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Reciprocal associations between teachers' use of disciplinary practices and aggression in elementary school students

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ABSTRACT

Transactional theories of human development suggest that the association between teachers' disciplinary practices and students' aggressive behavior may be reciprocal. However, no study has tested this possibility. Therefore, this study examines reciprocal associations between teachers' use of disciplinary practices (educational and punitive) and aggressive behaviors in elementary school students. A sample comprising 1038 students (62 % boys) was assessed at the start and end of the kindergarten year and annually from grades one to four. At each assessment, teachers reported how frequently they used disciplinary practices with each participating student and completed a measure of the aggressive behaviors of these students. Results of a latent curve model with structured residuals (LCM-SR) revealed that higher-than-usual levels of teacher-reported kindergarten students' aggressive behaviors in the fall predicted higher-than-usual levels of teacher-reported punitive practices in the spring. Moreover, higher-than-usual levels of kindergarten teachers' punitive practices in the spring predicted higher-than-usual levels of students' aggressive behaviors in grade one. In the following years, no other reciprocal influences were found between punitive practices and aggression. Moreover, using educational disciplinary practices did not lead to a decrease in aggression. The results underscore the need to equip teachers with the skills to manage disruptive classroom behaviors, particularly in kindergarten and during the transition to grade one, to prevent aggressive behaviors from spiraling downward.

1. Introduction

Besides facilitating student learning and the development of academic skills, teachers can influence their social behavior (Korpershoek et al., 2016; Maldonado-Carreño & Votruba-Drzal, 2011). In particular, teachers' disciplinary practices are likely to influence student behavior, notably aggressive behavior (Oliver et al., 2011; Weyns et al., 2017). In turn, students' aggressive behaviors will likely impact teachers' use of disciplinary practices (Nurmi & Kiuru, 2015). However, despite this presumed bidirectional process between teachers' disciplinary practices and students' behaviors, no study has adequately examined it to date. The few available longitudinal studies have only addressed the quality of teacher-student relationships, mainly during the preschool years. Furthermore, they have rarely disaggregated between-person and within-person effects. The present study aimed to fill this gap by

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investigating longitudinal associations between two types of teachers' disciplinary practices (educational and punitive) and students' aggressive behaviors from kindergarten to grade four. To do so, an advanced statistical approach using a latent curve model with structured residuals (LCM-SR) was applied to distinguish between changes operating at the between-person level (to better capture individual differences) and the within-person level (to better capture changes over time). A better understanding of the interplay between teachers' disciplinary practices and students' aggressive behavior could enhance teacher training in managing student behaviors in the classroom. The findings may also be relevant for school psychologists, helping them support teachers in their interventions with students.

1.1. Teachers' disciplinary practices and students' aggressive behaviors

Aggressive behaviors are characterized by an intention to harm the physical or psychological integrity of others, whether or not as a result of provocation (Malti & Rubin, 2018; Martinelli et al., 2018). They can be physical (e.g., shoving, hitting, breaking objects) or relational (e.g., threats, insults, spreading rumors, etc.). Although aggressive behaviors tend to decrease with age, some students continue to act aggressively throughout their schooling (Broidy et al., 2003; Girard et al., 2019). In the classroom, disruptive behavior often accompanies aggression (Bierman et al., 2013). Disruptive behavior refers to any behavior that breaks the rules set by the teacher (e.g., refusing to follow rules, disturbing peers, interruptive or inappropriate comments, etc.). Teachers are required to address these behaviors as they disrupt the delivery of educational activities and the learning processes in the classroom. How teachers react to disruptive behavior can impact the development of aggression, particularly when they use reactive disciplinary practices (Weyns et al., 2017). Unlike proactive disciplinary practices, which aim to prevent students' disruptive behaviors and promote appropriate classroom conduct, reactive disciplinary practices refer to how teachers intervene in response to students' disruptive behaviors in the classroom (Gaudreau, 2024). Teachers can use two main reactive disciplinary practices to manage student's disruptive behaviors: punitive and educational (Gaudreau, 2024). Punitive practices focus on punishing and sanctioning disruptive behaviors in the classroom (Gaudreau, 2024). They include, but are not limited to, yelling and scolding, isolation from other students, and classroom exclusion. Such punitive practices have been associated with the development and escalation of aggression (L'Écuyer et al., 2021; Weyns et al., 2017). According to social learning theory (Bandura, 1973), teachers serve as models for their students. Hence, when teachers use punitive or hostile practices, students may conclude that this is how others should be treated (Krause & Smith, 2022). These practices also prevent students from learning other more appropriate ways to behave and developing socioemotional skills (Denham, 2023; Li et al., 2022; Mayer, 2002). In contrast, educational disciplinary practices such as discussing the problem and suggesting acceptable solutions help students acquire appropriate classroom behaviors, notably when the expected behaviors are taught (Gaudreau, 2024). Unlike punitive practices, educational disciplinary practices are associated with reduced aggression (Bradshaw et al., 2012; Smith et al., 2011).

1.2. Reciprocal associations between teachers' disciplinary practices and students' behaviors

The ecological and transactional models of human development consider students and teachers as two entities that socially influence each other over time (Bronfenbrenner & Morris, 2006; Sameroff, 2009). In the case of aggressive behaviors, the interactive mechanisms at play recall Patterson's (1982) coercion theory of mutual reinforcement in the interactions between children and caregivers. Applying this principle to teacher-student interactions, students' aggressive behaviors would incite teachers to use reactive and punitive disciplinary strategies, which would, in turn, intensify students' aggressive behaviors (Doumen et al., 2008; Sutherland & Oswald, 2005). The reverse process can also occur; teachers' use of punitive practices may lead students to react aggressively, subsequently increasing teachers' use of punitive practices. This negative interaction cycle generates a downward spiral of coercive interactions in which the teacher and student grow increasingly hostile toward each other. Moreover, when students act aggressively in class, teachers may develop negative feelings such as anger and stress and, consequently, react with punitive measures (de Ruiter et al., 2019; Hastings, 2005). Teachers' use of punitive practices, such as raising their voice, reprimanding, or shouting, can teach students that these behaviors are socially acceptable, encouraging them to adopt similar behaviors with their peers. Inversely, when teachers handle students in a more positive manner, notably with educational discipline - when they calmly discuss the problem and describe acceptable alternative behaviors - they can serve as models of prosocial skills and positive social interactions (Luckner & Pianta, 2011; Serdiouk et al., 2015).

Despite their probable transactional nature, the links between teachers' disciplinary practices and students' aggressive behaviors have been examined mainly in unidirectional terms. Thus, past studies have shown that manifestations of aggressive behavior by students predicted teachers' use of punitive practices (Nurmi, 2012). Some studies have also found that students who acted aggressively were more likely to be reprimanded and tended to receive less positive attention from their teacher compared to students who did not engage in aggressive behavior (Sutherland et al., 2008; Sutherland & Oswald, 2005). Finally, studies focusing on the evaluation of interventions targeting teachers have shown that a reduction in teacher reprimands was associated with a decrease in externalizing behaviors among second-grade students (Spilt et al., 2016) and that improvement in teachers' classroom behavior management practices was linked to similar beneficial effects for students (Chuang et al., 2020; Korest & Carlson, 2022; Major et al., 2024).

The few longitudinal studies that have examined bidirectional associations for student aggression addressed the quality of the teacher-student relationship but not the disciplinary practices teachers used to manage the behavior of their students. Although teachers' disciplinary practices and the quality of the teacher-student relationship are distinct constructs, the findings of these studies provide valuable insights. Three of these studies, which utilized a cross-lagged panel model, revealed reciprocal associations between teacher-student conflict and externalizing behavior (including aggression) in preschool (Doumen et al., 2008; Zhang & Sun, 2011) and

during the transition from kindergarten to first grade (Skalická et al., 2015). However, no reciprocal associations were observed between teacher-student support and students' externalizing behavior in regular classrooms (Skalická et al., 2015; Zhang & Sun, 2011). Using a longitudinal design from kindergarten to grade six and multivariate latent growth curve models, Crockett et al. (2017) found that higher-than-usual teacher-student conflict consistently predicted higher-than-usual levels of externalizing behavior compared to the reverse direction, although one bidirectional association was found between teacher-student conflict and externalizing behavior from kindergarten to grade one. Lastly, using random-intercept cross-lagged panel models, Hendrickx et al. (2022) reported no reciprocal associations between students' externalizing behavior and teacher-student conflict or support measured at three time points in fifth grade. Taken together, these results suggest that bidirectional processes between teacher-student relationship quality and students' externalizing behaviors at school entry would diminish with age, and this could hold true for associations between teachers' disciplinary practices and students' aggressive behaviors.

In sum, although studies have not specifically examined bidirectional associations between teachers' educational and punitive disciplinary practices and students' aggressive behaviors, the findings in the related literature on the quality of teacher-student relationships suggest that these associations could operate, even though they may tail off over time. Associations between teachers' educational and punitive disciplinary practices and students' aggressive behaviors would have important practical implications since disciplinary practices represent a concrete target that can be acted upon to improve students' behaviors and the quality of the relationship between teachers and students.

1.3. Developmental issues

Transactional models of development have considered reciprocal associations, such as those proposed between teachers' practices and students' aggression, as well as the developmental changes over time that impact these associations (Sameroff, 2009). With respect to social development, the older children get, the more they develop their cognitive, language, emotional, and social skills (Bouchard, 2022). Thus, they gradually acquire the ability to self-regulate their emotions and use their communication skills to express their needs and feelings (Cole et al., 2010; Zeman et al., 2006). For example, these skills form the basis for alternative, non-aggressive behaviors to cope with potentially unpleasant situations. At the same time, aggressive behaviors decrease in frequency with age (Bongers et al., 2004; Nagin & Tremblay, 1999). These developmental changes affect how children interact with others in their environment, including teachers, and hence may trigger different responses. From this perspective, teachers will be less likely to resort to disciplinary practices as children grow up and gradually curtail their aggressive behaviors.

In this regard, Caldarella et al. (2021) showed that teachers relied less frequently on reprimands and praise as students progressed in their schooling. Similarly, some longitudinal studies focusing on the quality of the teacher-student relationship have shown that support and conflict in the teacher-student relationship tend to decline over the elementary school years (Wu & Hughes, 2014). This suggests that teachers' disciplinary practices, whether punitive or educational, could change similarly over this period. However, other studies have reported divergent results. For instance, Jerome et al. (2009) showed that teacher-student support and conflict followed different and nonlinear longitudinal trends from kindergarten to grade six. Conflict tended to increase from kindergarten to grade four and decrease thereafter from grades four to six, but teacher-student support declined, with a more pronounced drop in the higher elementary school grades. Other studies have reported similar trends (Crockett et al., 2017; Lee & Bierman, 2018).

1.4. Between-person and within-person variability

Studies that examined bidirectional associations between the quality of the teacher–student relationship and students' aggressive behaviors have generally used traditional statistical analysis methods such as cross-lagged panel modelling (CLPM) (Doumen et al., 2008; Skalická et al., 2015; Zhang & Sun, 2011). However, this method does not allow for disaggregating between-person and within-person effects (Hoffman & Hall, 2024; Lucas, 2023). Between-person effects refer to how individuals change over time compared to others (i.e., interindividual differences), whereas within-person effects refer to developmental changes at the individual level (i.e., intraindividual change over time). Traditional CLPM confounds these two sources of variability and can produce ambiguous and biased variable estimates (Hoffman & Hall, 2024). The latent curve model with structured residuals (LCM-SR) overcomes these shortcomings by distinguishing and isolating between-person and within-person changes (Hoffman & Hall, 2024). These two levels of analysis also need to be disaggregated, as they give rise to different interpretations. In the context of the link between teachers' disciplinary practices and students' displays of aggressive behavior, between-person effects correspond to the fact that students who tend to display higher (or lower) levels of aggressive behavior than their peers might tend to receive higher (or lower) levels of punitive and educational disciplinary practices from teachers over time, and vice versa. Intraindividual effects correspond to the fact that students who exhibit higher (or lower) levels of aggressive behavior than usual may tend to receive higher (or lower) levels of punitive and educational disciplinary practices than usual, and vice versa.

The results of Berry and Willoughby's (2017) study demonstrate the importance of disaggregating between-person and within-person effects. Using two real-life data examples, these researchers examined the reciprocal links between parental spanking and aggression in children. To do this, two models were specified and compared: an auto-regressive cross-lagged model (ARCL; also known as CLPM) and an autoregressive latent trajectory model with structured residuals (ALT-SR; also known as LCM-SR). In both examples, results from the CLPM showed significant cross-effects between corporal punishment and aggression, whereas the ALT-SR model showed no significant within-person effects between these variables. These results suggest that the ARCL results were largely due to confounding between intra- and interindividual effects. Hoffman and Hall (2024) also compared results from the CLPM and LCM-SR models and reached similar conclusions. To our knowledge, no study to date has attempted to isolate bidirectional associations

between teachers' disciplinary practices and within-person changes in students' aggressive behaviors in a school context, while accounting for potentially confounding between-person effects (i.e., factors such as gender and ethnicity that vary across individuals but tend to remain stable within individuals over time). However, a parallel study conducted in a home setting with parents and children highlights the importance of disaggregating between-person and within-person effects.

1.5. The present study

This study aimed to examine longitudinal associations between teachers' disciplinary practices (educational and punitive) and students' aggressive behaviors from kindergarten to grade four. A longitudinal design with annual assessments over five years was selected to better identify the reciprocal influential processes between the study variables as the students advanced through elementary school. Moreover, using an LCM-SR distinguished the between-person effects from the within-person effects. This study addresses three specific research questions, the first two referring to the interindividual level and the last to the intraindividual level: 1) How do teachers' punitive and educational disciplinary practices and students' manifestations of aggressive behavior change over time? 2) Is the starting point or rate of change in students' manifestations of aggressive behavior related to the starting point or rate of change in teachers' punitive and educational disciplinary practices? 3) Are there reciprocal associations between students' manifestations of aggressive behavior and teachers' punitive and educational disciplinary practices over time?

1.5.1. Between-person level hypothesis

Based on the above-cited studies, several hypotheses were formulated. Regarding the first research question, students' aggressive behaviors and punitive and educational disciplinary practices were expected to decrease significantly from kindergarten to grade four. Manifestations of aggressive behaviors are expected to decrease over time due to various factors, including socio-emotional and cognitive development, that promote adopting alternative behaviors to aggression (Bouchard, 2022; Cole et al., 2010). Similarly, the results of studies by Caldarella et al. (2021) and Wu and Hughes (2014) suggest that teachers' use of punitive and educational disciplinary practices tends to decrease over time.

Regarding the second research question, it is expected that kindergarten students who tend to exhibit higher levels of aggressive behaviors than their peers will receive higher levels of punitive disciplinary practices from teachers at the time and over time. A similar but negative effect was expected between educational practices and aggressive behaviors. These hypotheses build on previous studies showing positive associations between teachers' punitive practices and students' manifestations of aggressive behaviors and negative associations between educational practices and aggressive behaviors (Korest & Carlson, 2022; L'Écuyer et al., 2021; Weyns et al., 2017).

1.5.2. Within-person level hypothesis

Regarding the third research question, teachers' punitive practices and students' aggressive behaviors were expected to be positively and mutually influential over time, beyond the expected trajectories for disciplinary practices and aggressive behaviors. Specifically, it is anticipated that higher-than-usual levels of students' aggressive behaviors at one wave predict higher-than-usual levels of teachers' punitive practices at the next wave and vice-versa. A similar but negative effect was expected between educational practices and aggressive behaviors. These hypotheses are based on transactional models of human development and related to previous studies that have focused on the quality of the teacher-student relationship, suggesting that students' behaviors and those of their teachers are likely to influence each other over time (Patterson, 1982; Sameroff, 2009). These hypotheses are also supported by studies showing positive associations between punitive disciplinary practices and aggressive behaviors and negative associations between educational practices and aggressive behaviors (Korest & Carlson, 2022; L'Écuyer et al., 2021; Weyns et al., 2017). Lastly, more pronounced bidirectional associations were expected at school entry. Previous longitudinal studies on the quality of the teacher-student relationship suggest that students are more sensitive to the influence of teachers at the beginning of their schooling, and vice versa (Crockett et al., 2017; Hendrickx et al., 2022).

1.6. Control variables

Students' sex, family's socioeconomic status, teachers' characteristics, and peer rejection were included in the tested model as controls, given their associations with students' aggressive behaviors and the quality of teacher–student interactions. Studies have shown associations between socioeconomic status and manifestations of aggressive behavior (Letourneau et al., 2013) or the quality of teacher-student interactions (Rudasill et al., 2010). Gender differences have also been observed with regard to manifestations of aggressive conduct and the quality of teacher-student interactions (Auwarter & Aruguete, 2008; Lansford et al., 2012). In addition, teachers' highest education level and teachers' years of experience were included as control variables since studies have shown that these factors affect teachers' classroom behavior management practices (Clark et al., 2023; Nadeau et al., 2022; Unal & Unal, 2012). Finally, L'Écuyer et al. (2021) showed that in kindergarten, students rejected by their peers were more likely to display aggressive behavior and be the target of punitive disciplinary practices by teachers, and vice versa.

2. Method

2.1. Participants

Data for this study come from a longitudinal project designed to assess the impact of a prevention program of violence and school dropout implemented in kindergarten (Poulin et al., 2013). This multimodal prevention program included five components: social skills and problem-solving training, family intervention, teacher support, friendship skills, and pre-academic skills. Some students in the current sample were randomly assigned to the program (the children's intervention status – control or intervention – was included as a control variable in the current analyses). Previous analyses showed that the program did not change teacher reports of aggression over time (Poulin et al., 2013).

Recruitment of teachers and students spanned three consecutive years (i.e., three cohorts) and involved over 40 schools in a large urban school board in the Montreal Metropolitan Area (Québec, Canada). The project was initially presented to all the school board's kindergarten teachers, and 55 % volunteered to participate. The current sample was created by combining the three cohorts. In all cases, these were homeroom teachers of regular classrooms.

Approximately nine students were recruited in each classroom for a total sample of 1038 kindergarten students (62 % boys; mean age = 65.2 months, SD = 3.7). In kindergarten, most students lived with both biological parents (72 %), were born in Canada (84 %), and spoke French (100 %). 3.3 % were born in Africa, 0.3 % in the USA, 1.2 % in Asia, 1.8 % in the Caribbean, 4.2 % in Europe, 2.0 % in Latin America, and 3.2 % in the Middle East. Most parents had completed post-secondary education (mothers = 69.1 %; fathers = 64.0 %). The average annual family gross income was CAN$60,900, with 7 % below CAN$20,000 and 18 % above CAN$100,000. In Quebec, when the data were collected, 56.4 % of the adult population had completed post-secondary studies (Institut de la statistique du Québec, 2023a), and the average family income was CAN$58,400 (Institut de la statistique du Québec, 2023b).

Teacher characteristics were only available for kindergarten teachers. Among them, the majority were women (98 %), with an average teaching experience of 15.56 years (SD = 10.19; range 0–38 years). More than half (67.6 %) held a bachelor's degree, 28.9 % held or were pursuing a master's or doctoral degree, and 3.5 % were currently pursuing a bachelor's degree. Regarding age distribution, 8.2 % were between 20 and 29 years old, 36.8 % were between 30 and 39 years old, 24.1 % were between 40 and 49 years old, and 30.9 % were between 50 and 59 years old.

Data were gathered in six waves: the fall and spring of the kindergarten year and the spring of grades one, two, three, and four. During the longitudinal follow-ups, some student participants were lost because the family moved outside the school district, the teacher declined to participate, or the parents preferred to interrupt their child's participation. Participation rates in the assessment were 97.4 % in the fall of kindergarten, 95.4 % in the spring of kindergarten, 73.9 % in first grade, 56.4 % in second grade, 53.9 % in third grade, and 53 % in fourth grade. Children who were assessed in at least one of the six waves were included for analysis (N = 1038). Of these, 34.8 % participated in six waves, 20.4 % in five, 7.2 % in four, 17.5 % in three, 17.9 % in two, and 1.5 % in one. The number of teachers and students who participated at each measurement time is indicated in Table 1. Little's MCAR test was significant (χ^2 = 1131.62 (989), p = .001), suggesting that data were not missing completely at random (Little, 1988). We have no reason to

Table 1
Descriptive statistics.

Variable	N teachers	N students	*M*	*SD*	Skewness	Kurtosis
Punitive K-fall	123	1011	1.91	0.94	0.82	−0.34
Punitive K-spring	123	990	1.97	0.94	0.73	−0.46
Punitive G1	168	767	1.89	0.89	0.76	−0.42
Punitive G2	175	585	1.85	0.89	0.81	−0.36
Punitive G3	201	560	1.85	0.85	0.72	−0.46
Punitive G4	177	550	1.76	0.83	0.94	−0.09
Educational K-fall	123	1011	3.44	1.09	−0.52	−0.45
Educational K-spring	123	988	3.45	1.09	−0.54	−0.38
Educational G1	168	766	3.23	1.13	−0.36	−0.70
Educational G2	175	585	3.09	1.19	−0.26	−0.89
Educational G3	201	560	3.00	1.13	−0.29	−0.79
Educational G4	177	550	3.02	1.20	−0.22	−0.98
Aggression K-fall	123	1012	1.85	0.94	1.31	1.30
Aggression K-spring	123	990	1.86	0.93	1.30	1.29
Aggression G1	168	767	1.75	0.95	1.58	2.10
Aggression G2	175	585	1.65	0.83	1.73	3.02
Aggression G3	201	560	1.66	0.85	1.60	2.20
Aggression G4	177	551	1.70	0.90	1.71	2.67
Child's sex	–	1038	–	–	–	–
Family income	–	917	5.48	2.51	−0.17	−1.07
Peer rejection	–	1031	0.05	0.99	0.90	0.20
Years of teaching experience	123	–	16.21	10.59	0.41	−1.18
Teacher education level	123	–	2.46	0.53	−0.22	−1.19
Child's intervention status	–	1038	–	–	–	–

Note. M = mean; SD = standard deviation; K-fall = fall of the kindergarten year; K-spring = spring of the kindergarten year.

believe that the data is not missing at random. At baseline, students who took part in all measurement times ($n = 361$) were similar to those whose data was missing on at least one occasion ($n = 671$) regarding demographic variables, except for income ($t(718) = -3.45$; $p < .001$) peer rejection ($t(754) = -3.47$; $p < .001$) and years of teaching experience ($t(754) = -2.63$; $p < .01$). These variables were therefore included as control variables in the analyses. Additionally, students who took part in all measurement times had a higher level of aggressive behaviors at baseline than those whose data was missing on at least one occasion ($t(681) = -4168$; $p < .001$).

2.2. Procedure

Data were gathered in the fall and spring of kindergarten. After kindergarten, students were assessed only in the spring. The teachers varied from year to year, as did the classroom compositions. Each year, we first located the teachers of each of our participating students and contacted them to solicit their involvement in the project. As they progressed in their schooling, students spread out in an increasingly larger number of classrooms/teachers. The average number of participating students per class was 8.49 in kindergarten, 4.10 in first grade, 3.43 in second grade, 3.02 in third grade, and 2.89 in fourth grade.

At each assessment wave, the teachers completed a questionnaire for each participating student in their classroom. Teachers responded to items on various aspects of the student's social functioning, including statements on aggressive behaviors, and responded to items on their disciplinary practices with that student. On average, it took approximately 15 to 20 min to respond to each questionnaire. The teachers received financial compensation for their time spent completing questionnaires. Research assistants distributed and collected the questionnaires at the schools. The research team comprised undergraduate students in psychology and education. They received training sessions lasting from half a day to one day, depending on their specific tasks, and were closely supervised by the project coordinator.

Control variables were measured in the fall of kindergarten (October) with a parent questionnaire (student's sex and family's socioeconomic status) and a sociometric interview held in the classroom (peer rejection) by trained and qualified research assistants. These instruments are described below. All questionnaires were administered in paper/pencil format. This study was approved by the Institutional Review Board of the Université du Québec à Montréal. Written informed parental consent was obtained annually. Before each data collection, all children verbally expressed their consent. Each school year, teachers also provided written informed consent.

2.3. Measures

This section details how the main constructs were measured, based on teacher reports of their disciplinary practices and students' aggressive behaviors, along with control variables.

2.3.1. Teacher-reported punitive and educational disciplinary practices

Teachers' punitive and educational disciplinary practices were measured with four items from a questionnaire on parents' disciplinary practices used in the Québec Longitudinal Study of Child Development (Institut de la Statistique du Québec, 2001) and the Canadian National Longitudinal Survey of Children and Youth (Statistics Canada, 2002). The items were adapted for the present study to measure teachers' disciplinary practices. In response to the question: "Over the last month, when this student broke the rules or did things that he or she was not supposed to, how often did you … ?" teachers indicated on a Likert scale from 1 (*Never*) to 5 (*Always*) how often they used certain disciplinary practices with each participating student in their class. Punitive discipline was measured with two items: "Raise your voice, scold, or yell at him or her?" and "Take away privileges or isolate him or her from the other children?" (correlation between the two items varied from 0.56 to 0.66 ($p < .01$) over the six waves). Educational discipline was measured with two items: "Calmly discuss the problem?" and "Describe alternative behaviors that are acceptable?" (The correlation between the two items varied from 0.76 to 0.85 ($p < .01$) over the six waves). Average scores for the two items were calculated to obtain scale scores. Other studies have used these two scales to measure teachers' disciplinary practices (Guimond et al., 2023; L'Écuyer et al., 2021).

We conducted a multilevel confirmatory factor analysis (MCFA) using Mplus V7 (Muthén & Muthén, 2012) to confirm the factorial structure of punitive and educational disciplinary practices items. The residual variance of the statement "Describe alternative behaviors that are acceptable?" had to be fixed at 0. The results show that the factor structure of these two constructs is well represented by their respective indicators ($\chi 2\ (4) = 76.45$, $p = .38$; RMSEA = 0.06; CFI = 0.98; TLI = 0.96; SRMR(1) = 0.01, SRMR(2) = 0.03).

2.3.2. Teacher-reported students' aggressive behaviors

Students' aggressive behaviors were assessed using the aggression subscale of the Social Behavior Questionnaire (SBQ; Tremblay et al., 1991), completed by their classroom teacher. The SBQ was developed for the Québec Longitudinal Study of Child Development (Institut de la Statistique du Québec, 2001). Items were also drawn from other validated questionnaires (Achenbach, 1991; Boyle et al., 1993; Tremblay et al., 1987). The aggression subscale consisted of 13 items measuring physical aggression ("hit or fought with someone"), proactive aggression ("incited other children to hit or fight with another child"), reactive aggression ("reacted aggressively to teasing"), and indirect aggression ("tried to get others to dislike someone they were angry with"). Internal consistency for the scale (Cronbach's alpha coefficient and McDonald's *omega* coefficient) varied from 0.94 to 0.95 over the six waves. Teachers responded to all items on a Likert scale from 1 (*Never or Not True*) to 6 (*Often or Very True*). A score was computed by averaging all item responses.

2.3.3. Control variables

The variables were measured in the fall of kindergarten (October). Parents reported their children's sex and family's socioeconomic status (on a 9-point scale from CAN$19,999 or less to CAN$100,000 or more). Kindergarten teachers provided their number of years of

teaching experience. They also reported their highest education level by choosing from among nine items ranging from "Some courses leading to a bachelor's degree" to "doctoral degree." This variable was recoded into three categories: "studying toward a bachelor's degree," "bachelor's degree," and "obtained or studying toward a master's or doctoral degree." A dummy variable represented the child's intervention status (0 = control, 1 = intervention).

Peer rejection was assessed using a peer nomination procedure in the classroom administered by research assistants. Children included in the procedure were those targeted in the present study as well as all their classmates whose parents had given a written permission. Participating children were photographed (face only). All the photographs for each class were presented on a single page in a response booklet. Verbal instructions were given to the whole class. Test instructions were given to ensure that all children understood the procedure. The children were then asked to: "Circle the face of three children you don't like to play with." Peer rejection nominations for each child were compiled and standardized for each class to control for variability in classroom size (Coie et al., 1982). All student responses were verified at the end of the procedure, and all students received a sticker to thank them for participating. The participation rate in every class surpassed 50 %. This exceeded the typically advised threshold of 40 % to ensure the validity and reliability of peer nomination data (Marks et al., 2012). This procedure has proven to be both valid and reliable for assessing peer rejection among preschool-aged children (Bukowski et al., 2012; Wu et al., 2001).

2.4. Analytic strategy

Longitudinal associations between teachers' reports of their disciplinary practices (educational and punitive) and teachers' reports of students' aggressive behaviors were examined using an LCM-SR. This allowed for the estimation and disaggregation of between- and within-person effects within the same model. The two disciplinary practices (educational and punitive) were simultaneously included in the tested model to examine their respective associations with teachers' reports of students' aggressive behaviors. Although the teachers change from one school year to the next, the models represent the trajectories of children's exposure to these practices over time.

The LCM-SR model was built in three steps based on Curran et al.'s (2014) criteria. First, separate models of univariate latent growth curves were identified for teachers' reports of their punitive practices, educational practices, and students' aggressive behaviors. Factor loadings for the intercept were set to 1. For the slopes, the saturation coefficients were fixed proportionally to the passage of time between the six measurement points, with a 6-month interval between T1 and T2 and a one-year interval between the other measurement points (i.e., loadings were fixed to 0, 0.5, 1.5, 2.5, 3.5, 4.5). For each study variable, three trajectory forms were estimated and compared: without change (flat or stable), with linear change, and with quadratic change. To determine the best fit, the models were compared using chi-square difference tests with Satorra-Bentler correction (Satorra & Bentler, 2001).

Secondly, an LCM-SR model was estimated by combining the three univariate latent growth curves to simultaneously examine associations between the latent factors (between-person effects) and between the structured residuals (within-person effects) for each study variable. The time-adjacent and auto-regressive associations between the residuals for the repeated measures for each variable were then estimated. Cross-lagged associations were also estimated between the residuals for each disciplinary practice (educational and punitive) and for aggressive behaviors. All three study variables' latent factors (intercept, slope, and quadratic) were allowed to covary. Between-person variations were represented by links between the latent factors and within-person variations by time-adjacent, auto-regressive, and cross-lagged associations between the structured residuals.

Third, the control variables (sex, socioeconomic status, peer rejection, number of years of teaching experience, teacher's education level, intervention status) measured in the fall of kindergarten were included in the model. To do so, the latent factors were regressed on the control variables (sex, socioeconomic status, peer rejection, child's intervention status) while the structured residuals for teachers' punitive and educational disciplinary practices in kindergarten were regressed on the control variable "number of years of teaching experience", "teacher's education level" and "child's intervention status". The structured residuals for students' aggressive behaviors in kindergarten were regressed on the control variable "child's intervention status". The model fit was evaluated using several indices: the chi-square test ($p > .05$), the root mean square error of approximation (RMSEA; ≤ 0.06), the standardized root mean square residual (SRMR $\leq$0.08), the Tucker–Lewis index, and the comparative fit index (TLI and CFI; ≥ 0.90) (Hu & Bentler, 1999).

All analyses were performed in Mplus V7 (Muthén & Muthén, 2012). Missing data were handled with full information maximum likelihood (FIML) to allow all children who had participated in at least one wave to be included.

3. Results

3.1. Descriptive statistics

Table 1 presents the descriptive statistics and fit indices. The normality (skewness and kurtosis) obtained for all variables is adequate for analysis (skewness <2; kurtosis <7; West et al., 1995). Table 2 presents the bivariate correlations between the variables. The correlation matrix shows that teachers' reports of their punitive and educational practices and teachers' reports of students' aggressive behaviors are positively intercorrelated over the six waves. Sex and peer rejection positively correlate with the variables of interest at all waves. Family income correlates negatively with these variables at all waves, except for punitive practices at T1, educational practices at T1, T2, and T3, and aggressive behaviors at T1 at nonsignificant levels.

Table 2
Correlations among the study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Punitive KF																							
2. Punitive KS	0.72**																						
3. Punitive G1	0.55**	0.54**																					
4. Punitive G2	0.50**	0.45**	0.52**																				
5. Punitive G3	0.41**	0.39**	0.53**	0.48**																			
6. Punitive G4	0.47**	0.38**	0.45**	0.48**	0.44**																		
7. Educational KF	0.34**	0.26**	0.19**	0.23**	0.20**	0.27**																	
8. Educational KS	0.30**	0.35**	0.23**	0.20**	0.17**	0.19**	0.49**																
9. Educational G1	0.25**	0.25**	0.38**	0.26**	0.27**	0.23**	0.08*	0.14**															
10. Educational G2	0.31**	0.30**	0.27**	0.43**	0.23**	0.25**	0.21**	0.15**	0.22**														
11. Educational G3	0.27**	0.30**	0.30**	0.32**	0.43**	0.36**	0.15**	0.14**	0.21**	0.24**													
12. Educational G4	0.38**	0.33**	0.32**	0.36**	0.34**	0.47**	0.19**	0.17**	0.21**	0.19**	0.27**												
13. Aggression KF	0.67**	0.56**	0.46**	0.40**	0.35**	0.42**	0.28**	0.25**	0.17**	0.34**	0.29**	0.31**											
14. Aggression KS	0.55**	0.62**	0.45**	0.35**	0.34**	0.39**	0.24**	0.29**	0.18**	0.30**	0.26**	0.27**	0.77**										
15. Aggression G1	0.51**	0.50**	0.64**	0.43**	0.43**	0.37**	0.17**	0.24**	0.32**	0.30**	0.27**	0.27**	0.50**	0.51**									
16. Aggression G2	0.42**	0.42**	0.41**	0.56**	0.42**	0.37**	0.23**	0.21**	0.25**	0.40**	0.30**	0.26**	0.48**	0.47**	0.52**								
17. Aggression G3	0.40**	0.36**	0.41**	0.43**	0.55**	0.42**	0.22**	0.20**	0.22**	0.29**	0.39**	0.33**	0.46**	0.42**	0.43**	0.48**							
18. Aggression G4	0.36**	0.31**	0.38**	0.38**	0.38**	0.60**	0.19**	0.17**	0.24**	0.21**	0.28**	0.43**	0.41**	0.39**	0.41**	0.39**	0.53**						
19. Child's sex	0.21**	0.18**	0.22**	0.21**	0.18**	0.22**	0.15**	0.10**	0.13**	0.14**	0.18**	0.17**	0.08*	0.02	0.12**	0.12**	0.12**	0.07					
20. Family income	−0.04	−0.09**	−0.11**	−0.13**	−0.19**	0.17**	−0.02	0.01	−0.07	−0.10*	−0.14**	−0.14**	−0.06	−0.11**	−0.16**	−0.10*	−0.19**	−0.21**	0.02				
21. Peer rejection	0.47**	0.43**	0.32**	0.37**	0.26**	0.32**	0.22**	0.18**	0.11**	0.24**	0.20**	0.26**	0.39**	0.33**	0.31**	0.31**	0.33**	0.27**	0.18**	−0.10**			
22. Experience	−0.01	0.04	0.04	−0.03	0.01	0.01	0.07*	0.12**	−0.01	0.05	0.03	−0.03	0.02	0.05	0.02	−0.07	−0.01	0.00	0.00	0.02	0.01		
23. Education	0.00	0.02	−0.01	−0.01	−0.04	−0.01	0.05	0.05	0.08*	0.05	0.03	0.01	−0.01	0.00	−0.01	0.01	0.01	0.03	−0.01	−0.03	−0.03	0.26**	
24. Intervention	−0.04	−0.03	0.01	0.07	0.05	0.05	0.10**	0.09**	0.02	0.06	0.05	0.04	0.00	0.01	0.00	0.05	0.00	0.00	−0.02	−0.02	0.00	0.03	0.11**

Note. Experience = years of teaching experience, Education = teacher education, Intervention = child's intervention status, KF = fall of the kindergarten year, KS = spring of the kindergarten year.
***p < .001; **p < .01; *p < .05.

3.2. Univariate growth curves

Stable, linear, and quadratic models were tested for the three variables of interest. Results are presented in Table 3. The quadratic model provided the best data fit for the three variables. More precisely, all the study variables decrease quadratically with time. Respectively, Figs. 1, 2, and 3 show the growth curves for each variable. The curve for teacher-reported punitive practices follows a downward trajectory that begins to accelerate by about grade two. The curve for teacher-reported educational practices also decreases with time, but less so by grade two. The latent growth curve models for teachers' disciplinary practices represent the trajectories of children's exposure to educational and punitive discipline over time. Finally, the curve for teacher-reported students' aggressive behaviors follows a downward trajectory that becomes less pronounced by grade three and appears to stabilize more rapidly compared to educational practices.

3.3. Latent curve model with structured residuals

To facilitate the model estimation, the variances for all the quadratic terms and the linear slopes for educational practices and aggressive behaviors were fixed at zero. The model showed good data fit ($\chi^2 = 226.63$ (163), $p < .001$, CFI = 0.99, TLI = 0.98, RMSEA = 0.02, SRMR = 0.03). The results of the LCM-SR model are presented visually in Fig. 1. For clarity, the figure includes only the statistically significant parameters. The LCM-SR model makes it possible to simultaneously examine interindividual effects, represented by the links between latent factors (intercept, slope, and quadratic), and intraindividual effects, represented by the links

Table 3
Unconditional growth curve model fit comparisons and results.

Model	Fit	$\Delta\chi^2$	i	s	q	var i	var s	var q
Punitive								
Intercept	$\chi^2(19) = 291.708$, $p < .001$; RMSEA = 0.12 [90 % CI = 0.11, 0.13], CFI = 0.79, TLI = 0.83	–	0.409***	–	–	***	–	–
Linear	$\chi^2(16) = 82.611$, $p < .001$; RMSEA = 0.06 [90 % CI = 0.05, 0.08], CFI = 0.95, TLI = 0.95	195.18***	1.950***	−0.045***	–	***	***	–
Quadratic	**$\chi^2(12) = 32.59$, $p < .001$; RMSEA = 0.04** [90 % CI = 0.02, 0.06]**, CFI = 0.98, TLI = 0.98**	**52.24*** **	**1.928*** **	**0.003**	**−0.011***	***	***	*
Educational								
Intercept	$\chi^2(19) = 261.095$, $p < .001$; RMSEA = 0.11 [90 % CI = 0.10, 0.12], CFI = 0.29, TLI = 0.44	–	3.285***	–	–	***	–	–
Linear	$\chi^2(16) = 86.125$, $p < .001$; RMSEA = 0.06 [90 % CI = 0.05, 0.08], CFI = 0.79, TLI = 0.81	161.96***	3.457***	−0.119***	–	***	***	–
Quadratic	**$\chi^2(12) = 35.968$, $p < .001$; RMSEA = 0.04** [90 % CI = 0.03, 0.06]**, CFI = 0.93, TLI = 0.91**	**50.42*** **	**3.470*** **	**−0.175*** **	**0.014**	***	***	**
Aggression								
Intercept	$\chi^2(19) = 312.206$, $p < .001$; RMSEA = 0.122 [90 % CI = 0.11, 0.13], CFI = 0.74, TLI = 0.80	–	1.767***	–	–	***	–	–
Linear	$\chi^2(16) = 85.959$, $p < .001$; RMSEA = 0.06 [90 % CI = 0.05, 0.08], CFI = 0.94, TLI = 0.94	215,22***	1.855***	−0.058***	–	***	***	–
Quadratic	**$\chi^2(12) = 35.174$, $p < .001$; RMSEA = 0.04** [90 % CI = 0.03, 0.06]**, CFI = 0.98, TLI = 0.97**	**46,27*** **	**1.858*** **	**−0.100*** **	**0.011***	***	***	***

Note. The model in bold corresponds to the model that best represents the data. i = intercept, s = slope, q = quadratic, var. = variance.
***p < .001; **$p < .01$; *$p < .05$.

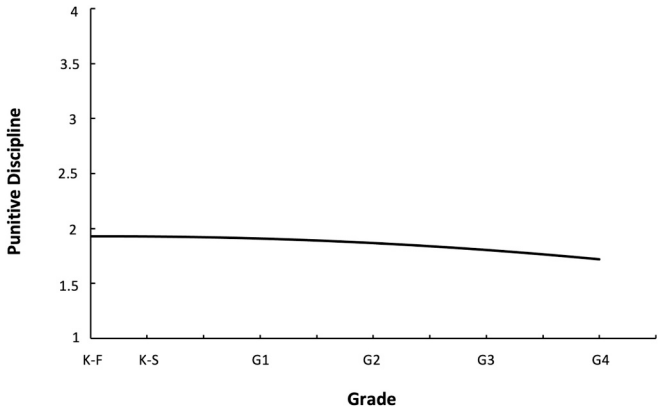

Fig. 1. Univariate growth curve model for teachers' punitive disciplinary practices.

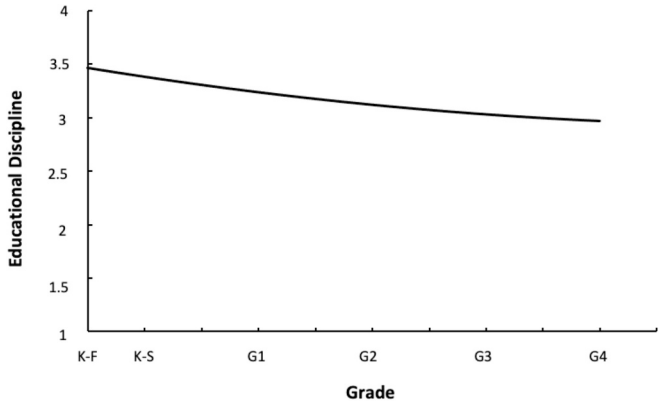

Fig. 2. Univariate growth curve model for teachers' educational disciplinary practices.

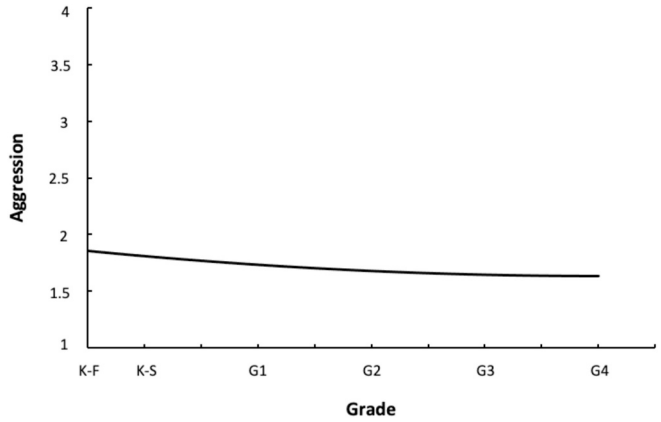

Fig. 3. Univariate growth curve model for students' aggressive behaviors.

between structured residuals. All coefficients reported in the results section are standardized.

3.3.1. Between-person effects

The between-person results show that the initial level of teacher-reported aggression is positively associated with the initial levels of teacher-reported punitive ($r = 0.79$, $p < .001$) and educational practices ($r = 0.91$, $p < .001$). This suggests that kindergarten teachers tend to use both punitive and educational discipline with students who demonstrate aggressive behaviors. Moreover, the initial level of punitive practices is positively associated with the initial level of educational practices ($r = 0.96$, $p < .001$), indicating that kindergarten teachers who use punitive practices with students also tend to use educational practices with these students. The initial level of punitive practices is negatively associated with linear changes over time ($r = -0.31$, $p < .05$), indicating a slower decrease from kindergarten to grade four for punitive practices with students who were punished more often in kindergarten. Given the complexity of the tested model, the estimation was facilitated by fixing at zero the variances for all the quadratic terms and the linear terms for educational practices and aggression. This precluded examining correlations between these latent factors and the other latent factors in the model.

3.3.2. Within-person effects

For the within-person effects, all the time-adjacent correlations between the structured residuals for each construct are positive and significant, except between teacher-reported students' aggression and teacher-reported educational practices in the fall of kindergarten. This indicates that when students show higher-than-usual levels of aggressive behaviors, teachers tend to react using higher-than-usual levels of punitive and educational practices. This effect is observed at all measurement times except for educational practices at the start of kindergarten. The magnitude of the correlations between punitive practices and aggression decreases from the fall of kindergarten to grade three. In contrast, the magnitude of the correlations between educational practices and aggression increases between the fall of kindergarten and grade four. In the interest of clarity, the time-adjacent correlations between the residuals for punitive and educational practices are not shown in Fig. 4, although they were estimated. The correlations are 0.12, 0.18, 0.21, 0.28, 0.23, and 0.22 at T1, T2, T3, T4, T5, and T6, respectively ($p < .001$).

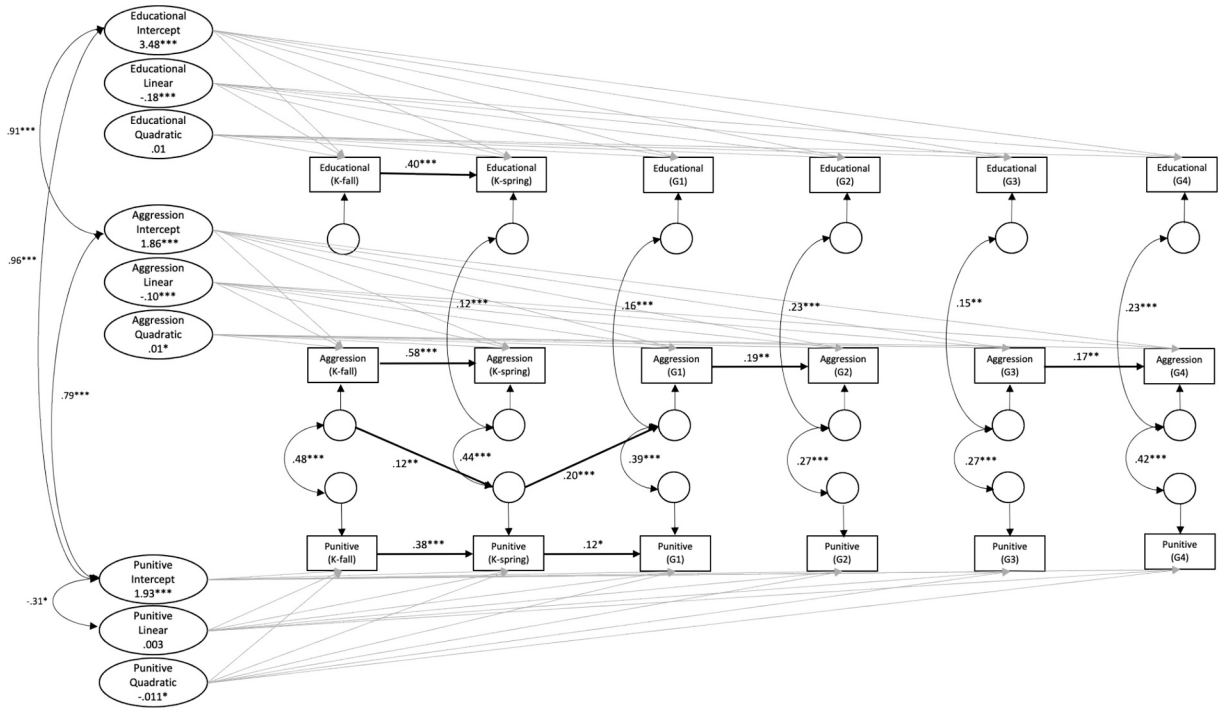

Fig. 4. Results of the latent curve model with structured residuals (LCM-SR) for teachers' punitive and educational discipline and students' aggressive behavior between kindergarten and Grade 4.
All correlations between the latent factors (intercept, slope, and quadratic) were estimated. All time-adjacent and autoregressive links between the residuals were estimated. Additionally, all cross-lagged associations were estimated between the residuals for each disciplinary practice (educational and punitive) and for the aggressive behaviors. For clarity, only associations significant at $p < .05$ are depicted. For simplicity, control variables are not presented in the figure. Standardized coefficients are presented except for latent factors, which are not standardized. Associations between latent factors represent between-person effects, and associations between structured residuals represent within-person effects.
***p < .001; **p < .01; *p < .05.

These results reveal the presence of positive and significant auto-regressive associations between the residuals for aggressive behaviors between the fall of kindergarten and the spring ($\beta = 0.58$, $p < .001$), between grades one and two ($\beta = 0.19$, $p < .01$), and between grades three and four ($\beta = 0.17$, $p < .01$). This suggests that students who exhibit higher-than-usual levels of aggressive behaviors at the start of kindergarten, in grade one, and in grade three tend to display higher-than-usual levels of aggression at subsequent waves, as reported by teachers. Positive and significant auto-regressive associations are also observed for punitive practices between the fall and spring of kindergarten ($\beta = 0.38$, $p < .001$) and between the spring of kindergarten and grade one ($\beta = 0.12$, $p < .05$). Positive and significant auto-regressive associations are observed for educational practices ($\beta = 0.40$, $p < .001$) between the fall and spring of kindergarten. This suggests that teachers who report using a higher-than-usual level of punitive discipline at the start of kindergarten tend to report using a higher-than-usual level of punitive discipline at the end of kindergarten. The trend is the same for educational practices. The results also suggest that teachers who report using a higher-than-usual level of punitive discipline at the end of kindergarten tend to report using a higher-than-usual level of punitive discipline in grade one.

A positive and significant cross-lagged association is observed between teacher-reported students' aggressive behaviors in the fall of kindergarten and teacher-reported punitive practices in the spring of kindergarten ($\beta = 0.12$, $p < .01$). A second positive cross-lagged association is seen between punitive practices in the spring of kindergarten and teacher-reported students' aggressive behaviors in grade one ($\beta = 0.20$, $p < .001$). This indicates that higher-than-usual levels of aggressive behaviors in the fall of kindergarten predict higher-than-usual levels of punitive practices in the spring. Moreover, higher-than-usual levels of punitive practices in the spring of kindergarten predict higher-than-usual levels of students' aggressive behaviors in grade one.

4. Discussion

This study examined trajectories of students' aggressive behaviors and teachers' punitive and educational disciplinary practices from kindergarten to grade four while considering bidirectional associations and controlling for a number of confounders. The teachers reported their own disciplinary practices along with students' aggressive behaviors. An LCM-SR model allowed for the simultaneous examination of between-person and within-person effects. Overall, the results suggest that all three variables tend to decrease over time and for all students. Moreover, within-person associations were obtained between punitive practices and aggressive behaviors between the start and end of kindergarten and between kindergarten and grade one. Finally, no directional within-person associations

were found between educational practices and aggression.

4.1. Trajectories for teacher-reported disciplinary practices and students' aggressive behaviors

In accordance with the hypotheses, the results for the growth curve models suggest that the three study variables followed similar longitudinal trends. Student exposure to punitive practices tended to decrease over time, and this downward trend accelerated by grade two. Student exposure to educational practices also decreased over time. These findings are consistent with those of Caldarella et al. (2021), who state that teachers tend to use fewer reprimands and praise as students progress in their schooling. These findings also align with some studies that addressed the quality of the teacher-student relationship, where lower proximity and conflict were observed with advancing student age (Wu & Hughes, 2014). The results for students' aggression show a downward trajectory that becomes less pronounced by grade three. This decline in aggression during childhood has been repeatedly documented (Bongers et al., 2004; Nagin & Tremblay, 1999). As children grow up and learn to socialize, they develop the ability to regulate their emotions, inhibit aggressive behaviors, and replace them with more socially appropriate behaviors (Bouchard, 2022). Therefore, as students advance through the years, their teachers would be less obliged to intervene to help them regulate aggressive behaviors, as reflected in the growth curves for disciplinary practices. Finally, it is noteworthy that the trajectories remain the same in the final LCM-SR, even after adding the control variables.

4.2. Teacher-reported disciplinary practices and aggressive behaviors: between-person effects

Cross-sectional results at the between-person level indicate that students whose teachers reported exhibiting high levels of aggression at the start of kindergarten tended to be exposed to more punitive and educational disciplinary practices simultaneously. Hence, kindergarten teachers tend to intervene more in the face of aggressive behaviors with punitive or educational practices. Longitudinally, the results for punitive practices correspond to our hypotheses but not for educational practices. Indeed, it was expected that students reported by teachers as showing high levels of aggression would be exposed to fewer educational disciplinary practices at the start of kindergarten. Studies tend to show that children who exhibit aggressive behaviors tend to receive less positive attention from their teachers than their peers who do not exhibit this type of behavior (Sutherland et al., 2008). It is encouraging, however, that kindergarten teachers are using more educational practices with students who exhibit aggressive behaviors, considering the positive links observed in other studies between the use of educational practices and students' behavioral and social adjustment (Bradshaw et al., 2012).

Moreover, the results show that the greater the child's exposure to punitive practices in kindergarten, the slower the decline of this exposure from kindergarten to grade four. Students who are exposed to higher levels of punitive practices in kindergarten may be so because of the presence of behavioral difficulties. For example, children with inattentive behaviors may elicit punitive responses from teachers (Sullivan et al., 2014). Since these behaviors may be stable over time (Vergunst et al., 2019), they may increase the risk that these students will be exposed to punitive practices for longer. Therefore, the decrease in their exposure to punitive practices will be slower.

4.3. Teacher-reported disciplinary practices and aggressive behaviors: within-person effects

As hypothesized, teacher-reported students' aggressive behaviors and teacher-reported punitive disciplinary practices mutually and positively influenced each other in the early stages of schooling. Specifically, higher-than-usual levels of students' aggressive behaviors at the start of kindergarten predicted higher-than-usual levels of teachers' punitive practices at the end of kindergarten. Moreover, higher-than-usual levels of teachers' punitive practices at the end of kindergarten predicted higher-than-usual levels of students' aggressive behaviors in grade one. The effect sizes of the cross-lagged associations between students' aggression and teachers' punitive practices were large (Orth et al., 2024). These results align with previous studies suggesting that higher levels of student aggression are often followed by increased teacher intervention, and that, in turn, the use of punitive disciplinary strategies may be associated with a rise in students' aggressive behaviors (Doumen et al., 2008; Weyns et al., 2017). The coercive cycle model offers a framework to understand this reciprocal escalation between punishment and aggression (Patterson, 1982; Shores et al., 1993). In this dynamic, teachers may experience heightened stress and frustration in response to students' aggressive behaviors, leading to more punitive responses, which may then contribute to the persistence or intensification of aggression (de Ruiter et al., 2019; Hastings, 2005).

Although most related previous studies have not disaggregated between-person and within-person effects, they share findings consistent with ours (Doumen et al., 2008; Skalická et al., 2015; Zhang & Sun, 2011). However, the LCM-SR model used in the present study is able to suggest that students' aggressive behaviors have an effect on teachers' punitive practices (and vice versa) at the beginning of schooling once all the contextual elements specific to the student have been taken into account, which the CLPM model is unable to do. Furthermore, the results are partly consistent with those of Crockett et al. (2017), who also disaggregated between-person and within-person effects. In their study, students' externalizing behaviors only predicted teacher-student conflict between kindergarten and first grade, as in the present study between aggressive behaviors and punitive practices. Moreover, the effect size of the observed link is very similar to that observed in this study. However, Crockett et al. (2017) observed a cross-lagged link from teacher-student conflict to students' externalizing behaviors at each measurement time, from kindergarten to grade 6, which diverges from our results. It should be noted that Crockett et al. (2017) focused on students' externalized behaviors, not aggressive behaviors specifically, which could explain the divergence in results observed.

The absence of intraindividual change over subsequent years suggests that teachers' punitive practices wield less influence over aggressive behaviors as students advance in age, and vice-versa. With age, students become more involved in peer relationships, which become increasingly influential over their aggressive behaviors (LaFontana & Cillessen, 2010; Laursen & Veenstra, 2021). For example, Leflot et al. (2011) assessed school-aged children intra-annually in grades two and three. They showed that peer rejection at a given time consistently predicted externalizing behaviors at subsequent measurement times, whereas teacher support was not associated. Therefore, peers may become a more predominant factor than teachers in explaining intraindividual variations in students' aggressive behaviors during this period.

The results also suggest that students' manifestation of aggressive behaviors would be more likely to influence teachers' punitive practices in kindergarten. Aggressive behaviors generally decline with age (Bongers et al., 2004), as the present results tend to confirm. Thus, kindergarten teachers would encounter aggressive behaviors more frequently than grade-school teachers. Moreover, teachers might lose their patience and tolerance more quickly in the face of frequent displays of aggression, as can happen for many children in kindergarten. This could lead to greater use of punitive practices. In fact, managing disruptive classroom behaviors constitutes a main source of stress for teachers (Aloe et al., 2014; Dicke et al., 2014).

Contrary to our expectations, no significant relationships were found across the years between teacher-reported educational disciplinary practices and teacher-reported students' aggressive behaviors. However, positive time-adjacent associations were observed at all waves except in the fall of kindergarten. This suggests that when children exhibit higher-than-usual levels of aggressive behaviors, they are more likely to be exposed to higher-than-usual levels of educational practices. Although teachers' educational practices showed time-adjacent associations with students' aggressive behaviors, they did not appear to reduce aggression from one school grade to the next or over the transition year of kindergarten. Instead, the observed time-adjacent associations suggest that teachers tend to use educational practices more to handle aggression. The exception was at the start of kindergarten when teachers seemed to report greater use of punitive practices to handle aggression. Moreover, the time-adjacent associations between punitive practices and aggression appeared stronger than between educational practices and aggression. In general, our results suggest that punitive practices contribute more strongly to developing aggressive behaviors than educational practices, and vice-versa (L'Écuyer et al., 2021; Weyns et al., 2019). Yet, educational practices might impact other important skills not measured in this study, such as student prosocial behavior and problem-solving skills.

4.4. Strengths, limitations, and future directions

This study has several strengths, notably the use of a large sample and a longitudinal design over five years (kindergarten to grade four) with annual assessments, simultaneous examinations of two types of teachers' disciplinary practices, and the use of advanced statistical analyses to disaggregate between-person and within-person effects. Nevertheless, certain limitations should be noted. First, the measure of disciplinary practices comprised only four items and should be expanded to ensure a comprehensive representation of the variable. Moreover, some statements in the measurement of teachers' disciplinary practices were formulated using both feminine and masculine pronouns (i.e., him/her). Future studies should use gender-inclusive language (i.e., their) in their questionnaires.

Second, the disciplinary practices and students' behaviors were measured with teacher-report instruments, which could have increased the observed associations due to a shared method variance effect. Thus, the results must be replicated in studies using various sources of information for students' aggressive behaviors and teachers' disciplinary practices in order to determine whether the observed links hold. Nevertheless, the cross-lagged association between teacher-reported punitive practices in kindergarten and teacher-reported students' aggressive behaviors in grade one was based on data reported by different teachers. Although teachers are accurate and reliable reporters of their disciplinary practices (Clunies-Ross et al., 2008; Floress et al., 2021) and students' aggressive behaviors (Juliano et al., 2006; Ostrov & Bishop, 2008), future studies could also benefit by including additional sources of information such as observational measures and students' perceptions of their behaviors and those of their teacher (Gaertner, 2014; Godleski & Ostrov, 2020). Furthermore, some studies have shown that implicit biases related to students' characteristics can influence teachers' perceptions of student behaviors, including gender, race/ethnicity, and socioeconomic status (Auwarter & Aruguete, 2008; Wymer et al., 2022). Including additional sources of information could help mitigate the impact of these biases and lead to a more nuanced understanding of students' behaviors. Related to the previous point, it is conceivable that teachers underestimated the frequency of the punitive practices they used while overestimating the frequency of the educational practices they used due to a social desirability bias. However, it should be noted that despite the possible underestimation of the punitive practices used, we observe significant effects. This suggests that the observed effects are robust and may even underestimate the true association between teachers' punitive practices and students' aggressive behaviors. This leads us to consider that the effects of punitive practices on aggressive behavior, and vice versa, could potentially be even more pronounced than is reflected in the current results. Furthermore, despite the possible overestimation of teacher-reported educational practices, they did not contribute to a reduction in students' manifestations of aggressive behaviors, and vice versa. At the same time, it is important to mention that the educational disciplinary practices examined in the present study are reactive practices, that is, practices used in reaction to students' behaviors (Gaudreau, 2024). It is possible that such practices could have a stronger effect on students' aggressive behaviors when combined with proactive practices. Proactive practices refer to interventions implemented by the teacher to prevent disruptive behaviors in the classroom and promote and reinforce appropriate behaviors (Gaudreau, 2024). Previous studies have shown that proactive classroom behavior management practices, such as praise, were associated with decreased disruptive and aggressive classroom behaviors (Cook et al., 2018; Stormont et al., 2007).

Third, teachers were asked to report their responses to instances where a student broke the rules or did things they were not supposed to, rather than their response to a student's aggressive behavior specifically. The results suggest that how teachers respond to

students' general disruptive behaviors is likely to contribute to the development of students' aggressive conduct, possibly through a social learning mechanism. For example, the use of punitive practices in response to disruptive behavior, such as a teacher yelling, can teach students that this is an acceptable form of communication, which can later translate into aggressive communication with their teacher and peers (Bandura, 1973; Krause & Smith, 2022). In addition, punishing students' disruptive behaviors, including aggressive behaviors, can give attention to the student and thus unintentionally reinforce these behaviors (Alstot & Alstot, 2015). Fourth, while the LCM-SR model represents a significant contribution, it also has a limitation. Specifically, our study could not account for the nested structure of the data. To our knowledge, implementing the LCM-SR model with a multilevel structure is not feasible, particularly in contexts where this structure varies across measurement points. As a result, the effect of class cannot be disentangled from the purely individual effect of the student. Consequently, some of the individual effects examined in this study may actually be conflated with classroom effects, which may have inflated the individual effects reported here.

Fifth, as in all longitudinal studies, some participants were lost over time. The retention rate is quite low from year to year. Despite this low rate, we have managed to maintain a sample that includes a good proportion of students who exhibit aggression. As our sample decreases over time, it is possible that the end of the trajectories is less precise and less representative of the studied population. Thus, further studies are needed to verify the shape of the trajectory of teachers' punitive and educational practices and students' aggressive behaviors as they progress through their schooling. Sixth, the sample was relatively homogenous in sociodemographic terms, thereby limiting the generalization of results. The findings need to be reproduced in samples with greater cultural and socioeconomic diversity. Seventh, the covariates are only available for the kindergarten year. The absence of time-varying covariates restricts our ability to fully account for fluctuations in family income and teacher characteristics, such as years of teaching experience, which may influence the links examined in this study. Finally, the correlational study design precluded drawing causal inferences.

Future studies could examine associations between teachers' disciplinary practices and other aspects of child functioning (e.g., academic and educational success, prosocial behaviors, socioemotional competence) to broaden understanding. It may also be interesting to simultaneously examine students' aggressive and prosocial behaviors in relation to teachers' disciplinary practices, allowing for changes in both desirable and undesirable behaviors in students. Furthermore, the present study examined only one aspect of teachers' disciplinary practices: a reactive approach or immediate reactions to disruptive behaviors. Proactive approaches to prevent problematic behaviors should also be investigated, alone or in conjunction with reactive practices. Finally, in the present study, the associations between our variables of interest were examined across school years and with different teachers, except for kindergarten, where they were examined in a single school year and with the same teacher. The directional effect observed in kindergarten suggests the potential for similar effects over and within subsequent school years. More studies are needed to explore this possibility.

4.5. Educational implications

The results have implications for educational practice. A strategy to improve teachers' skills in managing disruptive classroom behaviors should be implemented as early as kindergarten to prevent or curb aggressive behaviors at the start of school. These skills could be taught in initial teaching training programs. Pedagogy and didactics seem to figure prominently in initial teacher training programs, whereas managing challenging behaviors tends to receive lower priority (Stevenson et al., 2020; Woodcock & Reupert, 2017). Yet classroom management is essential, not just to prevent aggressive behaviors from arising but also to foster a positive classroom climate for learning (Gaudreau, 2024). Furthermore, using punitive practices in kindergarten may prevent children from developing a feeling of belongingness to school, which can undermine their academic involvement (Osterman, 2010). These findings also have implications for school psychologists who support teachers in their professional development as part of their work. By accompanying and assisting teachers in implementing positive behavior management practices in the classroom, school psychologists could help prevent a coercive interaction cycle between the teacher and the student from becoming established, thus promoting a classroom climate conducive to social and academic learning. Finally, the results of this study suggest that reducing the use of punitive practices appears to be a promising avenue for reducing manifestations of student's aggressive behavior. Moreover, it is essential that teachers' disciplinary practices are integrated into a broader, whole-school approach, such as those proposed by Positive Behavioral Interventions and Supports or Multi-Tiered System of Supports frameworks, to foster a coherent and supportive school environment for all students. The practices used with individual children, including positive practices, should be complemented with group interventions to promote a positive classroom climate that is socially inclusive for all students.

5. Conclusion

This study sheds light on the reciprocal processes at play between teacher-reported punitive and educational disciplinary practices and teacher-reported students' aggressive behaviors from kindergarten to grade four. The results reveal the presence of a transactional sequence in which students who exhibited a higher level of aggressive behaviors compared to their usual level at the start of kindergarten were exposed to a higher level of punitive practices by the teacher than normal at the end of kindergarten. This, in turn, predicted a higher-than-usual level of aggressive behaviors in these students in grade one. Hence, school entry appears to be a pivotal time for intervening in students' manifestation of aggressive behaviors and training teachers in classroom management practices to prevent aggressive behaviors from escalating.

CRediT authorship contribution statement

Roxane L'Écuyer: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **François Poulin:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Frank Vitaro:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Marie-Claude Salvas:** Writing – review & editing, Conceptualization.

Declaration of competing interest

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