, low social skills, and high problem behavior. This profile appears to align with previous variable centered work, suggesting that students who display externalizing behaviors and who have low social skills may be exposed, on average, to lower rates of teacher support and experience higher rates of conflict with teachers (Sutherland & Oswald, 2005). However, average rates of closeness were a defining feature for this profile and distinguished these dyads from profile 4 (detailed below).

The remaining dyads were split between profiles 2 and 4. These profiles were inconsistent with prior variable centered approaches, suggesting that the multidimensional nature of teacher-student working relationships is important to consider. Specifically, profile 2 (11% of the sample) included dyads with high rates of teacher practice delivery, low closeness, low conflict, low social skills, and low problem behavior, relative to other students with or at risk for EBD. This group was defined by the high rate of teacher practice delivery. This is surprising when considered in combination with the other factors that signal these students are relatively unengaged in their relationships with teachers (i.e., low closeness and low conflict) and are not exhibiting high rates of problem behavior. However, these students display low levels of social skills; it may be that teachers are more willing to engage with students with or at risk for EBD who need support in social skills, conditional on having lower rates of problem behavior. Finally, 7% of the sample was characterized by average adherence, low closeness, high conflict, low social skills, and high problem behavior. Given the intensity and combination of the dimensions that characterize this group, this profile may represent a subgroup of students with or at risk for EBD who have Tier 3 needs. The percentage of dyads in the current study who fit this profile is generally consistent with Multi-Tiered System of Supports and Positive Behavior Interventions and Supports conceptualizations of the breakdown of students who fall into Tier 3 category (~5% of the total population; Bohanon et al., 2021).

### **Distal Outcomes**

Drawing on the transactional model, which highlights the bidirectional influence of teachers and students upon each other, we anticipated that profiles of student teacher relationships would be related to distal outcomes (Sutherland & Oswald, 2005). Regarding teacher delivery of practices, differences did not emerge between profiles at the end of the school year. This was surprising given that we anticipated teachers would adapt their practices in response to student needs and behaviors. Future work should include teacher level factors (e.g., teacher education, years of teaching experience) and classroom contextual factors (e.g., number of students exhibiting challenging behaviors) as these factors are known to contribute to teacher practice delivery. This finding may also be due in part to a lack of teacher training and preparation to successfully prevent and mitigate problem behavior in the classroom (Flower et al., 2021); as a field we have done a poor job of training teachers in strategies and practices that can prevent or ameliorate these problem behaviors in the classroom (Bushaw & Gallup, 2008; Maag, 2004; Reinke et al., 2011). Thus, teachers may be ill equipped to adapt their teaching practices throughout the year in response to the multidimensional needs of students. Additionally, we found few profile differences in Social Skills scores; students in the responsive profile maintained higher rates of social skills compared to the other three profiles. This is consistent with prior work that documents student social skills are difficult to modify. Social skills interventions tend to produce small to moderate effects and gain are generally not sustained (Gresham, 1998).

However, as we expected most of the profile differences in outcomes remained significant at the end of the year with a few exceptions. At the end of the year only dyads in the “unresponsive” profile vs the “challenging” profile and “unresponsive” profile vs challenging profile did not differ on closeness. Additionally, all profile differences were significant except for the difference between the “Responsive” profile and the “unresponsive” profile for conflict. Finally, for student problem behavior, all profile differences were significant except for the difference between the “Responsive” profile and the “Unresponsive” and the difference between the “Difficult” and the “Challenging” profile. These findings help to validate the four profiles established in the present study and suggest that these profiles are relatively stable or durable across the year.

## Limitations

The present study provides a novel and person-centered investigation into teacher student working relationships; however, it is not without limitations. First, given the number of items (76) included in the calculation of SSIS Problem Behavior and Social Skills scores, we were unable to perform the kind of close measurement comparison that we were able to do with the STRS. However, this limitation may be minimized by the fact that both subscales are age (and gender) standardized, facilitating comparison between age groups.

Second, although the use of integrative data analysis is an important feature of the present study, there were unequal group sizes between early childhood classrooms and elementary classrooms. Future work should include a large sample with an equal distribution of teachers across developmental ranges to improve the robustness and generalizability of study findings. Third, teacher student relationships and student behavior were each rated by the teacher, raising concerns about reporter biases. Future work should look to directly assess student problem behavior and consider student reports on teacher student relationships to minimize these concerns. However, it is important to note that a majority of prior work examining teacher-student relationships relies on teachers’ perspectives whereas research examining teacher delivery of practices probes multiple perspectives (i.e., teacher or observer report) and tends to examine these reports separately rather than in combination (e.g., Downer et al., 2015; Hughes, 2011; Rey et al., 2007). In the present study, we assessed profiles including teacher reports on their relationships with students with or at risk for EBD and observations of teacher practice delivery. One of the benefits to using teacher reports of relationships alongside observations of practice delivery is that teacher and observer reports capture different relational aspects (Downer et al., 2015; Kunter & Baumert, 2006). Examining profiles which include different relational aspects allows for increased understanding in how teachers’ perceived relationships with children align with their day-to-day student interactions.

In the future, it will be important to re-calibrate these profiles including a wider range of teacher and student level characteristics that are known to influence student teacher interactions. This could include student achievement, measures of student’s peer relationship status (e.g., isolated or popular), additional teaching practices, teacher education, among others. Additionally, the relationships between a teacher and a student operate within the larger dynamic classroom system and a teacher must balance the needs of multiple students simultaneously. Future work should investigate thresholds for how many students may fall into each profile per classroom. For example, if a teacher has a working relationship with two students in the challenging profile, they may be less likely to have a responsive profile relationship with the third student. Finally, future work could investigate if profile membership is static or malleable across the school year; it may be that a teacher student dyad may begin the year in the challenging profile but through intervention or supports transition to responsive.

## Conclusion

Findings from the present study provide evidence that teacher student relationships in early childhood and elementary school classrooms are multifaceted and that transactional processes inherent in these relationships influence some outcomes at the end of the school year. We found significant evidence for the existence of four student teacher working relationship profiles. Importantly, we addressed these research questions by integrating data across three studies that included variation across teacher student populations. In line with the purpose of integrated data analysis methods, this approach has implications for generalizability of findings and the ability to make more robust claims across samples.

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## Figures

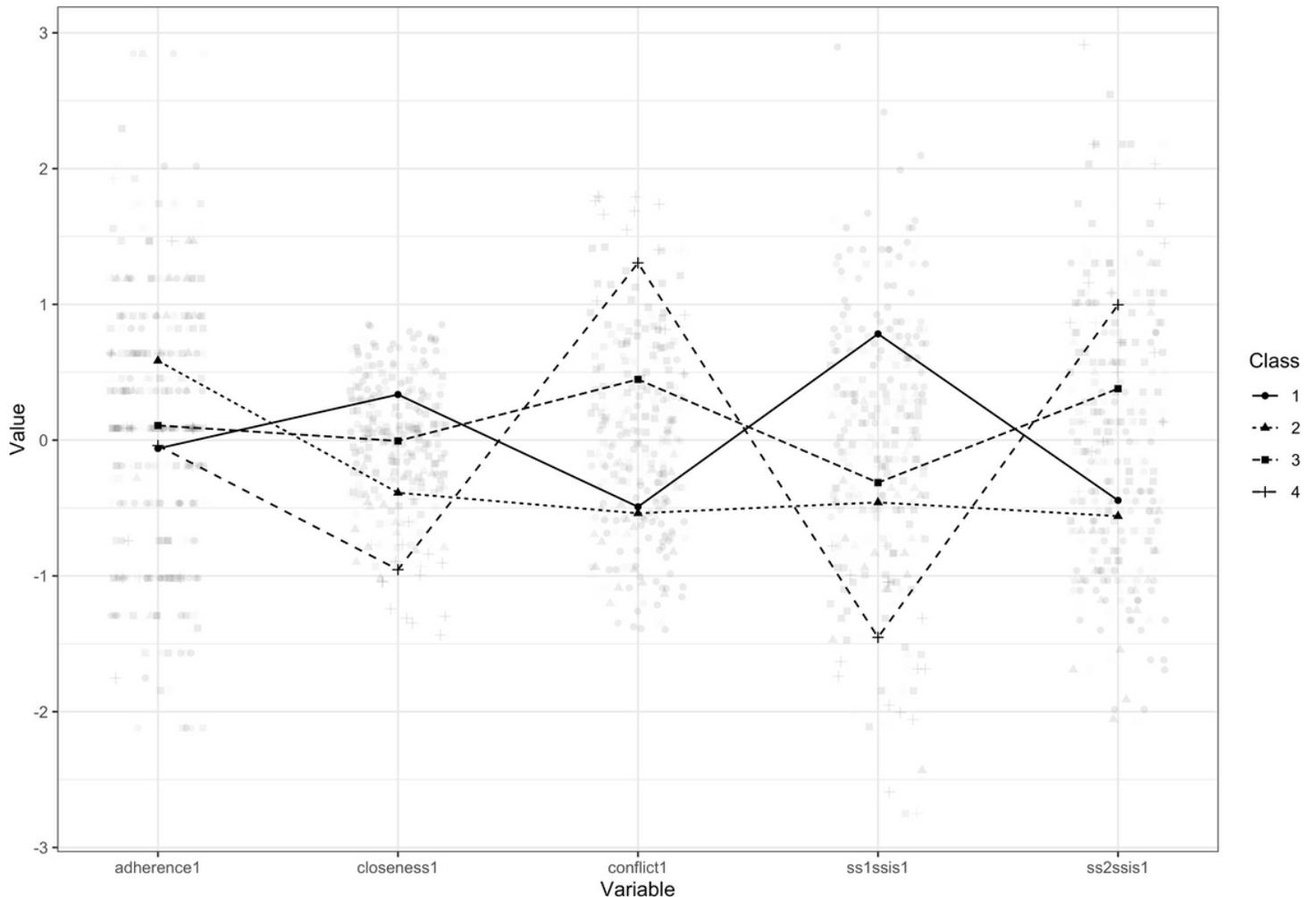


Figure 1

Figure illustrates all profiles, along with the underlying distribution of scores in the background.