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# Promoting social-emotional competence and wellbeing in university students: a mixed methods exploratory study of a relaxation-based intervention

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**Introduction:** The higher education years represent a critical period for social and emotional development, often marked by elevated stress and challenges to self-regulation that impact students' wellbeing and interpersonal functioning. These demands are particularly relevant for future childhood educators, whose professional effectiveness depends partly on their ability to model and support children's emotional development.

**Methods:** This mixed-methods, non-randomized study examined the effects of an 8 week psychomotor relaxation program on a small single-group sample of 20 first-year female university students in Education Sciences. Following a 4 week within-subject control phase, participants engaged in biweekly psychomotor relaxation sessions combining body awareness, muscle tone regulation, and breathing exercises. A single-arm repeated-measures design assessed changes in objective and subjective stress indicators, interoceptive awareness, affective states, and psychological wellbeing. Additionally, students' perceptions of the program's personal and professional impact were explored through open-ended questions and thematic analysis.

**Results:** Quantitative findings revealed selective improvements in emotional and bodily awareness, a reduction in confusion, and an enhanced sense of purpose in life. Qualitative data supported these results, with most students reporting regular use of learned strategies in daily life and recognizing the relevance of these skills for managing classroom stress and fostering children's emotional wellbeing in their future roles as childhood educators.

**Discussion:** These results reinforce the potential value of integrating body-oriented interventions, particularly those based on relaxation, into higher education curricula to support social and emotional development during this formative life stage.

## KEYWORDS

body-oriented intervention, coping, higher education, mental health, social-emotional development, students' wellbeing, stress, interoception

## 1 Introduction

A growing body of evidence highlights higher education years as a developmental period with various social, emotional, and academic challenges that overload students. During this period, some students leave home and must quickly acclimate to a new and unfamiliar environment, where they meet new colleagues and teachers. Additionally, students must be more independent and learn to manage and overcome new academic demands, which can influence their mental health and wellbeing (Almeida et al., 2016; Sussman and Arnett, 2014).

A considerable number of first-year university students report elevated levels of interpersonal and academic stress (Leppink et al., 2016). High self-reported levels of stress by university students have been associated with poorer quality of life and wellbeing (Ribeiro et al., 2017). Such a high level of academic stress brings negative consequences for academic performance (Bruffaerts et al., 2018; Frazier et al., 2019), and increases the risk of students experiencing mental and physical stress-related problems, such as depression (Deng et al., 2022), anxiety (Rathnayake and Ekanayaka, 2016), and sleep disorders (Waqas et al., 2015). Besides, academic stress has a significant relationship with university students' social-emotional competence, such as self-regulation (Ramli et al., 2018) and empathy (Park et al., 2015), and negatively affecting interpersonal relationships (Ofori et al., 2018).

One protective factor of students' stress-related problems is their capacity for self-regulation (Thomas and Zolkoski, 2020). Self-regulation can be defined as the ability to successfully regulate one's thoughts, emotions, and behaviors in a variety of situations to pursue goal-directed behaviors (Hofmann et al., 2012). People who can adaptively regulate their emotions, behaviors, and thoughts are more likely to develop positive interpersonal relationships (Diamond, 2012), be happier (Cheung et al., 2014), have greater career success (Diamond, 2012), and experience better wellbeing (Mascia et al., 2020). A critical foundation of self-regulation lies in the ability to recognize and understand one's emotional experiences. Emotions are not just psychological experiences but are deeply tied to the awareness of internal physiological signals, like changes in heart rate, muscle tension or temperature, a phenomenon known as interoception. Interoceptive awareness enables individuals to effectively regulate their emotions and maintain homeostasis (Barrett, 2017). Recent research suggests that increases in interoceptive awareness may improve self-regulation by helping individuals identify bodily signals linked to emotional states, enabling more adaptive regulatory responses such as controlled breathing or cognitive reappraisal (Price and Hooven, 2018; Tan et al., 2023). Improved interoception has also been associated with enhanced mood regulation, and better stress resilience (Aydemir et al., 2025; Poerio et al., 2024). This competence is crucial not only for healthy emotional functioning (Barrett, 2017; Critchley and Garfinkel, 2017), but also in social contexts, where it supports the ability to understand others' feelings and emotions, promoting positive interpersonal relationships (Arnold et al., 2019).

A growing body of evidence emphasize that body-oriented interventions are valuable approaches to promote self-regulation and interoceptive awareness, either through attention regulation

(e.g., meditation, breathing exercises), or muscle tone regulation (e.g., progressive relaxation, muscle stretching) (Janjhua et al., 2020; Price and Hooven, 2018; Veiga and Marmeleira, 2018). In particular, relaxation intervention programs have been shown to effectively improve self-regulation (Bond et al., 2013; Patel et al., 2018; Shastri et al., 2017; Veiga et al., 2019) and self-compassion (Erkin and Aykar, 2021; Patel et al., 2018). To the best of our knowledge, several studies have examined the effects of relaxation programs on university students' interoceptive awareness and self-regulation, with most of this research focusing on meditation or mindfulness-based interventions (Fagioli et al., 2023; Lee et al., 2024; Loucks et al., 2021; Schuh et al., 2021). However, research specifically investigating the effects of psychomotor relaxation interventions on these outcomes remains limited.

As mentioned above, university students face numerous stressors throughout their academic journey. For students of Education Sciences, the ability to regulate stress is particularly important, as their self-regulation skills directly influence the development of self-regulation in the children they work with (Denham and Bassett, 2019; Durlak et al., 2011). Children learn by observing, listening to, and mimicking significant role models in their environment. Therefore, the teacher's self-regulated behaviors, emotions and daily interactions serve as powerful examples, shaping children's ability to become more aware of their emotions and better equipped to manage both emotions and social interactions adaptively (Denham and Bassett, 2019; Lam and Wong, 2017).

The development of body-oriented programs to improve self-regulation could be crucial for the professional development of university students, specifically for the acquisition, refinement and enhancement of specific professional skills (Nastasa and Cazan, 2013), empowering students to apply learned strategies, and effectively manage stress in the future workplace.

Considering that professional development is deeply intertwined with self-development (Nastasa and Cazan, 2013), engagement in a body-oriented program may positively influence the personal and professional growth of university students. Despite this potential, to the best of our knowledge, no study has yet examined the effects of a body-oriented program based on psychomotor relaxation, on self-regulation and professional development of university students. Addressing this gap constitutes the primary aim of the present study. More specifically, this study aimed to: (a) investigate the effects of the intervention program on students' self-regulation and personal wellbeing indicators; (b) examine students' perceptions of the influence of the intervention program on their personal development; and (c) assess students' perceptions of the potential benefits the intervention program may have on their future practice as early childhood educators.

Based on these aims, we formulated the following exploratory hypotheses: the intervention would (i) increase self-regulation, (ii) improve wellbeing indicators, including positive mood, reduced confusion, and greater sense of purpose, (iii) enhance interoceptive awareness, (iv) be perceived by students as beneficial for personal development, particularly in managing academic and emotional stress, and (v) be perceived as supportive of future professional practice, especially in applying self-regulation strategies in teaching.

Given the pilot nature of the study, these hypotheses are exploratory and intended to generate preliminary insights.

Given these aims, the primary outcome of this exploratory study was self-regulation, operationalized through perceived stress and salivary cortisol. Secondary outcomes included affective states, interoceptive awareness, psychological wellbeing, and students' perceptions of personal and professional development.

## 2 Methods

### 2.1 Participants

The study was presented to a class of students of the first-year bachelor's degree in Basic Education of the University of Évora, taught by one of the authors. Then, those interested in participating in the study were asked to fill in an informed consent declaring their willingness to participate in this study. Students received course credit for their participation as an incentive, while non-participants were not penalized or disadvantaged in any way. Participation was entirely voluntary, and students were explicitly informed that their decision to participate or not would not affect their course grades.

This pilot study used a convenience sample of 20 female university students. The sample corresponded to all students enrolled in the course where the intervention was implemented, which determined the final sample size. No a priori sample size or power calculation was performed, and the study was designed primarily to assess feasibility and preliminary trends. The inclusion criteria were (a) being between 18 and 30 years of age; (b) not having participated in a similar intervention program within the past 6 months, (c) not having a physical condition that could affect participation in the program, and (d) not taking medication that could influence the studied outcomes. All inclusion and exclusion criteria were assessed through a baseline sociodemographic questionnaire completed prior to study enrolment. This questionnaire included structured yes/no items and open-response fields to ensure accurate verification of eligibility before participation.

Table 1 shows the main descriptive characteristics of the participants. The participants were all single females with no children, their age ranged from 19 to 26 years old ( $M_{\text{age}} = 21.35 \pm 2.28$  years), and the majority (80%) lived in the city of Évora. Only 2 of the participants were employed. Twelve participants practiced physical activity regularly, namely walking ( $n = 6$ ), running ( $n = 4$ ), gymnastics ( $n = 1$ ), and weight training ( $n = 1$ ).

### 2.2 Procedure

This study was approved by the Ethics Committee of the University of Évora (#21018) and was carried out under the standards set by the Declaration of Helsinki. All the collected data was fully encrypted to ensure the privacy of the participants.

This was a non-random one-group repeated measures study with a mixed approach (quantitative and qualitative analysis), where participants served as their own controls (the class consisted of only 20 students, and no other comparable class was available to serve as a control). This research was designed as a pilot

TABLE 1 Participants characteristics.

	M (SD)	Min, max
Age (years)	21.35 (2.28)	19, 26
Height (cm)	165.05 (7.41)	150, 178
Weight (kg)	64.85 (12.95)	51, 100
Leisure activities (h/week)	4.30 (3.01)	0, 10
Physical activities (h/week)	3.08 (2.91)	0, 9

study to assess feasibility, acceptability, and preliminary trends regarding the effects of the program. Therefore, the results should be understood as preliminary and hypothesis-generating rather than conclusive. A mixed-methods approach was justified by the research questions, which aimed to quantify changes while exploring participants' perceptions.

To examine the chronic effects of the intervention program, instruments related to the quantitative analysis were collected online at week 1 (pre-test 1; March) and week 5 (pre-test 2; April) to establish the baseline measures. At the end of the 8 week intervention period (post-test; end of June), both quantitative and qualitative (a questionnaire with open-ended questions) data were gathered to evaluate changes and to gain deeper insights into participants' perceptions. During the control period (pre-test 1 to pre-test 2) the participants maintained their usual routines. Salivary cortisol was also measured at the beginning and end of the first and the fifteenth sessions to evaluate the acute effects of the intervention program. Participants were asked to avoid potential cortisol-altering substances (e.g., smoke, food, and caffeine) for at least 1 hour before the testing sessions. The same researcher collected all the saliva samples throughout the different stages of testing.

Data integration was achieved through triangulation, comparing quantitative trends with themes from qualitative responses to provide a comprehensive understanding of intervention effects.

### 2.3 Outcome measures

The primary outcome of this exploratory study was self-regulation, operationalized through perceived stress and salivary cortisol. Secondary quantitative outcomes were affective states, interoceptive awareness, and psychological wellbeing. In addition, qualitative data were collected on students' perceptions of their personal and professional development.

#### 2.3.1 Primary outcome: self-regulation

##### 2.3.1.1 Perceived stress

Stress was measured through the Portuguese version of the Perceived Stress Scale (PSS-10; Cohen et al., 1983), a self-report that measures, over the past month, the degree to which events of life have been experienced as unpredictable, uncontrollable, and overloaded. This questionnaire comprises 10 items, where participants are asked to rate on a five-point Likert scale (0 = never;

4 = very often). To calculate the total score of the questionnaire it is necessary to reverse the quotation of the responses to the items that refers to positive situations (items 4, 5, 7 and 8). Higher scores indicate higher levels of perceived stress. The Portuguese version of the PSS-10 showed good internal consistency in a previous psychometric study (Trigo et al., 2010) and in this study ( $\alpha = 0.87$ ).

### 2.3.1.2 Salivary cortisol

Cortisol levels (mg/dL) were quantified in saliva samples collected at the same time (before and after the first and 15th sessions, at 11:00 am and 11:20 am, respectively) and in the same place where the intervention occurred. The samples were collected directly from each participant's mouth (without stimulation) by passive drool (for 5 min) to a polyethylene tube maintained on ice and further kept at  $-20^{\circ}\text{C}$ , until laboratory analysis. After thawing, samples were centrifuged for 20 min at 13,000 g, at  $4^{\circ}\text{C}$ , for removal of mucins, cells, and food debris. Cortisol determination was performed in the supernatant using the Salimetrics<sup>®</sup> Cortisol Enzyme Immunoassay (EIA) Kit, following manufacturer instructions and absorbance reading was carried out at 450 nm, in a microplate reader (Glomax, Promega).

## 2.3.2 Secondary quantitative outcomes

### 2.3.2.1 Affective states

Affective states were measured through the Portuguese short version (Viana et al., 2001) of the Profile of Mood States (POMS; McNair et al., 1981). This self-report questionnaire comprised 36 items and measures the extent to which six affective states (6 items for each subscale) have been felt during the past week: Tension-anxiety; depression-dejection; anger-hostility; vigor; fatigue; and confusion. This questionnaire measures on a five-point scale (0 = not at all; 4 = extremely), and the sums score of each scale is obtained by the average of the respective six items. All the six subscales of this study showed a good internal consistency ( $\alpha = 0.89$ ).

### 2.3.2.2 Interoceptive awareness

Interoceptive awareness was measured through the Portuguese version (Machorrinho et al., 2019) of the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012). This self-report questionnaire comprises 33 items rated on a six-point Likert scale (0 = never; 5 = always) within seven scales that measure interoceptive bodily awareness: Noticing (3 items); Not-distracting (4 items); Not-worrying (4 items); Attention regulation (7 items); Emotional awareness (5 items); Self-regulation (7 items); and Trusting (3 items). All the scales of the MAIA showed good internal consistency (Cronbach's  $\alpha$  of 0.88 for the present study).

### 2.3.2.3 Psychological wellbeing

Psychological wellbeing was measured through the Portuguese short version (Novo et al., 2006) of the Scales of Psychological Wellbeing (EBEP; Ryff and Keyes, 1995). This self-report questionnaire is comprised of 18 items rated on a six-point Likert scale (1=I completely disagree; 6=I completely agree), within the six dimensions of psychological wellbeing, which one with 3 items: Autonomy; Environmental mastery; Personal growth;

Positive relations with others; Purpose in life; and Self-acceptance. Each dimension is calculated by summing the score of each item, being necessary to reverse the scores of negative items (items 2, 4, 5, 7, 13 to 18).

In the present study, the Autonomy, Purpose in life, and Self-acceptance subscales showed acceptable internal consistency (Cronbach's  $\alpha$  between 0.63 and 0.96). In contrast, the Environmental Mastery, Personal Growth, and Positive Relations with Others showed low internal consistency (Cronbach's  $\alpha < 0.60$ ). As low values undermine the reliability and interpretability of subscales scores (Tavakol and Dennick, 2011; Boateng et al., 2018), these subscales were considered insufficiently reliable for inferential analysis and were therefore not included in the statistical analyses.

### 2.3.2.4 Perceptions of personal and professional development

The questionnaire created to the present study comprised 3 open-ended questions regarding the students' perceptions of the influence of the intervention program on their personal development, and the benefits for their future profession as early childhood educators: 1) "Think about the changes that have occurred in the way you deal with stressful situations. What skills do you think you have acquired by participating in the program (e.g., being able to manage emotions when faced with a stress-inducing situation)?"; 2) "Of all the strategies and techniques applied in the sessions, do you use any of them in your daily life? If yes, which ones and in which contexts?"; 3) "What are the benefits of participating in the program that you consider to be an asset to your future profession? Why?"

## 2.4 Intervention program

The body-oriented program based on psychomotor relaxation program comprised two 20 mins sessions per week for 8 weeks (from April 19th to June 6th) with the whole class. As in a previous study (Veiga et al., 2019) the program combined body awareness, muscle tone regulation and breathing exercises. Participant attendance was monitored through a sign-in sheet.

After participants lied down on a mattress, the sessions began with an initial ritual (3 min), where the therapist described and demonstrated the activities, and ended with a final dialogue (2 min). The main section (15 min) combined relaxation activities, involving: body awareness, focusing on participants' proprioceptive and interoceptive sensations of their own bodies (e.g., "focus your attention on your whole body... now, feel the sensations in the parts of your body that are in contact with the mattress..."); tonus regulation, aiming the relaxation of different muscle groups (e.g., "focus on your right hand... contract it... feel the tension... and now relax... feel the relaxation... and contract again..."); and breathing regulation, where the participants explored, focused and controlled their own breathing process (e.g., "breathe deeply... inhale... exhale... focus on your breathing... feel the air entering your lungs... feel if your inhalations and exhalations are cold, or warm..."). A structured script, carefully prepared by the therapist, was followed in all sessions to ensure consistency and fidelity to the intervention.

The sessions were designed to develop a progressive level of complexity of the exercises along the program. In cases where the exercise complexity was not perceived as tolerable by the participants, the difficulty was reduced until being perceived as comfortable (e.g., by decreasing the number of repetitions, or focusing on larger muscle groups). Participants were encouraged to practice the exercises learned in the sessions in their daily lives, particularly in moments or situations that induced stress. The sessions were planned and conducted by a psychomotor therapist that was not related to the class, and a university professor specialized in relaxation supervised the intervention program, both authors of this article. If a participant was unable to attend one of the two weekly sessions, it was possible to attend an additional online session. During the final 2 weeks of the intervention program, approximately half of the class attended one of the two weekly sessions online.

## 2.5 Data analysis

A descriptive analysis (frequencies, means and standard deviations) and normality tests (Shapiro-Wilk test) were performed for all variables. Due to the normal distribution of PSS-10 and MAIA questionnaires variables, one-way repeated measures analyses of variance (ANOVA) with a *post-hoc* test were used to compare within-group changes between pre-test 1 and pre-test 2, pre-test 2 and post-test, and pre-test 1 and post-test. Significance levels were adjusted using the Bonferroni correction. The results are expressed as mean and standard deviation.

Since the variables of the Profile of Mood States (POMS), the Scales of Psychological wellbeing (EBEP), and cortisol measures did not follow a normal distribution, non-parametric Friedman tests were conducted. Scores were tested for change over time using *post-hoc* pairwise comparisons with the Wilcoxon Signed-Rank test, with a Bonferroni adjustment ( $p = 0.017$ ) applied to account for multiple comparisons. Results were expressed in median and interquartile range (IQR). Wilcoxon Signed-Rank test was used to examine changes on salivary cortisol from baseline to post-session of the 1st and 15th sessions.

The effect sizes and delta value ( $\Delta\%$ ) between each moment (pre-test 1, pre-test 2 and post-test) for all the assessment instruments except cortisol, was calculated using the formula:

$$\Delta\% = \left[ \frac{\text{moment}(y) - \text{moment}(y-1)}{\text{moment}(y-1)} \right] \times 100$$

Given the small sample size ( $N = 20$ ), the study was treated as an exploratory investigation, and no a priori power analysis was conducted. To contextualize the quantitative findings, a *post-hoc* detectable-effect estimation was performed. For a repeated-measures design with  $N = 20$  and  $\alpha = 0.05$  (two-tailed), the study had approximately 80% power to detect medium-to-large within-person effects ( $d_z \approx 0.66$ ), whereas smaller effects ( $d_z \approx 0.30-0.40$ ) were likely underpowered. This should be taken into account when interpreting the non-significant results.

Analyses were conducted with the statistical software SPSS 27.0 (SPSS, Chicago, IL). For all statistical tests, significance was set at  $p < 0.05$ .

Regarding the qualitative analysis, after collecting all the completed questionnaires, an inductive content analysis with manual categorization was performed. Content analysis is a set of techniques for processing previously collected information (Erlingsson and Brysiewicz, 2017). First, we identified evidence (i.e., phrases, words, or expressions) relevant to the aims of the study and converted these into registration units, while excluding content not aligned with the study objectives. Through an inductive process, we then developed a categorization system with corresponding categories and subcategories (Esteves, 2006). The registration units were subsequently grouped into the identified categories and subcategories. Once the entire categorization system was reviewed, several indicators could be extracted and the frequency of each registration unit per category and subcategory was counted.

All coding and categorization were carried out manually, without the use of qualitative analysis software, allowing the researchers to engage closely with the data throughout the analytic process. To ensure rigor and reliability, the coding process was conducted independently by three researchers, and discrepancies were discussed and resolved through consensus, enhancing the trustworthiness of the final themes.

## 3 Results

The average percentage of the attendance rate to psychomotor relaxation intervention sessions was 83% (13 out of 16 sessions per participant). All participants completed the pre- and post-intervention measures, and no dropouts occurred during the study. Attendance was generally consistent across participants, with most attending at least 13 sessions. Engagement during the sessions was high, as observed by active participation in the exercises and responsiveness to instructions.

Results for the primary outcome (self-regulation, assessed through perceived stress and salivary cortisol) are presented first, followed by secondary outcomes (interoceptive awareness, affective states, psychological wellbeing) and qualitative perceptions of personal and professional development.

### 3.1 Primary outcome: self-regulation (perceived stress and salivary cortisol)

Scores of both measures did not change significantly during the baseline period (Table 2). No significant effects were observed regarding the Perceived Stress Scale.

Regarding the chronic effects of salivary cortisol, no significant differences in salivary cortisol concentration were found between pre-session of the 1st ( $Mdn = 0.337$ , IQR = 0.350) and 15th sessions ( $Mdn = 0.383$ , IQR = 0.265),  $Z = -0.411$ ,  $p = 0.681$ .

Regarding the acute effects, in the 1st session, there was no significant difference between salivary cortisol concentration from pre-session ( $Mdn = 0.337$ , IQR = 0.350) to post-session ( $Mdn = 0.218$ , IQR = 0.211),  $Z = -1.083$ ,  $p = 0.279$ . In the 15th session, no significant changes occurred from pre-session ( $Mdn = 0.383$ , IQR = 0.265) to post-session ( $Mdn = 0.280$ , IQR = 0.202),  $Z = -1.083$ ,  $p = 0.279$ .

TABLE 2 Results for perceived stress scale and the multidimensional assessment of interoceptive awareness.

	Pre-test 1 (A)	Pre-test 2 (B)	Post-test (C)	$p$	Partial $\eta^2$	Post-hoc test ( $\Delta\%$ )
<b>Perceived Stress</b>						
Positive situations	2.01 ± 0.69	2.17 ± 0.81	1.99 ± 0.74	0.52	-	-
Negative situations	1.87 ± 0.77	2.12 ± 1.01	2.27 ± 0.77	0.17	-	-
Total PSS-10	1.94 ± 0.67	2.22 ± 0.63	2.13 ± 0.68	0.15	-	-
<b>Interoceptive Awareness</b>						
Noticing	2.83 ± 1.48	2.68 ± 1.56	3.55 ± 1.18	<0.01*	0.23	C > A (25%) C > B (32%)
Not-distracting	1.86 ± 1.56	1.94 ± 1.48	1.86 ± 1.24	0.95	-	-
Not-worrying	2.81 ± 1.09	2.79 ± 0.95	2.86 ± 1.00	0.92	-	-
Attention regulation	2.21 ± 1.36	2.12 ± 1.27	2.30 ± 0.87	0.76	-	-
Emotional awareness	2.87 ± 1.42	2.72 ± 1.15	3.59 ± 0.98	0.02*	0.22	C > B (32%)
Self-regulation	1.85 ± 1.29	1.69 ± 1.26	2.31 ± 0.98	0.60	-	-
Trusting	2.80 ± 1.52	2.65 ± 1.33	2.98 ± 1.52	0.39	-	-

Data are means ± SD. \* $p$ -values are for the ANOVA repeated measures test. In the *post-hoc* test, statistical significance between pairs was declared when  $p < 0.017$  (Bonferroni adjustment).

Given the exploratory nature of the study and the small sample size ( $N = 20$ ), the repeated-measures analyses were primarily sensitive to medium-to-large within-person changes. The detectable-effect estimation indicated that the design had approximately 80% power to detect effects of about  $d_z \approx 0.66$ , whereas smaller changes (e.g.,  $d_z \approx 0.30$ – $0.40$ ) were likely underpowered. Therefore, the non-significant findings for perceived stress and cortisol should be interpreted with caution, as they may reflect the limited sensitivity of the study rather than the absence of meaningful effects.

## 3.2 Secondary outcomes: interoceptive awareness, affective states, and psychological wellbeing

### 3.2.1 Interoceptive awareness

Significant changes were found for two subscales of Multidimensional Assessment of Interoceptive Awareness: Noticing ( $F_{(1.9,36.1)} = 5.67$ ,  $p = 0.008$ , partial  $\eta^2 = 0.23$ ) and emotional awareness ( $F_{(1.4,26.9)} = 5.53$ ,  $p = 0.017$ , partial  $\eta^2 = 0.22$ ).

*Post-hoc* analysis with a Bonferroni adjustment revealed that noticing improved from pre-test 1 to post-test (25%,  $p = 0.024$ ), and from pre-test 2 to post-test (32%,  $p = 0.025$ ). Regarding emotional awareness, significant improvements were found from pre-test 2 to post-test (32%,  $p = 0.005$ ). No significant differences were found for the remaining outcomes.

### 3.2.2 Affective states

As shown in Table 3 significant changes along the three assessments in two subscales of Profile of Mood States: Tension-anxiety,  $\chi^2(2) = 6.919$ ,  $p = 0.031$ , Kendall's  $W = 0.17$ ; and confusion,  $\chi^2(2) = 9.942$ ,  $p = 0.007$ , Kendall's  $W = 0.25$ .

*Post-hoc* analysis revealed statistically significant differences in tension-anxiety from pre-test 1 ( $Mdn = 1.17$ ) to pre-test 2 ( $Mdn = 1.75$ ) (21%,  $p = 0.007$ ), and in confusion from pre-test 1 ( $Mdn =$

1.42) to post-test ( $Mdn = 1.33$ ) (−12%,  $p = 0.027$ ) and from pre-test 2 ( $Mdn = 1.50$ ) to post-test ( $Mdn = 1.33$ ) (−19%,  $p = 0.006$ ).

### 3.2.3 Psychological wellbeing

Regarding the scores of the Scales of Psychological Wellbeing, significant improvements were found along the three assessments in purpose in life,  $\chi^2(2) = 6.113$ ,  $p = 0.047$ , Kendall's  $W = 0.15$ . *Post-hoc* analysis revealed statistically significant differences from pre-test 2 ( $Mdn = 5.00$ ) to post-test ( $Mdn = 5.67$ ) (11%,  $p = 0.022$ ). Although a statistically significant change was observed in the Purpose in Life subscale, this result should be interpreted cautiously, as it represents only one dimension of the broader psychological wellbeing construct, and other subscales did not show significant changes.

## 3.3 Perceptions of personal and professional development

The content analysis of the questionnaire surveys resulted in a grid with 3 categories, 7 subcategories, and 12 indicators (Table 4).

### 3.3.1 Acquired competences

Regarding stress self-management, we found 3 relevant indicators in the answers of the interviewed. The first indicator (self-regulation) tells us that most of the participants' answers ( $n = 13$ ) focuses on the use of self-regulation to better manage stress (e.g., E1: "I was able to better control my emotions in moments of stress."; E20: "In these moments, I try to calm me down first..."). Another strategy indicated was body awareness/noticing ( $n = 7$ ) (e.g., E2: "Letting go of feelings of stress and focusing on my body and breathing."; E10; "... When I think in my body, when I breath in and breath out..."), and one of the participants said to have not acquired any skill with the participation in the intervention program (E17; "... in the face of the situations I come up with in the day to day, I have not noticed any changes...").

TABLE 3 Results for profile of mood states and psychological wellbeing.

	Pre-test 1 (A)	Pre-test 2 (B)	Post-test (C)	<i>p</i>	Kendall's W	Post-hoc test ( $\Delta\%$ )
<b>Mood States</b>						
Tension-anxiety	1.17 (1.46)	1.75 (1.71)	1.92 (0.79)	0.03*	0.17	B > A (21%)
Depression	0.83 (0.33)	0.83 (1.87)	0.58 (1.46)	0.38	-	-
Anger-hostility	1.08 (1.42)	1.08 (1.58)	0.92 (1.21)	0.86	-	-
Vigor	2.08 (1.08)	2.25 (1.83)	1.92 (1.12)	0.13	-	-
Fatigue	1.17 (1.75)	1.25 (2.17)	1.67 (1.79)	0.48	-	-
Confusion	1.42 (1.17)	1.50 (1.12)	1.33 (0.92)	<0.01*	0.25	C < A (-12%) C < B (-19%)
Total POMS	1.23 (0.97)	1.13 (0.89)	1.33 (0.77)	0.13	-	-
<b>Psychological Wellbeing</b>						
Autonomy	4.17 (1.67)	4.33 (1.75)	4.17 (1.92)	0.52	-	-
Purpose in life	5.33 (2.17)	5.00 (1.92)	5.67 (1.67)	<0.05*	0.15	C > B (11%)
Self-acceptance	4.50 (1.42)	5.00 (2.17)	4.67 (1.58)	0.55	-	-
Total	4.64 (1.47)	4.19 (1.01)	4.64 (0.93)	0.06	-	-

Data are medians and interquartile ranges. Note: \**p*-values are for the Friedman test. In the *post-hoc* test, statistical significance between pairs was declared when  $p < 0.017$  (Bonferroni adjustment).

### 3.3.2 Application of the techniques and strategies in daily life

In this category, we observed that most of the participants' answers ( $n = 17$ ) demonstrates that they resort to the techniques and strategies learned in the sessions in their daily routine, such as: breathing regulation ( $n = 11$ ) (e.g., E7: "... controlled breathing was an added value in stress control and regulation learning"; E9: "I focus on my breathing and make deeper and slower inspirations"); tone regulation ( $n = 1$ ; E10: "I remember contracting and relaxing the muscles."); body awareness ( $n = 1$ ) (E2: "... and focus on the sensations of my body."; attention regulation ( $n = 1$ ) (E4: "...I can see that I no longer exalt myself so easily."); and eutony ( $n = 3$ ; E18: "... I lie down and put an anti-stress ball in the place of tension..."). Instead, four of the participants reported not using the techniques and strategies in their daily routine.

### 3.3.3 Benefits of the program for the practice of the future profession

We found that one of the benefits of participating in the intervention program for the future practice of the future practice of early childhood educators was an improved ability to manage occupational stress through the promotion of self-regulation ( $n = 14$ ) (E5: "...as future teachers, learn to calm down in times of more stress."; E11: "Help calm the class and the teacher."). Another benefit was the promotion of positive interpersonal relationships management, through the ability to better deal with people of the work context ( $n = 2$ ) (e.g., E12: "...I find it very beneficial, because in my future profession I will have to deal with several people, of different ages and know how to respond in an exemplary and calm way, for example to parents"). The last benefit found of the participation in the study was the promotion of children's wellbeing, through the promotion of children self-regulation ( $n$

= 6) (e.g., E2: "...may be useful to apply with children to also control their anxiety."; E13: "...be able to perform a relaxation for children...").

## 4 Discussion

University students face numerous stress-inducing situations throughout their academic journey, emphasizing the need for strategies to promote mental and physical health and wellbeing. This study highlights the potential of body-oriented interventions, such as relaxation, to promote social-emotional development, health and wellbeing and support the professional development of university students. To our knowledge, this is the first mixed-methods study examining the preliminary effects of a psychomotor relaxation intervention on university students' social-emotional competence, wellbeing and health related outcomes, also amplifying their voices by considering their experiences and perspectives. Quantitative analysis showed that the 8 week psychomotor relaxation program facilitated the regulation of confusion feelings and increased interoceptive awareness among university students, particularly their ability to notice bodily sensations and recognize the emotional significance of these sensations. Moreover, the intervention program was associated with increases in students' sense of purpose in life. The improvement in purpose in life provides a preliminary indication of a possible positive trend; however, given that other wellbeing subscales did not show consistent change, and that some subscales presented low reliability, this finding should be viewed cautiously. These quantitative findings converge with the qualitative results, in which students reported having developed competencies for better stress management and actively applying the learned techniques in

TABLE 4 Summary of the content analysis performed for the categories, subcategories, indicators, and frequencies.

Categories	Subcategories	Indicators	Frequencies
<i>Acquired competences</i> Competences that participants believe they have acquired through the participation in the study.	<i>Stress self-management</i> Self-management is self-directed and informal, comprising strategies that individuals use on their own, without professional guidance, to manage their symptoms (Jorm and Griffiths, 2006). In this subcategory, we can find two indicators: self-regulation; and body awareness/noticing.	Self-regulation	13
		Body awareness/Noticing	7
	<i>None acquired competence</i> Statements in which participants report that they have not acquired any competences.	None acquired competence	1
<i>Application of the techniques and strategies in daily life</i> Concerns whether the participants use the strategies and techniques applied in the intervention program sessions in their daily lives.	<i>Use of the techniques or strategies on daily routine</i> Contemplates the statements of the participants about the use of the strategies and techniques learned in the sessions in their daily lives, and which ones they use (e.g., breathing regulation, tone regulation, body awareness, attention regulation, and eutony).	Breathing regulation	11
		Tone regulation	1
		Body awareness	1
		Attention regulation	1
	<i>Does not use the techniques or strategies on daily routine</i> Statements in which participants reports that they do not use the strategies and techniques learned in the sessions in their daily lives.	Does not use	4
<i>Benefits of the program for the practice of the future profession</i> This considers the benefits that the participants believe they gained from their participation in the program for their future professional practice.	<i>Occupational stress management</i> Participants' opinion about the benefits they believe they have had from their participation in the program for better deal with stressful situations that will occur in their future profession (i.e., promotion of self-regulation).	Promotion of self-regulation	14
	<i>Management of interpersonal relationships</i> Participants' opinion about if the strategies and techniques learned in the sessions will promote their positive interpersonal relationships related to work context (e.g., children, parents, other teachers).	Ability to better deal with people of the work context	2
	<i>Promoting the well-being of the children</i> Participants' opinions on whether they believe that the strategies and techniques learned in the sessions will help them in the future, for promoting children's self-regulation.	Promotion of children/students' self-regulation	6

daily life, highlighting the practical implementation of increased interoceptive awareness and emotion regulation.

The program's high attendance may be related to its convenient location, the low time commitment (20 min per session), and hybrid format. Sessions were held either in person at the university, aligned with students' lectures schedules; while the first session of the week was held after the lecture, the second session was held before the lecture. Also, students could attend the session online if they were unable to join in person. Moreover, the ease of integrating the exercises into daily routines likely contributed to participants' sustained motivation and commitment with the program.

The findings align with previous research (Fujino, 2012; Gulsen, 2019), demonstrating that participating in a relaxation intervention program at the University increases students' ability to notice and focus on emotions and body sensations. Given that the program involved body awareness and regulation exercises, this finding was somewhat expected, as participants became progressively more aware of the tensions in their bodies and learned how to release these tensions to achieve greater relaxation and a better understanding of the relationship between their

bodily sensations and emotional states. Indeed, qualitative analysis confirms this progression, revealing that students perceived the program as an opportunity to acquire competencies for more effective stress management, first by becoming aware of their tensions, and second by learning how to intentionally release those tensions. Also, most students reported using the strategies and techniques (e.g., breathing and tonus regulation, body awareness, attention regulation) learned in the intervention sessions in their daily lives.

After participating in the 8 week relaxation program there was a decrease in feelings of confusion. Possibly, having an opportunity to calm down and focus on bodily sensations may be particularly important to improve mental clarity, focus and confidence in understanding one's surroundings.

Taken together, the increase in interoceptive awareness, the reduction in feelings of confusion, and the enhanced sense of empowerment regarding self-regulation may have contributed to the improved sense of life purpose observed in participants, with students both quantitatively reporting higher life purpose scores and qualitatively acknowledging benefits for personal and professional development. In other words, the ability to better

notice and understand bodily states and to connect these states to emotions, appears to enable students to live in a more focused and conscious manner. This heightened awareness facilitates better self-organization and awareness of barriers to personal and professional goals (Kreibich et al., 2020). These findings are particularly significant at this academic stage, as university students often report a lower sense of purpose in life at the beginning of their academic journey compared with graduate students (Hodges et al., 2014). Moreover, students acknowledged that the program could offer valuable benefits for their future careers as educators, such as improved stress management, stronger and more positive interpersonal relationships within the school context, and the ability to promote children's wellbeing. This recognition of their enhanced capacity to handle the challenges of their future profession may have also contributed to the observed increase in their perceived sense of life purpose.

Despite these encouraging outcomes, some anticipated improvements were not observed. Specifically, the decrease in salivary cortisol levels was not significant, and tension-anxiety feelings increased over the course of the program. It is possible that the relatively short duration of the intervention program limited the ability to detect changes in these measures. Regarding salivary cortisol, several factors may have influenced the results. First, the 20 minutes duration of each session may have been insufficient to elicit detectable physiological changes, even if improvements in subjective wellbeing were observed. Second, samples were collected in the classroom setting, which could have introduced stressors or distractions affecting cortisol levels. Third, the timing of sample collection may not have aligned with participants' natural circadian rhythms, which strongly influence cortisol secretion. Additionally, individual variability in stress responses, contextual school-related stressors, and the small sample size may have contributed to the lack of significant changes. Although significant improvements have been reported in other populations (Veiga et al., 2019), developmental and contextual factors specific to university students may have further influenced the physiological response to the intervention.

Interestingly, during the control period (from pre-test 1 to pre-test 2), tension-anxiety feelings significantly increased, likely due to this phase coinciding with the beginning and end of final exams, a time when stress levels naturally fluctuate. However, the post-test was conducted at the end of the semester, a period often associated with elevated stress and anxiety among university students (Pozos-Radillo et al., 2014; von Haaren et al., 2016). Additionally, this period coincided with the COVID-19 lockdown and associated restrictions in Portugal, which likely introduced additional stressors beyond the usual academic and personal factors, as students were experiencing confinement with its inherent limitations and anticipating a return to normality and in-person classes, which may have further elevated tension levels. Other external factors, such as personal, family, or environmental influences may also have contributed to these fluctuations.

Overall, these findings highlight the importance of cultivating body awareness, the awareness of body in relation to others, and the connection between body and emotions, early in the academic training of childhood educators. This is particularly relevant given that "teaching is more socially and emotionally demanding

than it has ever been in the past" (Jennings, 2011), and that teachers' self-regulation skills play a crucial role in children's social-emotional development (Denham and Bassett, 2019; Jennings, 2011).

Because this was a single-group, non-randomized exploratory study with a small sample and multiple outcomes tested, causal inference is necessarily limited. Alternative explanations for the observed changes, such as regression to the mean, expectancy effects, maturation, or unmeasured fluctuations in students' academic and personal contexts, cannot be ruled out. Accordingly, the findings should be interpreted as preliminary and hypothesis-generating rather than conclusive. Future research should seek to replicate this study with a larger and heterogenous sample of in-service childhood educators, who have been practicing for some time, as a growing body of evidence indicates that relaxation-based interventions enhance teachers' social-emotional competence (Frank et al., 2013; Jennings et al., 2017), with these positive impacts being sustained over time (Jennings et al., 2019; Schussler et al., 2016).

## 4.1 Study limitations

Considering the exploratory nature of the study, several limitations should be acknowledged. First, the study lacked an a priori power calculation and included a relatively small sample, with all participants being women from a single university course. This limits the generalizability of the findings to male students, students from other academic programs, or those in different academic or cultural contexts. Although the recruitment occurred within a for-credit class, participation was entirely voluntary, and students who opted out were not disadvantaged, reducing the likelihood of coercion or demand characteristics.

In addition to these sampling limitations, the small sample size ( $N = 20$ ) limits statistical power. In a repeated-measures design of this size, only medium-to-large within-person effects (approximately  $d_z \approx 0.66$ ) could be detected with adequate power, meaning that smaller but potentially meaningful effects may have gone undetected. Thus, null results, particularly for perceived stress and cortisol, should be interpreted cautiously.

Second, the absence of a control or comparison group limits causal inference. As this was an exploratory study designed primarily to assess feasibility, acceptability, and preliminary trends, the findings should be interpreted with caution. In this small, non-controlled sample, significant effects were restricted to specific facets of interoceptive awareness, confusion, and purpose in life, whereas perceived stress, salivary cortisol, autonomy, self-acceptance, and most mood dimensions did not show measurable change. Together with the low reliability observed in some wellbeing subscales, this selective pattern limits the strength and generalizability of the conclusions and reinforces the need for replication in larger, controlled studies.

Third, the use of an online open-ended questionnaire may have limited the depth of qualitative responses.

Fourth, the post-intervention evaluation coincided with the end of the academic semester, a particularly stressful period that may have influenced participants' responses.

Fifth, given the relatively large number of outcomes examined, the risk of Type I error cannot be excluded. Although Bonferroni adjustments were applied within scales, the number of statistical tests means that some significant findings (particularly those from secondary outcomes) should be interpreted with caution.

Additionally, some psychological wellbeing subscales displayed low internal consistency ( $\alpha < 0.60$ ). Although these scales were removed, this might limit the completeness of the psychological wellbeing profile assessed.

Future studies should address these limitations by incorporating a larger and more diverse sample (e.g., diversity across gender, academic programs, and institutions), and including a control or active control condition to strengthen internal validity. The use of in-depth qualitative techniques, such as semi-structured interviews or focus groups, could enrich the understanding of participants' experiences and perceptions. Moreover, integrating objective classroom-level indicators of teaching behavior or child outcomes and including a follow-up evaluation could provide valuable insights into the long-term effects of the intervention on the outcomes studied.

## 5 Conclusion

This mixed-methods exploratory study explored the impact of a psychomotor relaxation program on university students' social-emotional competence, health and wellbeing, as well as their personal and professional development. The findings revealed preliminary evidence that a brief psychomotor relaxation program may be associated with improvements in specific facets of interoceptive awareness, confusion, and sense of purpose in life in a small sample of first-year female education students. Qualitative data further indicated that participants developed practical stress management skills, integrated the learned techniques into their daily routines, and recognized the relevance of these tools for their future role as childhood educators.

Despite some limitations, this study adds to the growing body of evidence supporting the benefits of body-oriented interventions in higher education. The positive outcomes observed suggest that such approaches may be an effective means of promoting emotional regulation and wellbeing during a formative stage of professional identity development.

Incorporating body-oriented practices into university wellness initiatives or teacher-training curricula could enhance students' ability to manage academic stress and support long-term personal and professional wellbeing. Furthermore, the brief session duration and flexible, hybrid delivery format suggest a potential for scalability and feasibility across diverse university settings, which should be tested as a hypothesis in larger, controlled studies.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Ethics Committee of University of Évora. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

ADR: Formal analysis, Writing – review & editing, Writing – original draft, Data curation, Investigation. JM: Formal analysis, Methodology, Writing – review & editing. CP: Supervision, Writing – review & editing, Methodology, Formal analysis, Data curation. EL: Methodology, Formal analysis, Writing – review & editing. GV: Formal analysis, Writing – review & editing, Visualization, Methodology, Data curation, Writing – original draft, Validation, Supervision, Project administration, Funding acquisition, Conceptualization.

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## Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors EL and GV declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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