Early childhood education settings are also organizations: indirect associations between transformational leadership and children's autonomy support through teachers' self-efficacy and work engagement

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Abstract

Early Childhood Education (ECE) teachers play an essential role in delivering high-quality education, yet they often struggle with diverse job demands and lack of job and personal resources to help them manage those demands. To understand the needs of ECE teachers, it is important to study personal and professional factors that support them. Based on the Job Demands-Resources Model, this study aimed to examine the indirect association between ECE transformational leadership and children's autonomy support through ECE teachers' self-efficacy and work engagement. Data were collected from 381 ECE teachers (373 women), aged between 23 and 65 years ($M=47.5$, $SD=10.3$). Participants responded online to a sociodemographic questionnaire and self-report measures. Despite the small effect sizes, the results revealed that teachers' self-efficacy and work engagement were independently involved in the indirect associations between ECE transformational leadership and children's autonomy support by ECE teachers, whereas their combined sequential contribution was less evident. These findings help understand the needs of ECE teachers and identify organizational features (e.g., leadership) that can be improved to support ECE teachers' self-efficacy and work engagement, ultimately fostering higher-quality education.

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1 Introduction

Early childhood education (ECE) includes services with the intended educational purpose of supporting children's lifelong learning and development (European Commission/EACEA/Eurydice, 2019). Based on the European Pillar of Social Rights (European Commission, Secretariat General, 2018), children have the right to attend affordable high-quality ECE. High-quality ECE comprehends structural and process features (Slot, 2018). Structural features include regulable aspects of classrooms, such as adult-child ratios and group sizes, as well as teacher attributes like teacher education (Slot, 2018; Slot et al., 2015). Process quality refers to teacher-child interactions, child-child interactions and relationships, and appropriate activities/materials and curriculum (Anders, 2015; Slot et al., 2015). An indicator of process quality is the autonomy support provided by ECE teachers to children. Research has shown that ECE teachers who adopt autonomy supportive practices are more likely to have children who are more intrinsically motivated and engaged in classroom activities (Grolnick & Seal, 2007), contributing to children's perseverance and motivation in learning (Davis, 2003).

ECE teachers are essential to high-quality education. However, teaching is a highly complex profession. It involves managing multiple relationships and responding to demands that often test teachers' personal resources and ability to cope (Timms & Brough, 2012). Indeed, ECE teachers struggle with job hindering conditions such as large class sizes, unfavorable teacher-child ratios, and lack of support (Aguiar & Aguiar, 2022; Hakanen et al., 2006). Further, evidence suggests that as ECE teachers age, they may encounter increased challenges in managing groups of children in these conditions (Aguiar & Aguiar, 2022). Despite the challenges ECE teachers face, little is known about the organizational and psychological factors that help teachers maintain high-quality, autonomy-supportive practices. This study aims to address this gap, considering that ECE teachers need support to better manage their working conditions and responsibilities.

The Job Demands-Resources Model (JD-R; Bakker & Demerouti, 2007) offers a framework for understanding the working conditions of the ECE workforce (Kwon et al., 2021; Lipscomb et al., 2022). According to this model, personal resources (e.g., self-efficacy) and psychological states (e.g., work engagement) play a key role in how employees manage demands and maintain performance. Importantly, leaders can allocate job demands and resources to their workers (Schaufeli, 2015). Thus, within ECE settings, professionals in leadership roles may enhance teachers' personal resources and positively influence their motivation, performance (Bass, 1985), and work engagement (Meng et al., 2022). Based on the JD-R model, this study examined the role of ECE teachers' self-efficacy and work engagement in the associations between perceptions of ECE leadership and reports of children's autonomy support by ECE teachers.

1.1 The job demands-resources model

The JD-R Model (Demerouti et al., 2001) assumes each occupation has factors associated with job strain or motivation. These factors can be divided into job demands

and job resources. Job demands include aspects of the job that require continuous physical and/or psychological (cognitive and emotional) effort or abilities and are linked with certain physiological and/or psychological costs. In turn, job resources include elements that may be useful in achieving work goals, and/or lessening job demands and the associated physiological/psychological costs, and/or promoting development, learning, or personal growth (Bakker & Demerouti, 2007).

Previous studies have shown that job demands are the main predictors of job strain (Bakker et al., 2003, 2004), and job resources are the predominant predictors of work engagement (e.g., Hakanen et al., 2006). Additionally, the JD-R model proposes that two different psychological processes are responsible for job strain and motivation. In the straining process, unsuccessfully designed jobs can cause work overload and emotional needs, exhausting employees' mental and physical resources (Bakker & Demerouti, 2007). In the motivational process, job resources may have an intrinsic motivational role because they foster workers' growth, learning, and development, leading to high work engagement and excellent performance (Bakker & Demerouti, 2007). Consequently, the JD-R model offers a perspective in which having considerable resources from the leader and supportive colleagues is associated with work engagement and an increased likelihood of being successful in work.

Importantly, although the JD-R model emphasizes both job characteristics and personal resources, prior research has focused predominantly on job characteristics. As a result, employees' personal resources, such as self-efficacy, optimism, and self-esteem (Schaufeli & Taris, 2014), have been less examined, despite their central role in shaping how individuals respond to work demands. Personal resources are aspects of the individual that are generally linked to resilience (Hobfoll et al., 2003) and are also dependent on environmental factors (Bandura, 2000). Within the JD-R framework, transformational leadership can be conceptualized as a key job resource that supports teachers' functioning by providing guidance, feedback, and opportunities for growth. These job resources are expected to strengthen teachers' personal resources, for instance self-efficacy, which, in turn, foster higher levels of work engagement (Lipscomb et al., 2022). Additionally, work based on JD-R model has suggested that providing ECE teachers with the resources that they require to perform their duties successfully might encourage them to work with enthusiasm, commitment, and positive energy, potentially supporting the implementation of appropriate classroom practices (Lipscomb et al., 2022).

1.2 Children's autonomy support

Children show better academic and social skills, behavior, and student-teacher relationships when they attended higher-quality ECE (Lerkkanen et al., 2016; Schuitema et al., 2016). According to Self-Determination Theory (SDT) (Deci & Ryan, 1985; Ryan & Deci, 2000, 2020), people have three basic psychological needs that sustain motivation growth and development – autonomy (a sense of choice and internal perceived locus of causality in one's undertakings), competence (a sense of mastery and efficacy in one's activities), and relatedness (the extent to which a person feels connected to others and belongs to a community). Therefore, according to SDT, teachers influence student motivation by supporting students' basic needs of autonomy,

competence, and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2000), by encouraging student autonomy, providing structure for learning, and by being interpersonally involved (Connell & Wellborn, 1991; Jang et al., 2012).

Teachers support children's autonomy by listening and respecting their ideas, providing choices, emphasizing the relevance of content, encouraging initiative, and stimulating them to explore their interests (Assor et al., 2002; Grolnick & Pomerantz, 2009; Reeve & Jang, 2006; Skinner et al., 2005). Grolnick and Seal (2007) found that autonomy supportive ECE teachers are more likely to have children who are more engaged and intrinsically motivated in classroom activities. Therefore, autonomy support is associated with children's persistence and motivation in learning tasks (Davis, 2003), self-regulation skills (Cadima et al., 2018), children's social self-concept (Leflot et al., 2010), a sense of ability to direct their behaviors, and feelings of competence and acceptance (Ryan & Deci, 2000). Importantly, ECE teachers' practices, including autonomy support, are likely directly and indirectly influenced by diverse factors, namely organizational variables such as the ECE leadership behaviors/practices.

1.3 Transformational leadership in ECE settings

Leadership is fundamental for workers' well-being and performance (Tummers & Bakker, 2021). While there are different types of leadership, this study focuses on transformational leadership (TFL) (Gawke et al., 2017). TFL has four separate dimensions: (1) idealized influence, when the leader provides a vision and a sense of mission, gaining the respect and trust of workers; (2) inspirational motivation, when the leader has high expectations and expresses important purposes in more straightforward ways; (3) intellectual stimulation, when the leader shows workers new visions and rational solutions; and (4) individualized consideration, when the leader pays close attention to worker differences and needs (Avolio et al., 1991; Bass & Avolio, 1994). Therefore, TFL occurs when the leader is seen as charismatic, respectful, and trustworthy (Neves & Coimbra, 2018), promotes motivation and change of attitudes among workers, and inspires them to achieve their goals (Neves & Coimbra, 2018). Consistent with the JD-R model, transformational leaders provide specific job resources, strengthening workers' personal resources and diminishing job-hindering demands (Diebig et al., 2017; Hentrich et al., 2017). At the organizational level, recent evidence suggests that principals can improve collective teacher efficacy (CTE) by implementing TFL practices that teachers deem beneficial (Nassir & Benoliel, 2025). Nassir and Benoliel's (2025) results suggest that teachers serving in all education levels feel more dedicated to their school when they view their principals as TFL leaders, which in turn boosts their collective confidence in their ability to enhance student outcomes.

Good leadership is also essential to high-quality ECE, as professionals in leadership roles handle many different tasks, including organizing educational provisions and managing human and financial resources (European Commission/EACEA/Eurydice, 2019). ECE leaders who adopt TFL practices encourage teachers to communicate their ideas, opinions, and cognitive judgment, fostering problem-solving in the educational environment and inspiring them to look for novel approaches (Bass,

1985). As a result, ECE teachers may adopt more autonomous and effective behaviors, including children's autonomy support.

According to Self-Determination Theory, adults who feel autonomous and psychologically supported are more likely to adopt interpersonal styles that support others' autonomy (Deci & Ryan, 1985; Ryan & Deci, 2000). Thus, when ECE teachers work with leaders who empower them, value their judgment, and model autonomy-supportive behaviors, they may be more likely to replicate these same supportive practices with children, for example by offering choices, encouraging initiative, and fostering children's self-directed engagement.

1.4 The role of self-efficacy

Self-efficacy is considered a powerful personal resource (Vera et al., 2012; Wattoo et al., 2019). Bandura's (1997) Social Cognitive Theory (SCT) defines self-efficacy as one's belief about the capacity to accomplish a task or cope with environmental demands. Self-efficacious people deal more effectively with difficulties, recover more rapidly from various issues and setbacks, and attain valued outcomes through persistence (e.g., Yakin & Erdil, 2012).

Teacher self-efficacy can be understood as teachers' beliefs in their own ability to effectively influence students' capacities to engage in successful behavior, and to effectively engage in planning, organizing, and implementing educational activities (Tschannen-Moran et al., 1998; Skaalvik & Skaalvik, 2007). Consequently, self-efficacious teachers dedicate more effort to teaching, persist longer when facing obstacles, and are more likely to embrace innovative teaching methods (Tschannen-Moran et al., 1998). Fantuzzo et al. (2012) showed that ECE teachers with higher self-efficacy spent more time communicating with parents and teaching cognitive and social-emotional skills to children. Therefore, teacher beliefs can help explain individual differences in teachers' educational practices (Perren et al., 2017).

Self-efficacy can act as a motivating mechanism that guides teachers' goals, their dedication to achieving those goals, and their persistence and task engagement (Fives & Buehl, 2012). Additionally, research suggests that ECE teachers' self-efficacy is adjustable and may be strengthened with good leadership and professional development (Ciyer et al., 2010; Von Suchodoletz et al., 2018). Interestingly, Xie et al. (2022) examined the associations between teachers' perceptions of principals' leadership and teacher self-efficacy, showing this relationship was mediated by teacher collaboration.

Self-efficacy has been used as a mediator in the relationship between job resources and organizational outcomes (e.g., Xanthopoulou et al., 2009) but has also been identified as a personal resource that influences directly and indirectly children's development (Gist & Mitchell, 1992; Lipscomb et al., 2022). Teachers who feel more confident in allowing children to take initiative, make choices, and engage independently, tend to show higher self-efficacy, and are more likely to implement autonomy-supportive practices in the classroom (Davis, 2003; Lipscomb et al., 2022). Importantly, within the JD-R framework, self-efficacy is conceptualized as a personal resource that precedes, and fosters work engagement (Bakker & Demerouti, 2007; Lipscomb et al., 2022).

1.5 The role of work engagement

Work engagement has been defined as a condition of optimal worker well-being that is associated with greater worker contentment, input, and productivity (Timms & Brough, 2012). In addition, it fulfills basic psychological needs, such as autonomy, competence, and relatedness (Ryan & Deci, 2000, 2001). According to Schaufeli and Bakker (2004a), work engagement comprises three dimensions: vigor (keenness to invest effort because the individual is resilient and has considerable energy), dedication (a sense of fulfillment and pride in one's work), and absorption (when people are happily involved in their work and do not notice the course of time).

The JD-R model posits that work engagement can be predicted by balance (and burnout by imbalance) between demands and resources within the work environment (Bakker & Demerouti, 2007; Demerouti et al., 2001). Across professions, job and personal resources have become important indicators of work engagement. More specifically, job resources such as leader feedback and social support (Bakker et al., 2008; Schaufeli & Bakker, 2004a) predict work engagement in several professionals, including teachers.

Research in education settings demonstrates that TFL is positively associated with teachers' work engagement (Bae et al., 2013; Meng et al., 2022) and, further, that teacher self-efficacy is associated with teacher work engagement (Lipscomb et al., 2022). However, we are unaware of any studies on the relationship between TFL and work engagement in ECE settings or studies examining the associations between ECE teachers' work engagement and children's autonomy support by teachers. Nevertheless, engaged teachers tend to be more emotionally available, enthusiastic and responsive, which may support the implementation of autonomy-supportive behaviors (Lipscomb et al., 2022).

1.6 ECE context in Portugal

This study was conducted in Portugal, a Southwestern European country, adding to the international evidence on the conditions that support ECE teachers and ECE quality. In 2021, about 95.2% of children aged three or older attended ECE in Portugal (DGEEC/ME-MCTES, 2021), with 53.9% attending public ECE, 17.2% attending privately funded ECE, and 28.9% attending private non-profit ECE (Direção Geral de Estatísticas da Educação e Ciência/Direção de Serviços de Estatísticas da Educação, 2021). Portugal has demanding requisites of teacher education, as an ECE teacher must have a master's degree in ECE or an equivalent level (European Commission/EACEA/Eurydice, 2019; Governmental Law No. 43/2007). However, there are no minimum requisites to be an ECE coordinator, besides having a bachelor's degree (European Commission/EACEA/Eurydice, 2019); nevertheless, when choosing or selecting an ECE coordinator, priority should be given to ECE teachers with a master's degree (European Commission/EACEA/Eurydice, 2019). Importantly, in 2018, 42% of ECE teachers in Portugal were over 50 years, and only 1% were under 30 years (OECD, 2020). Relevant to our study, Portuguese ECE teachers are required to promote children's autonomy and their inclusion in society (Governmental Law No. 241/2001).

1.7 The present study

The conceptual model proposed in this study is visually represented in Fig. 1. Building on the JD-R Model, this study aimed to analyze the indirect associations between ECE transformational leadership and children's autonomy support by teachers through ECE teachers' self-efficacy and work engagement. Considering the literature above, we formulated the following research hypotheses (with mediation considered at a statistical and not at a causal level): (H1) ECE teachers' self-efficacy mediates the relationship between ECE transformational leadership and children's autonomy support by ECE teachers; (H2) ECE teachers' work engagement mediates the relationship between ECE transformational leadership and children's autonomy support by ECE teachers; (H3) ECE teachers' self-efficacy and work engagement mediate the relationship between ECE transformational leadership and children's autonomy support by ECE teachers. H3 tests whether ECE transformational leadership and teachers' autonomy-support practices are sequentially mediated by teacher self-efficacy and teacher work engagement. Teachers' years of experience in ECE, education level (master/PhD vs. lower education levels), number of classrooms, and ECE sector (public vs. private), were included as controls.

2 Method

2.1 Procedure

Prior to data collection, the study was submitted to and approved by the Ethics Commission at Iscte-Instituto Universitário de Lisboa (Reference No. 131/2022). The study was also approved by the General Directorate of Education (i.e., Direção Geral da Educação). We used a quantitative approach through a self-administered ques-
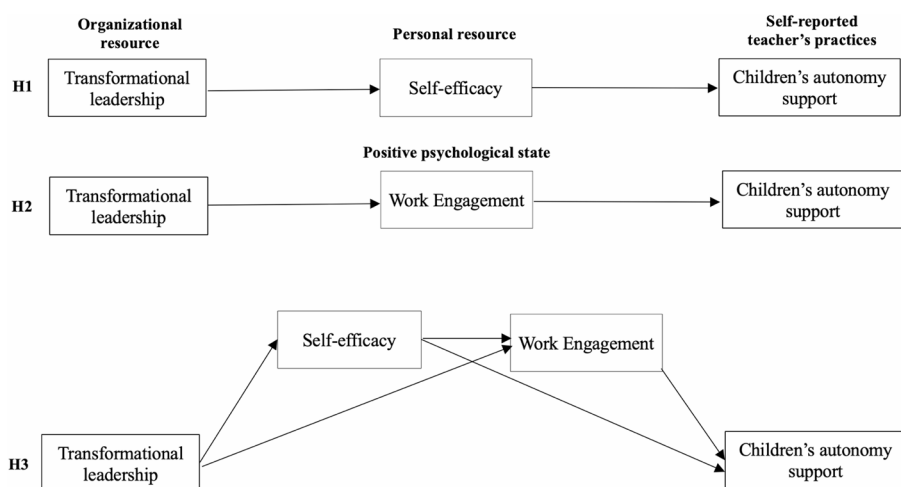

Fig. 1 Hypotheses Model

tionnaire composed of sociodemographic questions (e.g., age, years of experience in ECE, group size, socioeconomic context) and the measures described below. The questionnaire was created in Qualtrics (https://www.qualtrics.com), an online survey platform, and the participants also filled in the informed consent form online. No personal information from the participants (including IP address) was collected (i.e., the "Don't record respondents' IP Address, location data, and contact info" setting was activated). The questionnaire was shared on social media platforms (e.g., Facebook, Instagram) to collect data and sent to ECE settings' email contacts. To this effect, the Social Letter (e.g., Carta Social) publicly available website was consulted, and e-mails asking for collaboration were sent to all the settings/institutions that were listed in the category "Children and young people in preschool education establishment" (i.e., Crianças e jovens em estabelecimento de educação pré-escolar). The e-mail content included an overview of the research objectives, the participation criteria, and a request to the director/coordinator to share the questionnaire with all the teachers who met the requirements (i.e., ECE teachers without leadership roles, working in classrooms serving children aged between 3 and 6 years of age). Data were collected once for each participant, with an estimated duration of 10 min, between January and March 2023. Throughout the manuscript, the term "leader/s" refers to professionals that serve as directors, coordinators of the preschool education department, and/or pedagogical coordinators. Materials and data for this study are available by emailing the corresponding author.

2.2 Participants

The final sample of this study was composed of 381 Portuguese ECE teachers. Most were women ($N = 371$, 97.9%), aged between 23 and 65 years ($M = 47.5$, $SD = 10.3$). ECE teachers had between one year and 45 years of experience in the ECE field ($M = 23.1$, $SD = 11.1$) and 60.4% had a bachelor's degree, 11.5% had a post-graduation, 23.2% had a master's degree, and two participants had a doctorate. Approximately 45% worked in public ECE settings (within school clusters offering all levels of instruction from early childhood to secondary education), and 55.1% worked in private ECE settings. Regarding employment status, 43.5% had a permanent contract and 56.5% had temporary contracts. Referring to the region, 26.2% worked in the north of Portugal, 30.2% worked in the center, 36.5% worked in the Lisbon metropolitan area, 2.9% worked in Alentejo, 3.9% worked in Algarve, and only one worked in the Madeira autonomous region. Additionally, participant ECE teachers classified the socioeconomic context of their setting as high (2.6%), medium-high (18.9%), medium (37.8%), medium-low (32.3%), and low (8.4%). Finally, the number of children per classroom varied between 3 and 26 children, with 27.7% of teachers reporting 25 children in their classroom and 18.6% reporting 20 children in the classroom.

2.3 Measures

2.3.1 Children's autonomy support

The Teacher as Social Context Questionnaire (TASC; Wellborn et al., 1992; cit in Cadima et al., 2018) was adapted for the Portuguese population (Wellborn et al., 2013) and used to measure ECE teachers' behavior toward children in their classroom (Cadima et al., 2018). In this study, we only used the autonomy support subscale, with a total of 12 items, measured on a 4-point scale (0=*not at all true*, 1=*not very true*, 2=*something true*, 3=*very true*) (Cadima et al., 2018; Iglesias-García et al., 2020). Items 2, 3, 4, 5, 6, 8 and 9 are formulated negatively (e.g., "I can't let the children do things their own way") and, thus, were reverse-coded. In addition, similarly to Iglesias-García et al. (2020), each item addressed the practices targeting all children in the classroom (vs. single children).

To examine the adequacy of the hypothesized one-factor structure, a confirmatory factor analysis (CFA) was conducted on the 12 items of the scale. Model fit was assessed using several indices: χ^2 (43)=113.43, p <.001, CFI=0.96, TLI=0.94, $RMSEA$ =0.04, 90% CI [0.05, 0.08], and $SRMR$ = 0.07. Overall, these values indicated an acceptable fit to the one-factor model according to conventional cutoffs (Hu & Bentler, 1999; Kline, 2016). The factor demonstrated adequate composite reliability (CR = 0.72), exceeding the recommended threshold of 0.70 (Hair et al., 2019). Responses were then averaged to obtain a final score, with higher values indicating greater autonomy support (Cadima et al., 2018).

2.3.2 Transformational leadership

The Transformational Leadership Questionnaire (TLQ) (Avolio & Bass, 2004) was adapted for the Portuguese population by Neves and Coimbra (2018) and was used to determine the extent to which transformational leadership behaviors and results were reported by ECE teachers. ECE teachers were asked to report on their cluster preschool education coordinator, if they worked in a public ECE setting, or on their pedagogical coordinator, if they worked in a private ECE setting. In this study, we used the transformational leadership subscale, with a total of 13 items, measured on a 5-point Likert scale (from 1=*strongly disagree* to 5=*strongly agree*) (Neves & Coimbra, 2018).

The factorial validity of the transformational leadership subscale was examined through a CFA analysis including its 13 items. The analysis tested the adequacy of the hypothesized one-factor structure. Model fits indices were as follows: χ^2 (63)=213.77, p <.001, CFI =0.94, TLI =0.93, $RMSEA$ =0.08, 90% CI [0.07, 0.09], and $SRMR$ = 0.04. These results suggest an acceptable fit between the data and the one-factor model, in line with conventional criteria (Hu & Bentler, 1999; Kline, 2016). The construct also showed high internal consistency, with composite reliability of 0.91, surpassing the recommended threshold (Hair et al., 2019). Mean scores were computed by averaging responses, with higher values on the TLQ represent higher transformational leadership, based on the perception of ECE teachers.

2.3.3 Self-efficacy

The Ohio State Teacher Efficacy Scale (OSTES; Tschannen-Moran & Hoy, 2001), adapted for the Portuguese population by Dias as cited in (Bonjardim, 2012), was used to measure ECE teachers' self-efficacy. The OSTES is composed of three sub-scales, namely, efficacy for instructional strategies (e.g., "…use a variety of assessment strategies"), efficacy for classroom management (e.g., "…get children to follow classroom rules"), and efficacy for student engagement (e.g., "…help children value learning") (Tschannen-Moran & Hoy, 2001). We used the short form, which includes four items in each subscale, in a total of 12 items, measured on a 9-point scale (from 1 = *nothing* to 9 = *a great deal*) (Tschannen-Moran & Hoy, 2001). Considering the target group, we used "children" (vs. students) in the phrasing of all items. The short form was used to reduce participant burden and maintain engagement throughout the questionnaire. The abbreviated version has been validated in previous research and has demonstrated acceptable psychometric properties (Bonjardim, 2012). In this study, the short version showed an adequate fit to the data, according to the recommendations previously mentioned. The CFA including the 12 items yielded the following fit indices χ^2 (51) = 173.16, *p* < .001, *CFI* = 0.97, *TLI* = 0.95, *RMSEA* = 0.08, 90% *CI* [0.07, 0.09], and *SRMR* = 0.03. The analysis also revealed a composite reliability of 0.94, supporting the internal consistency of the measure. A single score for teacher efficacy was computed by averaging the responses to the 12 items, with higher scores representing greater self-efficacy.

2.3.4 Work engagement

The Utrecht Work Engagement Scale (UWES; Schaufeli & Bakker, 2004b), validated for the Portuguese population by Teles et al. (2017), was used to measure ECE teachers' work engagement. UWES is composed of three dimensions, vigor (e.g., "At my work, I feel bursting with energy"), dedication (e.g., "My job inspires me"), and absorption (e.g., "I get carried away when I'm working") (Schaufeli & Bakker, 2004b). In this study, we used the reduced version, which includes three items for each dimension, in a total of nine items, measured on a 7-point Likert scale (from 0 = *never* to 6 = *always/every day*) (Schaufeli & Bakker, 2004b). To reduce response burden and maintain participant's attention, a short version of the scale was employed. The abbreviated version has been validated in previous research and has demonstrated acceptable psychometric properties (Teles et al., 2017). For the current sample, the one-factor model, based on the short version of the scale, showed an acceptable fit to the data, according to the previously mentioned criteria. The CFA including the nine items produced the following fit indices: χ^2 (20) = 74.24, *p* < .001, *CFI* = 0.98, *TLI* = 0.97, *RMSEA* = 0.08, 90% *CI* [0.06, 0.11], and *SRMR* = 0.03. Composite reliability was 0.94, supporting the internal consistency of the measure. A global score for work engagement was obtained by averaging the nine items, with higher scores representing greater work engagement.

2.4 Measurement model and common method variance

After the validation of each individual measure, the overall measurement model was tested to examine how well the four latent variables – children's autonomy support, transformational leadership, self-efficacy and work engagement – represented their respective constructs. A confirmatory factorial analysis was conducted, and the results indicated a good fit of the data to the hypothesized four-factor structure: χ^2 (968) = 1921.91, p <.001, CFI = 0.92, TLI = 0.91, $RMSEA$ = 0.05, 90% CI [0.048 0.054], and $SRMR$ = 0.08.

Because all measures were self-reported, the potential influence of common method variance (CMV) was examined. Following the procedure recommended by Podsakoff et al.,(2003), a common latent factor (CLF) was added to the four-factor model. In this extended model, each item loaded on its theoretical construct and, simultaneously, on the CLF. The fit of this model was then compared to the model without the CLF. The model including the CLF showed poor fit: χ^2 (933) = 2563.39, p <.001, CFI = 0.86, TLI = 0.84, $RMSEA$ = 0.07, 90% CI [0.065, 0.071], and $SRMR$ = 0.05.). Moreover, the model without the CLF presented a significantly lower chi-square value ($\Delta\chi^2$ (35) = 641.48, p <.001). Taken together, these results suggest that common method variance did not substantially bias the data (Table 1).

2.5 Control variables

Covariates included teachers' years of experience in ECE, education level (master/ PhD vs. lower education levels), number of classrooms, and ECE sector (public vs. private).

2.6 Data analysis

Descriptives statistics, including means, standard deviations, and intercorrelations among the study variables, were computed. To test the research hypotheses two analytical strategies were implemented using multiple linear regressions supported by the PROCESS macro v.5.0. for SPSS (Hayes, 2022). First, two individual mediation models were estimated to test H1 and H2. The significance of the indirect effects was assessed using the bootstrapping method with 10,000 bootstrap samples and 95% confidence intervals. Subsequently, a serial mediation model was conducted to test H3, which predicted that ECE transformational leadership would be associated with children's autonomy (as perceived by ECE teachers) through the sequential mediation of teachers' self-efficacy and work engagement. Indirect effects (specific and total) were again tested using the bootstrap method with 10,000 resamples and 95% confidence intervals. Given that some study variables displayed slight asymmetry, bootstrap confidence intervals were also computed for all estimated effects, as shown in Tables 2 and 3. Multicollinearity was examined by calculating tolerance (Tol) values for each independent variable within each model. The obtained tolerance values ranged from 0.67 to 0.99, indicating no multicollinearity concerns. Missing data on the four scales items were evaluated using Little's MCAR test to determine whether data were missing completely at random (MCAR). The obtained chi-square value

was not significant, χ^2 (13)=11.853, p =.539, indicating that the data met MCAR assumption. Consequently, multiple imputation (MI) was applied, resulting in a final sample size of N=381. All individual and serial mediation models were tested while controlling for years of experience in the ECE field, teacher education, size of setting (number of classrooms) and sector (public vs. private).

3 Results

The descriptive statistics, correlations, and reliabilities for the study variables are presented in Table 1. The first research hypothesis proposed that ECE teachers' self-efficacy mediates the relationship between ECE transformational leadership and children's autonomy support by ECE teachers. The 95% confidence interval for the indirect effect ($B \equiv 0.012$) did not include zero (95% CI [0.001 to 0.025]), indicating a significant indirect effect (see Table 2). Therefore, this hypothesis was supported.

Table 1 Descriptive statistics, intercorrelations, and reliabilities for study variables

	M	SD	1	2	3	4	5	6	7	8
1. Years of experience	23.11	11.15								
2. Teacher education [a]	0.24	¾	-0.414***							
3. Size of setting	4.96	3.77	-0.200***	0.183***						
4. Sector (public vs. private)	0.55	0.50	-0.488***	0.267***	0.394***					
5. Transformational leadership [b]	3.59	0.83	-0.025	-0.024	0.099*	0.031	(.91)			
6. Self-efficacy [c]	7.22	1.02	0.188***	-0.024	-0.106*	-0.107*	0.202***	(.94)		
7. Work engagement [d]	4.71	1.04	0.080	0.001	-0.060	-0.081	0.295***	0.574***	(.94)	
8. Autonomy support [e]	2.15	0.32	0.193***	0.030	-0.114*	-0.150**	0.005	0.181***	0.129**	(.69)

N = 381. Cronbach's alpha for the scales is in parenthesis.

[a] Dummy variable. It is reporting the proportion of participants holding a master's or doctoral degree.

[b] Scores range from of 1 to 5.

[c] Scores range from of 1 to 9.

[d] Scores range from of 0 to 6.

[e] Scores range from of 0 to 3.

*p < .05. **p < .01. ***p < .001.

Table 2 Regression results for the individual indirect effects models

	Autonomy support				
	B	SE	95% Bootstrap CI		
			Lower	Upper	
Total effect					
Transformational leadership	0.009	0.020	-0.033	0.050	
Direct effect (with M1)					
Transformational leadership	-0.003	0.020	-0.043	0.040	
Indirect effect (with M1)					Effect size
Transformational leadership g Self-efficacy g Autonomy support	0.012	0.006[a]	0.001	0.025	0.001
Direct effect (with M2)					
Transformational leadership	-0.004	0.021	-0.045	0.040	
Indirect effect (with M2)					
Transformational leadership g Work employment g Autonomy support	0.013	0.007[a]	0.001	0.028	0.001

$N = 381$. Unstandardized regression coefficients are reported. Number of bootstrap samples: 10,000. *SE* – Standard error. *CI* – Confident interval. All effects were estimated while controlled for years of experience in the ECE field, teacher education, size of setting (number of classrooms) and sector (public vs. private).

[a] Bootstrap *SE* is reported

According to Cohen's guidelines (2016), the effect size associated with this indirect effect was very small (see Table 2).

The second research hypothesis posited that ECE teachers' work engagement mediates the relationship between ECE transformational leadership and children's autonomy support by ECE teachers. The 95% confidence interval for the indirect effect ($B \equiv 0.013$) did not include zero (95% CI [0.001 to 0.028]), revealing a significant indirect effect (see Table 2). Thus, this hypothesis was also supported, although the corresponding effect size was very small.

Finally, the study examined whether ECE teachers' self-efficacy and work engagement would jointly mediate the relationship between ECE transformational leadership and children's autonomy support by ECE teachers through a serial mediation process. The bootstrap 95% confidence intervals for the specific indirect effects included zero, indicating that neither the indirect path through teachers' self-efficacy, nor the indirect path through work engagement, nor the serial path through self-efficacy and work engagement was significant (see Table 3). However, the total indirect effect ($B = 0.015$) was significant (95% CI [0.001, 0.031]), suggesting that, taken together, the mediators contributed to an overall indirect association between transformational leadership and children's autonomy support. Therefore, this hypothesis received partial support, with the effect size of the total indirect effect classified as very small (see Table 3).

Table 3 Regression results for the serial indirect effects model

	Autonomy support				
	B	SE	95% Bootstrap CI		
			Lower	Upper	
Total effect					
Transformational leadership	0.009	0.020	-0.033	0.050	
Direct effect					
Transformational leadership	-0.006	0.021	-0.049	0.037	
Indirect effect					*Effect size*
Specific indirect effects					
1) Transformational leadership g Self-efficacy g Autonomy support	0.010	0.007[a]	-0.002	0.025	0.001
2) Transformational leadership g Work employment g Autonomy support	0.003	0.005[a]	-0.006	0.014	0.000
3) Transformational leadership g Self-efficacy g Work employment g Autonomy support	0.015	0.008[a]	-0.004	0.009	0.000
Total indirect effect					
Total [1) + 2) + 3)]	0.015	0.008[a]	0.001	0.031	0.002

N = 381. Unstandardized regression coefficients are reported. Number of bootstrap samples: 10,000. *SE* – Standard error. *CI* – Confident interval. All effects were estimated while controlled for years of experience in the ECE field, teacher education, size of setting (number of classrooms) and sector (public vs. private).

[a] Bootstrap *SE* is reported

4 Discussion

The aim of this study was to analyze the role of ECE teachers' self-efficacy and work engagement in the indirect association between ECE teachers' perceptions about ECE transformational leadership and children's autonomy support by teachers.

4.1 The role of self-efficacy, a personal resource

Regarding the first hypothesis, we anticipated that ECE teachers' self-efficacy mediated the relationship between ECE transformational leadership and children's autonomy support by ECE teachers and our findings support this hypothesis. Despite the small effect size, these results are consistent with previous evidence suggesting that transformational leadership was associated with self-efficacy in elementary school (e.g., Demir, 2008). Further, the relationship between teachers' self-efficacy and children's autonomy support is consistent with findings suggesting that ECE teachers with higher levels of self-efficacy tend to adopt more proactive and student-centered approaches, contributing to high-quality practice (Zee & Koomen, 2016). Importantly, our results suggest that leaders who use transformational leadership practices, such as inspirational motivation, towards ECE teachers may be more likely to foster

self-efficacy in ECE teachers, supporting them in believing in themselves and their own capabilities and, in turn, increasing the likelihood of teachers engaging in practices supporting children's autonomy. Overall, these findings add to the evidence that self-efficacy is a powerful personal resource (Vera et al., 2012; Wattoo et al., 2019) and an important predictor of successful professional practices.

4.2 The role of work engagement, a psychological state

Referring to the second hypothesis, we expected that ECE teachers' work engagement mediated the relationship between ECE transformational leadership and children's autonomy support by ECE teachers. The results supported the hypothesized indirect effect and are consistent with other studies reporting that transformational leadership was positively associated with work engagement in educational (Bae et al., 2013; Meng et al., 2022) and non-educational settings (Bakker et al., 2008; Schaufeli & Bakker, 2004a). However, to the best of our knowledge, this is the first study that examined and supported this association in ECE settings. In addition, as far as we know, this was also the first study to examine and report an association between ECE teachers' work engagement and children's autonomy support. Therefore, despite the small effect size, our results suggest that transformational leadership practices may be associated with ECE teachers' increased work dedication, focus, and energy, which could contribute to the adoption of better classroom practices (Lipscomb et al., 2022), namely children's autonomy support.

4.3 The combined role of self-efficacy and work engagement

Regarding the third hypothesis, we expected that ECE teachers' self-efficacy and work engagement would jointly mediate the relationship between ECE transformational leadership and children's autonomy support by ECE teachers through serial mediation. While consistent with theory (Bakker & Demerouti, 2007), this hypothesis was not confirmed, possibly due to the increased difficulty in estimating such effects as the number of mediators increases (Zugna et al., 2022).

The pattern of indirect effects observed in this study provides insight into the mechanisms linking transformational leadership with teacher's autonomy-supportive practices. Taken together, these findings suggest that both self-efficacy and work engagement were independently involved in the indirect associations between transformational leadership and children's autonomy support, whereas their combined, sequential contribution was less evident. These results indicate that transformational leadership relates to teachers' autonomy-supportive practices primarily through distinct rather than serial motivational pathways.

Further, the absence of total effects aligns with theoretical expectations: transformational leadership is not expected to influence children's autonomy support at the classroom level directly, but rather indirectly, by enhancing teachers' personal and psychological resources (e.g., self-efficacy and work engagement). This indirect pathway is consistent with the JD-R model (Bakker & Demerouti, 2007), which posits that leadership primarily operates through its influence on employees' resources and motivational states.

4.4 Study limitations and future research

After a thorough analysis of the research process, several limitations have been identified. Firstly, while it is important to consider the perspectives of ECE teachers, namely about ECE transformational leadership, only considering teacher perceptions is a limitation. The perceptions of ECE teachers can be influenced by their opinion of ECE leaders' personal characteristics and by their own relationship with ECE leaders. To overcome these limitations in the future, it is recommended to use multiple data collection methods (e.g., surveys, interviews, and observation not only with ECE teachers but also with ECE leaders, children, ECE teacher assistants, etc.) (Iglesias-García et al., 2020).

Secondly, this study only considered ECE teachers working with children between three and six years of age. Therefore, generalization is not possible to ECE teachers working with younger children (aged 0–3) nor to other education levels. To get beyond these restrictions in the future, other research should be done, including more countries and educational levels.

A third limitation relates to the gender imbalance in our sample, which mirrors the broader demographic profile of the ECE workforce in Portugal and many other countries. While challenging, future studies could explore whether these associations differ by gender, thus contributing to a more comprehensive understanding of these dynamics within ECE.

Fourthly, although the cross-sectional design, without time precedence, precludes our ability to draw causal inferences between variables, indirect effects can still be meaningfully estimated when supported by a strong theoretical rationale (Hayes, 2022). As Kline (2015) notes, while mediation implies a temporal sequence of effects, theoretically driven cross-sectional models can still provide valuable insights into the relational patterns among variables. In this study, the mediation model was grounded in the JD–R framework (Bakker & Demerouti, 2007), which offers a well-established rationale for the directional paths tested. Future research would benefit from adopting longitudinal or experimental designs to further test these relationships over time and validate findings with complete datasets. Moreover, using multiple informants and incorporating observational tools would allow for methodological triangulation, helping to reduce potential biases associated with single-source, self-reported data.

Fifthly, future research could examine additional variables, as mediators or moderators, that may provide a deeper insight into the complex dynamics involved in increasing positive ECE teachers' experiences and outcomes. Specifically, we suggest that future investigations examine other organizational predictors of children's autonomy support (e.g., teachers' job autonomy), such as teacher collaboration and professional development opportunities, which have already been suggested as variables that are associated with self-efficacy (Cieyer et al., 2010; Chong & Kong, 2012; Von Suchodoletz et al., 2018). In addition, future research could also consider examining variables associated with leaders' behaviors and work conditions, and the associations between leadership practices and auxiliary staff resources and practices. Finally, while future research may continue to consider the associations between organizational variables and children's autonomy support by ECE teachers, other ECE teacher practices or even specific child outcomes could be also examined.

4.5 Practical implications and conclusions

Our findings enhance the importance of promoting and fostering transformational leadership within ECE settings. In other European countries (e.g., Austria, Wales, France, and Switzerland), to be the coordinator of an ECE setting, it is necessary to have specific leadership training (European Commission/EACEA/Eurydice, 2019). However, to the best of our knowledge, in Portugal there are no minimum requisites to be an ECE coordinator, besides having a licentiate degree (European Commission/EACEA/Eurydice, 2019). Therefore, it may be important to investigate what education and/or training do ECE leaders have in Portugal and how they are selected to become leaders. In addition, considering that previous research confirmed that transformational leadership skills can be learned (Parry & Sinha, 2005), findings suggest the potential importance of designing and implementing trainings and workshops (Nielsen & Munir, 2009) focused on the four dimensions of transformational leadership: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Avolio et al., 1991; Bass & Avolio, 1994). Relatedly, addressing ECE settings as organizations, starting in the initial training of ECE teachers and potential future ECE leaders, is warranted. Specifically, transformational leadership could be incorporated into foundational training for individuals aspiring to become ECE teachers. Existing literature suggests that the transformational leadership practices that are more likely to increase teachers' self-efficacy are the ones focused on inspirational motivation, as it happens when the coordinator expresses high expectations, which are more likely to support teachers believing themselves (e.g., Skaalvik & Skaalvik, 2007). On the other hand, to increase work engagement, the literature suggests transformational leadership practices focused on individualized consideration, such as providing social support and feedback (Bakker et al., 2008; Schaufeli & Bakker, 2004a).

Moreover, one of the key contributions of this study is the confirmation of indirect associations through ECE teachers' self-efficacy. This finding suggests that self-efficacy serves as a mechanism through which transformational leadership influences children's autonomy support in the classroom. This insight highlights the importance of empowering teachers and building their confidence in their ability to create a supportive and autonomous learning environment for children, which can happen through professional development programs and interventions that focus on enhancing teachers' beliefs in their instructional capabilities.

Another contribution of this study is the involvement of work engagement in the indirect association between ECE transformational leadership and children's autonomy support. This finding highlights the importance of promoting teachers' active involvement, enthusiasm, and dedication to their work. Strategies such as supportive supervision and recognition can be adopted to foster work engagement among ECE teachers, which may ultimately lead to improved educational outcomes for children. Additionally, leaders can also benefit from these findings by focusing on developing transformational leadership practices that inspire and motivate teachers, fostering a positive and supportive work environment, and addressing the unique challenges faced by ECE teachers in Portugal.

Additionally, this study was conducted in Portugal, a European country, adding value to the existing literature, which is primarily based on studies conducted in the USA. By conducting the research in a different cultural context, this study contributes to a more diverse and comprehensive understanding of the topic.

Overall, our results highlighted the potential dynamics between transformational leadership, self-efficacy, work engagement, and teacher self-reported practices in ECE, going beyond typically examined organizational contexts (e.g., companies and industry). ECE settings can and should be understood and studied as organizations, if we want to improve ECE teachers' working conditions and, consequently, the quality of education provided in ECE settings.

Data availability   Materials and data for this study are available by emailing the corresponding author.

Declarations

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