



# Associations Between Classroom Quality, Child Self-Regulation, and Psychological Adjustment in Early Childhood<sup>1</sup>

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## Abstract

Early childhood classroom quality can significantly influence children's social-emotional and behavioral development, particularly during the early years, as shown in research emphasizing the importance of high emotional support, organization, and instructional quality. This study analyzes the influence of classroom quality dimensions, namely, emotional support, classroom organization, and instructional support, with self-regulation skills, on preschool children's psychological adjustment, including prosocial behavior, hyperactivity, peer problems, emotional difficulties, and conduct. Participants included 193 Portuguese preschool children ( $M_{age}=46.60$  months,  $SD=6.58$ ). Classroom quality was assessed using the Classroom Assessment Scoring System; self-regulation was measured using the Head-Toes-Knees-Shoulders; psychological adjustment was reported by teachers using the Strengths and Difficulties Questionnaire. Results revealed that classrooms generally had medium-high emotional support ( $M=4.89$ ,  $SD=0.75$ ), moderate organization ( $M=4.19$ ,  $SD=0.90$ ), and low instructional support ( $M=2.76$ ,  $SD=0.94$ ). Emotional support strongly predicted reduced difficulties ( $\beta=-0.53$ ) and hyperactivity ( $\beta=-0.44$ ), while classroom organization significantly predicted more emotional symptoms ( $\beta=0.65$ ). Self-regulation emerged as a key predictor across child adjustment dimensions, enhancing the overall explanatory power of models. Findings highlight the roles of quality of teacher-child interactions and self-regulation in supporting psychological adjustment, emphasizing the need for early education to foster high-quality teacher-child interactions and actively develop children's self-regulatory abilities to promote well-being and future learning success.

**Keywords** classroom quality · self-regulation · child adjustment · teacher-child interactions

It is well-established that the quality of classroom environments plays a pivotal role in supporting children's social-emotional and behavioral development (La Paro et al., 2004; Vandenberg, 2024). According to the bioecological perspective of development, children's adjustment is shaped by ongoing transactions between individual characteristics and the relational environments in which children participate

(Bronfenbrenner & Morris, 2006). In ECEC, teacher-child interactions are a particularly salient "proximal process" that drives children to learn to regulate emotion and behavior, engage with peers, and adapt to classroom demands (Hofkens et al., 2023). A growing body of research highlights that classrooms' positive climates and high-quality teacher-child relationships not only foster academic achievement

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but also promote key competencies such as emotional regulation, positive social interactions, and appropriate behavioral responses (Garcia-Peinado, 2024). This is especially true in early childhood education and care (ECEC) settings, where the quality of the environment is a determinant of children's developmental trajectories, overall well-being, and future learning outcomes (Organization for Economic Co-operation and Development [OECD], 2017).

In particular, the quality of teacher-child interactions within ECEC significantly shapes children's developmental outcomes (Osher et al., 2020). Research demonstrates that these environmental factors enable all children to thrive in early educational settings (Williford et al., 2013). Thus, the quality of early educational environments contributes to fostering optimal developmental outcomes for all children and promoting a sense of belonging and engagement within the classroom. Beyond promoting children's sense of belonging and engagement, high-quality classroom environments are also critical contexts for the development of self-regulation, a core competence underlying psychological adjustment in early childhood. Self-regulation enables children to manage emotions, attention, and behavior in response to classroom demands, supporting adaptive participation in learning and social interactions (Blair et al., 2010; McClelland et al., 2017). Emotionally supportive and well-organized classrooms provide essential co-regulatory experiences through which children learn to regulate distress, sustain attention, and engage constructively with peers and adults (Williford et al., 2013; Rimm-Kaufman et al., 2009). In this sense, self-regulation represents a key developmental pathway linking classroom interaction quality to broader indicators of psychological adjustment, including emotional well-being, behavioral regulation, and positive social functioning.

## Early Childhood Classroom Quality and Child Adjustment

Preschool classroom quality is a multifaceted construct encompassing structural and process dimensions, each contributing uniquely to children's developmental outcomes (Clifford et al., 2020). Structural quality relates to regulated aspects of the educational environment, including teacher qualifications, class size, adult-to-child ratios, and physical infrastructure (Manning et al., 2019). Conversely, process quality involves dynamic interactions within the classroom, such as teacher-child and peer interactions, which are less regulated and more variable (Raikes et al., 2023). Among these, process quality has garnered particular attention due to its direct influence on children's learning and development. Empirical studies have linked high-quality teacher-child interactions to improved cognitive and social

outcomes (e.g., Eliassen et al., 2023; Mashburn et al., 2008). Key components of process quality, such as emotional support, classroom organization, and instructional support, have been identified as critical factors in fostering effective learning environments (Mashburn et al., 2008; Vandenberg, 2024). These dimensions of classroom quality have been associated with academic readiness (e.g., Pianta et al., 2020) and with children's broader psychological adjustment, including the development of prosocial behaviors, emotional competence, and behavioral self-control (Hamre & Pianta, 2005; Mashburn et al., 2008).

Emotional support refers to educators creating a warm, respectful, and responsive environment, attending to children's emotional needs, and fostering secure teacher-child relationships. This dimension is critical for children to feel safe and valued, supporting their willingness to engage in learning and social interactions (e.g., Jennings & Greenberg, 2009; Pianta et al., 2008). Research increasingly demonstrates that emotionally supportive classrooms foster secure attachments with teachers, which serve as a protective factor against emotional difficulties and promote the development of empathy and cooperative behavior (Hatfield et al., 2013). Classroom organization encompasses the effective management of children's behavior, time, and attention, and includes teachers' ability to maintain productive routines, minimize disruptions, and support autonomous engagement. A well-organized classroom environment, characterized by consistent routines, clear expectations, and proactive behavior management, is critical in promoting self-regulation and reducing externalizing behaviors such as impulsivity, hyperactivity and conduct problems (e.g., Alderman & MacDonald, 2015; Pianta et al., 2020; Rudasill et al., 2016). Finally, instructional support involves using feedback, modeling, and language-rich interactions to scaffold children's cognitive and linguistic development (Pianta et al., 2008). Although it is often less emphasized in early childhood compared to the other dimensions, and usually presents lower levels of quality in preschool contexts, instructional support has been shown to contribute to children's emerging executive function and problem-solving skills (e.g., Hu et al., 2020) and language development (e.g., Gosse et al., 2014), all of which are crucial for regulating behavior and emotions.

Furthermore, longitudinal studies suggest that high-quality teacher-child interactions in preschool not only predict better social-emotional outcomes in the short term but also have lasting effects into later childhood and adolescence, including reduced risk of behavioral problems and improved emotional regulation (Ansari et al., 2020; McCoy et al., 2017). In a multilevel meta-analysis of 16 longitudinal studies, Sluiter et al. (2025) showed that the process quality of ECEC is a significant and stable predictor of socioemotional

development and well-being over time, and gains persist through adolescence. Altogether, these findings underscore the importance of attending to classroom quality, as contextual factors that support young children's development of competencies that will allow them to develop prosocial behaviors (Longobardi et al., 2021), crucial for social relationships, and manage emotions and behaviors (Kaya, 2020), all considered essential aspects of child psychological adjustment.

### Self-Regulation and Psychological Adjustment during Early Years

Self-regulation is usually defined as the ability to manage one's emotions, behaviors, and thoughts (e.g., Blair et al., 2010), and plays a crucial role in achieving adaptive developmental tasks across every stage of life (McClelland et al., 2017). In early childhood, self-regulation is recognized as a foundational skill, associated with children's social competence, emotional stability, and learning engagement (Savina, 2021). Enhancing self-regulation and executive functions strengthens children's ability to manage and direct their behaviors, emotions, and thoughts, enabling them to adapt to their environments and achieve their goals (Muir et al., 2024).

Research links preschoolers' self-regulation to several short- and long-term developmental outcomes that set the foundation for successful school, psychological, and social adjustment (Adynski et al., 2024; Perry, 2019). Previous research shows a positive relationship between self-regulation during the early ages and early achievement in literacy and math (McClelland et al., 2007, 2014; Skibbe et al., 2019) and further academic performance (Blair et al., 2010; McClelland & Cameron, 2012; Perry, 2019; Robson et al., 2020; Savina, 2021; Skibbe et al., 2019). Furthermore, self-regulation is an essential competence for school adjustment, allowing children to adjust their behavior to social and academic demands, including interacting with teachers, caregivers and classmates, preventing behavior and emotional problems in the classroom (Adynski et al., 2024; Savina, 2021). Children with better self-regulation have also been found to have lower levels of internalizing problems (e.g., anxiety, depression) and externalizing problems (e.g., aggression, hyperactivity) (Howard et al., 2018; Solé-Ferrer et al., 2019).

In the present study, children's psychological adjustment is conceptualized as a multidimensional profile encompassing both adaptive functioning and difficulties in socioemotional and behavioral domains (Bornstein et al., 2010; Bulotsky-Shearer et al., 2023). Specifically, we consider prosocial behavior, internalizing (emotional and peer problems) and externalizing behaviors (hyperactivity and

conduct problems) (Goodman, 2001). These domains capture distinct but interrelated dimensions of children's early adjustment and are theoretically expected to be influenced by both classroom interaction quality and children's self-regulatory capacities (Lin et al., 2024).

Higher self-regulation is linked to higher levels of social skills (e.g., Korocu et al., 2022; Robson et al., 2020), as it is a crucial skill that fosters positive peer relationships among children (Lucas-Nihei et al., 2025). Children relationships in early childhood seem to be closer when their capacity for self-regulation is high (Cadima et al., 2016). This capacity enables them to employ social skills more effectively and manage the expression of negative emotions, thereby fostering greater acceptance among their peers (Lucas-Nihei et al., 2025).

Despite robust evidence linking classroom quality to children's socioemotional and behavioral development, important gaps remain in the literature. First, many studies conceptualize classroom quality as a global construct, overlooking the potentially distinct and even divergent contributions of its core dimensions—emotional support, classroom organization, and instructional support—to specific child adjustment outcomes. Second, existing models often emphasize contextual features of the classroom while giving limited attention to internal child-level processes, such as self-regulation, that may shape how children experience and benefit from classroom environments. As a result, our understanding of how classroom interaction quality and child self-regulation jointly contribute to psychological adjustment in early childhood remains incomplete.

To address these gaps, the present study examines the distinct dimensions of teacher–child interaction quality using separate CLASS scores and investigates the unique and combined contributions of classroom quality and children's self-regulation in predicting multiple indicators of psychological adjustment in preschool children.

### Study Goals

This study explored the relationships between classroom quality dimensions and children's psychological adjustment, as well as the role of self-regulation skills in this context. Specifically, the study aimed to: (a) analyze the quality of teacher-child interactions in preschool classrooms; (b) explore relations between dimensions of teacher-child interactions quality, namely emotional support, classroom organization, and instructional support, and children's self-regulation, prosocial behavior, hyperactivity, peer problems, emotional difficulties, and conduct problems; (c) analyze the predictive role of preschoolers' self-regulation skills and quality of teacher child-interactions for child adjustment dimensions. By addressing these objectives, the study

aimed to provide insights into how educational settings can be optimized to support children's psychological adjustment, laying the foundation for interventions targeting both teacher practices and child self-regulation development.

## Method

### Participants

Participants included 193 preschool-aged children ( $M=46.60$  months old,  $SD=6.58$ ; 111 males; 82 females) from ECEC classrooms in the North of Portugal schools. Following a random list of numbers, preschools identified at the Ministry of Education website for the referred district were contacted. Directors were contacted until 42 preschool classrooms agreed to participate. Overall, 80 early childhood education institutions were contacted, and 26 declined to participate. In each classroom, three to five children were selected.

The 42 classrooms participating had an average enrollment of 20.98 children ( $SD=2.98$ ). All preschool educators in the sample were female, aged 27–59 years ( $M=50.04$ ,  $SD=6.58$ ). These professionals had a minimum of a bachelor's degree in early childhood education, with an average of 16.09 years of formal education ( $SD=0.42$ ). Their professional experience in preschool education spanned from 2 to 36 years ( $M=25.50$ ,  $SD=7.13$ ).

The Portuguese Data Protection Authority and the Committee for Monitoring Studies in Education Settings of the General Direction of Education Ministry approved all measures and data collection procedures (authorization number REMOVED FOR REVISION; and authorization number REMOVED FOR REVISION; respectively); informed consent was obtained from the preschool directors, preschool teachers, and families. During data collection, children were also asked if they agreed to participate. If a child manifested that did not want to participate, that was respected, respecting the child's right to decide.

### Measures

#### Classroom Assessment Scoring System (CLASS; Pianta et al., 2008)

This widely used observational measure captures teacher-child interaction quality in three dimensions: emotional support, classroom organization, and instructional support. Additionally, it is possible to calculate an overall dimension of teacher-child interaction quality. The emotional support dimension assesses how teachers create a positive and nurturing classroom atmosphere. It captures the quality of

relationships between teachers and children, highlighting teacher sensitivity to children's needs and the promotion of a positive climate. Emotional support also emphasizes the teacher's regard for students' perspectives, including encouraging autonomy and valuing their input. Classroom organization evaluates how effectively teachers manage student behavior, time, and activities to optimize learning opportunities. It examines the teacher's strategies for maintaining productive and orderly environments, ensuring efficient use of time and resources, and facilitating engaging and structured learning experiences. Instructional support measures the teacher's ability to foster cognitive and language development. This dimension focuses on promoting higher-order thinking skills, providing meaningful feedback to enhance understanding, and using language-rich interactions to support vocabulary and communication skills. CLASS is scored using a 7-point Likert scale, with higher scores indicating better quality. Reliability is ensured through rigorous observer training and calibration, often assessed using interobserver agreement metrics such as Cohen's kappa.

Recognized for its applicability across various age groups and educational contexts, CLASS has been extensively validated and remains a valuable tool for linking classroom processes to children's developmental outcomes. CLASS reliability has been demonstrated through high internal consistency and strong interrater reliability. For example, in the context of preschool observations, scores for emotional support typically demonstrate excellent reliability (e.g., kappa values above 0.80), while classroom organization and instructional support show similarly robust reliability metrics (e.g., Mashburn et al., 2008). Its content validity is well-established through the theoretical alignment of its dimensions, emotional support, classroom organization, and instructional support, with developmental and educational theories of effective teaching practices (Hamre & Pianta, 2007). Criterion-related validity is supported by studies linking CLASS scores to student outcomes, such as social-emotional competencies and academic achievement. For instance, Mashburn et al. (2008) found that higher CLASS scores predicted better preschool children's language, literacy, and social development. Construct validity has been demonstrated through factor-analytic studies that confirm the three-factor structure of the measure (Pianta et al., 2008). The CLASS has been widely used, showing that this is a reliable, valid measure in different contexts, including in Portugal (e.g., Aguiar et al., 2019; Coelho et al., 2023; Rimm-Kaufman et al., 2009; Thorpe et al., 2020). Data collectors in this study received formal training in the measure and successfully completed the reliability test to become certified observers. Interobserver reliability was controlled for 25% of observations, with a Cohen's kappa

between 0.69 (classroom organization) and 0.89 (emotional support). Exact agreement was 67.25%. The within-one-point agreement was 99.50%. The study focuses its analysis on the three specific dimensions provided by the measure for teacher-child interactions quality.

### Head-Toes-Knees and Shoulders (HTKS; Ponitz et al., 2008)

This is a direct behavioral assessment of young children's self-regulation. This task requires children to perform the opposite of an instructed action (e.g., touching their head when told to touch their toes), measuring their ability to inhibit automatic responses, follow multi-step instructions, and shift attention between rules. The task is particularly suitable for assessing executive functioning components in early childhood, such as inhibitory control, cognitive flexibility, and working memory. Psychometric properties of the HTKS task have been extensively studied, demonstrating strong reliability and validity. Internal consistency is consistently reported as high, with Cronbach's alpha values typically exceeding 0.90 (Ponitz et al., 2008). Test-retest reliability is also robust, with correlations ranging from 0.70 to 0.80, indicating stability over time. Construct validity has been supported through its correlations with established measures of executive functioning and behavioral self-regulation, its predictive validity for academic achievement, particularly in early mathematics and literacy skills (McClelland et al., 2014). This measure has been used in several studies that report data validity in different samples, including in Portugal (e.g., Coelho et al., 2023; McClelland & Cameron, 2012). Researchers received training in HTKS, provided by the authors, and successfully completed the certification test in the measure. In the present study, Cronbach's alpha for HTKS was very good, with a value of 0.91.

### Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001)

This is a widely used measure for assessing the psychological adjustment of children and adolescents aged 3 to 17. The questionnaire comprises 25 items, divided into five subscales: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Relationship Problems, and Prosocial Behavior. Each subscale contains five items, scored on a 3-point Likert scale (0 = not true, 1 = somewhat true, 2 = undoubtedly true). These scores generate a Total Difficulties Score (sum of the first four subscales). SDQ has been widely used, and several studies provide evidence on its adequate psychometric properties and validity (Goodman, 2001; Marzocchi et al., 2004), including in Portugal (e.g., Ferreira et al., 2021). In the present study, Cronbach's alpha was 0.41 for Conduct Problems, 0.77 for

Hyperactivity, 0.79 for Prosocial Behavior, 0.77 for Peer Relationship problems, and 0.62 for Emotional Problems. All subscales present adequate to good reliability, except for Conduct Problems. Cronbach's alpha for the overall scale of Total Difficulties was good, with a value of 0.81.

### Procedures

Data collection was conducted over the course of a full pre-school day. During the morning period, a 3-hour classroom observation was carried out using the CLASS. Two observers certified in the CLASS were involved in data collection, with approximately 25% being simultaneously observed by the two researchers for inter-observer agreement control. Each classroom was observed across four 20-minute cycles, focusing on emotional support, classroom organization, and instructional support. In the afternoon, each child was individually assessed using the HTKS task, which measures self-regulation. Finally, teachers completed the SDQ for every child participating, providing teacher-reported data on emotional and behavioral adjustment, and completed a brief sociodemographic questionnaire.

## Results

### Quality of Teacher-Child Interactions in Preschool Classrooms

Results indicate that Portuguese preschool classrooms exhibit overall low to moderate-high levels of classroom process quality regarding teacher-child interactions (Table 1). Specifically, Emotional Support was rated in the medium-high range ( $M=4.89$ ,  $SD=0.75$ ), suggesting that educators generally fostered warm, responsive, and supportive interactions with children. This score reflects a relatively

**Table 1** Descriptive statistics and scale ranges for classroom quality, self-regulation, and child adjustment measures

|                        | Scale | M (SD)        | Min. – Max. |
|------------------------|-------|---------------|-------------|
| Classroom quality      |       |               |             |
| Emotional Support      | 1–7   | 4.89 (0.75)   | 3.33–6.38   |
| Classroom Organization | 1–7   | 4.20 (0.89)   | 2.50–5.92   |
| Instructional Support  | 1–7   | 2.76 (0.94)   | 1.42–4.75   |
| Global Quality         | 1–7   | 4.04 (1.83)   | 2.53–5.68   |
| Self-Regulation        | 0–60  | 24.34 (20.34) | 0–60        |
| Child Adjustment       |       |               |             |
| Total Difficulties     | 0–50  | 9.35 (5.71)   | 2.00–28.00  |
| Emotional Problems     | 0–10  | 1.60 (1.83)   | 0.00–9.00   |
| Hyperactivity Behavior | 0–10  | 3.81 (3.38)   | 0.00–14.00  |
| Prosocial Behavior     | 0–10  | 7.97 (2.39)   | 1.00–10.00  |
| Conduct Problems       | 0–10  | 2.81 (1.74)   | 0.00–9.00   |
| Peer Problems          | 0–10  | 1.28 (1.52)   | 0.00–7.00   |

consistent provision of emotional support across classrooms, as indicated by the low standard deviation. Classroom Organization was rated at a moderate level ( $M=4.19$ ,  $SD=0.90$ ), implying that while routines and behavior management strategies were present, there may be room for improvement in terms of consistency and effectiveness in maintaining productive classroom environments. In contrast, Instructional Support received the lowest average rating ( $M=2.76$ ,  $SD=0.94$ ), placing it in the lower range of the scale. This suggests limited opportunities for concept development, feedback quality, and language modeling. The relatively higher variability in this domain indicates that while some classrooms may provide moderate instructional support, others offer very little, highlighting a potential area for targeted professional development.

### Relations Between the Quality of Teacher-Child Interactions, Self-Regulation, and Child Adjustment

Children's self-regulation, measured on a 0–60 scale, had a mean score of 24.34 ( $SD=20.34$ ). This value is in the lower-mid range of the scale, indicating moderate but variable self-regulatory abilities among children, with some children showing very low levels (Table 1). Regarding child adjustment, the Total Difficulties score averaged 9.35 ( $SD=5.71$ ) on a 0–50 scale, which is relatively low, suggesting that most children exhibited few behavioral or emotional difficulties. Subscale scores further support this interpretation: Emotional Problems ( $M=1.60$ ,  $SD=1.83$ ), Conduct Problems ( $M=2.81$ ,  $SD=1.74$ ), and Peer Problems ( $M=1.28$ ,  $SD=1.52$ ) were scored low, in relation to their maximum possible scores (0–10). This indicates a generally positive adjustment. Hyperactivity Behavior had a slightly higher mean of 3.81 ( $SD=3.38$ ), placing it in the mid-range, suggesting some variability in attention-related behaviors. In contrast, Prosocial Behavior had a high mean score of 7.97 ( $SD=2.39$ ) on a maximum score of 10, indicating that children were generally perceived as frequently engaging in positive social behaviors.

A series of hierarchical multiple regressions was conducted to examine the predictors of children's adjustment, including total difficulties, emotional problems, hyperactivity behaviors, and prosocial behavior (Table 2). For all models, the same predictors were entered in three blocks: (1) demographic variables, namely gender and age, (2) quality of teacher-child interactions dimensions, namely emotional support, classroom organization, instructional support, and (3) child self-regulation.

Specifically, for the variable Total Difficulties, the first block explained a small but significant portion of the variance (Table 2). Gender was a significant predictor ( $B =$

$-1.65$ ,  $SE=0.84$ ,  $\beta = -0.15$ ,  $p = .052$ ), with boys showing higher levels of difficulties than girls. Age was not a significant predictor. The second block added classroom quality variables and explained an additional 4% of the variance. Emotional support was a significant negative predictor ( $B = -4.21$ ,  $SE=1.73$ ,  $\beta = -0.53$ ,  $p = .016$ ). In the final block, self-regulation significantly improved the model, with a total variance explained of 12%. Self-regulation was a significant negative predictor ( $B = -0.09$ ,  $SE=0.02$ ,  $\beta = -0.34$ ,  $p < .001$ ), and instructional support became a significant positive predictor ( $B=1.72$ ,  $SE=0.87$ ,  $\beta=0.28$ ,  $p = .050$ ).

For emotional problems, gender and age were not significant predictors. The second block – with teacher-child interactions dimensions – explained an additional 6% of the variance. Emotional support negatively predicted emotional problems ( $B = -1.08$ ,  $SE=0.57$ ,  $\beta = -0.41$ ,  $p = .050$ ); Unexpectedly, classroom organization was a significant positive predictor ( $B=1.39$ ,  $SE=0.45$ ,  $\beta=0.65$ ,  $p = .002$ ) of emotional. The model improved slightly with the addition of self-regulation in the third block, and the total variance explained was 11%. Self-regulation significantly predicted fewer emotional problems ( $B = -0.02$ ,  $SE=0.008$ ,  $\beta = -0.17$ ,  $p = .045$ ).

For hyperactivity behaviors, the demographic model explained 6% of the variance. Gender was a significant predictor ( $B = -1.65$ ,  $SE=0.48$ ,  $\beta = -0.25$ ,  $p < .001$ ), with boys displaying more hyperactivity. Age was not a significant factor. The second block added 4% to the explained variance. Emotional support negatively predicted hyperactivity ( $B = -2.08$ ,  $SE=0.99$ ,  $\beta = -0.44$ ,  $p = .038$ ); unexpectedly, instructional support emerged as a positive predictor ( $B=0.25$ ,  $SE=0.52$ ,  $\beta=-0.35$ ,  $p = .017$ ). The final block, including self-regulation, accounted for an additional explanation of 11% of the variance, resulting in a total variance explained of 19%. Self-regulation was a strong negative predictor of hyperactivity behaviors ( $B = -0.06$ ,  $SE=0.01$ ,  $\beta = -0.38$ ,  $p < .001$ ); instructional support remained a significant positive predictor ( $B=1.45$ ,  $SE=0.49$ ,  $\beta=-0.41$ ,  $p = .004$ ), and emotional support a negative ( $B=-1.96$ ,  $SE=0.93$ ,  $\beta=-0.43$ ,  $p = .037$ ).

For prosocial behavior, the demographic model explained 7% of the variance. Gender significantly predicted prosocial behavior ( $B=1.10$ ,  $SE=0.34$ ,  $\beta=0.24$ ,  $p < .001$ ), with girls scoring higher. Age was also a significant positive predictor ( $B=0.06$ ,  $SE=0.03$ ,  $\beta=0.15$ ,  $p = .040$ ). Including classroom quality variables in the second block explained an additional 2% of the variance. However, none of the added predictors were significant. The final model with self-regulation added another 2% to the variance explained. Self-regulation was a marginally significant positive predictor ( $B=0.02$ ,  $SE=0.01$ ,  $\beta=0.16$ ,  $p = .061$ ).

**Table 2** Hierarchical multiple regression analyses predicting child adjustment outcomes from classroom quality and self-regulation

|                        | Total Difficulties             |             |         | 95% CI    |           | Emotional Problems            |             |         | 95% CI    |           |
|------------------------|--------------------------------|-------------|---------|-----------|-----------|-------------------------------|-------------|---------|-----------|-----------|
|                        | <i>B</i>                       | <i>SE B</i> | $\beta$ | <i>LL</i> | <i>UL</i> | <i>B</i>                      | <i>SE B</i> | $\beta$ | <i>LL</i> | <i>UL</i> |
| Block 1                | $R^2=0.01$                     |             |         |           |           | $R^2=0.003$                   |             |         |           |           |
| Gender                 | -1.65*                         | 0.84        | -0.15   | -3.31     | 0.01      | 0.34                          | 0.28        | 0.09    | -0.21     | 0.88      |
| Age                    | -0.03                          | 0.07        | -0.03   | -0.16     | 0.11      | 0.02                          | 0.02        | 0.08    | -0.01     | 0.06      |
| Block 2                | $\Delta R^2=0.04^*$            |             |         |           |           | $\Delta R^2=0.06^*$           |             |         |           |           |
| Gender                 | -1.65*                         | 0.84        | -0.15   | -3.30     | -0.01     | 0.37                          | 0.27        | 0.10    | -0.16     | 0.91      |
| Age                    | -0.04                          | 0.07        | -0.05   | -0.17     | 0.09      | 0.03                          | 0.02        | 0.09    | -0.01     | 0.07      |
| Emotional Support      | -4.21*                         | 1.73        | -0.53   | -7.62     | -0.79     | -1.08*                        | 0.57        | -0.41   | -2.19     | 0.03      |
| Classroom Organization | 2.22                           | 1.37        | 0.34    | -0.49     | 4.92      | 1.39**                        | 0.45        | 0.65    | 0.50      | 2.27      |
| Instructional Support  | -1.43                          | 0.91        | 0.24    | -0.36     | 3.21      | -0.29                         | 0.30        | -0.15   | -0.87     | 0.29      |
| Block 3                | $\Delta R^2=0.09^{***}$        |             |         |           |           | $\Delta R^2=0.02^*$           |             |         |           |           |
| Gender                 | -0.96                          | 0.82        | -0.09   | -2.58     | 0.65      | 0.48                          | 0.28        | 0.13    | -0.06     | 1.03      |
| Age                    | 0.10                           | 0.07        | 0.11    | -0.04     | 0.25      | 0.05*                         | 0.03        | 0.17    | 0.00      | 0.09      |
| Emotional Support      | -4.02*                         | 1.66        | -0.50   | -7.29     | -0.75     | -0.05                         | 0.56        | 0.40    | -2.16     | 0.05      |
| Classroom Organization | 1.73                           | 1.32        | 0.26    | -0.87     | 4.33      | 1.31**                        | 0.45        | 0.61    | 0.43      | 2.19      |
| Instructional Support  | 1.72*                          | 0.87        | 0.28    | 0.01      | 3.43      | -0.24                         | 0.29        | -0.12   | -0.82     | 0.34      |
| Self-regulation        | -0.09***                       | 0.02        | -0.34   | -0.14     | -0.05     | -0.02*                        | 0.008       | -0.17   | -0.03     | 0.00      |
|                        | $R^2 \text{ Total}=0.12^{***}$ |             |         |           |           | $R^2 \text{ Total}=0.11^{**}$ |             |         |           |           |
|                        | Hyperactivity Behaviors        |             |         |           |           | Prosocial Behavior            |             |         |           |           |
| Block 1                | <i>B</i>                       | <i>SE B</i> | $\beta$ | <i>LL</i> | <i>UL</i> | <i>B</i>                      | <i>SE B</i> | $\beta$ | <i>LL</i> | <i>UL</i> |
| Gender                 | $R^2=0.06^*$                   |             |         |           |           | $R^2=0.07^{***}$              |             |         |           |           |
| Age                    | -1.65***                       | 0.48        | 0.25    | -2.60     | -0.69     | 1.10**                        | 0.34        | 0.24    | 0.43      | 1.76      |
| Block 2                | -0.05                          | 0.04        | -0.09   | -0.12     | 0.03      | 0.06*                         | 0.03        | 0.15    | 0.00      | 0.10      |
| Gender                 | $\Delta R^2=0.04^*$            |             |         |           |           | $\Delta R^2=0.02^{**}$        |             |         |           |           |
| Age                    | -1.67***                       | 0.48        | -0.25   | -2.61     | -0.72     | 1.11**                        | 0.34        | 0.24    | 0.44      | 1.77      |
| Emotional Support      | -0.06                          | 0.04        | -0.11   | -0.13     | 0.02      | 0.06*                         | 0.03        | 0.17    | 0.00      | 0.11      |
| Classroom Organization | -2.08*                         | 0.99        | -0.44   | -4.03     | -0.12     | 1.28                          | 0.70        | 0.39    | -0.10     | 2.65      |
| Instructional Support  | 0.56                           | 0.79        | 0.14    | -0.99     | 2.10      | -0.63                         | 0.55        | -0.23   | -1.72     | 0.46      |
| Block 3                | 0.25*                          | 0.52        | 0.35    | 0.23      | 2.27      | -0.40                         | 0.37        | -0.16   | -1.11     | 0.32      |
| Gender                 | $\Delta R^2=0.11^{***}$        |             |         |           |           | $\Delta R^2=0.02^{**}$        |             |         |           |           |
| Age                    | -0.21**                        | 0.46        | -0.18   | -2.11     | -0.30     | 0.98**                        | 0.34        | 0.21    | 0.29      | 1.65      |
| Emotional Support      | 0.04                           | 0.04        | 0.07    | -0.04     | 0.12      | 0.03                          | 0.03        | 0.09    | -0.02     | 0.09      |
| Classroom Organization | -1.96*                         | 0.93        | -0.43   | -3.79     | -0.11     | 1.24                          | 0.69        | 0.38    | -0.13     | 2.61      |
| Instructional Support  | -0.23                          | 0.74        | 0.06    | -1.23     | 1.69      | -0.54                         | 0.55        | -0.20   | -1.62     | 0.55      |
| Self-regulation        | 1.45**                         | 0.49        | 0.412   | 0.48      | 2.41      | 0.45                          | 0.36        | -0.18   | -1.17     | 0.26      |
|                        | -0.06***                       | 0.01        | -0.38   | -0.08     | -0.03     | 0.02                          | 0.01        | 0.16    | 0.00      | 0.03      |
|                        | $R^2 \text{ Total}=0.19^{**}$  |             |         |           |           | $R^2 \text{ Total}=0.08^{**}$ |             |         |           |           |

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ 

LL=Lower Limit; UL=Upper Limit

Overall, emotional support, classroom organization, and instructional support are related to children's difficulties, emotional symptoms, and hyperactivity. Specifically, emotional support consistently predicted reduced adverse outcomes, such as total difficulties and hyperactivity (Table 2). Unexpectedly, classroom organization significantly predicted more emotional symptoms. Instructional support emerged as a positive predictor of hyperactivity and increased total difficulties when self-regulation was accounted for. Besides classroom quality, self-regulation emerged as a strong predictor of improved outcomes across domains of child adjustment, including fewer total difficulties, fewer emotional symptoms, and less hyperactivity. For

prosocial behavior, self-regulation was only marginally significant ( $p = .06$ ). The inclusion of self-regulation consistently increased the explanatory power of the models.

## Discussion

Classroom quality in ECEC, especially the quality of teacher-child relationships, lays the foundation for children's learning and development (e.g., La Paro et al., 2004; Vandenbroeck, 2024), with developmental frameworks emphasizing that interactions drive development, especially in the early years. Building on this literature, the present

study examined how classroom process quality, specifically dimensions of teacher–child interactions, relates to children’s positive adjustment, including fewer emotional, conduct, and hyperactivity problems, and greater prosocial behavior. These findings are best understood within bioecological and developmental-systems frameworks (Bronfenbrenner & Morris, 2006; Osher et al., 2020), which conceptualize children’s development as emerging from dynamic, reciprocal interactions between individuals and their environments. From this perspective, the quality of teacher–child interactions functions as a key proximal process through which preschool contexts shape children’s emotional and behavioral adjustment.

Overall, our findings reveal that Portuguese ECEC classrooms tend to present medium to low levels of quality regarding teacher–child interactions. Specifically, emotional support had the highest scores among those assessed, as reported in national studies (Cadima et al., 2016; Coelho et al., 2023). These values place Portuguese classrooms in the medium-high range of quality, suggesting a relatively positive climate regarding the quality of teacher–child interactions but also indicating room for improvement. On the other hand, instructional support showed the lowest scores, positioning the observed classrooms within the low-quality range for that dimension. This pattern of lower instructional support has been consistently documented in research using the CLASS across infant, toddler, and preschool classrooms, with meta-analytic evidence indicating that instructional support is systematically the lowest-rated CLASS domain and that its associations with children’s cognitive, language, and socioemotional outcomes are generally weaker than those observed for emotional support and classroom organization (Zheng et al., 2023). Recent methodological work also suggests that these attenuated associations may partly reflect measurement constraints and non-linear relations between instructional interactions and child outcomes, rather than a limited developmental relevance of instructional practices per se (Lee & Hooper, 2025). Taken together, these findings indicate that instructional quality remains an area requiring targeted political and pedagogical interventions.

Concerning the relations between dimensions of teacher–child interactions and child adjustment, this study distinguishes the roles of emotional support, classroom organization, and instructional support. It explores how each of these dimensions differentially predicts various indicators of child adjustment, including prosocial behavior, emotional problems, conduct problems, and hyperactivity, thereby extending previous research on the effects of high-quality interactions. The conceptualization of teacher–child interaction quality as a single overarching construct or as separate dimensions remains a topic of debate in the literature, with both perspectives presenting advantages and disadvantages

(Gordon & Peng, 2020). However, evidence from structural factor models using the CLASS measure suggests a better model fit when these dimensions are considered separately (Gordon & Peng, 2020). Consistent with this view, the present findings indicate that different domains of teacher–child interaction quality play distinct roles in children’s adjustment outcomes.

Emotional support emerged as a particularly important dimension, being associated with fewer overall difficulties and lower levels of hyperactivity. This suggests that positive and supportive teacher–child relationships may serve as a protective factor in early educational contexts. These findings are consistent with ecological and relational frameworks (Osher et al., 2020), which highlight the central role of proximal environments and everyday interactions in promoting children’s development and well-being.

Although effective classroom organization and behavior management are widely recognized as essential for promoting positive educational outcomes (Thangarajathi & Joel, 2010), the present finding that higher classroom organization was associated with greater child emotional problems suggests a more complex dynamic. This association should be interpreted with caution, given the cross-sectional nature of the data and the possibility that classroom organizational practices may be responsive to, rather than causal of, children’s emotional difficulties. One possible explanation is that an increased emphasis on structure, behavioral control, and academic routines may inadvertently constrain teachers’ emotional responsiveness, reducing the classroom’s affective warmth and sensitivity (Hu et al., 2020; Jennings, 2015). In environments where organization is prioritized to the extent that flexibility and emotional attunement are limited, or perceived as such by children, those with heightened emotional sensitivity or regulatory challenges may experience greater stress and discomfort (Hatfield et al., 2013). This interpretation supports the idea that classroom organization alone may be insufficient to promote children’s psychological adjustment, highlighting instead the crucial role of emotionally supportive relationships in buffering stress and enhancing well-being (Jennings & Greenberg, 2009). Recent studies emphasize that effective organization and classroom management depend not only on the presence of clear structure but also on teachers’ socioemotional competencies and ability to regulate their own emotions (Hagenauer et al., 2015; Sandilos et al., 2023; Valente et al., 2019). Teachers who can manage stress and remain emotionally attuned tend to create structured yet emotionally secure environments that foster children’s engagement and self-regulation (Schonert-Reichl, 2017). Accordingly, the effects of classroom organization on children’s adjustment appear to be context-dependent,

varying according to the emotional climate and the socioemotional skills teachers bring to their professional practice (Guerrero-Rosada et al., 2021). These findings underscore the need to further examine how teacher emotional competence and well-being interact with classroom organizational practices to influence young children's emotional development and adjustment in early educational settings.

It is also plausible that the relationship between organization and emotional difficulties is reciprocal rather than unidirectional, as suggested by research showing bidirectional links between classroom management and child behavior (Rudasill et al., 2016). Teachers facing more emotionally reactive or dysregulated groups may implement stricter behavioral management strategies, which could elevate classroom organization scores but simultaneously reduce perceived emotional warmth. Longitudinal or cross-lagged designs would be valuable in clarifying these temporal dynamics. Additionally, cultural expectations regarding discipline and compliance in Portuguese preschool settings may shape teachers' approaches to organization, potentially explaining variations across studies conducted in other sociocultural contexts (Vandenbroeck, 2024).

Across all models, self-regulation consistently contributed to explaining children's adjustment, reinforcing its role as a core developmental mechanism in early childhood. Its influence extended across multiple dimensions of child adjustment, including total difficulties, emotional problems, hyperactivity, and prosocial behavior, thus stressing its central role in early development. These findings align with theoretical perspectives that view self-regulation as a foundational skill affecting both internalizing and externalizing behaviors (Howard et al., 2018; Solé-Ferrer et al., 2019), reinforcing its importance as a key target for early intervention, alongside with the promotion of positive climate in the ECEC classrooms. Emotionally supportive environments foster children's self-regulation by providing co-regulatory experiences, such as modeling calm responses, empathy, and problem-solving, which gradually evolve into autonomous self-regulatory strategies. This process aligns with evidence showing that children's regulatory skills serve as a pathway through which environmental quality affects academic and social outcomes (McClelland & Cameron, 2012; Robson et al., 2020). Overall, classroom process quality and self-regulation function as interconnected systems that reinforce one another (Salminen et al., 2021). Findings involving the Total Difficulties score should be interpreted with caution, as the lower internal consistency of the Conduct Problems subscale may have attenuated the observed associations. Interventions that simultaneously enhance teachers'

emotional responsiveness and support children's executive and self-regulatory functions may therefore produce cumulative benefits for children's well-being (Jones et al., 2014). In this regard, policymakers and training institutions should promote integrated professional learning programs that address both relational and cognitive aspects of teaching, ensuring preschool environments that are organized, emotionally supportive, and developmentally responsive (Jennings et al., 2017).

## Limitations

Some limitations must be acknowledged. First, this was a cross-sectional study, limiting causal inferences. Longitudinal research is needed to examine how classroom quality and self-regulation interact over time to influence developmental trajectories. A further limitation concerns measurement reliability, with the recognition of the need for more reliable tools for measuring conduct problems in Portugal. The Conduct Problems subscale of the SDQ showed relatively low internal consistency in the present sample, which may weaken the interpretation of the Total Difficulties score, as this subscale contributes to the composite measure. Consequently, associations involving Total Difficulties should be interpreted with caution, as measurement error in this subscale may have attenuated or biased observed effects. In contrast, findings related to SDQ subscales with acceptable reliability (e.g., Emotional Symptoms, Hyperactivity, and Prosocial Behavior) are likely to be more robust and should therefore be given greater interpretive weight. Additionally, teacher-reported measures may be subject to bias and social desirability, so future studies incorporating more direct child assessments and multi-informant reports are important to further understand these relationships. Similarly, reliance on teacher reports for children's behavioral outcomes may have contributed to shared method variance and thus influenced the observed associations with classroom quality. Although classroom quality was assessed through independent observations, all data were collected in a single day, so future studies should include reports from multiple informants, in multiple moments, or objective behavioral assessments to reduce potential bias. The number of observed classrooms was restricted to 42, and one geographic area of Portugal, thus limiting the generalization of data. Finally, we underline the need of further research to better understand the unexpected relation between higher classroom organization and more emotional problems, as well as exploring contextual factors such as teacher training, socioemotional competencies, and family background to provide a more comprehensive understanding of the mechanisms of child adjustment.

## Conclusion

Despite some limitations, this study contributes to the growing body of research on ECEC by highlighting the role of classroom process quality and self-regulation in shaping preschool children's socio-emotional and behavioral adjustment. Overall, this study supports the notion that early learning environments function as relational ecosystems where emotional, organizational, and instructional processes intersect to shape developmental outcomes. Strengthening teachers' socioemotional capacities and embedding explicit opportunities for children to practice self-regulation within daily routines may represent powerful levers for fostering equitable and emotionally healthy early education. Continued investment in longitudinal and intervention research will be essential to guide evidence-based policies that promote high-quality, emotionally supportive, preschool experiences.

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## Declarations

**Competing interests** The authors declare no conflict of interest.

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