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The role of play partners for preschoolers' observed emotion Regulation in dyadic play situations

Pablo Nischak[a,b], Sonja Lorusso[a,b], Tatiana Diebold[a], Ori Harel[b,c], Carine Burkhardt Bossi[a], and Sonja Perren[a,b]

[a]Thurgau University of Teacher Education, Unterer Schulweg 3, CH-8280 Kreuzlingen; [b]University of Konstanz, Universitaetsstrasse 10, DE-78457 Konstanz; [c]Max-Planck-Institute of Animal Behavior, Buecklestrasse 5, DE-78467 Konstanz

ABSTRACT

Emotion regulation (ER) is a critical socio-emotional skill that develops early and is strongly shaped by social experiences. Using the Social Relations Model, this study examined how individual characteristics and emotion-related behavior in dyadic interactions influence observed ER in preschoolers ($N = 86$, $M_{age} = 46.23$ months, 46.4% girls) during semi-standardized peer play in Swiss playgroups. Results revealed that although ER was largely stable and trait-like, with actor variance accounting for most variability, relationship variance indicated that ER was also significantly shaped by specific peer interactions. Trait-like ER was positively linked to focal children's own reported ER skills and positive peer relationships and negatively related to their behavioral difficulties. Moreover, play partners' calm, positive emotion expressions enhanced focal children's dyad-specific, unique ER, while play partners' distraction, avoidance, aggression, and expressions of jealousy or embarrassment diminished it. These findings highlight the importance of both individual ER capacities and peer dynamics in early emotional development.

Introduction

Early childhood is a pivotal period for acquiring social and emotional competencies, which are essential for successful social interactions and overall well-being (Denham, 2018, 2023; Saarni, 1999; Thompson & Lagattuta, 2008). Emotional competence comprises emotional experience and expression, emotion knowledge, and emotion regulation (Denham, 2018). Emotion regulation (ER) refers to the processes through which individuals influence their emotions—how they experience, express, and modulate them to align with individual or social goals and expectations (Denham, 2018; Gross, 2015). These processes include modifying the intensity, persistence, and duration or type of emotional experiences or responses to meet situational demands and targets both positive and negative emotions (Thompson, 2011). ER encompasses both intrinsic (self-regulation) and extrinsic (co-regulation) processes, underscoring the role of social interactions in shaping emotional responses, particularly in early childhood when self-regulatory skills are still developing (Thompson, 1994).

Preschool children's ER is closely linked to various developmental outcomes. In their meta-analytic review, Robson et al. (2020) report that preschool children's self-regulation—defined as the ability to control thoughts, behaviors, and emotions and therefore encompassing ER—is positively associated with social competence, engagement, and academic performance. Conversely, self-regulation shows negative associations with peer victimization, internalizing problems (i.e. emotional or psychological states related to depressive symptoms, withdrawal and anxiety), and externalizing problems (i.e. problems related to disruptive and aggressive behavior; Robson et al., 2020). These relationships were consistently observed in both cross-sectional and longitudinal studies, underscoring the critical role of self-regulation and, by extension, ER in supporting children's current functioning, well-being, and long-term developmental outcomes into adulthood (Robson et al., 2020). Similarly, another

CONTACT Pablo Nischak pablo.nischak@hfh.ch Thurgau University of Teacher Education; University of Konstanz.
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meta-analytic review by Compas et al. (2017) found negative cross-sectional associations between children's ER and both internalizing and externalizing problems. This further emphasizes the protective role of effective ER in reducing emotional and behavioral difficulties during childhood.

Emotion regulation in peer interactions

Robson et al. (2020) findings regarding associations between children's ER and interpersonal outcomes (i.e. social competence, peer victimization, externalizing behaviors) are in line with those reported by Gülay Ogelman and Fetihi (2021) and Qashmer (2023) who found that children who can adequately express and regulate their emotions exhibit less aggressive and more calm behavior. These children also have more positive peer interactions because they demonstrate higher abilities to relate to their peers in a caring and considerate manner (Adynski et al., 2024; Blair et al., 2016). Conversely, children who express anger more frequently are less accepted by their peers (Hernández et al., 2017).

As children transition into increasingly complex social environments during childhood, peer interactions become a vital context for practicing and refining ER strategies (Pahigiannis & Glos, 2020; Valiente et al., 2020). In these emotionally charged interactions, children must regulate their own emotions and respond to their peers' emotional cues—a skill essential for developing and maintaining positive relationships (Ramani et al., 2010). When children struggle with ER they often encounter increased conflicts, social exclusion, or difficulties forming lasting friendships (Adynski et al., 2024; Blair et al., 2016; Robson et al., 2020).

Furthermore, peers influence ER directly: Supportive peer responses to emotional expressions have been linked to improved ER outcomes in adolescents, while unsupportive peer responses show a more complex relationship with ER (Delios et al., 2023). Although research on peers' contribution to preschool children's ER is limited, Pahigiannis and Glos (2020) suggest that young children's self-regulation is influenced by peer interactions in diverse ways. Negative experiences such as exclusion, victimization, and poorly managed conflicts with peers may hinder self-regulation development, whereas positive peer interactions and friendships, with their inherent social rewards and role modeling, can enhance it (Pahigiannis & Glos, 2020). This is further supported by findings from Alamos et al. (2022), who demonstrate that peer interactions mediate the relationship between inhibitory control and ER in preschoolers over the course of a school year, and Diebold et al. (2025), who found that a friend's ER is linked to preschoolers' contemporaneous ER, with empathetic co-regulation fostering ER development over time. In sum, early peer interactions critically shape children's ER, either enhancing it through supportive engagement or hindering it through adverse social experiences.

Social relations model

Given that ER is not only an individual capacity but also shaped by social and relational dynamics, understanding it requires moving beyond traditional individual-centered approaches. The Social Relations Model (SRM; Kenny & La Voie, 1984) provides a powerful framework for disentangling the relative contributions of individual characteristics, peer influences, and dyadic dynamics in shaping children's ER. Specifically, the model distinguishes between three components:

1. *Actor variance*: The stable, general tendency of children to regulate emotions across different social partners.
2. *Partner variance*: The extent to which children consistently elicit a certain level of ER in their peers across multiple interactions.
3. *Relationship variance*: The unique, dyad-specific dynamics that shape ER beyond individual traits, reflecting the interplay between two specific interaction partners. Despite its dyadic nature, this component is directional: Child A's relationship variance can differ from child B's within the same dyad.

Empirical studies applying SRM to children's social behavior remain scarce but provide valuable insights into the interplay between individual and relational influences on social and emotional development. For example, Jaggy et al. (2020) found that preschool children's observed social pretend play quality was roughly equally determined by stable individual differences (actor variance) and dyadic interactions (relationship variance), whereas their ability to elicit high-quality pretend play in others (partner variance) was relatively small. Similarly, Hubbard et al. (2024) demonstrated that both individual traits (actor and partner variance) and dyadic processes (relationship variance) contribute to children's observed emotion expression, with relationship variance even exceeding actor variance for several emotions. These findings emphasize that social and emotional

behaviors are not only shaped by stable, trait-like differences but also by the unique dynamics of specific peer relationships.

The present research

We aim to examine how both stable, trait-like components (actor and partner variance) and unique, dyad-specific components (relationship variance) contribute to preschool children's observed ER during dyadic play with peers, and how the behaviors and characteristics of both children affect these components.

To our knowledge, the current study is the first SRM investigation of observed ER in any developmental period. In line with the findings of Hubbard et al. (2024) and Jaggy et al. (2020), we hypothesize that a substantial portion of the variance in observed ER will be attributable to the actor level, reflecting ER as a stable, trait-like characteristic of the child. In contrast, the variance attributed to the partner level is expected to be relatively low, indicating the children's general tendency to elicit a consistent level of ER in their peers. Simultaneously, a significant portion of the variance is anticipated at the relationship level, capturing ER as a state specific to the unique dynamics of each dyadic interaction. Significant dyadic reciprocity is expected, with the focal children's unique, dyad-specific ER positively associated with the peers' relationship unique, dyad-specific ER.

Building on prior research suggesting that positive emotional and social competencies enhance trait-like ER, we also hypothesize that focal children's reported emotional and social skills will be positively associated with both their own stable level of ER they exhibit across differing peers (actor ER) and their consistent influence on their peers' ER (partner ER), regardless of age and gender. Conversely, focal children's behavioral and emotional difficulties are expected to be negatively related to both the actor and partner ER, reflecting their detrimental impact of such difficulties on both individual and interpersonal ER processes.

In addition, based on evidence that peers contribute to preschool children's ER, we hypothesize that both the focal children's and their play partners' reported characteristics will show similar associations with the focal children's unique, dyad-specific level of ER (relationship ER). Specifically, higher levels of positive or supportive predictors are expected to increase the focal children's relationship ER, whereas higher levels of negative or unsupportive predictors are expected to diminish it.

Finally, we expect that the observed emotion-related behaviors of both children during the play situation will influence the focal children's relationship ER, with simultaneous positive or supportive behaviors increasing and negative or unsupportive behaviors decreasing the unique, dyad-specific ER.

The hypotheses and proposed data analyses were preregistered on the Open Science Framework (OSF).

Method

Sample

A sample of $N = 86$ children (M_{age} = 46.23 months; SD_{age} = 6.25 months; 46.4% girls), from Swiss playgroups ($N = 19$) was selected from a bigger sample of $N = 113$ children due to statistical constraints of the SRM approach (i.e. recommended number of missings within a round robin unit; see Schönbrodt et al. (2012) for details). In Switzerland, playgroups are a common form of out-of-family care for 2- to 4-year-olds, typically operating on one or two days a week for two to three hours per visit under the supervision of trained staff (i.e. the playgroup educator).

Prior to participation, parents and educators were informed in their native language about the study's aims and procedures and provided written consent. Parents and educators completed online questionnaires, with educators receiving CHF 5.00 per completed questionnaire as compensation. In 86% of the families, German or Swiss German was spoken, and at least one parent had a college degree in 40% of the families. Participation was voluntary, and children could withdraw at any time without consequences. Most children visited playgroups since the beginning of the school year. Thus, educators knew the children for at least 2.5 months at the time of data collection. As a token of appreciation, all children received a gratitude of 10 cartoon animal stickers.

Study design

To observe ER in a semi-standardized play situation repeatedly with different partners, the children were randomly assigned to round robin units of four ($N = 18$), allowing them to interact in all possible pairwise combinations ($N = 105$ dyads). Within each unit, every child ideally played with three randomly assigned peers in a fixed order to ensure, as far as possible, an equal level of experience across sessions (i.e. 1st dyad: child A – child B; 2nd dyad: child C – child D; 3rd dyad: child A – child C; 4th dyad: child B – child D; 5th dyad: child A – child D; 6th dyad: child

B – child C). To meet the required sample size, some children played in different round robin units on separate days. Since the play situations were video recorded, each child served as both a focal child and a play partner within a dyad to ensure the required reciprocal data structure. Of the initial 33 round robin units, 9 were excluded due to more than 20% missing observations.

Each dyad within the round robin units participated in a semi-standardized play situation in a separate room within the playgroup facility. The play situation, balancing blocks, aimed to elicit a variety of emotions and related behavior. The experimenter presented the children with a mouse figure and 50 Montessori balancing blocks in different shapes, colors and sizes, and asked the children to build structures of their own liking for the mouse. Due to the angled shape of the blocks the structures were meant to collapse. Once the standardized prompt was completed, a 3-min timer began with an audible signal marking the end of the situation. The experimenters withdrew after starting the timer, deliberately appearing occupied to minimize their influence.

Measures

Observed emotion regulation

The recorded play situations were segmented into three 1-min intervals and coded by trained raters with the use of a newly developed instrument to observe ER in preschool children—the Emotion Regulation Scoring System (ERSS; Nischak et al., 2026). Each child's behavior was coded individually. The ERSS encompasses observations of ER, emotion expressions, responses to emotion-eliciting situations and social skills. The individual items were rated on a 7-point scale from (1) 'not observable' to (7) 'observable on an intense level'. The *observed ER* scale comprises five items (i.e. 'displays appropriate emotions/emotion-related behavior', 'displays dysregulated emotions/emotion-related behaior' (reverse coded), 'remains on a high level of emotionality/arousal' (reverse coded), 'can return/maintain its focus', and 'modulates its emotions/emotion-related behavior successfully without support'), demonstrated acceptable model fit in a confirmatory factor analysis using maximum likelihood estimation (RMSEA = .085, 90% CI [.056; .113]; CFI = .969), and satisfying convergent and concurrent validity with established measures of ER and related constructs (Nischak et al., 2026). It also showed strong internal consitency (α = .90). Additionaly, interrater reliability for 20% of the recorded videos was good (ICC = .83, 95% CI [.82; .84] or 75.9% relative agreement, allowing for a ± 1 point deviation).

Furthermore, we also rated children's *emotion expressions* (9 items; e.g. 'pride'), *responses to emotion-eliciting situations* (14 items; e.g. 'distraction') and *social skills* (5 items; e.g. 'sociability') with the ERSS (Nischak et al., 2026), each represented by individual items. The raters achieved an overall relative agreement of 76.5% within a ± 1-point tolerance across all items of these subscales.

Educator questionnaires

To assess children's **emotional skills** from the educators' perspective we asked them to complete a series of well-established questionnaires online.

The subscales *emotion regulation* (5 items; e.g. 'can calm him-/herself down when upset') and *verbal emotion expression* (6 items; e.g. 'expresses him-/herself about the feelings of other children') of the Kompetenzen und Interessen von Kindern [Competencies and Interests of Children] (KOMPIK; Mayr, 2012) were rated on a 5-point scale from (1) 'very rare' to (5) 'very often'. The subscales showed an acceptable to good internal consistency (emotion regulation: α = .75; verbal emotion expression: α = .89).

Children's **social skills** were reported by educators using the Self- and Other-oriented Social Skills Competences questionnaire (SOCOMP; Perren, 2007), which employed a 5-point scale from (1) 'not true' to (5) 'certainly true' to align with the scaling of other questionnaires. The *self-oriented social skills* subscale, consisting of 10 items (e.g. 'converses with peers easily'), measures leadership, sociability, and setting limits, and demonstrated good internal consistency (α = .87). The *other-oriented social skills* subscale, also comprising 10 items (e.g. 'compromises in conflicts with peers'), evaluates cooperative and prosocial behavior and showed comparable internal consistency (α = .87). In addition, *positive peer relationships* (5 items; e.g. 'has many friends') was assessed and showed a good internal consistency (α = .82).

To assess children's **behavioral and emotional difficulties**, educators completed the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). We assessed *hyperactivity/inattention* (5 items; e.g. 'restless, overactive, cannot stay still for long'), *conduct problems* (5 items; e.g. 'often loses temper'), and *emotional symptoms* (e.g. 'often unhappy, depressed or tearful'). We applied a 5-point scale from (1) 'not true' to (5) 'certainly true' to match with other questionnaires. The subscales demonstrated acceptable to good internal

consistency (emotional symptoms: $\alpha = .80$; conduct problems: $\alpha = .70$; hyperactivity: $\alpha = .89$)

The *closeness of relationship* within each dyad was assessed with a single question. The educators reported on how often the two members of a dyad played or interacted on a typical day in the playgroup on a 5-point scale from (0) 'never' to (4) 'almost always'.

Furthermore, the educators reported on children's age and gender.

We were able to confirm the proposed factorial structures of all reported measures using principal component analysis with varimax rotation.

Ethical approval

The institutional review board (ethics commission) of the University of Konstanz approved that the proposed research procedure was in line with the specific regulations of the University for ethical experimentation and data storage, the Declaration of Helsinki and relevant national and international law and regulations.

Data analyses

Statistical analyses were conducted using R (Version 4.4.2). We worked with a long-format dataset where each dyad was represented by two rows, one per child. In the first row, child A was coded as the focal child and child B as the play partner. In the second row, roles were reversed. The SRM was computed using the R package 'TripleR' (Schönbrodt et al., 2012). To model observed ER as a latent construct and separate error variance from relationship variance, we used the ratings from the 2nd and 3rd 1-min interval of the balancing blocks situation ($r = .73$; $p < .001$), while disregarding the 1st minute to allow for initial adjustment. The SRM analysis decomposed the total variance of observed ER into actor, partner and relationship components, as well as residual error.

We extracted individual actor, partner and relationship ER estimates from the SRM analysis for further analyses of how focal children's and their play partners' characteristics contribute to these estimates. Since TripleR calculates variance components at the round robin unit level—and some children participated in more than one round robin unit, resulting in multiple, sometimes varying actor and partner ER estimates—we accounted for this nested data structure using mixed linear models with maximum likelihood estimation. Models predicting actor and partner ER were specified as two-level mixed linear models, with the child as the first level and the round robin unit as the second level, while analyses with the relationship ER as the outcome were conducted at the dyad level.

Due to multicollinearity among predictors, separate models were estimated for each predictor. In models with actor and partner ER as outcomes, focal children's educator-reported characteristics were entered as predictors, with the focal children's age and gender included as covariates. Models with the relationship ER as outcomes contained either educator-reported characteristics or observed emotion-related behavior of both members of the dyad as predictors, with the dyad's gender composition and both children's age as covariates. Educator-reported predictors were grand-mean centered and standardized, while observed predictors were group-mean centered on the round robin unit level and standardized to align with the relationship ER.

Results

In the following section, we report the detailed results of the SRM analysis and examine how actor, partner and relationship ER relate to both reported and observed predictors.

SRM analysis

The SRM analysis revealed that 38% of the variance ($b = 0.58$; $SE = 0.17$; $p < .01$) in observed ER, and thus the largest portion, was attributable to a general, stable ability to display ER independent of play partners (actor variance). In contrast, no variance (0%; $b = 0.00$; $SE = 0.07$; $p = .50$) was linked to a stable level of ER that children consistently elicited in their play partners (partner variance). Finally, 27% of the variance ($b = 0.41$; $SE = 0.11$; $p < .001$) was due to the specific dyadic relationship between the children (relationship variance), with 34% ($b = 0.52$) remaining unexplained (see supplemental material for a graphic representation of unstandardized estimates). The dyadic reciprocity, which posits that a focal child's relationship ER is associated with their play partner's relationship ER, revealed a small, non-significant correlation ($r = .28$, $SE = 0.11$; $p = .28$).

Associations between educator-reported Predictors and actor emotion regulation

As hypothesized, children reported by educators to possess higher ER skills ($\beta = .35$; $p = .005$) and more positive relationships with their peers ($\beta = .25$; $p = .040$), exhibited significantly greater general, stable ER

Table 1. Mixed Linear models analyses with focal children's actor and partner emotion regulation as criteria and focal children's reported characteristics as predictors.

				Actor ER			Partner ER		
					95% CI			95% CI	
		M	*SD*	β	LL	UL	β	LL	UL
Gender[1]		1.48	0.50	.07	−.16	.29	−.08	−.21	.05
Age (months)		46.21	6.01	.11	−.11	.33	.02	−.11	.14
Emotional	Emotion regulation[a]	3.77	0.69	.35**	.11	.58	.03	−.11	.17
	Verbal emotion expression[a]	3.49	0.89	.14	−.10	.37	−.06	−.19	.07
Social	Self-oriented social skills[a]	3.49	0.78	.09	−.14	.32	−.03	−.16	.10
	Other-oriented social skills[a]	3.79	0.60	.16	−.09	.40	.01	−.13	.15
	Positive peer relationships[a]	3.59	1.04	.25*	.01	.49	−.04	−.17	.10
Behavioral	Emotional symptoms[a]	1.61	0.67	−.21†	−.45	.03	−.08	−.22	.06
	Conduct problems[a]	1.56	0.61	−.36**	−.58	−.14	−.13†	−.26	.00
	Hyperactivity[a]	2.10	0.86	−.26*	−.49	−.02	−.10	−.23	.04

Note. All predictor variables were grand-mean centered and standardized; [1] = (0) other, (1) male, (2) female.
[a]= controlled for focal children's gender and age.
M = mean; *SD* = standard deviation; β = standardized regression coefficient; 95% CI = 95% confidence interval of the standardized regression coefficient.
†$p < .10$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

across differing play partners (actor ER), even after controlling for gender and age (see Table 1). In other words, children who were reported to be better at regulating their emotions or to enjoy more positive relationships with peers tended to handle their emotions more consistently over different interaction partners. On the other hand, higher behavioral difficulties (i.e. conduct problems: $\beta = -.36$; $p = .002$; hyperactivity: $\beta = -.26$; $p = .035$) were linked to a smaller actor ER as expected, indicating that children with more challenges in these areas exhibited less consistent ER. Notably, gender, age, reported levels of verbal emotion expression, and both self-and other-oriented social skills were not significantly related to the actor ER.

Associations between educator-reported Predictors and partner emotion regulation

Although the overall partner variance was minimal, we hypothesized that individual differences in the focal children's characteristics would be associated with their consistent influence on play partners' ER (partner ER). Contrary to this expectation, none of the reported factors showed a significant relationship with the partner ER, suggesting that these characteristics did not reliably predict consistent influences on play partners' ER (see Table 1).

Associations between educator-reported Predictors and relationship emotion regulation

The relationship ER, which captures a child's unique capacity to regulate emotions in the presence of a specific play partner (beyond the general actor and partner ER), was not predicted by any reported characteristics of either the focal children or their play partners (see Table 2). In particular, the focal children's relationship ER showed no significant associations with the dyads' gender composition, the focal children's or play partners' reported closeness of relationship, age, reported emotional and social skills, or reported behavioral and emotional difficulties. These findings suggest that while a substantial portion of the variance in observed ER was attributable to the unique relationship between two play partners, the relationship ER was not influenced by the children's reported characteristics.

Associations between observed predictors and relationship emotion regulation

Associations with observed emotion regulation

We assumed that the emotion-related behavior (i.e. observed ER, emotion expressions, responses to emotion-eliciting situations and social skills) both children exhibited within the same situation as focal children's observed ER was assessed, would be related to the focal children's relationship ER (see Table 3). As expected, the play partners' observed ER ($\beta = .28$; $p < .001$) was positively associated with the focal children's relationship ER. Contrarily, the focal children's own level of observed ER did not contribute to their own relationship ER in a meaningful way. This finding indicates that the more effectively the play partners regulated their emotions during the play situation, the more pronounced the focal children's unique, dyad-specific ER became, independent of their

Table 2. Mixed linear models analyses with focal children's relationship emotion regulation as criteria and focal children's and play partners reported characteristics as predictors.

						95% CI	
		M	*SD*		*β*	LL	UL
Gender composition – male[1]					.01	−.14	.16
Gender composition – female[1]					.02	−.15	.19
Age (months)		46.21	6.01	fc	−.01	−.08	.05
				pp	.00	−.06	.07
Closeness of relationship [a]		1.70	1.42		−.01	−.08	.07
Emotional	Emotion regulation[a]	3.77	0.69	fc	−.01	−.08	.06
				pp	.00	−.07	.07
	Verbal emotion expression[a]	3.49	0.89	fc	.01	−.06	.08
				pp	.01	−.06	.07
Social	Self-oriented social skills[a]	3.49	0.78	fc	.01	−.06	.08
				pp	−.00	−.07	.07
	Other-oriented social skills[a]	3.79	0.60	fc	−.01	−.07	.06
				pp	.01	−.06	.08
	Positive peer relationships[a]	3.59	1.04	fc	.01	−.06	.08
				pp	.00	−.07	.07
Behavioral	Emotional symptoms[a]	1.61	0.67	fc	−.00	−.07	.06
				pp	.00	−.07	.07
	Conduct problems[a]	1.56	0.61	fc	.01	−.06	.08
				pp	−.01	−.09	.06
	Hyperactivity[a]	2.10	0.86	fc	.00	−.07	.07
				pp	−.01	−.07	.06

Note. All predictor variables are grand-mean centered and standardized.
[1]= (0) mixed ($n = 67$ dyads), (1) male ($n = 40$ dyads), (2) female ($n = 29$ dyads).
[a]= controlled for dyad's gender composition and focal children's and play partners' age.
M = mean; *SD* = standard deviation; β = standardized regression coefficient; 95% CI = 95% confidence interval of the standardized regression coefficient; LL = lower limit; UL = upper limit; fc = focal children; pp = play partners.
$^{\dagger}p < .10$.
$^{*}p < .05$.
$^{**}p < .01$.
$^{***}p < .001$.

own level of observed ER, the dyad's gender composition, or the age of the children.

Associations with observed emotion expressions

Regarding positive emotion expressions, the analyses demonstrated that play partners' displays of pride ($\beta = .08$; $p = .029$), pleasure/satisfaction/relaxation ($\beta = .12$; $p < .001$), and curiosity/interest/involvement ($\beta = .20$; $p < .001$) were positively associated to the focal children's relationship ER, even after controlling for the focal children's own emotion expressions and other covariates (see Table 3). In other words, when play partners exhibited greater interest, involvement, relaxation, or pride, the focal children displayed a higher dyad-specific ER. In contrast, neither the play partners' nor the focal children's level of amusement/excitement/happiness were significantly related to the focal children's relationship ER.

In terms of negative emotion expressions, the play partners' display of jealousy/envy ($\beta = -.16$; $p < .001$) was negatively associated with the focal children's relationship ER, whereas the focal children's own expressions of jealousy/envy ($\beta = .10$; $p = .009$) were positively associated with their relationship ER (see Table 3). This suggests that focal children tended to exhibit more unique, dyad-specific ER when they themselves expressed higher levels of envy, but showed reduced dyad-specific ER when their play partners expressed greater envious behavior. Additionally, the play partners' expressions of shame/guilt/embarrassment ($\beta = -.11$; $p < .001$) were negatively linked to focal children's relationship ER, indicating that higher levels of these socially evaluative negative emotion expressions in play partners corresponded with a smaller relationship ER for the focal children. Notably, expressions of anger/irritation/frustration, fear/worry/anxiety or sadness/resignation/disappointment by either focal children or play partners were not significantly associated with focal children's relationship ER.

Associations with observed responses to emotion-eliciting situations

Contrary to our hypotheses, none of the social responses to emotion-eliciting situations—whether exhibited by the focal children or their play partners—were significantly associated with the focal children's relationship ER (see Table 4). However, among internalizing responses, higher levels of distraction ($\beta = -.10$; $p = .002$) or avoidance/withdrawal ($\beta = -.14$; $p < .001$) by play partners were linked to a diminished relationship ER, suggesting that when

Table 3. Mixed linear model analyses with focal children's relationship emotion regulation as criteria and focal children's and play partners' observed emotion regulation and emotion expressions as predictors.

						95% CI	
Emotion regulation		*M*	*SD*		*β*	LL	UL
	Observed emotion regulation	4.95	1.25	fc	.01	−.04	.07
				pp	.28***	.23	.33
Emotion expression							
Positive	Amusement / excitement / happiness	2.67	1.41	fc	.02	−.06	.09
				pp	−.03	−.10	.04
	Pride	2.08	1.31	fc	.06†	−.01	.13
				pp	.08*	.01	.14
	Pleasure / satisfaction / relaxation	3.03	1.55	fc	−.04	−.11	.02
				pp	.11***	.05	.19
	Curiosity / interest / involvement	4.44	1.46	fc	−.01	−.07	.05
				pp	.20***	.15	.26
Negative	Anger / irritation / frustration	1.98	1.05	fc	−.01	−.07	.06
				pp	.00	−.07	.07
	Jealousy / envy	1.53	0.87	fc	.10**	.03	.18
				pp	−.16***	−.24	−.09
	Fear / worry / anxiety	1.87	1.06	fc	−.03	−.10	.04
				pp	−.05	−.11	.02
	Sadness / resignation / disappointment	1.82	0.99	fc	.02	−.05	.09
				pp	−.05	−.12	.02
	Shame / guilt / embarrassment	1.50	0.88	fc	.03	−.03	.09
				pp	−.11***	−.17	−.05

Notes. All predictor variables were group-mean centered on the round robin level and standardized; All models are controlled for focal children's and play partners' age and gender composition of the dyad *M* = mean; *SD* = standard deviation; *β* = standardized regression coefficient; 95% CI = 95% confidence interval of the standardized regression coefficient; LL = lower limit; UL = upper limit; fc = focal children; pp = play partners.
†$p < .10$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

play partners are more distracted or withdrawn, the focal children exhibit less pronounced dyad-specific ER. Additionally, neither the play partners' nor the focal children's levels of disregarding, self-directed speech or self-soothing were significantly related to the focal children's relationship ER.

In line with our predictions, play partners' externalizing responses were negatively related to focal children's relationship ER (see Table 4). In other words, as play partners exhibited more affective releases (i.e. verbal venting ($\beta = -.07$; $p = .040$), physical venting (= -.09; $p = .006$), interpersonal aggression (i.e. verbal aggression ($\beta = -.10$; $p = .005$), physical aggression (β = -.11; $p = .001$), object aggression (β = -.08; $p = .015$) or regressive/inappropriate behavior (β = -.15; $p < .001$) the focal children's dyad-specific ER worsened.

Associations with observed social skills

In contrast, the social skills displayed by play partners were not significantly related to the focal children's relationship ER (see Table 5). However, the focal children's own prosocial behavior ($\beta = .07$; $p = .036$) was positively linked to their relationship ER, indicating that higher levels of empathy and helpfulness were associated with more pronounced dyad-specific ER within the interaction.

Discussion

This study aimed to elucidate how preschoolers' observed ER is shaped by both stable individual competencies and dynamic, dyad-specific processes that occur during peer interactions. Using the SRM, we assessed the contributions of stable individual differences (actor ER), the general influence of play partners (partner ER), and the unique interplay between dyad members (relationship ER). Additionally, we explored how children's and their play partners' age, gender, and reported socio-emotional characteristics predicted these ER estimates, along with the role of real-time emotion-related behaviors in shaping individuals' dyad-specific ER.

Findings revealed that ER was predominantly trait-like, with the actor level explaining the largest portion of variance, suggesting that preschool children regulate their emotions in a relatively stable manner across different peers. Contrary to expectations, the partner variance was negligible, indicating that preschool children did not elicit a consistent ER response in their peers. However, a significant relationship effect emerged, underscoring the importance of dyad-specific interactions in shaping ER. Despite this, dyadic reciprocity was not observed, suggesting that preschool children's ER levels in a specific dyad were not necessarily mirrored by their play partners. These findings highlight the complex interplay between

Table 4. Mixed linear model analyses with focal children's relationship emotion regulation as criteria and focal children's and play partners' observed responses as predictors.

Responses to emotion-eliciting situations		*M*	*SD*		*β*	95% CI	
Social	Verbal interaction	3.02	1.76	fc	.00	−.06	.07
				pp	.03	−.03	.10
	Distal interaction	4.08	1.33	fc	−.00	−.08	.07
				pp	.02	−.06	.09
	Proximal interaction	1.94	1.22	fc	.05	−.02	.11
				pp	−.02	−.09	.05
Internalizing	Distraction	3.64	1.47	fc	−.03	−.09	.04
				pp	−.10**	−.16	−.04
	Disregard / ignoring	2.19	1.30	fc	.02	−.04	.09
				pp	−.00	−.07	.07
	Avoidance / withdrawal	2.28	1.46	fc	.02	−.04	.08
				pp	−.14***	−.20	−.08
	Self-directed speech	1.69	1.01	fc	.04	−.03	.10
				pp	−.03	−.09	.04
	Self-soothing	2.97	1.34	fc	.01	−.05	.08
				pp	−.04	−.10	.03
Externalizing	Verbal venting	2.47	1.48	fc	−.01	−.07	.06
				pp	−.07*	−.13	−.00
	Physical venting	2.46	1.36	fc	.03	−.03	.09
				pp	−.09**	−.15	−.03
	Verbal interpersonal aggression	1.31	0.65	fc	.04	−.03	.11
				pp	−.10**	−.17	−.03
	Physical interpersonal aggression	1.33	0.72	fc	−.04	−.11	.02
				pp	−.11**	−.17	−.04
	Object aggression	1.57	0.96	fc	−.03	−.09	.04
				pp	−.08*	−.15	−.02
	Regression / inappropriate behavior	1.73	1.11	fc	.03	−.03	.09
				pp	−.15***	−.21	−.09

Notes. All predictor variables were group-mean centered on the round robin level and standardized; All models are controlled for focal children's and play partners' age and gender composition of the dyad *M* = mean; *SD* = standard deviation; *β* = standardized regression coefficient; 95% CI = 95% confidence interval of the standardized regression coefficient; LL = lower limit; UL = upper limit; fc = focal children; pp = play partners.

†$p < .10$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

Table 5. Mixed linear model analyses with focal children's relationship emotion regulation as criteria and focal children's and play partners' observed social skills as predictors.

Social Skills	*M*	*SD*		*β*	95% CI	
Leadership / assertiveness	1.97	1.39	fc	−.03	−.10	.04
			pp	.04	−.03	.11
Setting limits	1.59	1.01	fc	−.03	−.10	.03
			pp	−.02	−.09	.04
Sociability	3.67	1.64	fc	.03	−.04	.10
			pp	.05	−.02	.12
Prosocial behavior	1.38	0.77	fc	.07*	.00	.13
			pp	.02	−.04	.08
Cooperation	2.28	1.46	fc	.02	−.07	.11
			pp	.06	−.04	.15

Notes. All predictor variables were group-mean centered on the round robin level and standardized; All models are controlled for focal children's and play partners' age and gender composition of the dyad *M* = mean; *SD* = standard deviation; *β* = standardized regression coefficient; 95% CI = 95% confidence interval of the standardized regression coefficient; LL = lower limit; UL = upper limit; fc = focal children; pp = play partners.

†$p < .10$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

individual competencies and peer interactions in shaping early ER in line with Pahigiannis and Glos (2020).

Children's general emotion regulation across different peers (actor emotion regulation)

The findings revealed that a significant portion of the variance in observed ER stems from stable, trait-like differences across children (actor variance), emphasizing their emerging capacity to regulate emotions consistently across different contexts. The positive associations of the focal children's educator-reported ER and their positive peer relationships with the actor ER suggest that these factors contribute to a child's consistent ability to regulate emotions across differing peers. Educator-reported ER was linked to observed general, stable ER, reinforcing the idea that children with stronger ER capacities exhibit this strength across a range of social contexts. Similarly, positive peer relationships may support consistent ER by providing children with opportunities to practice and refine their regulatory skills in supportive and cooperative social environments which aligns with previous research linking positive social outcomes and ER (Adynski et al., 2024; Blair et al., 2016; Robson et al., 2020). These findings emphasize the role of both intrinsic regulatory abilities and relational experiences in

shaping trait-like ER capacities in line with Diebold et al. (2025), Pahigiannis and Glos (2020), and Ramani et al. (2010). In contrast, the negative associations of behavioral difficulties with the actor ER indicate that problematic behaviors may undermine the stability of ER across dyadic interactions. Children with higher levels of conduct problems and hyperactivity may struggle to maintain consistent ER across interactions due to impulsivity, emotional dysregulation, or challenges in responding to social demands. These findings highlight externalizing behaviors as a key factor undermining stable, trait-like ER across interactions, and align with meta-analytic reviews that link externalizing problems to deficits in self-regulation and ER (Compas et al., 2017; Robson et al., 2020). Notably, no significant associations were found for gender, age, verbal emotion expression, self- and other-oriented social skills. These non-significant results suggest that these factors may have less influence on the stable, trait-like aspects of children's ER and could be more relevant in specific contexts or relationships. Overall, these results underscore the role of both intrinsic regulatory capacities and social experiences in shaping trait-like ER, while also highlighting how externalizing problems may reduce ER consistency across peers.

Children's general influence on play partners' observed emotion regulation (partner emotion regulation)

Despite the substantial actor variance, partner variance—the extent to which children consistently influenced their peers' observed ER—was negligible in relation to the other proportions of variance. Similarly, individual differences in partner ER were not significantly linked to specific child characteristics. The absence of associations with age, educator-reported ER, self- and other-oriented social skills, positive peer relationships, and behavioral and emotional difficulties highlights the complexity of stable partner ER in peer interactions. One likely explanation is developmental: Preschoolers' social and emotional competencies are still emerging, and their ability to act as consistent regulators for others may be limited. Importantly, this does not imply that preschoolers are unable to influence their peers' regulation within specific interactions. Rather, at this age, children's influence on peers' emotional states is often situational and dependent on immediate contextual factors, rather than stable personal traits (Denham, 2023; Thompson, 1994). Methodologically, the semi-standardized play context and short observation windows may further attenuate detectable partner variance by emphasizing moment-to-moment dynamics over enduring influence patterns. Together, these factors suggest that the absence of significant partner variance likely reflects both developmental characteristics of preschool interaction and the transient, context-bound nature of early peer regulation.

Play partners' influence on dyad-specific observed emotion regulation (relationship emotion Regulation)

The SRM analysis revealed that the dyadic constellation of two children accounted for a substantial portion of the variance in children's observed ER (relationship variance), over and above the stable, trait-like actor and partner variance components. While the partner variance contributed little to observed ER, relationship variance explained more than a quarter of the total variability. This finding underscores the importance of specific pairings of children, in line with the findings of Diebold et al. (2025), revealing that who interacts with whom matters more than the general extent to which a partner elicits ER across different peers.

Importantly, dyadic reciprocity was not significant, meaning that one child's unique ability to regulate emotions in interactions with a specific play partner (focal children's relationship ER) did not reliably predict their partner's unique ER (play partners' relationship ER). In other words, if a child regulated their emotions more dyad-specific with a particular peer, that peer did not necessarily show higher dyad-specific ER in return. Moreover, the play partners' educator-reported emotion-related, social and behavioral characteristics were all not significantly associated with the focal children's relationship ER as well as the closeness of relationship frequency of interactions on a typical day in the playgroup between the specific children. This indicates that the unique dyadic interactions between focal children and their play partners were not systematically influenced by the focal children's or play partners' general educator-reported traits or behaviors or the educator-reported closeness of relationship between children, seemingly contrasting with Diebold et al. (2025) who found that reported relationship quality affects peers' influence on preschool children's reported ER. Instead, relationship ER appears to emerge from real-time, context-specific interaction dynamics that are not fully captured by reported characteristics. These findings emphasize the importance of situational influences in ER, suggesting

that how children regulate their emotions is highly dependent on the immediate relational context.

Associations with observed emotion regulation

To assess associations between emotion-related behavior and relationship ER, we conducted multilevel analyses linking focal children's relationship ER to their own and play partners' real-time emotion-related behaviors observed during the same interaction. The positive association between play partners' observed ER and focal children's relationship ER suggests that the emotional regulation capacities exhibited by play partners during the interaction may create a relational context that fosters dyad-specific ER dynamics. When play partners effectively regulate their own emotions, they may provide a supportive, and less emotionally taxing environment that enables the focal children to exhibit higher dyad-specific ER. This finding aligns with theories of co-regulation, which emphasize the reciprocal nature of ER in interpersonal contexts (Pahigiannis & Glos, 2020; Thompson, 1994; Valiente et al., 2020), suggesting that emotionally regulated peers may serve as external regulators, modeling adaptive strategies and easing emotional demands within the interaction.

Associations with observed emotion expressions

Play partners' emotion expressions also contributed significantly to shaping dyadic ER. Expressions of pride, relaxation, curiosity, and involvement were positively associated with focal children's relationship ER, whereas jealousy, shame, and embarrassment undermined it. These findings suggest that successful, engaging interactions in a relaxed atmosphere strengthen ER within dyads, while self-conscious, socially evaluative negative emotions introduce competitive or judgmental elements, and therefore relational tension, that disrupts dyad-specific ER processes. The lack of significant relationships for other positive emotions (e.g. excitement, happiness) and negative emotions (e.g. sadness, anger, fear) suggests that not all emotions expressed by play partners are equally influential in shaping dyad-specific ER. This could indicate that more energetic positive and general negative emotional states might not be as directly tied to the unique relational dynamics of the dyad. These emotion expressions may introduce emotional intensity without necessarily disrupting or enhancing the unique relational dynamics between dyad members.

Associations with observed responses to emotion-eliciting situations

The relationship between children's responses to emotion-eliciting situations and the focal children's relationship ER revealed that, surprisingly, none of the play partners' positive or supportive responses were positively related to the focal children's relationship ER, whereas negative or unsupportive responses consistently undermined it. This asymmetry may reflect the "negativity bias" in early social-emotional development, whereby negative behaviors and emotions exert a stronger and more immediate impact on children's affective and regulatory processes than positive ones (Vaish et al., 2008).

In the domain of social responses, neither the focal children's nor the play partners' levels of verbal, distal or proximal interaction about emotion-related situations were significantly related to the relationship ER. This implies that emotion-related social exchanges with peers do not contribute substantially to focal children's dyad-specific ER. One important consideration here is that our sample consisted of preschool children, whose social and emotional competencies are still in the earlier stages of development (Denham, 2023). It is conceivable that older children, with more mature and nuanced social emotion-related engagement, might exhibit different associations.

In contrast, internalizing responses revealed a more differentiated pattern. Although none of the focal children's own internalizing responses were significantly associated with their relationship ER, higher levels of distraction or avoidance in play partners were linked to a reduced relationship ER. This suggests that when a play partner becomes distracted or withdraws, it may reduce or disrupt the mutual engagement necessary for effective dyad-specific ER, thereby reducing the focal children's capacity to regulate emotions within that specific interaction. The more subtle or intrapersonal responses of disregarding, self-soothing or self-directed speech did not contribute to the focal children's relationship ER in a meaningful way. This might indicate that, while more overt behaviors like distraction or withdrawal alter the interaction dynamic in a way that is captured by the relationship ER, these subtle behaviors are less obvious and emotionally charged for the interaction partner and thus may have a limited impact on the relational dynamics or the unique regulatory processes occurring between two children.

The most pronounced effects emerged from externalizing responses. None of the play partners' positive behaviors increased the focal children's relationship

effect. Instead, their negative or unsupportive responses had a detrimental impact. Specifically, play partners' affective releases (i.e. verbal and physical venting), interpersonal aggression (both verbal and physical), object aggression, and regressive or inappropriate behavior were all significantly associated with a diminished unique, dyad-specific ER in the focal children. While aggression introduces tension and conflict that undermines the cooperative dynamics required for effective relational ER, affective releases and regressive or inappropriate behaviors may introduce perturbation or unpredictability, making it difficult for the dyad to maintain a collaborative emotional interaction. Notably, the focal children's own externalizing responses did not predict their relationship ER, underscoring that it is the play partner's negative behaviors that primarily reduce the focal child's dyad-specific ER.

Taken together, these findings indicate that play partners exert a stronger influence on the dyad-specific ER than the focal children themselves. One possible explanation is developmental: preschoolers' regulatory capacities are still emerging, making them more receptive to external cues and behavioral models provided by others. When one partner in the dyad displays well-regulated behavior or maintains composure, this may facilitate the other child's ability to regulate. By contrast, when the same partner exhibits dysregulated or disruptive behaviors, the interactional system becomes more fragile, leaving less room for effective co-regulation. This asymmetry likely reflects both the developing self-regulatory competencies of preschoolers and the dynamic, reciprocal nature of early peer interactions.

Associations with observed social skills

Interestingly, play partners' social skills were not significantly associated with the focal children's relationship ER, suggesting that while these behaviors foster general peer interactions, they may not directly shape dyad-specific ER in preschool children. Only the focal children's own prosocial behavior significantly predicted their unique ER within the dyad. This suggests that a child's capacity for empathy and helpfulness plays a crucial role in facilitating effective emotional interactions with a specific play partner. In other words, when focal children exhibit higher levels of prosocial behavior, they may be better equipped to engage cooperatively during challenging emotional exchanges, thereby increasing their unique ability to regulate emotions within that dyadic context. This finding aligns with Adynski et al. (2024) and Robson et al. (2020), who reported associations between children's ER and their social competencies, yet our results extend their work by capturing the children's actual behavior *in situ*.

Overall, the findings highlight that ER is not solely an individual, trait-like skill but also emerges dynamically from specific peer interactions. While general social, behavioral and emotional characteristics of play partners did not directly shape preschool children's dyad-specific ER, negative or unsupportive behaviors within the situation undermined it. This is further supported by the negative association of socially evaluative negative emotion expressions, such as envy or shame, with the relationship ER. In contrast, play partners' expressions of pride, relaxation, or involvement foster focal children's unique, dyad-specific ER. This highlights that the quality of emotional engagement, rather than general peer characteristics, is a crucial factor in shaping children's ER at the dyadic level.

While Diebold et al. (2025) reported that the quality of peer relationships—particularly friends' empathic and supportive behaviors—predicted improvement in preschoolers' ER over time, the present findings offer a complementary perspective. In the current study, educator-reported closeness of relationship was not significantly related to dyad-specific observed ER (relationship ER), suggesting that reported or trait-like indicators of relationship quality may not fully capture the situational dynamics that shape children's ER within interactions. Instead, our results indicate that situational ER emerges from real-time, context-dependent interaction patterns between specific peers. Together, both studies underscore that peer relationship quality matters but at different levels: Diebold et al. (2025) emphasized enduring friendship characteristics, whereas the present work suggests that the moment-to-moment interactional quality is of high importance. This integrated view highlights that interventions should aim to strengthen both stable peer relationships and supportive emotional engagement during everyday interactions.

Practical implications

The present findings emphasize the need for early interventions that support both individual ER skills and the quality of children's peer relationships and interactional engagement. Since ER was largely explained by stable, trait-like differences, fostering ER abilities through structured social-emotional learning (SEL) programs and mindfulness exercises can help children develop consistent ER across contexts (Hosokawa et al., 2024; Rowland et al., 2023). In early childhood education settings, such programs can be

integrated into daily routines through brief emotional check-ins, shared reflection on feelings, or guided relaxation exercises.

At the same time, the significant dyadic relationship ER indicates that ER emerges within specific peer interactions. Educators therefore play a key role in fostering emotionally supportive classroom climates–by organizing cooperative play, modeling constructive responses to emotionally challenging situations, and facilitating guided discussions about emotions. Teacher training programs could explicitly address these competencies by including modules on peer co-regulation, emotion coaching, and group management strategies that promote empathic peer engagement.

Finally, the association between externalizing behaviors and both lower general actor ER and dyad-specific relationship ER underscores the need for targeted support for children with conduct problems or hyperactivity. Interventions such as emotion coaching, perspective-taking exercises, and responsive classroom management techniques may help these children develop more consistent and adaptive regulation capabilities across diverse social interactions (Dunsmore et al., 2016).

Strengths, limitations and future directions

This study highlights the interplay between general, trait-like and state-like, dyadic components in explaining preschool children's observed ER, with a particular focus on the play partner's contribution to its dyadic manifestation. To our knowledge, no prior study has examined these relationships in any age group. By assessing observed emotion-related behavior in a naturalistic setting, this study offers valuable insights beyond traditional other-reported measures in this age group. Moreover, the latent modeling of observed ER allowed for the separation of error variance from relationship variance, reducing bias in the results.

Despite these strengths, certain methodological limitations must be acknowledged. The aggregation of two 1-min intervals, while necessary for modeling, may have masked finer distinctions in ER dynamics and peer influences. A more fine-grained, second-by-second analysis could yield richer insights but would impose substantial demands on coders. Additionally, the small sample size and constraints in round robin unit composition may have introduced biases, particularly as some units contained one additional missing participant beyond the recommended threshold (Schönbrodt et al., 2012). While larger round robin units are statistically preferable (Kenny et al., 2006), logistical constraints in playgroup structures made their implementation challenging. Although the participation of some children in multiple round robin units might appear problematic, excluding these cases would have substantially reduced the sample size, and additional analyses indicated that their exclusion would have yielded comparable results. While we aimed to maintain an equal level of experience among play partners, deviations from the fixed dyad order occasionally occurred when children were reluctant to participate. Likewise, children who took part in more than one round robin unit likely had a slight experiential advantage compared to their play partners. By excluding the first minute of the play situations from the analyses, we aimed to minimize this experiential advantage and allow for initial adjustment. Furthermore, children with internalizing tendencies may be underrepresented in this study. Since participation was voluntary, more withdrawn or socially inhibited children might have avoided engagement in the play situations, potentially leading to an overrepresentation of more extroverted children.

Future research could also benefit from a more heterogeneous age sample, as older children may exhibit a stronger tendency to elicit ER in their interaction partners, potentially increasing the likelihood of a detectable partner ER. Additionally, a longitudinal approach could provide deeper insights into how peer interactions shape emotional development over time. Advances in artificial intelligence and facial recognition software could further enhance data collection and analysis, allowing for a more fine-grained and scalable examination of ER dynamics in peer interactions.

Conclusion

This study highlights the complex interplay of individual traits and dyadic interactions in shaping preschoolers' observed ER. Although observed ER is largely driven by stable, trait-like differences between children, the unique dynamics between play partners contribute to variability in observed ER, underscoring the importance of peer interactions. By applying the Social Relations Model to observed ER, this study extends prior work by quantifying the relative influence of individual, partner, and relationship components within early peer interactions. The findings suggest that, in early childhood, ER is primarily an individual capacity but is modulated by situational dyadic factors rather than consistent partner effects. This perspective contributes to refining current

understandings of ER development in peer contexts, indicating that preschoolers' ER appears to be both trait-like and shaped through interactional processes. Accordingly, interventions might benefit from considering both children's individual ER capacities and the peer contexts in which regulation occurs.

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Generative artificial intelligence (AI)

ChatGPT (OpenAI, GPT-4, 2025 version) was used to support grammar and spelling corrections during the writing process.

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ORCID

Pablo Nischak http://orcid.org/0000-0001-6159-4357
Sonja Lorusso http://orcid.org/0000-0001-9698-198X
Tatiana Diebold http://orcid.org/0000-0002-4137-6157
Ori Harel http://orcid.org/0009-0006-8505-8229
Sonja Perren http://orcid.org/0000-0002-7916-4037

Data availability statement

Data and R syntax are available from the corresponding author upon reasonable request.

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