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Reciprocal associations between teacher-student relations and students’ externalizing behavior in elementary education? A within-dyad analysis

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A B S T R A C T
The goal of this study was to investigate the transactional link between the affective quality of teacher-student relations and students’ externalizing behavior in upper elementary education. We studied teacher support and conflict separately and examined whether associations differed for boys and girls. Data were collected from 1452 Dutch fifth graders (M age = 10.60 years) at three time points within one school year, including peer nominations of teacher-student relationships and external observations of teacher-student interactions. We used random-intercept cross-lagged panel models to examine the associations within the school year. Student behavior and teacher conflict and support were clearly interrelated within measurement moments. That is, within each time point, deviations from students’ typical level of externalizing behavior were associated with deviations in teacher conflict and support in teacher-student relations. In contrast to earlier work, we found no transactional link between students’ externalizing behavior and their relationships and interactions with their teacher over time, neither for teacher conflict nor for support. However, for boys, an association was found between externalizing behavior and later increased teacher conflict. We concluded that it remains important to invest in supportive teacher-student relations to prevent increasing conflict and that transactionality may occur within shorter time intervals.

Students who show externalizing behavior (i.e., hyperactive, impulsive, and aggressive behaviors; Achenbach & Edelbrock, 1978) tend to underperform in elementary school, presumably due to limited academic engagement and difficulties in social relations (Henricsson & Rydell, 2006; O’Connor et al., 2011). Since externalizing behavior disrupts classroom processes, it is often associated with teacher conflict or decreased support (Sutherland & Oswald, 2005). At the same time, conflict between teachers and students can further exacerbate externalizing student behavior because teacher conflict further fuels students’ negative emotions and limits their motivation (Carr et al., 1991; O’Connor et al., 2011). Although such a transactional process between teacher conflict and students’ externalizing behavior is assumed, empirical studies of reciprocity and specifically the direction of the underlying associations are scarce and mostly focused on preschool. Knowing how teacher-student relations and student externalizing behavior affect each other over time —whether teachers primarily trigger student externalizing behaviors or vice versa—can provide teachers with more clear-
cut points of action to effectively manage behavior problems in the classroom. Therefore, the goal of the present study was to extend current knowledge of transactional processes by examining directions of associations between teacher-student relations and student externalizing behaviors in teacher-student dyads (Hamaker et al., 2015) and over time.

1. Transactional processes of teacher-student relationships and externalizing behavior

Within the teacher-student dyad, similar to any adult-child dyad, both parties are active participants who mutually influence each other’s behavior (Patterson et al., 1992; Zhang & Sun, 2011). Students are shaped by the social classroom context, including the teacher’s behavior, but students also affect this context and in turn are affected by the changes in the social context they elicited (Sutherland & Oswald, 2005). The transactional model emphasizes the further accumulation of developmental outcomes over time. Teachers are an important contextual factor in the development of students’ externalizing behavior (Cornelius-White, 2007; Sutherland & Oswald, 2005), in terms of the general affective quality of teacher-student relationships (TSRs), and specific teacher-student interactions (TSIs) in which the affective quality is enacted. Teacher-student relations are often operationalized in terms of the dimensions conflict, referring to anger, negativity, and discordance, and support, referring to closeness, openness, empathy, and warmth (Pianta, 1999; Roorda et al., 2011).

Within the teacher-student dyad, a student’s externalizing behavior is likely to evoke a reprimand or other negative response from the teacher, who wishes to restore their classroom management and may experience negative emotions (Nurmi & Kiuru, 2015; Spilt et al., 2011). Teacher conflict, in return, can result in increased externalizing behavior because the teacher provides an insecure environment and models conflicted behavioral expectations (Farmer et al., 2011; Gest & Rodkin, 2011; Verschueren & Koomen, 2012). In sum, student externalizing behavior can evoke teacher conflict, whereas in turn may further trigger student externalizing behavior. This reciprocity may ultimately amplify students’ externalizing behavior (Doumen et al., 2008; Sutherland & Oswald, 2005; Zhang & Sun, 2011). However, when teachers manage to increase support rather than conflict in response to a student’s externalizing behavior, they may break that cycle. That is, supportive TSRs can scaffold the development of social, behavioral, and self-regulatory competencies (Hamre & Pianta, 2001) and thus protect against (increases in) externalizing behavior (Buyse et al., 2008).

1.1. Existing research supporting reciprocity

In the transactional model, student behavior and the teacher-student relation mutually reinforce each other; therefore, they need to be examined together and over time (Sameroff & Mackenzie, 2003; Sutherland & Oswald, 2005). However, research directly targeting this reciprocity is scarce; to our best knowledge, only three studies used a cross-lagged design to assess bidirectional associations over time (Crockett et al., 2018; Doumen et al., 2008; Zhang & Sun, 2011). In a US-based study with students followed yearly from kindergarten to Grade 6, Crockett et al. (2018) found more consistent support for teacher conflict predicting externalizing behavior than the other way around. Doumen et al. (2008) showed that Belgian kindergartners’ aggressive behavior at the beginning of the year increased mid-year teacher conflict, which in turn amplified aggressive behavior at the end of the year. Zhang and Sun (2011) studied Chinese children at the start and end of their first year of preschool and found that earlier teacher conflict predicted later externalizing behaviors and vice versa.

Other studies also support the transactionality between the quality of teacher-student relations and students’ externalizing behavior, yet design limitations prevented direct conclusions regarding reciprocity. These studies included, for example, concurrent correlations, unidirectional models, or separate unidirectional analyses for teacher and student effects (e.g., Birch & Ladd, 1998; Howes et al., 2000; Silver et al., 2005).

The current study added to this line of research by directly targeting reciprocity between teacher-student relations and student externalizing behaviors. Specifically, we aimed to extend existing knowledge in three important ways by (a) including moment-to-moment teacher-student interaction next to the overall quality of teacher-student relationships, (b) focusing on external perceptions rather than teacher perceptions of teacher-student relations, and (c) statistically modelling transactional processes within teacher-student dyads, rather than across students over entire samples.

1.2. Teacher-student relationships and teacher-student interactions

So far, research on the transactionality of teacher-student relationships (TSRs) and student externalizing behavior has primarily focused on the general quality of teacher-student relationships (TSRs). TSRs are the result of an accumulation of instances of teacher behavior and student responses in teacher-student interaction (TSI). Interacting individuals constantly negotiate how supportive or conflictive they are with each other, and these interactions develop into relationships over time (Granic & Hollenstein, 2003). A focus on actual teacher behavior may provide a clearer image of transaction as it occurs, rather than perceptions of more generalized teacher-student relations. Moreover, studying TSIs may make it possible to formulate concrete points of action for teachers and classroom interventions, as teachers can improve their actual behavior more easily than their established relationships with students (Eraut, 2004).

In one of the few empirical studies on the associations between TSIs and externalizing behavior, Nelson and Roberts (2000) observed sequences of TSIs in students (Grades 1–8) with high rates (target students) and low rates (criterion students) of disruptive behaviors. Teachers were more likely to use commands in response to disruptive behavior by criterion students and reprimands in response to disruptive behavior by target students. In turn, target students were more likely to respond negatively and be non-compliant, whereas criterion students mainly complied with a teacher’s request to change their behavior. This suggests that negative interaction patterns increase disruptive behavior and that teachers interact more negatively with students who exhibit problem
behavior, implying reciprocity between TSIs and externalizing behavior.

1.3. An outside perspective on teacher-student relations

Existing studies mainly used teacher perceptions to assess both teacher-student relations and student externalizing behavior (e.g., Baker et al., 2008; Doumen et al., 2008; Zhang & Sun, 2011), using the same observer for both constructs, and offering a perspective from inside the teacher-student dyad. This could bias results, as teachers’ perceptions may primarily reflect their own general attitude towards a student rather than actual support or conflict (Abikoff et al., 1993). Indeed, Crockett et al. (2018) found associations between teacher conflict and children’s externalizing behavior as rated by teachers but not as rated by mothers. Furthermore, the complexity and simultaneity of classroom processes can make it difficult for teachers to evaluate their own teaching (Scherzinger & Wettstein, 2019). Therefore, and as advised by Crockett et al. (2018), we used an outside perspective, that is external observers and classroom peers, to study the transactions between teacher-student relations and student externalizing behavior.

The main advantage of external observation is an expert view on classroom processes that, as compared to teachers and students, is not biased by previous classroom processes and therefore well able to assess what actually happens in the classroom (Praetorius et al., 2012; Scherzinger & Wettstein, 2019). Peers, on the other hand, as multiple observers of classroom processes, can reliably estimate TSRs based on a wealth of witnessed interactions between their teacher and classmates (Hughes et al., 2001; Li et al., 2012). Already at a young age peers notice how their teacher interacts differently with classmates (Weinstein et al., 1987). Instead of using a single observation, having observations from up to 30 peers yields reliable estimates of classroom processes by evening out individual observers’ idiosyncrasies (Lüdtke et al., 2009).

1.4. A within-dyad model

Inferences regarding transactional processes between teacher-student relations and student externalizing behavior, so far, have been based on analyses that did not separate processes that occur within teacher-student dyads from stable between-dyad differences, comparable to a within- versus between-person model (see Hamaker et al., 2015). There may be stable differences between teacher-student dyads in the level of externalizing behavior a student exhibits with a specific teacher, or in the level of a teacher’s conflict and support that do not reflect dynamics or a transactional process as it takes place. Hamaker et al. (2015) showed how a between-dyad analysis, as in extant studies on transactionality so far, can lead to misleading results such as finding effects that do not exist, not finding effects that do exist, or finding negative effects that are in fact positive and vice versa. In existing between-dyad analyses, within-dyad effects are confounded with sample-average effects. Within-dyad analyses are better suited to reveal whether changes within a teacher-student dyad at one time may reorganize behavior within that same dyad later. Therefore, the current study applied a cross-lagged longitudinal within-dyad analysis.

1.5. Role of age and gender

Existing studies on transactional associations between teacher-student relations and student externalizing behavior were mainly performed with young students in kindergarten to second grade. As an exception, Crockett et al. (2018) studied these associations up to Grade 6 and found fundamentally different transactional processes in kindergarten and Grade 1 than in the higher grades. The current study focused on upper elementary classrooms, in particular Grade 5. Later elementary classrooms represent an important phase in the development of social behaviors as teachers in these classrooms have the opportunity and even the task to help students develop and refine their social skills before leaving the predictable peer context of elementary school (Luckner & Pianta, 2011). It is important for teachers to understand how they can affect students’ behavior at this age to benefit their further social and academic development. Moreover, teachers still seem to influence students’ social behavior and peer relations in this age group (e.g., Crockett et al., 2018; Hendrickx et al., 2017a, 2017b), whereas these effects are smaller after elementary school (e.g., Engels et al., 2016). As students transition to secondary education, peers become more important (LaFontana & Cillessen, 2010). In Grade 5, teachers have a unique opportunity to help shape their students’ social development and prepare them to navigate the complex peer world later.

Gender may play a role in the association between teacher behavior and students’ externalizing behavior. Base rates of externalizing behavior and teacher conflict are generally higher for boys than for girls, whereas girls generally receive more teacher support (e.g., Hill et al., 2006; Lahey et al., 2000; McCormick & O’Connor, 2015). Deviations from these gender norms may have a different impact on subsequent student behavior as well as on the teacher-student relation. For example, Hamre and Pianta (2001) found that conflicted TSRs in kindergarten were associated more strongly with boys’ than with girls’ disruptive behavior in upper elementary school. Conversely, in Lei et al. (2016) externalizing behavior was less susceptible to a decrease in teacher support for boys than girls. Thus, students’ gender should be considered in the associations between teacher behavior and students’ externalizing behavior.

1.6. The present study

 Elementary school students with externalizing behavioral problems are at risk for low school performance and face negative consequences that may extend into adulthood (O’Connor et al., 2011). Although research suggests that externalizing behavior is reciprocally associated with teacher-student relations, both in terms of TSRS and TSIs, empirical evidence for a transactional association is scarce and primarily based on teacher-rated TSRS. The present study further examined the transactional associations between student externalizing behavioral problems and teacher-student relations. Specifically, this study addressed two research questions: (a)
Are there reciprocal associations between students’ externalizing behaviors and the affective quality of peer-perceived TSRs over time? and (b) Are there reciprocal associations between students’ externalizing behaviors and the affective quality of observed TSIs over time? We studied supportive and conflicted TSRs and TSIs and examined whether associations differed for boys and girls. Within-dyad associations were studied with a cross-lagged longitudinal model with data from three time points within one school year.

Based on theory regarding transactional processes, we hypothesized to find reciprocal associations between teacher-student relations and externalizing behavior over time, both for TSRs and TSIs. Based on Doumen et al. (2008), we expected that students’ externalizing behavior at the start of the year would lead to more teacher conflict and less support during the year, which in turn would increase students’ externalizing behavior at the end of the year.

2. Method

2.1. Participants

As part of a larger project on classroom climate, participants were students and teachers of 57 fifth grade classrooms from 39 Dutch elementary schools. Classes ranged in size from 18 to 34 students ($M = 26.7$, $SD = 3.6$). Only students with parental consent to complete questionnaires and to be recorded on camera participated (1452 out of 1499; 96.9%). In total, 1452 students participated (Time 1 [T1] = 1409; Time 2 [T2] = 1379; Time 3 [T3] = 1390). The average age of the participating students was 10.6 years (range = 8.4–12.8, $SD = 0.5$); 47% were girls. Following to the classification of Statistics Netherlands (2012a), 84.4% of the students were Dutch (both parents born in the Netherlands), 5.6% had another Western background (at least one parent born in another Western country), and 10.0% had a non-Western background (at least one parent born in a non-Western country). This distribution was representative for the areas in which the schools were located (Statistics Netherlands, 2012b). Observation data were available at all three waves for 68.5% of the students, at two waves for 24.8% of the students, and at only one wave for 6.3%. Twenty-two students had no peer observation data at one or more waves. Missing values were due to absence on the day of data collection, students who were not yet or no longer attending school, or to omitted external observation data.

In the Netherlands, elementary school students have either the same teacher for every lesson (approximately 25 h per week; 14 classes, 24.6%), or two teachers who each work part-time (43 classes, 75.4%). In the latter case, the teacher who spent the most hours inside the classroom participated (59.7% of all teachers worked at least four days a week). Teachers’ mean age was 41.1 years (range = 24.5–62.5, $SD = 12.0$); 64% were female. Teachers had an average of 15.0 years of teaching experience (range = 1.0–39.0, $SD = 11.0$). Due to personal leaves, two substitute teachers were present at T2 and three at T3. External observation data of these classes at those waves were therefore omitted.

2.2. Measures

2.2.1. Peer nominations

Externalizing behavior and peer-perceived teacher-student relationships were measured with peer nominations. Students received a description of student or teacher behavior and were asked which of their classmates best fitted that description. Students nominated classmates from a list containing all first names. Nominations were unlimited, with a minimum of one. For each item, we calculated a proportion score for every student by dividing the number of nominations received by the number of nominators (i.e., the students who were present and consented, reduced by one if the student was among the nominators). Because the measures of externalizing behavior and TSIs were both based on peer nominations, we conducted confirmatory factor analyses (CFAs) at the three measurement occasions to verify the proposed factor structure separating student behavior from peer-perceived TSRs. CFAs confirmed the proposed factor structure: $\chi^2$ ranged from 0.05 to 4.35, which with a $df$ of 1 corresponded to $p$ values of 0.825 to 0.037. Range in RMSEA was 0.000–0.048, CFI was 0.999–1.000, and TLI was 0.995–1.002.

Externalizing Behavior. Externalizing behavior was assessed with two peer nomination items: “Which classmates call other children mean names?” and “Which classmates hit or kick other children?”. Externalizing behavior was calculated as the average of the two proportion scores. Omega was 0.96 for all three waves.

Peer-Perceived Teacher-Student Relationships. We used two items to measure peer-teacher conflict reputation (PTCR): “Which classmates are liked least by the teacher?” and “At which classmates does the teacher often get angry?”; see Hendrickx et al., 2017b; Omega = 0.95 [T1], 0.93 [T2], 0.86 [T3]). Two additional items were used to assess peer-teacher support reputation (PTSR): “Which classmates are liked most by the teacher?” and “Which classmates are praised a lot by the teacher?”; Omega = 0.86 [T1], 0.88 [T2], 0.89 [T3]). Reputation refers to the combined perceptions of all peers. For each student we calculated a proportion score for both PTCR and PTSR, similar to externalizing behavior.

1 In total, 59 classes participated in the research project. Two classes were not included in this study; one because the class dropped out after the T1 and one because two teachers were present at all times. Furthermore, between T1 and T2 an intervention occurred in 23 of the classes, aimed at increasing teachers’ awareness of their classes’ peer systems and ameliorating teacher and peer contact of students with difficult peer relationships (i.e., target students; for more information, see Boor-Klip et al., 2016). A logistic regression analysis showed that being a target student could not be predicted by the student’s difference score (T2-T1), $\chi^2 (4) = 5.743, p = .219$. Therefore, these target students are included in this study.
2.2.2. Observed teacher-student interactions

TSIs were coded from 2 h of video observation in each classroom at each wave. Event sampling was used to select all teachers’ interactions that occurred during the 2 h that were (a) directed at a single student or a small group (maximum four students) and (b) expressed in the presence of at least half the classroom. Teachers’ mean frequencies of interactions with each student were 12.23 times (T1), 12.54 times (T2), and 11.08 times (T3). Teachers on average had more interactions with boys than with girls at all time points (T1: M_boys = 13.56, M_girls = 10.78; t(1382.34) = 4.85, p < .001; T2: M_boys = 14.06, M_girls = 10.82; t(1344.52) = 5.06, p < .001; T3: M_boys = 12.04, M_girls = 9.91; t(1231.75) = 3.87, p < .001).

Each TSI received a score for the amount of conflict or support and was classified as either conflicted (scored as −2 or −1) or supportive (scored as +1 or +2). TSIs were scored as neutral (0) when they did not contain affective valence (see Table 1). For each student, a separate mean score was computed for conflicted and supportive TSIs as the sum of the conflicted/supportive scores divided by this student’s total number of TSIs (conflicted, supportive, and neutral TSIs). The mean scores for conflicted TSIs were reversed, resulting in a positive mean score ranging from 0 to 2 for conflicted and supportive TSIs separately.

The second author and five trained research assistants scored the videos. Inter-observer agreement was checked for video segmentation; agreement that an event had occurred ranged from 81% to 87% for the pairs of observers. A set of 1624 TSIs (9% of the total number of fragments) was selected as an inter-rater reliability sample, which was coded for to the level of conflict/support. For the pairs of observers, weighted Cohen’s kappa ranged from 0.72 to 0.77 (i.e., substantial agreement; Landis & Koch, 1977).

2.3. Procedure

Elementary schools in the middle, south, and east of The Netherlands were recruited to participate through convenience sampling, based on existing contacts with schools and school boards in the region. Only students for whom parental consent was obtained to both complete questionnaires and be recorded on camera participated; data of non-consented students were excluded. Data were collected in the fall (T1), winter (T2), and spring (T3) of 2012–2013, 13–15 weeks (T1-T2) and 9–11 weeks (T2-T3) apart. At each wave, students completed the questionnaires on netbook computers in their classroom. Students were seated separately and netbooks were flanked by partitioning screens to increase students’ privacy and prevent distraction. Standard instructions were given concerning the content of the questions and confidential data handling. The netbooks presented the peer nomination items one by one. Students chose the classmates who best fitted the description from this list. Names were presented in random order to avoid sequence effects (Poulin & Dishion, 2008).

Two hours of video were recorded on the same day students completed questionnaires. A camera was positioned in the back of the classroom. The researcher introduced the camera and asked students to interact with it (e.g., wave at the camera). After the introduction, researchers were not present during observations to limit intrusion. Coding started when the researchers left the classroom. After that, teachers could follow their normal lesson plans, except for scheduling tests, when little interaction takes place, and for individual student presentations, when interactions typically revolve around the presenting student. After T3, teachers received a summary of the findings for their classrooms.

2.4. Analysis

To examine whether the quality of observed conflicted and supportive TSIs and peer-perceived TSRs (i.e., PTCR and PTSR) predicted within-dyad changes in students’ externalizing behavior and vice versa, we estimated four random intercept cross-lagged panel models (RI-CLPMs; see Fig. 1). RI-CLPMs are considered the most appropriate analyses to examine within-person processes, or in this

| Score | Teacher-Student Interaction quality | Indicators |
|-------|------------------------------------|------------|
| -2    | Strong conflict                    | Angry or hostile |
|       |                                    | Sarcasm     |
|       |                                    | “Stop that!” |
|       |                                    | “You are being really annoying now!” |
| -1    | Moderate conflict                  | Voice is not louder than normal |
|       |                                    | Warning a student by calling their name |
|       |                                    | “I want you to listen now” |
|       |                                    | “Could you sit normally?” |
| 0     | Neutral                            | Organizational comments |
|       |                                    | “What is the answer to question 8?” |
|       |                                    | “That is correct” |
| +1    | Moderate support                   | Showing compassion |
|       |                                    | Smiling     |
|       |                                    | “That’s nice of you” |
|       |                                    | “You are wearing a nice coat” |
| +2    | Strong support                     | Words of affection, like sweetheart, darling, dear, my friend |
|       |                                    | Laughing and joking |
|       |                                    | “That is very nice of you!” |
|       |                                    | “Thank you very much!” |
study, within-dyad processes over time (Hamaker et al., 2015). Traditional cross-lagged panel models assume that every person varies over time around the same mean, and that there are no stable, trait-like individual differences that endure. However, many psychological measures are, at least to some extent, characterised by stable individual differences, implying that we should focus on processes occurring within a teacher-student dyad. RI-CLPMs take a multilevel approach by allowing individuals to vary around their own mean. More specifically, this model decomposes variables into (a) trait-like, time-invariant (between-dyad) components and (b) state-like, time-varying (within-dyad) components. Because trait-like components are stable over time, it is difficult to study notions of sequentiality that are based on temporal precedence and change over time, whereas state-like components can assess this causality by capturing variations in individuals’ behavior in response to situational changes relative to their own expected score. Hence, RI-CLPMs result in more appropriate conclusions about the presence, direction, and strength of effects within dyads (Hamaker et al., 2015).

Before estimating RI-CLPMs, data were screened for outliers. After reducing univariate outliers to standardized residuals of 3.29 (ranging from 0 to 45 cases [0–3.4%] for each variable), 161 multivariate outliers in total (< 0.01%) were detected based on Mahalanobis distance (Tabachnick & Fidell, 2013). These outliers were not deleted because the combinations of values in these cases were not unusual. Furthermore, to take non-normality of the data into account, RI-CLPMs were tested using maximum likelihood estimation with robust standard errors. Full information maximum likelihood estimation with robust standard errors was applied to handle missing data (0.8%–6.9% for each model).

All analyses were conducted in Mplus, version 8.3 (Muthén & Muthén, 1998-2017), with the TYPE = COMPLEX command specified to correct for the nested nature of the data with students clustered in classes. The models were evaluated using \( \chi^2 \) test, Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and Root Mean Squared Error of Approximation (RMSEA). Good fit is indicated if \( \chi^2 \) test is not significant, CFI and TLI are larger than 0.95, and RMSEA is smaller than 0.05 (Hu & Bentler, 1999). Significance of the \( \chi^2 \) test is soon
Table 2
Descriptive statistics and zero-order correlations of externalizing behavior and observed TSIs.

| Variable          | M (SD) | Range | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     |
|-------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                   | Full sample | Boys  | Girls |       |       |       |       |       |       |       |
| 1. EB (T1)        | 0.11 (0.17) | 0.18 (0.20) | 0.03 (0.07) | 0-1 | –     |       |       |       |       |
| 2. EB (T2)        | 0.12 (0.19) | 0.20 (0.22) | 0.04 (0.08) | 0-1 | 0.911 * | –     |       |       |       |
| 3. EB (T3)        | 0.12 (0.18) | 0.20 (0.21) | 0.04 (0.08) | 0-1 | 0.881 * | 0.933 * | –     |       |       |
| 4. Conflicted TSIs (T1) | 0.18 (0.24) | 0.23 (0.26) | 0.14 (0.21) | 0-2 | 0.200 * | 0.199 * | 0.209 * | –     |       |
| 5. Conflicted TSIs (T2) | 0.17 (0.23) | 0.19 (0.24) | 0.14 (0.21) | 0-2 | 0.140 * | 0.181 * | 0.167 * | 0.153 * | –     |
| 6. Conflicted TSIs (T3) | 0.16 (0.20) | 0.19 (0.21) | 0.13 (0.19) | 0-2 | 0.173 * | 0.185 * | 0.192 * | 0.187 * | 0.177 * | –     |
| 7. Supportive TSIs (T1) | 0.14 (0.20) | 0.13 (0.18) | 0.14 (0.22) | 0-2 | –0.019 | –0.041 | –0.034 | –0.157 * | –0.061 * | –0.009 | –     |
| 8. Supportive TSIs (T2) | 0.14 (0.19) | 0.14 (0.18) | 0.14 (0.20) | 0-2 | 0.007 | 0.001 | 0.012 | –0.095 * | –0.138 * | –0.065 * | 0.192 * | –     |
| 9. Supportive TSIs (T3) | 0.15 (0.19) | 0.14 (0.18) | 0.15 (0.19) | 0-2 | –0.047 | –0.050 | –0.033 | –0.053 | –0.056 | –0.166 * | 0.141 * | 0.089 * |

Note. EB = Externalizing Behavior, TSIs = Teacher-Student Interactions.

* p < .01.
Table 3
Descriptive statistics and zero-order correlations of externalizing behavior and peer-perceived TSRs.

| Variable | M (SD) | Range | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------|--------|-------|---|---|---|---|---|---|---|---|
|          | Full sample | Boys | Girls |   |   |   |   |   |   |   |
| 1. EB (T1) | 0.11 (0.17) | 0.18 (0.20) | 0.03 (0.07) | 0–1 | – | – | – | – | – | – |
| 2. EB (T2) | 0.12 (0.19) | 0.20 (0.22) | 0.04 (0.08) | 0–1 | 0.911 * | – | – | – | – | – |
| 3. EB (T3) | 0.12 (0.18) | 0.20 (0.21) | 0.04 (0.08) | 0–1 | 0.881 * | 0.933 * | – | – | – | – |
| 4. PTCR (T1) | 0.11 (0.18) | 0.18 (0.21) | 0.04 (0.08) | 0–1 | 0.816 * | 0.759 * | 0.747 * | – | – | – |
| 5. PTCR (T2) | 0.12 (0.18) | 0.19 (0.22) | 0.04 (0.08) | 0–1 | 0.762 * | 0.783 * | 0.758 * | 0.857 * | – | – |
| 6. PTCR (T3) | 0.14 (0.18) | 0.21 (0.21) | 0.07 (0.09) | 0–1 | 0.720 * | 0.734 * | 0.754 * | 0.826 * | 0.881 * | – | – |
| 7. PTSR (T1) | 0.29 (0.15) | 0.24 (0.13) | 0.35 (0.17) | 0–1 | –0.325 * | –0.324 * | –0.340 * | –0.393 * | –0.380 * | –0.351 * | – |
| 8. PTSR (T2) | 0.36 (0.18) | 0.31 (0.17) | 0.41 (0.17) | 0–1 | –0.242 * | –0.274 * | –0.275 * | –0.285 * | –0.359 * | –0.256 * | 0.707 * | – |
| 9. PTSR (T3) | 0.38 (0.18) | 0.33 (0.17) | 0.44 (0.17) | 0–1 | –0.223 * | –0.248 * | –0.256 * | –0.277 * | –0.348 * | –0.267 * | 0.684 * | 0.831 * |

Note. EB = Externalizing Behavior, PTCR = Peer Teacher Conflict Reputation, PTSR = Peer Teacher Support Reputation.

* p < .01.
Fig. 2. Within-dyad associations for All RI-CLPMs.

Note. Bold lines depict significant associations, whereas dotted lines depict non-significant associations.
reached with large samples, so should not be viewed too harshly. Models were compared using the Satorra-Bentler scaled \( \chi^2 \) difference test (Satorra & Bentler, 2001). As recommended by Hamaker et al. (2015), we first tested if the variable means were time-invariant by constraining their means to be equal over time. Certain means were freed when the constrained models fit worse than the non-constrained model. Next, given that the three measurement times were about equally spaced (i.e., 3–4 months), we tested whether the effects of the variables on each other were stable over time by constraining the lagged parameters. The imposed constraints were relatively similar in the final four models; the mean of externalizing behavior at T1 was freed in each model and the lagged parameters were constrained only in the model of conflicted TSIs. Furthermore, all means of PTSR and the mean of PTCR at T3 were estimated freely. Finally, we conducted a multiple group analysis to examine whether associations varied for boys and girls.

3. Results

3.1. Descriptive statistics

Tables 2 and 3 show the descriptives of peer-perceived TSRs, observed TSIs, and externalizing behavior. The mean of externalizing behavior was 0.11 at T1, 0.12 at T2, and 0.12 at T3, indicating that on average, students were nominated by slightly over 10% of their classmates for externalizing behaviors. We compared the means of our study variables using \( t \)-tests (see Appendix A, Table A1). Boys received significantly more peer nominations for externalizing behavior than girls (\( M = 0.18 \) vs. 0.02, respectively). Observers reported significantly more conflicted than supportive TSIs at T1 and T2, whereas peers perceived significantly more supportive than conflicted TSRs at all occasions. Observers and peers reported significantly more teacher conflict for boys than for girls at each time. Peers also observed significantly more teacher support for girls than boys at each time.

Overall, peer-perceived TSRs and observed TSIs showed similar correlation patterns. Teacher conflict and support were negatively correlated. Teacher conflict correlated positively, and teacher support negatively, with externalizing behavior. Correlations with externalizing behavior were stronger for peer-perceived TSRs than for observed interactions.

Conflicted TSIs and PTCR were weakly positively correlated at each occasion (\( r = 0.25 \) [T1], \( r = 0.24 \) [T2], \( r = 0.28 \) [T3], \( p < .001 \)), similarly to supportive TSIs and PTSR (\( r = 0.13 \) [T1], \( r = 0.14 \) [T2], \( r = 0.20 \) [T3], \( p < .001 \)). Intraclass correlations indicated that 17.7% of the variance of conflicted TSIs, 11.5% of supportive TSIs, 85.2% of PTCR, 68.5% of PTSR, and 90.8% of externalizing behavior were represented between-dyad/student differences and could thus be viewed as trait-like components.

Table 4
Standardized parameter estimates of the RI-CLPMs for the within-dyad associations between peer-perceived TSRs and externalizing behavior across three waves.

| Parameter | \( \beta \) | \( SE \) | \( p \) |
|-----------|------------|---------|-------|
| Peer-perceived conflicted TSRs | | | |
| Autoregressive pathways | | | |
| a1. PTCR (T1 – T2) | 0.157 | 0.169 | 0.352 |
| a2. PTCR (T2 – T3) | 0.444 | 0.148 | 0.003** |
| a3. EB (T1 – T2) | 0.695 | 0.080 | <0.001** |
| a4. EB (T2 – T3) | 0.806 | 0.061 | <0.001** |
| Cross-lagged pathways | | | |
| b1. PTCR (T1) – EB (T2) | 0.080 | 0.082 | 0.334 |
| b2. EB (T1) – PTCR (T2) | 0.442 | 0.166 | 0.008** |
| b3. PTCR (T2) – EB (T3) | 0.020 | 0.049 | 0.688 |
| b4. EB (T2) – PTCR (T3) | 0.228 | 0.121 | 0.058 |
| Correlations | | | |
| b1. PTCR (T1) – EB (T1) | 0.724 | 0.076 | <0.001** |
| b2. PTCR (T2) – EB (T2) | 0.441 | 0.073 | <0.001** |
| b3. PTCR (T3) – EB (T3) | 0.236 | 0.054 | <0.001** |
| Peer-perceived supportive TSRs | | | |
| Autoregressive pathways | | | |
| a1. PTSR (T1 – T2) | 0.044 | 0.376 | 0.908 |
| a2. PTSR (T2 – T3) | 0.607 | 0.138 | <0.001** |
| a3. EB (T1 – T2) | 0.748 | 0.080 | <0.001** |
| a4. EB (T2 – T3) | 0.821 | 0.052 | <0.001** |
| Cross-lagged pathways | | | |
| b1. PTSR (T1) – EB (T2) | –0.062 | 0.060 | 0.299 |
| b2. EB (T1) – PTSR (T2) | 0.048 | 0.118 | 0.683 |
| b3. PTSR (T2) – EB (T3) | 0.031 | 0.030 | 0.296 |
| b4. EB (T2) – PTSR (T3) | –0.007 | 0.070 | 0.919 |
| Correlations | | | |
| c1. PTSR (T1) – EB (T1) | –0.079 | 0.207 | 0.703 |
| c2. PTSR (T2) – EB (T2) | –0.161 | 0.070 | 0.021* |
| c3. PTSR (T3) – EB (T3) | –0.020 | 0.040 | 0.615 |

Note. EB = Externalizing Behavior, PTCR = Peer Teacher Conflict Reputation, PTSR = Peer Teacher Support Reputation. Paths (a, b, and c) are displayed in Fig. 1. * \( p < .05 \). ** \( p < .01 \).
3.2. RI-CLPMs

3.2.1. Peer-perceived teacher-student relationships

Fig. 2 summarizes the within-dyad associations in all RI-CLPMs.

Table 4. Model fit was excellent,

\[
\chi^2(15) = 1766.60, p < .001, CFI = 1.000, TLI = 1.000, RMSEA = 0.000. \]

At the within-dyad level, the positive cross-lagged paths from externalizing behavior at T1 to PTCR at T2 indicated that students exhibiting more externalizing behavior than expected based on their predicted personal mean level had higher PTCR scores on the next occasion. Note that the estimation of RI-CLPMs involves the calculation of predicted means per dyad and variable, along with deviations from this predicted mean level. The deviations in turn were tested for statistical association. Predicted and actual mean scores would be identical only in the hypothetical case of measurement without error.

We also found weak positive concurrent correlations between PTCR and externalizing behavior on all occasions, indicating that when students scored above their mean level of externalizing behavior at a certain occasion, they were likely to score above their mean level of PTCR at that occasion. The positive autoregressive paths of externalizing behavior and PTCR indicated a within-person carry-over effect: Occasions on which students scored above their predicted means were followed by occasions on which they still scored above their expected score. At the between-dyad level (see Fig. 1, path d), PTCR and externalizing behavior were strongly positively correlated (\( \hat{\beta} = 0.851, p < .001 \)). Peers clearly observed more conflicted TSRs for students who exhibited more externalizing behavior on average.

The lower part of Table 4 shows standardized results of the model testing associations between PTSR and externalizing behavior. This model also fit the data well, \( \chi^2(2) = 2.62, p = .700, CFI = 0.999, TLI = 0.996, RMSEA = 0.015 \). At the within-dyad level, PTSR and externalizing behavior did not significantly predict each other over time. We did find a weak negative concurrent correlation between PTSR and externalizing behavior at T2. At this wave, students exhibiting more externalizing behavior than expected based on their predicted personal mean level had higher PTSR scores on the next occasion. Note that the positive autoregressive paths of externalizing behavior and PTSR indicated a within-person carry-over effect: Occasions on which students scored above their predicted means were followed by occasions on which they still scored above their expected score. At the between-dyad level (see Fig. 1, path d), PTCR and externalizing behavior were strongly positively correlated (\( \hat{\beta} = 0.408, p < .001 \)); students with higher levels of externalizing behavior had lower levels of PTSR.

When comparing within-dyad associations by gender (see Appendix B, Table B1), there was a moderately strong cross-lagged

### Table 4

| Observed conflicted TSIs | \( \beta \) | \( SE \) | \( p \) |
|-------------------------|---------|--------|-------|
| Autoregressive pathways |         |        |       |
| a1. Conflicted TSIs (T1 – T2) | -0.012 | 0.042 | 0.765 |
| a2. Conflicted TSIs (T2 – T3) | -0.013 | 0.044 | 0.763 |
| a3. EB (T1 – T2) | 0.532 | 0.064 | <0.001* |
| a4. EB (T2 – T3) | 0.695 | 0.059 | <0.001* |
| Cross-lagged pathways |         |        |       |
| b1. Conflicted TSIs (T1 – EB (T2)) | 0.013 | 0.028 | 0.642 |
| b2. EB (T1) – conflicted TSIs (T2) | 0.030 | 0.040 | 0.457 |
| b3. Conflicted TSIs (T2 – EB (T3)) | 0.013 | 0.028 | 0.638 |
| b4. EB (T2) – conflicted TSIs (T3) | 0.042 | 0.057 | 0.463 |
| Correlations |         |        |       |
| b1. Conflicted TSIs (T1) – EB (T1) | 0.048 | 0.071 | 0.498 |
| b2. Conflicted TSIs (T2) – EB (T2) | 0.124 | 0.043 | 0.004* |
| b3. Conflicted TSIs (T3) – EB (T3) | 0.043 | 0.046 | 0.351 |
| Observed supportive TSIs |         |        |       |
| Autoregressive pathways |         |        |       |
| a1. Supportive TSIs (T1 – T2) | 0.057 | 0.080 | 0.482 |
| a2. Supportive TSIs (T2 – T3) | -0.074 | 0.080 | 0.354 |
| a3. EB (T1 – T2) | 0.748 | 0.077 | <0.001* |
| a4. EB (T2 – T3) | 0.813 | 0.052 | <0.001* |
| Cross-lagged pathways |         |        |       |
| b1. Supportive TSIs (T1) – EB (T2) | -0.038 | 0.022 | 0.074 |
| b2. EB (T1) – supportive TSIs (T2) | 0.069 | 0.069 | 0.313 |
| b3. Supportive TSIs (T2) – EB (T3) | 0.036 | 0.025 | 0.156 |
| b4. EB (T2) – supportive TSIs (T3) | -0.036 | 0.049 | 0.457 |
| Correlations |         |        |       |
| c1. Supportive TSIs (T1) – EB (T1) | 0.017 | 0.057 | 0.762 |
| c2. Supportive TSIs (T2) – EB (T2) | -0.004 | 0.037 | 0.908 |
| c3. Supportive TSIs (T3) – EB (T3) | 0.046 | 0.039 | 0.244 |

**Note.** EB = Externalizing Behavior, TSIs = Teacher-Student Interactions. Paths (a, b, and c) are displayed in Fig. 1. * \( p < .01 \).
predictive effect of externalizing behavior at T1 on PTCR at T2 for boys but no cross-lagged effects for girls. PTSR and externalizing behavior did not predict each other over time for boys or girls. At the between-dyad level, there was a stronger positive correlation between PTCR and externalizing behavior for boys ($\beta = 0.829, p < .001$) than for girls ($\beta = 0.685, p < .001$). The negative correlation between PTSR and externalizing behavior was stronger for girls ($\beta = -0.326, p = .117$) than for boys ($\beta = -0.299, p = .001$).

3.3. Observed teacher-student interactions

Standardized results of the model testing associations between conflicted TSIs and externalizing behavior are shown in the upper part of Table 5. This model had good fit, $\chi^2(15) = 2126.76, p < .001$, CFI = 0.997, TLI = 0.994, RMSEA = 0.024. At the within-dyad level, conflicted TSIs did not predict externalizing behavior over time and vice versa. The weak positive concurrent correlations at T2 and T3 showed that students scoring above their mean level of externalizing behavior also scored above their mean of conflicted TSIs at these occasions. Similar to the model for PTCR, the positive autoregressive pathways of externalizing behavior indicated a within-person carry-over effect. At the between-dyad level, conflicted TSIs and externalizing behavior correlated moderately ($\beta = 0.408, p < .001$); students exhibiting more externalizing behavior were likely to have more conflicted TSIs.

The lower portion of Table 5 shows standardized results of the model testing associations between supportive TSIs and externalizing behavior. This model fit very well, $\chi^2(15) = 2068.84, p < .001$, CFI = 1.000, TLI = 1.005, RMSEA = 0.000. At the within-dyad level, supportive TSIs and externalizing behavior did not significantly predict each other over time. We did find positive autoregressive paths of externalizing behavior, indicating a within-person carry-over effect similarly to the model of PTCR. At the between-dyad level, supportive TSIs and externalizing behavior did not correlate significantly ($p = .354$). Overall, the degree of externalizing behavior was not related to the number of supportive TSIs.

A comparison of these latter models between boys and girls revealed that, at the within-dyad level, neither conflicted TSIs nor supportive TSIs predicted externalizing behavior over time nor vice versa for either gender (see Appendix B, Table B2, Table B3). At the between-dyad level, slightly stronger correlations between conflicted TSIs and externalizing behavior were found for boys ($\beta = 0.321, p < .001$) than for girls ($\beta = 0.297, p < .001$). There was no significant correlation between supportive TSIs and externalizing behavior for either gender.

4. Discussion

In this study, mutual influences between teacher-student relations and student externalizing behavior were examined. Although students’ externalizing behavior can be disruptive to classroom processes and trigger teacher conflict (Sutherland & Oswald, 2005), teacher-student conflict can fuel students’ negative emotions and externalizing behavior (Carr et al., 1991; O’Connor et al., 2011). We investigated reciprocity between fifth grade students’ externalizing behavior and the affective quality of teacher-student relations, in terms of peer-perceived teacher-student relationships (TSRs) and observed teacher-student interactions (TSIs), over the course of one school year.

Unlike earlier studies, our results indicated no reciprocity between students’ externalizing behavior and teacher-student relations over the course of the school year, neither for teacher conflict nor for support. However, within-time deviations in conflict were positively associated with deviations in students’ externalizing behavior at that time point. Thus, if a teacher showed more conflict at a certain occasion (both in terms of TSRs and TSIs), students showed more externalizing behavior at that same occasion too, but not one occasion later. We did find associations over time (but not transaction) within teacher-student dyads for boys; boys who scored above their own mean of externalizing behavior in the beginning of the school year had more conflicted TSRs three months later.

4.1. Reciprocity between teacher-student relations and externalizing behavior?

The few existing studies on externalizing behavior and TSRs indicated reciprocity (e.g., Doumen et al., 2008; Zhang & Sun, 2011). We found similar results at the sample level in terms of the rank order of individuals in that the more externalizing behavior that students exhibited on average over the entire year, the more likely it was that their teachers showed more conflict towards them than to other students. These rank orders where rather stable and teacher support, as opposed to conflict, was not associated with externalizing behavior (cf. Hamre & Pianta, 2001). When examining within-dyad processes over time, we did not find reciprocal associations between externalizing behavior and either TSRs or TSIs.

Because previous studies reporting transactional processes have not investigated within-dyad dynamics separately from stable, trait-like differences between students or between teachers, their findings may be biased (Hamaker et al., 2015). According to our findings, students exhibiting externalizing behavior seemed not to get caught in transactional processes that further exacerbated their behavioral problems over time. Many psychological measures are characterized by stable, trait-like individual differences. Hamaker et al. showed that cross-lagged models that do not account for such stable differences can lead to spurious results regarding the assumed direction of transactional effects. Our results indicated that fifth graders’ externalizing behaviors were especially characterized by stable, trait-like individual differences and that reciprocity over the course of a school year between externalizing student behavior teacher behavior cannot be assumed.

A second explanation for the deviation of our findings from existing work could be that existing studies used teacher ratings of teacher-student relationships and student behavior, whereas we used the perspectives of peers and external observers. Prior findings could have emerged from teachers’ response bias due to a halo effect; teachers’ perceptions of TSRs are often strongly related to their perceptions of students’ behavior (Abikoff et al., 1993; Pianta & Stuhlman, 2004). Additionally, teacher ratings offer perspectives from
inside teacher-student dyads whereas we included an outside perspective. Associations between teacher and student behaviors might thus be of a more psychological nature. Spilt and Koomen (2009) showed that teachers reported more conflict and expressed more helplessness and anger concerning students they perceived as disruptive than with nondisruptive students. Using an outside viewpoint can result in a different perspective due to the psychologically more disconnected nature of observations. Observations of TSIs are not biased by previous classroom processes and might therefore better reflect what actually happens in classrooms (Praetorius et al., 2012; Scherzinger & Wettstein, 2019).

Interestingly, our findings echo earlier studies that used teacher reports: students who showed more externalizing behavior were also involved in more teacher conflict and negative interactions. This underpins that teacher reports, which take much less time and effort to collect than peer nominations and certainly observations, can be a valuable measure in this respect as well. In sum, based on the possible shared method variance of previous studies, the reliability of peers and external observers, and the application of sophisticated statistical models in the current study, we conclude that in fifth grade a teacher’s relationship with a specific student and that student’s externalizing behavior were not reciprocally associated over the applied time frame, that is, one school year.

4.2. Teacher conflict and teacher support

Our findings showed that teachers tended to respond more harshly to students exhibiting externalizing behavior. However, we found no such within-dyad associations between teacher support and externalizing behavior. This underlines the importance of examining teacher conflict and support as separate constructs and could be due to a negativity bias in which negative interaction might have a stronger impact than positive interaction (Vaish et al., 2008), especially because teacher conflict, more than teacher support, contrasts with what is perceived as normative teacher behavior (Hendrickx et al., 2016). In addition, teacher support may become less important for students’ behavioral development during elementary school, whereas peer relations become increasingly important. Lefot et al. (2011) found no associations between teacher support and second and third-graders’ externalizing behavior, whereas peer social preference predicted decreases in externalizing behavior. However, future studies on the relative importance of teacher support compared to positive peer relations for externalizing behavior are necessary to draw firmer conclusions.

4.3. Gender differences

The only longitudinal effect we identified was that boys’ externalizing behavior at the beginning of the school year predicted conflicted TSRs three months later. This effect was not present for girls. In our study, teachers interacted more frequently with boys than with girls, and these interactions with boys consisted of higher levels of conflict. Furthermore, externalizing behavior was more strongly positively correlated with conflicted TSRs and TSIs for boys than for girls. Particularly for girls, externalizing behavior was generally limited, with some students who did show these behaviors. Overall, boys were more often showing externalizing behavior and were more often involved in conflicted relationships. Possibly, particularly these differences between boys and girls in their mean levels of externalizing behavior have driven the differences in effects. This is consistent with Beaman et al. (2007), who found that boys not only displayed more externalizing behavior, but also had a higher risk of developing conflicted TSRs than girls. Also, consistent with findings of Lei et al. (2016), girls’ externalizing behavior was more strongly negatively correlated with supportive TSRs than that of boys. Girls might care more about their relationships with their teacher and seek more positive emotions from them, causing girls to be more susceptible to teacher support (Hu et al., 2015).

4.4. Limitations and directions for future research

We concluded that reciprocity between teacher-student relations and externalizing behavior at the within-dyad level cannot simply be assumed; yet, our results should be interpreted in light of several limitations. Also, our study points towards several directions for further research.

First, although aggregated peer perceptions have extensively proven their value in previous studies (e.g., Cillessen, 2009; Hughes et al., 2001), there also appears to be considerable stability in several peer nomination measures over time (e.g., Tomada & Schneider, 1997; Wu et al., 2001), which may make it too challenging to find fluctuations in classroom dynamics over the course of one school year. Externalizing behavior was measured using two sociometric items, whereas norm-referenced measures exist with which a more comprehensive spectrum of externalizing behavior can be measured (e.g., Child Behavior Checklist [CBCL], Achenbach, 1991; or Child Behavior Scale [CBS], Ladd & Proffit, 1996). Using aggregated peer perceptions of both externalizing behavior and TSRs may have resulted in shared method variance. This seems to be reflected in the strong correlations between conflicted TSRs and externalizing behavior ratings, suggesting that these variables measured rather similar constructs. However, a CFA supported our use of these two measures as separate constructs and RI-CLPM controlled for within-time associations between both variables and captured variations in individuals’ behavior relative to their average behavior. Thus, the cross-lagged paths between externalizing behavior and conflicted TSRs cannot be entirely explained by a shared response bias (Eisenberg et al., 1999; Hamaker et al., 2015). Future research may benefit from triangulating these data by including a teacher or self-rated norm-referenced measure for externalizing behavior and adding teacher perceptions of TSRs. This would also enhance the comparability with extant research on the transaction between teacher-student relations and students’ externalizing behavior, which primarily used teacher perceptions for both.

Second, we measured TSIs on three occasions across one school year that were about equally spaced by three months. However, externalizing behavior was rather stable over the course of the year and deviations from students’ average externalizing behavior and from the average quality of teacher-student relations co-occurred at the same time point. This may indicate that the association with
TSIs occurs within a shorter time frame. The finding of the T1-T2 (autoregressive) effects generally being somewhat less strong than T2-T3 effects underlines this possibility because there were on average four weeks more in between T1 and T2 than between T2 and T3. However, the mechanisms may be at play in a much shorter timeframe. For example, Nelson and Roberts (2000) studied ongoing reciprocal sequences of TSIs around disruptive behaviors by observing what happened in a specific moment. They found that teachers interacted more negatively with students who exhibited externalizing behavior to which in turn students were likely to respond negatively, implying that reciprocity occurred from moment to moment. For future research, it will be informative to study transaction with students’ externalizing behavior form moment-to-moment, lesson-to-lesson or over weeks.

Related to this, it would be worthwhile to further consider what processes may counteract transaction over longer time periods. Research in social psychology indicates that impression formation in newly formed relationships is a rather fast and automatic process and that relationships, once formed, are rather resistant to change (Kenny, 2004). In the educational context, there is some evidence that students’ impressions of their teacher at the beginning of the school year are highly correlated with their perceptions in fall (Mainhard et al., 2011). This also is consistent with our findings. Future research could investigate how teachers form relationships with students who are at risk of externalizing behavior at the very beginning of the school year – it is possible that especially then interventions may be helpful to reduce externalizing behaviors in class.

Finally, future studies could investigate to what extent our findings are generalizable across cultures, school settings, and age groups. Students in the Netherlands are generally in the same classroom group of peers for their entire primary school career, that is, from first to sixth grade. Although teachers differ from year to year, peer reputations may build for years, which may have added to the stability of the autoregressive paths. In samples where students’ peer groups alter every year, stability of reputational effects may be much smaller. Regarding age, in our fifth-grade sample, students may have been focused less on the teacher for cues regarding how to behave and more on their peers (LaFontana & Cillessen, 2010) than in younger samples (Doumen et al., 2008; Zhang & Sun, 2011). Peer relationships become more important to older students (LaFontana & Cillessen, 2010), possibly causing them to be less influenced by teacher-student relations than younger students (Hamre & Pianta, 2001; LaFontana & Cillessen, 2010; Lefflot et al., 2011). Additionally, Silver et al. (2005) showed that conflicted TSRs were associated with rapid increases in externalizing behavior between kindergarten and third grade. Because our results indicated that fifth graders’ externalizing behaviors were especially characterized by stable individual differences, preschoolers and lower elementary school students might be more susceptible to changes in teacher behavior. Once established, younger students’ externalizing behavior tends to persist over time and can even develop into more severe disorders (Bennett et al., 1999). Therefore, it is valuable to examine whether processes at the within-dyad level of younger students differ from those of older students, so that targeted intervention programs can be offered at the right time.

4.5. Conclusions and implications

The findings of this study enhance our understanding of the assumed reciprocity between the affective quality of teacher-student relationships and interactions and externalizing behavior. Similar to prior research, externalizing behavior and teacher-student relations were associated and no reciprocity was found over the course of one school year within specific teacher-student dyads, thus showing no evidence of transactional processes over time. Differences both between teacher-student dyads in externalizing behavior and in teacher conflict and support were rather stable and trait-like over time as teachers tended to respond more harshly to students, in particular boys, who exhibited more externalizing behavior. Thus, although reciprocity between students’ externalizing behavior and their teachers’ behavior over a longer time period cannot simply be assumed as previous studies indicated (e.g., Doumen et al., 2008), our findings confirm that these constructs are interrelated. Transaction therefore may take place within a shorter time frame.

If transaction indeed takes place from moment-to-moment, teachers and students affect each other with their behavior and can thus be regarded as components of a social system (Pennings & Mainhard, 2016). This implies that behavioral change in one component can bring about change in the other component. This is also consistent with Nelson and Roberts (2000) who indicated that less conflict corresponds with less externalizing behavior during classroom interaction. Because students who experience much teacher conflict are often more disadvantaged in their socioemotional and/or academic adjustment (O’Connor et al., 2011), it is worthwhile to consider how teachers as professionals can be supported to change their behavior. It seems decreasing conflict in particular, rather than increasing support, can potentially decrease externalizing student behavior. Recently, a growing body of research has focused on teachers’ mental representations of specific students and of the quality of the relationship as one way to change teachers’ responses. For example, perspective taking and imagining several alternative ways how a student may experience a lesson and view the teacher, can help teachers to identify dyad specific behavioral dynamics and come up with behavioral alternatives to reduce teacher-student conflict and thus students’ externalizing behavior. If transaction is indeed present from moment to moment it is worthwhile to consider direct observations or video to identify dyad specific (mal-)adaptive action-reaction patterns in teacher-student interactions.

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Appendix A. Results of comparing means

Table A1
Results of paired sample t-test (comparing means of conflicted TSIs and supportive TSIs, and of PTCR and PTSR) and independent sample t-test (comparing means of boys and girls).

|                  |        |        |       |         |       |       |
|------------------|--------|--------|-------|---------|-------|-------|
|                  | M (SD) | M (SD) | t     | df      | p     | Cohen’s d |
|                  | EB boys | EB girls |       |         |       |       |
| **T1**           | 0.18 (0.20) | 0.03 (0.07) | 19.11 | 956.31 | <0.001** | 0.97   |
| **T2**           | 0.20 (0.22) | 0.04 (0.08) | 19.72 | 968.23 | <0.001** | 1.00   |
| **T3**           | 0.20 (0.22) | 0.04 (0.08) | 19.23 | 968.03 | <0.001** | 0.98   |
| **Confl/Supp TSIs** |        |        |       |         |       |       |
|                  | Conflicted TSIs | Supportive TSIs |       |         |       |       |
| **T1**           | 0.13 (0.24) | 0.14 (0.21) | –5.35 | 1334 | <0.001** | 0.39   |
| **T2**           | 0.19 (0.24) | 0.14 (0.21) | 7.20 | 1318.15 | <0.001** | 2.72   |
| **T3**           | 0.19 (0.21) | 0.13 (0.19) | 4.90 | 1150.00 | <0.001** | 0.29   |
| **Supp TSIs (boys/girls)** |        |        |       |         |       |       |
|                  | Conflicted TSIs boys | Conflicted TSIs girls |       |         |       |       |
| **T1**           | 0.13 (0.18) | 0.14 (0.22) | –1.02 | 1223.18 | 0.306 | –0.16  |
| **T2**           | 0.14 (0.18) | 0.14 (0.20) | –0.06 | 1221.78 | 0.952 | –0.00  |
| **T3**           | 0.14 (0.18) | 0.15 (0.19) | –0.26 | 1150.00 | 0.798 | –0.01  |
| **PTCR/PTSR**    | PTCR boys | PTCR girls |       |         |       |       |
| **T1**           | 0.11 (0.18) | 0.29 (0.15) | 25.09 | 1443 | <0.001** | 0.66   |
| **T2**           | 0.12 (0.18) | 0.36 (0.18) | 29.89 | 1439 | <0.001** | 0.79   |
| **T3**           | 0.14 (0.18) | 0.38 (0.18) | 31.46 | 1437 | <0.001** | 0.83   |
| **PTCR (boys/girls)** |        |        |       |         |       |       |
|                  | PTCR boys | PTCR girls |       |         |       |       |
| **T1**           | 0.18 (0.21) | 0.04 (0.08) | 17.77 | 971.05 | <0.001** | 0.79   |
| **T2**           | 0.19 (0.22) | 0.04 (0.08) | 17.81 | 962.88 | <0.001** | 0.80   |
| **T3**           | 0.21 (0.21) | 0.07 (0.09) | 17.16 | 1032.54 | <0.001** | 0.77   |
| **PTSR (boys/girls)** |        |        |       |         |       |       |
|                  | PTCR boys | PTCR girls |       |         |       |       |
| **T1**           | 0.24 (0.13) | 0.35 (0.15) | –14.47 | 1343.81 | <0.001** | –0.88  |
| **T2**           | 0.31 (0.17) | 0.41 (0.17) | –11.37 | 1432 | <0.001** | –0.71  |
| **T3**           | 0.33 (0.17) | 0.44 (0.17) | –12.06 | 1427 | <0.001** | –0.75  |

Note. EB = Externalizing Behavior, TSIs = Teacher-Student Interactions, PTCR = Peer Teacher Conflict Reputation, PTSR = Peer Teacher Support Reputation.
* p < .05. ** p < .01.

Appendix B. Results of multiple group analysis

Table B1
Standardized parameter estimates of the RI-CLPMs for the within-dyad associations for boys and girls between peer-perceived TSRs and externalizing behavior across three waves.

|                  |        |        |       |     |     |     |
|------------------|--------|--------|-------|-----|-----|-----|
|                  |        |        |       | Boys | Girls |     |
|                  | β     | SE     | P     | β   | SE   | P   |
| Peer-Perceived conflicted TSRs |        |        |       |     |     |     |
| Autoregressive pathways |        |        |       |     |     |     |
| a1. PTCR (T1 – T2) | 0.179 | 0.199 | 0.367 | 0.014 | 0.517 | 0.979 |
| a2. PTCR (T2 – T3) | 0.522 | 0.134 | <0.001** | 0.220 | 0.221 | 0.319 |
| a3. EB (T1 – T2)  | 0.689 | 0.105 | <0.001** | 0.467 | 0.270 | 0.084 |
| a4. EB (T2 – T3)  | 0.788 | 0.072 | <0.001** | 0.597 | 0.124 | <0.001** |
| Cross-lagged pathways |        |        |       |     |     |     |
| b1. PTCR (T1) – EB (T2) | 0.034 | 0.105 | 0.742 | 0.021 | 0.182 | 0.908 |
| b2. EB (T1) – PTCR (T2) | 0.402 | 0.191 | 0.036* | 0.167 | 0.453 | 0.712 |
| b3. PTCR (T2) – EB (T3) | 0.009 | 0.054 | 0.862 | 0.093 | 0.105 | 0.375 |
| b4. EB (T2) – PTCR (T3) | 0.167 | 0.122 | 0.171 | 0.107 | 0.153 | 0.482 |
| Peer-perceived supportive TSRs |        |        |       |     |     |     |
| (continued on next page) |        |        |       |     |     |     |
Table B1 (continued)

|                      | Boys                      |     |     |     | Girls                      |     |     |     |
|----------------------|---------------------------|-----|-----|-----|---------------------------|-----|-----|-----|
|                      | β  | SE  | p    | β  | SE  | p    |
| **Autoregressive pathways** |     |     |     |     |     |     |
| a1. PTSR (T1 – T2)   | −0.323 | 1.443 | 0.823 | 0.213 | 0.258 | 0.409 |
| a2. PTSR (T2 – T3)   | 0.650  | 0.135 | <0.001** | 0.574 | 0.161 | <0.001** |
| a3. EB (T1 – T2)     | 0.706  | 0.131 | <0.001** | 0.511 | 0.253 | 0.043* |
| a4. EB (T2 – T3)     | 0.799  | 0.070 | <0.001** | 0.647 | 0.137 | <0.001** |
| **Cross-lagged pathways** |     |     |     |     |     |     |
| b1. PTSR (T1) – EB (T2) | −0.082 | 0.193 | 0.670 | 0.113 | 0.143 | 0.427 |
| b2. EB (T1) – PTSR (T2) | −0.101 | 0.499 | 0.840 | 0.277 | 0.154 | 0.072 |
| b3. PTSR (T2) – EB (T3) | 0.011  | 0.035 | 0.746 | 0.109 | 0.099 | 0.271 |
| b4. EB (T2) – PTSR (T3) | 0.034  | 0.084 | 0.685 | 0.069 | 0.052 | 0.183 |
| **Correlations**      |     |     |     |     |     |     |
| c1. PTSR (T1) – EB (T1) | −0.186 | 0.557 | 0.739 | 0.184 | 0.196 | 0.354 |
| c2. PTSR (T2) – EB (T2) | −0.234 | 0.385 | 0.543 | 0.043 | 0.143 | 0.761 |
| c3. PTSR (T3) – EB (T3) | 0.002  | 0.059 | 0.971 | −0.002 | 0.064 | 0.974 |

Note. EB = Externalizing Behavior, TSIs = Teacher-Student Interactions, PTCR = Peer Teacher Conflict Reputation, PTSR = Peer Teacher Support Reputation. Paths (a, b, and c) are displayed in Fig. 1.
* p < .05. ** p < .01.

Table B2

Standardized parameter estimates of the RI-CLPMs for the within-dyad associations for boys and girls between observed TSIs and externalizing behavior across three waves.

|                     | Boys                      |     |     |     | Girls                      |     |     |     |
|---------------------|---------------------------|-----|-----|-----|---------------------------|-----|-----|-----|
|                     | β  | SE  | p    | β  | SE  | p    |
| **Observed conflicted TSIs** |     |     |     |     |     |     |
| a1. Conflicted TSIs (T1 – T2) | −0.016 | 0.053 | 0.757 | −0.015 | 0.048 | 0.756 |
| a2. Conflicted TSIs (T2 – T3) | −0.002 | 0.061 | 0.979 | −0.002 | 0.059 | 0.979 |
| a3. EB (T1 – T2)   | 0.638  | 0.130 | <0.001** | 0.561 | 0.162 | 0.001** |
| a4. EB (T2 – T3)   | 0.737  | 0.086 | <0.001** | 0.699 | 0.074 | <0.001** |
| **Cross-lagged pathways** |     |     |     |     |     |     |
| b1. Conflicted TSIs (T1) – EB (T2) | 0.016  | 0.016 | 0.323 | 0.028 | 0.029 | 0.325 |
| b2. EB (T1) – conflicted TSIs (T2) | −0.021 | 0.091 | 0.813 | −0.009 | 0.041 | 0.817 |
| b3. Conflicted TSIs (T2) – EB (T3) | −0.003 | 0.020 | 0.881 | −0.006 | 0.037 | 0.881 |
| b4. EB (T2) – conflicted TSIs (T3) | 0.077  | 0.077 | 0.313 | 0.038 | 0.038 | 0.321 |
| **Correlations**  |     |     |     |     |     |     |
| b1. Conflicted TSIs (T1) – EB (T1) | 0.016  | 0.085 | 0.854 | 0.130 | 0.093 | 0.161 |
| b2. Conflicted TSIs (T2) – EB (T2) | 0.139  | 0.051 | 0.007** | 0.060 | 0.042 | 0.152 |
| b3. Conflicted TSIs (T3) – EB (T3) | 0.058  | 0.057 | 0.305 | 0.033 | 0.069 | 0.635 |
| **Observed supportive TSIs** |     |     |     |     |     |     |
| a1. Supportive TSIs (T1 – T2) | 0.105  | 0.083 | 0.205 | 0.020 | 0.101 | 0.845 |
| a2. Supportive TSIs (T2 – T3) | 0.007  | 0.086 | 0.186 | −0.135 | 0.109 | 0.215 |
| a3. EB (T1 – T2)   | 0.717  | 0.089 | <0.001** | 0.466 | 0.282 | 0.098 |
| a4. EB (T2 – T3)   | 0.790  | 0.066 | <0.001** | 0.641 | 0.127 | <0.001** |
| **Cross-lagged pathways** |     |     |     |     |     |     |
| b1. Supportive TSIs (T1) – EB (T2) | −0.049 | 0.032 | 0.124 | −0.034 | 0.042 | 0.417 |
| b2. EB (T1) – supportive TSIs (T2) | 0.110  | 0.113 | 0.330 | 0.020 | 0.101 | 0.845 |
| b3. Supportive TSIs (T2) – EB (T3) | 0.056  | 0.042 | 0.186 | 0.009 | 0.043 | 0.829 |
| b4. EB (T2) – supportive TSIs (T3) | −0.093 | 0.072 | 0.198 | 0.053 | 0.061 | 0.384 |
| **Correlations**  |     |     |     |     |     |     |
| c1. Supportive TSIs (T1) – EB (T1) | 0.063  | 0.081 | 0.441 | −0.030 | 0.087 | 0.731 |
| c2. Supportive TSIs (T2) – EB (T2) | −0.010 | 0.055 | 0.859 | 0.017 | 0.058 | 0.764 |
| c3. Supportive TSIs (T3) – EB (T3) | 0.011  | 0.053 | 0.843 | 0.131 | 0.067 | 0.048* |

Note. EB = Externalizing Behavior, TSIs = Teacher-Student Interactions. Paths (a, b, and c) are displayed in Fig. 1.
* p < .05. ** p < .01.

Table B3

Model fit of RI-CLPMs in multiple group analysis.

| Model              | CFI  | TLI  | RMSEA |
|--------------------|------|------|-------|
| Conflicted TSIs    | 0.995| 0.966| 0.054 |
| Supportive TSIs    | 0.996| 0.979| 0.019 |
| PTCR               | 0.996| 0.979| 0.046 |
| PTSR               | 0.995| 0.966| 0.054 |

Note. TSIs = Teacher-Student Interactions, PTCR = Peer Teacher Conflict Reputation, PTSR = Peer Teacher Support Reputation.
