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Mental health outcomes following a four week online training on social emotional and ethical learning for public school teachers

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This study aimed to evaluate the effects of a 4-week social, emotional and ethical learning online training (SEELOT) on public school teachers' stress, well-being, social-emotional learning literacy, positive and negative emotions, attention, motivation, and frustration, and to assess the impact on their classes and personal lives. During the Covid-19 pandemic, teachers from public schools in Brazil (*N* = 333) were invited to participate and were divided into two groups: an active group (SEELOT) and a waiting-list group (WLC). They were evaluated before and after one month. A robust trimmed means ANOVA was used for data analysis. The SEELOT group showed improvements in their well-being, attention, motivation, and frustration, and decreased their stress levels compared to the WLC group. Additionally, a subset of the active group participated in semi-structured interviews and reported developing new skills and knowledge related to human values, emotional management, and the ability to handle the challenges of education.

Keywords Online training, Socioemotional learning, Stress management, Teacher's well-being, Education, Mental health, Compassion

The access to education has been rapidly changing since the beginning of this century. Old models have been questioned, especially the content-based teaching approach designed for an industrial society, along with the means of educating. Distance education has been experienced since the beginning of the 20th century through mail and later through internet means. However, when the Covid-19 pandemic occurred, educators, schools, and students were forced to adapt rapidly to the lockdown situation and shift all efforts towards creating an efficient and favorable learning environment in the midst of the crisis[1]. Now, in addition to changes in the education model, there is another challenge: the mental and emotional health of teachers and students. Is it possible to effectively teach social and emotional skills in an online format?

Social and emotional learning (SEL)[2] supports children in fostering skills such as recognizing and managing emotions, developing empathy, building cooperative relationships, solving problems effectively, and enhancing their communication skills[3]. Taught in several schools it has gained importance following the evidence of its positive effects, as can be seen in the Annual Report from the Mahatma Gandhi Institute of Education for Peace and Sustainable Development from UNESCO, one of the foremost global agencies responsible for the dissemination of SEL programs worldwide. According to the same agency there was an increase of 350% in the number of youths trained in SEL and an increase of 1057% in the number of teachers trained in SEL compared to the previous year[4].

In a meta-analysis of 213 programs involving 270,034 participants from kindergarten to high school, SEL participants showed improvement in their social, emotional skills, behavior, and academic performance (11% points gained in performance) when compared to control students[5]. In another meta-analysis of 79 studies evaluating SEL interventions with preschoolers, children receiving SEL showed significant improvement in social and emotional competence, early learning skills, and behavioral self-regulation when compared to a control group[6].

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Furthermore, there is evidence that combining SEL with contemplative elements can enhance its effectiveness. In a study of 99 students (4th and 5th grade) randomly assigned to receive SEL plus a mindfulness program alternatively to a social responsibility program, the former group showed greater improvement in stress management, executive functions, emotional control, mindfulness, proactive behavior, socialization, reduction of depression symptoms and aggressiveness[7].

A training program combining SEL and contemplative techniques is the Social, Emotional and Ethical Learning (SEEL), created at Emory University in partnership with contemplative practitioners, scientists, psychologists, and educators. This program aims to cultivate compassion, wisdom, and ethical attitudes through the development of self-awareness, awareness of others and of the systems young people are integrated in. This program provides students and educators with tools to support their own emotional development in positive engagement with all spheres of relational connections[8].

Brazil offers a unique context for the evaluation of social emotional learning programs, as we can see by the results of the Teaching and Learning International Survey (TALIS)[9] conducted by the OECD in 2018. The Survey showed that 87% of Brazilian teachers reported frequently having to dedicate their time to calming down students with behavioral problems that disrupt the flow of classes (OECD average 65%). Additionally, TALIS indicated that Brazilian teachers spend only 67% of the time in any given class on actual teaching and learning-related activities (OECD average 78%)[10];[11]. Yet, there is a lack of studies about social and emotional learning programs that can be implemented in the Brazilian context.

Most studies on social and emotional learning (SEL) focus on evaluating students. However, teachers must be prepared and have incorporated SEL principles before teaching them. Many teachers report limited training and, as a result, a lack of confidence in supporting SEL in students[12]. Teacher education programs should prioritize SEL training as much as they do mathematics or science instruction[13]. Additionally, online implementations may be crucial, as seen during the COVID-19 pandemic.

Therefore, this study utilized an adapted online version of the original SEEL program from Emory University, specifically designed for teachers. It is crucial to clarify that this study does not assess the effectiveness of the original SEEL program, but rather the current 4-week training program known as SEE-Learning Online Training (SEELOT). The study was developed by incorporating tools and conceptual framework of the original program, tailored to the context of Brazilian public schools, offering an opportunity of a more equitable and accessible education, following the Sustainable Development Goals 4 from UN[14], which aims to "ensure inclusive and equitable quality education (…) for all" .

The aim of this study was to assess the impact of SEELOT on perceived stress, well-being, SEL literacy, positive and negative affect, attention, motivation, and frustration among school teachers in the Brazilian public school system. The study also examined teachers' opinions of the training program and how it affected their teaching abilities and personal lives.

We hypothesize that the SEELOT group will show enhancements in teachers' well-being and mental health indicators when compared to the waiting list group.

Methods

This was a controlled study, with a randomized controlled subsample, followed by semi-structured interviews. Elementary and high school teachers from public schools across Brazil were invited to participate in the SEELOT program through collaborations with municipal education departments and educational networks. After electronically endorsing the Informed Consent, teachers were divided into two groups: some teachers were included in the SEEL classes (SEELOT) immediately after the initial evaluation (T0) and others belonged to a Wait-List Control group- WLC (this group received the training after the completion of this phase of the study). Qualitative interviews were scheduled after the end of SEELOT one month training in T1 (Fig. 1).

Ethical approval was obtained from the ethics committee of Hospital Israelita Albert Einstein (CAAE 48284621.9.0000.0071), and the study was registered on Clinical Trials under NCT05234073 (first release 10/02/2022). The consort checklist was not followed in this study because only a subsample of the participants were randomized. All research was performed in accordance with relevant guidelines/regulations, and the informed consent was obtained from all participants and/or their legal guardians. The research was performed in accordance with the Declaration of Helsinki.

Data was collected in six waves, meaning that at six different points in time, the SEELOT program was offered and the participants who signed up were invited to participate in this research. In each wave we had the participants attribute either to SEELOT and WLC groups. This attribution was class dependent (all the participants in a given class were either allocated to SEELOT or to WLC). In the first four waves, teachers chose the time and date of the training without knowing if they were choosing the SEELOT or WLC groups. However, the groups were predefined in a way that the WLC was always the class that started later. So, although the teachers were not directly choosing which study group they would be included, they indirectly did this by selecting the sooner or later class, purely based on their availability. In the last two waves, the teachers were randomly assigned to the times of the course and, therefore, to the SEELOT or WLC groups, without choosing the preferred class time (referred to as the Randomized Subsample). This was performed to be able to control for the effects of the choice from the teachers during their application. As this was expected to minor or null and we realized that most teachers would not comply with the training if the time and month of their classes were imposed on them, we decided to have this randomization only in a subsample. Due to the pandemic, we decided on 100% online training and assessments.

SEE learning online training

The one month training program consisted of both synchronous elements (two-hour meetings twice a week) and asynchronous elements, including handouts with pedagogical structure and course curriculum for use in

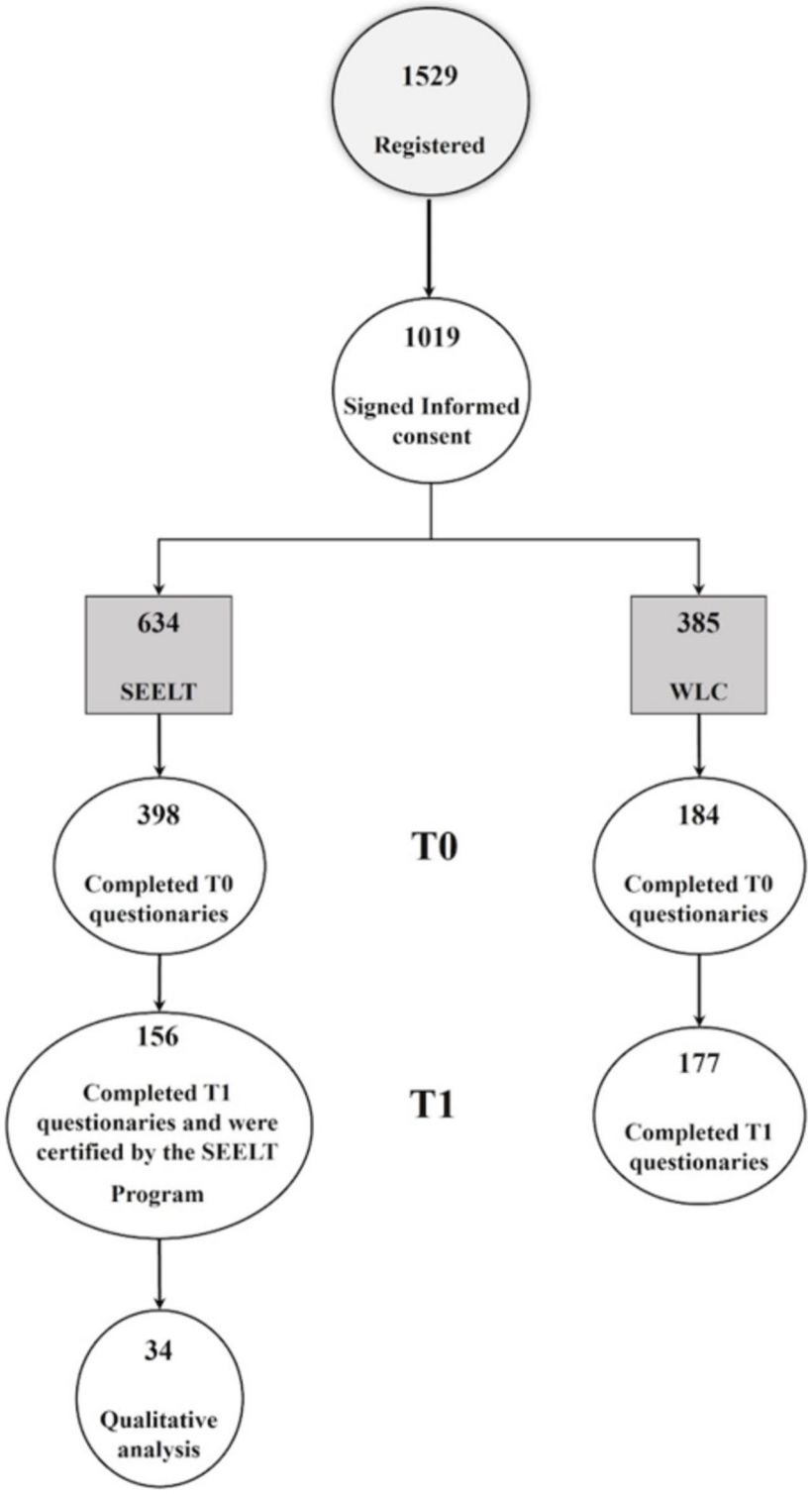


Fig. 1. Participants flow chart. Number of participants that completed each step of the study, from signing informed consent to completing the questionnaires and being included in the analysis, as well as participating in the qualitative assessment. T0: assessment before training or waiting period; T1: assessment after training of waiting period.

classrooms, assigned readings and videos sent via email and WhatsApp to prepare students for upcoming classes. Additionally, audio files with recorded relaxation practices and meditation, aligned with SEEL curriculum standards, were provided for students to practice four days a week[15].

Context, framework, and pedagogical model
The SEE Learning framework builds on innovative work with attention training, focus on ethics, trauma-informed approach, and systems thinking development and, it is built on three dimensions (awareness, compassion, and engagement) and three domains (personal, social, and systems).

Resourcing for emotional self-regulation and dealing with difficult situations and dilemmas
Teaches students to contrast their bodies' sensations and processes when recalling their resources to how their bodies feel when they are stressed or dysregulated.

Grounding
Involves bringing attention to any physical contact that creates a sense of support, security, safety, or well-being.

Conceptual foundations
Seeks to promote engaged citizenship, by means of understanding and managing one's emotions, feeling and develop empathy, developing healthy relationships and making responsible decisions.

Shift and stay practices
If one notices an unpleasant sensation in the body, one can move the attention to another part of the body that feels better (shift) and then keep attention there for a few moments (stay).

Help now! Strategies
Tools for bringing the body's autonomic nervous system into a more regulated state, such as attending to sights or sounds, drinking a glass of water, or pushing against a wall.

Tracking
Attending to sensations in the body has been given various names, including "mindfulness of sensations," "tracking," and "reading the nervous system."

Resilient zone
Being in the resilient zone is contrasted with being in stuck in the high zone or low zone, where one does not feel in control and where one's decisions and actions are less likely to be productive.

Attention training
Structured methods for learning to attend to one's feelings, thoughts, and impulses without being carried away by them or being distracted by outside stimuli.

Body literacy
Gaining awareness of sensations felt in the body and the words to describe them.

Mindful dialogue
A protocol for reflection and sharing in which one student asks a series of questions and listens attentively, without comment or interruption to another student, switching roles after 60–90 s.

Activities to foster kindness, empathy, and compassion
SEE Learning are based on personal insight and understanding, cultivating compassion and kindness. This includes the ability to discern what will bring about theirs and others' long-term well-being.

Interdependence
Interdependence is a key characteristic of systems, meaning one part of a system can impact several other parts through chains of causal relations.

Data collection
Questionnaires and scales

The REDCap platform[16,17] was used for online questionnaires and scales in the two moments of the study: before intervention or waiting period (T0) and after intervention or waiting period (T1).

The questionnaires and scales that were applied are detailed below:

Positive and negative affect scales (PANAS)

The Positive and negative affect scale (PANAS) is a self-report questionnaire consisting of two 10-item scales to measure positive and negative affect. Each item is rated on a 5-point scale from 1 (not at all) to 5 (a lot). The measure is used primarily as a research tool in group studies, with possible use in clinical and non-clinical populations. Clinical and non-clinical studies have shown the PANAS is reliable and valid for assessing positive and negative affect[18].

World health organization 5-item well-being index (WHO-5)
WHO-5 a short questionnaire consisting of 5 simple, non-invasive, and positively formulated items to measure subjective well-being. Participants rate each of the 5 statements on a 6-point Likert scale, from 5 (all of the time) to 0 (not at all) indicating how they have felt during the last 2 weeks. The raw score theoretically ranges from 0 (absence of well-being) to 25 (maximum well-being), but it is advisable to multiply the result by 4 to translate it into a percentage scale from 0 to 100, with higher scores meaning better subjective well-being[19].

Perceived stress scale (PSS-10)
It was developed by Cohen et al., 1983[20], to assess how stressful individuals perceive their life situations to be. PSS-10 items verify how unpredictable, uncontrollable, and overloaded respondents consider their lives; it also includes the number of items that inquire about current levels of stress experienced. PSS-10 is a general scale, as the content of its questions is not specific to any subpopulation or age group; however, it is targeted at participants who have completed high school. The 10 questions address the frequency of participants' feelings and thoughts about events and situations that occurred during the previous 30 days. A total of 6 questions are negative (1, 2, 3, 6, 9 and 10) and 4 are positive (4, 5, 7 and 8). Question is rated on a 5-point Likert scale from 0 (never) to 4 (very often)[20].

Perception of stress, well-being, attention, frustration, motivation in the last week
We assessed perceived stress, well-being, attention, frustration, and motivation before and after the last week using an online sliding percentage scale from 0 (absent) to 100 (maximum). Here, simple questions were presented: (1) What is your stress level in the last week? (2) What was your level of well-being in the last week? (3) What was your level of attention in the last week? (4) What was your frustration level in the last week? (5) What was your level of motivation in the last week? The first two questions were tested and published in[21].We performed the reliability study of the present scales using data from this study.

Questionnaire on social and emotional learning literacy
It is an evaluation of 10 questions about the acquired knowledge about SEELOT (they were prepared by educators specialized in social and emotional learning). For better verification of results, three tests with different questions, called alpha, beta and gamma, were randomized and distributed via REDCap to teachers at the time of research. It is a test, in the format of an 'exam' with 10 questions regarding social and emotional learning, each one with 4 multiple choices.

Qualitative approach
The aim was to obtain a range of reports about general perception, practical tools, life skills in personal life and career, and implementation of SEELOT in the context of Brazilian education involved in the experience.

SEELOT participants were invited to attend an online semi-structured interview, which is a method that "combines closed and open questions, in which the interviewee can talk about the topic in question without being attached to the formulated question"[22]. These interviews were conducted after the completion of the training course. We offered the participants various schedules to participate in the qualitative interviews. As a result, they were able to choose the time and date that best suited their routines. We allowed them to select the optimal time/date to encourage more participants to contribute. The following questions were proposed in sequential order:

- What is your general perception of the training program?
- What are your comments on the practical tools shared during this training course and their contribution to your classes?
- What is your perception of the life skills shared during this training and how they contribute to your personal life and your career?
- Choose one word to best describe your experience with this training course.
- Describe your plans on how to implement SEEL in your classes.

Participants were organized in small groups of 4 to 6 volunteers. Their objective was to know the opinions and behaviors of each member of the group, in a psychosocial context, in which individuals share perceptions about the intervention. It is an interesting technique due to its richness of data and the fact that moderators can informally encourage participants to reveal important details about their perception, interest, and meaning of the intervention. The data was recorded and fully transcribed, constituting the corpus of analysis[23].

Thirty-four teachers who participated in SEELOT were interviewed, in 5 groups, for approximately 1 h and 15 min per group. Interviews were video recorded, transcribed, and conducted by a trained interviewer, with a script. Transcriptions and categorizations were validated by 3 researchers.

Data analysis
The quantitative analysis of data was executed in software environment R[24] using the R Studio integrated development environment[25] Allaire[26]. The threshold of the significance level was $p < 0.05$ throughout the analysis.

As a pre-processing step, incomplete data at T0 and T1 was removed. Complete questionnaires were evaluated, except for the literacy test, which was not applied to the first wave of data collection (the literacy test was not ready to apply at that moment). For the SEELOT group, only participants certificated by the program were included. To be certificated, participants had to attend at least half of the lectures and complete all the course assignments.

To assess the impact of SEELOT, a trimmed means ANOVA[27] of mixed effects was used, evaluating the effects of time (T0 or T1), group (WLC or group SEELOT), and their interaction. This method is an alternative when there are violations of ANOVA assumptions, such as normality. The hypothesis of a significant training effect would be represented by a significant interaction effect in the ANOVA – the groups should differ only at T1, and only the SEELOT group should present a better result at T1 compared to T0. Significant ANOVA results were accompanied by post hoc trimmed mean tests evaluating the differences between times within each group (paired tests), and the differences between groups at each time (two-sample tests), using Bonferroni correction for multiple comparisons within each type of test for each variable (as there were two levels for each effects, the p-values were multiplied by two). A robust version of Cohen's d effect size was estimated for the trimmed means post hoc analyses, to provide information about the relevance of the observed differences[28]. This analysis was applied to the general and the randomized samples.

We used Content Analysis to analyze qualitative data, defined as "a set of techniques for analyzing communication processes through systematic and objective procedures for describing the content analysis of messages that allow the interpretation of knowledge about the conditions under which these messages were produced"[29] Bardin. We performed the analysis in the following steps:

- Pre-analysis – "float" analysis of each core; selection of documents to be submitted to analytical procedures; formulation of hypotheses and objectives; and category design and coding.
- Material exploration – during this phase, data are categorized according to similarities and differences.
- Content interpretation – discussion of categories and topics correlated with theoretical frameworks.

Results

Social-demographic data of participants

Below we present the sociodemographic data of the participants who answered the questionnaires between September 2021 and September 2022 (the first four waves called general sample). Table 1 shows the demographic data of this sample. The majority of the participants were female, the mean age was 42.6 (9.69) years, and most were graduated (81.4%). Most of the participants identified as white (64.3%) and were from the Brazilian middle class (39.3% declared to earn between US$ 634.63–1,269.23). The randomized sample, as can be seen in Table 2, follows a similar pattern.

Internal consistency of the questionnaires- general sample

For this sample, the internal consistency measured by cronbach's alpha for negative affect, was 0.88 in T0 and T1, while for Positive Affect was 0.90 (T0) and 0.89 (T1); for WHO-5, was 0.91 (T0) and 0.89 (T1); for PSS-10, was 0.79 and 0.80. The internal consistency measured with Cronbach's alpha for the 3 different versions of the literacy questionnaire were respectively 0.76, 0.92, and 0.89 (T0) and 0.88, 0.92 and 0.91 (T1).

Quantitative results of the questionnaires – general sample

The trimmed means ANOVA revealed significant effects of SEE Learning (interaction effect between group and time) for all variables (Table 3). The post hoc tests revealed an improvement from T0 to T1 in SEELOT group for all variables, except stress: PANAS positive (Trimmed mean difference = 1.29; $p = 0.023$; effect size = 0.15), PANAS negative (Trimmed mean difference = -1.69; $p = 0.028$; effect size = 0.15), WHO-5 (Trimmed mean difference = 1.18; $p = 0.031$; effect size = 0.15), PSS10 (Trimmed mean difference = -2.44; $p < 0.001$; effect size = 0.26), well-being (Trimmed mean difference = 0.73; $p = 0.003$; effect size = 0.21), attention (Trimmed mean difference = 0.46; $p = 0.049$; effect size = 0.14), frustration (Trimmed mean difference = -1.26; $p < 0.001$; effect size = 0.26), motivation (Trimmed mean difference = 1.12; $p < 0.001$; effect size = 0.32), and literacy (Trimmed mean difference = 2.20; $p < 0.001$; effect size = 0.63). Worsening was observed in the WLC group on the following scales: PANAS-Positive (Trimmed mean difference = -1.07; $p = 0.040$; effect size = 0.12); WHO-5 (Trimmed mean difference = -1.76; $p < 0.001$; effect size = 0.19), stress (Trimmed mean difference = 0.95; $p < 0.001$; effect size = 0.22), well-being (Trimmed mean difference = -0.60; $p = 0.002$; effect size = 0.17), frustration (Trimmed mean difference = 0.78; $p = 0.028$; effect size = 0.15), motivation (Trimmed mean difference = -0.60; $p = 0.005$; effect size = 0.14). As for the literacy questionnaires, there was an improvement also in the WLC (Trimmed mean difference = 0.62; $p = 0.047$; effect size = 0.18). It should also be considered that the SEELOT group had better results than the WLC at T1 in the PANAS-Positive scales (Trimmed mean difference = 2.25; $p = 0.002$; effect size = 0.27), WHO-5 (Trimmed mean difference = 2.46; $p = 0.001$; effect size = 0.29), PSS10 (Trimmed mean difference = -2.19; $p = 0.008$; effect size = 0.24), stress (Trimmed mean difference = -1.59; $p < 0.001$; effect size = 0.36), well-being (Trimmed mean difference = 0.90; $p = 0.001$; effect size = 0.26), frustration (Trimmed mean difference = -2.15; $p < 0.001$; effect size = 0.43). motivation (Trimmed mean difference = 1.16; $p < 0.001$; effect size = 0.33), and literacy score (Trimmed mean difference = 2.06; $p < 0.001$; effect size = 0.6). There were no significant differences in the T0 moment among the groups in any of the measured scales.

Next, we present only the randomized subsample of T0 and T1 questionaries. Here we find 48 SEELOT participants (who completed the training) and 94 WLC. Comparing, the General Sample and the Randomized Subsamples, we noticed significant and similar results.

Quantitative results of the questionnaires – randomized subsample

Assessing the differences between T0 and T1 in each group, robust post hoc tests indicated improvements in SEELOT regarding: PSS-10 (Trimmed mean difference = −3.43, corrected p-value = 0.009, Effect size = 0.36), Motivation (Trimmed mean difference = 1.10, corrected p-value = 0.022, Effect size = 0.32) and Literacy (Trimmed mean difference = 2.28, corrected p-value < 0.001, Effect size = 0 ,56). In literacy, improvement was observed from T0 to T1 also in Group WLC (Trimmed mean difference = 0.90, corrected p-value = 0.014, Effect

	SEELOT	WLC	Total
	(*N* = 156)	(*N* = 177)	(*N* = 333)
Gender			
Female	139 (89.1%)	161 (91.0%)	300 (90.1%)
Male	17 (10.9%)	14 (7.9%)	31 (9.3%)
Other	0 (0%)	1 (0.6%)	1 (0.3%)
Missing	0 (0%)	1 (0.6%)	1 (0.3%)
Age (years)			
Mean (SD)	42.7 (9.94)	42.5 (9.50)	42.6 (9.69)
Median [min, max]	41.0 [22.0, 73.0]	42.0 [18.0, 68.0]	41.0 [18.0, 73.0]
Education			
Higher secondary education	1 (0.6%)	5 (2.8%)	6 (1.8%)
Undergraduate/bachelor	26 (16.7%)	30 (16.9%)	56 (16.8%)
Graduate, MBA, MSc, PhD	129 (82.7%)	142 (80.2%)	271 (81.4%)
Monthly income* (USD)			
Less than 211,54	0 (0%)	2 (1.1%)	2 (0.6%)
211.55–634.62	24 (15.4%)	42 (23.7%)	66 (19.8%)
634.63–1,269.23	67 (42.9%)	64 (36.2%)	131 (39.3%)
1,269.24–1,903.85	24 (15.4%)	34 (19.2%)	58 (17.4%)
1,903.86–2,538.46	19 (12.2%)	11 (6.2%)	30 (9.0%)
2,538.47–3,173.08	9 (5.8%)	7 (4.0%)	16 (4.8%)
3,173.08 or more	6 (3.8%)	11 (6.2%)	17 (5.1%)
I'd rather not answer	7 (4.5%)	6 (3.4%)	13 (3.9%)
Marital status			
Married	93 (59.6%)	94 (53.1%)	187 (56.2%)
Divorced	24 (15.4%)	27 (15.3%)	51 (15.3%)
PNI	0 (0%)	2 (1.1%)	2 (0.6%)
Single	38 (24.4%)	52 (29.4%)	90 (27.0%)
Widow/widower	1 (0.6%)	2 (1.1%)	3 (0.9%)
Psychiatric disorders			
Anxiety	37 (23.7%)	40 (22.6%)	77 (23.1%)
Depression	12 (7.7%)	18 (10.2%)	30 (9.0%)
Bipolar disorder	4 (2.6%)	1 (0.6%)	5 (1.5%)
Other(s)	2 (1.3%)	3 (1.7%)	5 (1.5%)
None	114 (73.1%)	129 (72.9%)	243 (73.0%)
Uses medication			
No	125 (80.1%)	149 (84.2%)	274 (82.3%)
Yes	31 (19.9%)	28 (15.8%)	59 (17.7%)
Ethnicity			
East Asian	2 (1.3%)	3 (1.7%)	5 (1.5%)
White	98 (62.8%)	116 (65.5%)	214 (64.3%)
Indigenous	0 (0%)	1 (0.6%)	1 (0.3%)
Multiracial	0 (0%)	2 (1.1%)	2 (0.6%)
Other	43 (27.6%)	42 (23.7%)	85 (25.5%)
Undeclared	2 (1.3%)	0 (0%)	2 (0.6%)
African	11 (7.1%)	13 (7.3%)	24 (7.2%)

Table 1. Socio-demographic data of the participants. *Brazilian minimum wage at the time of questionnaire application: R$ 1,100.00 (approx. USS 211.55 in 2021).

size = 0.27). Worsening in WLC was observed in the variables: WHO-5 (Trimmed mean difference = −2.29, corrected *p*-value = 0.001, Effect size = 0.23), Stress (Trimmed mean difference = 1.48, *p*-value corrected < 0.001, Effect size = 0.29), Frustration (Trimmed mean difference = 0.91, corrected *p*-value = 0.045, Effect size = 0.17) and Motivation (Trimmed mean difference = −0.81, corrected *p*-value = 0.012, Effect size = 0.20). Although only worsening of frustration was observed on the WLC, the effect size of a possible improvement appeared larger than the effect size of the worsening (Trimmed mean difference = −1.17, corrected *p*-value = 0.144, Size of effect = 0.28), suggesting that the fact that the sample is smaller makes the test less sensitive. Comparing the groups at T1, the SEELOT Group had better results regarding: WHO-5 (Trimmed mean difference = 2.90,

	SEELT (*N* = 48)	WLC (*N* = 94)	Total (*N* = 142)
Gender			
Female	43 (89.6%)	85 (90.4%)	128 (90.1%)
Male	5 (10.4%)	7 (7.4%)	12 (8.5%)
Other	0 (0%)	1 (1.1%)	1 (0.7%)
Missing	0 (0%)	1 (1.1%)	1 (0.7%)
Age (years)			
Mean (SD)	43.6 (11.5)	43.6 (9.23)	43.6 (10.0)
Median [min, max]	43.0 [22.0, 73.0]	44.0 [18.0, 68.0]	43.5 [18.0, 73.0]
Age groups (years)			
< 25	2 (4.2%)	2 (2.1%)	4 (2.8%)
25–34	6 (12.5%)	14 (14.9%)	20 (14.1%)
35–44	21 (43.8%)	32 (34.0%)	53 (37.3%)
45–54	11 (22.9%)	36 (38.3%)	47 (33.1%)
55–64	5 (10.4%)	9 (9.6%)	14 (9.9%)
>= 65	3 (6.3%)	1 (1.1%)	4 (2.8%)
Education			
Higher secondary education (incomplete or complete)	1 (2.1%)	2 (2.1%)	3 (2.1%)
Undergraduate/bachelor (Incomplete or complete)	8 (16.7%)	15 (16.0%)	23 (16.2%)
Graduate, MBA, MSc, PhD (Incomplete or complete)	39 (81.3%)	77 (81.9%)	116 (81.7%)
Monthly income* (R$)			
Less than 1.100,00	0 (0%)	1 (1.1%)	1 (0.7%)
1.100,01–3.300,00	11 (22.9%)	17 (18.1%)	28 (19.7%)
3.300,01–6.600,00	19 (39.6%)	31 (33.0%)	50 (35.2%)
6.600,01–9.900,00	5 (10.4%)	24 (25.5%)	29 (20.4%)
9.900,01–13.200,00	3 (6.3%)	7 (7.4%)	10 (7.0%)
13.200,01–16.500,00	5 (10.4%)	4 (4.3%)	9 (6.3%)
16.500,00 or more	3 (6.3%)	7 (7.4%)	10 (7.0%)
I'd rather not answer	2 (4.2%)	3 (3.2%)	5 (3.5%)
Marital status			
Married	31 (64.6%)	52 (55.3%)	83 (58.5%)
Divorced	8 (16.7%)	16 (17.0%)	24 (16.9%)
PNI	0 (0%)	2 (2.1%)	2 (1.4%)
Single	8 (16.7%)	23 (24.5%)	31 (21.8%)
Widow/widower	1 (2.1%)	1 (1.1%)	2 (1.4%)
Psychiatric disorders			
Anxiety	8 (16.7%)	18 (19.1%)	26 (18.3%)
Depression	2 (4.2%)	9 (9.6%)	11 (7.7%)
Bipolar disorder	1 (2.1%)	1 (1.1%)	2 (1.4%)
Other(s)	1 (2.1%)	1 (1.1%)	2 (1.4%)
None	38 (79.2%)	68 (72.3%)	106 (74.6%)
Uses medication			
No	40 (83.3%)	77 (81.9%)	117 (82.4%)
Yes	8 (16.7%)	17 (18.1%)	25 (17.6%)
Ethnicity			
Asian	1 (2.1%)	1 (1.1%)	2 (1.4%)
European	32 (66.7%)	69 (73.4%)	101 (71.1%)
Native	0 (0%)	1 (1.1%)	1 (0.7%)
Mixed European and African	13 (27.1%)	18 (19.1%)	31 (21.8%)
Other	0 (0%)	1 (1.1%)	1 (0.7%)
I'd rather not answer	1 (2.1%)	0 (0%)	1 (0.7%)
African	1 (2.1%)	4 (4.3%)	5 (3.5%)

Table 2. Analysis of actually randomized classes only: demographic characteristics of actually randomized participants. *Brazilian minimum wage at the time of questionnaire application: R$ 1,100.00.

	SEELOT (*N* = 156)		WLC (*N* = 177)		*P*-Value	F-Value
	T0	T1	T0	T1	Interaction	Interaction
PANAS positive						
Mean (*SD*)	29.9 (5.99)	31.0 (5.15)	29.4 (6.55)	28.5 (6.39)	< 0.001	*F* (1, 184.32)
Median [min, max]	30.0 [15.0, 45.0]	31.5 [17.0, 43.0]	30.0 [11.0, 44.0]	29.0 [13.0, 43.0]		12.21
PANAS Negative						
Mean (*SD*)	21.6 (7.42)	20.0 (6.96)	21.3 (7.36)	21.7 (7.47)	0.017	*F* (1, 176.11)
Median [min, max]	20.0 [10.0, 43.0]	19.0 [10.0, 46.0]	20.0 [10.0, 40.0]	20.0 [10.0, 41.0]		5.72
WHO-5						
Mean (*SD*)	13.9 (5.06)	15.0 (4.49)	14.1 (5.66)	12.8 (5.47)	< 0.001	*F* (1, 184.16)
Median [Min, Max]	15.0 [3.00, 25.0]	15.0 [3.00, 25.0]	15.0 [2.00, 25.0]	13.0 [0, 25.0]		20.72
PSS-10						
Mean (*SD*)	19.7 (6.51)	17.6 (6.18)	19.4 (6.22)	19.5 (6.29)	< 0.0001	*F* (1, 174.88)
Median [Min, Max]	20.0 [1.00, 34.0]	17.0 [2.00, 34.0]	19.0 [5.00, 34.0]	20.0 [3.00, 35.0]		16.17
Stress						
Mean (*SD*)	5.16 (2.86)	4.74 (2.71)	5.05 (2.75)	5.90 (2.69)	< 0.001	*F* (1, 174.36)
Median [min, max]	5.00 [0, 10.0]	5.00 [0, 10.0]	5.00 [0, 10.0]	6.00 [0, 10.0]		15.34
Well-being						
Mean (*SD*)	6.42 (2.12)	7.08 (1.99)	6.80 (2.23)	6.39 (2.23)	< 0.0001	*F* (1, 175.32)
Median [min, max]	7.00 [0, 10.0]	8.00 [1.00, 10.0]	7.00 [0, 10.0]	6.00 [0, 10.0]		22.19
Attention						
Mean (*SD*)	6.78 (2.01)	7.13 (1.79)	6.94 (2.09)	6.76 (2.03)	0,007	*F* (1, 184.28)
Median [min, max]	7.00 [1.00, 10.0]	7.00 [2.00, 10.0]	7.00 [1.00, 10.0]	7.00 [0, 10.0]		7.44
Frustration						
Mean (*SD*)	4.43 (2.86)	3.41 (2.54)	4.60 (2.87)	5.17 (3.02)	< 0.0001	*F* (1, 185.99)
Median [min, max]	4.00 [0, 10.0]	3.00 [0, 10.0]	4.00 [0, 10.0]	5.00 [0, 10.0]		21.13
Motivation						
Mean (*SD*)	6.37 (2.35)	7.39 (2.03)	6.77 (2.42)	6.27 (2.56)	< 0.0001	*F* (1, 178.02)
Median [min, max]	7.00 [0, 10.0]	8.00 [1.00, 10.0]	7.00 [0, 10.0]	7.00 [0, 10.0]		30.75
Literacy score						
Mean (*SD*)	4.39 (1.97)	6.36 (2.02)	3.89 (2.04)	4.41 (1.99)	< 0.0001	*F* (1, 144.60)
Median [min, max]	4.00 [0, 9.00]	7.00 [0, 10.0]	4.00 [0, 8.00]	5.00 [0, 9.00]		20.21
Missing	26 (16.7%)	25 (16.0%)	35 (19.8%)	42 (23.7%)		

Table 3. Positive and negative affect, well-being, perceived stress, attention, frustration, motivation and literacy results before and after 1 month in a trimmed-mean ANOVA. *$p < 0.05$. *WLC* waiting list control, *SEELOT* SEE-learning online training intervention group, *PANAS* positive and negative affect schedule, *WHO-5* world health organization well-being index, *PSS-10* perceived stress scale 10-item: literacy score - score of the questionnaire on social and emotional learning literacy.

corrected p-value = 0.022, Effect size = 0.34), Stress (Trimmed mean difference = −2.13, corrected p-value < 0.001, Effect size = 0.44), Well-being (Trimmed mean difference = 1.13, corrected p-value = 0.006, Effect size = 0.35), Frustration (Trimmed mean difference = −2.16, corrected p-value < 0.001, Effect size = 0.43), Motivation (Trimmed mean difference = 1.50, corrected p-value = 0.002, Effect size = 0.44) and Literacy (Trimmed mean difference = 2.03, corrected p-value < 0.001, Effect size = 0.63). No differences were observed between groups at T0 (Table 4).

Qualitative results

To illustrate the qualitative data, a word cloud was created with answers given by the interviewed participants to the question: Choose a single word to describe your experience with this training program ($N = 34$). In the word cloud, we notice the words "self-compassion", "self-knowledge" and "resilience" were predominant (Fig. 2).

The excerpts of the interviews are presented in Supplementary Material 1.

Analyzing the interviews within their respective categories, we observed a consistent positive trend among participants with regards to the training content. They appreciated that the focus was on enhancing their well-being, rather than solely training them to support their students. The predominant themes that emerged from the reports included the significance of self-compassion, self-care, compassion, and emotional management, which are central to the SEELOT pedagogic approach. Additionally, participants expressed satisfaction with the training program and highlighted the importance of feeling supported during the challenges brought about by the pandemic.

Despite their lack of familiarity with Social Emotional materials and teaching methods, participants demonstrated a commitment to implementing them with their students. They found the program and materials



Fig. 2. Word Cloud containing the answer to the question: Choose a single word to describe your experience with this training program.

to be practical and suitable for use in classrooms. However, a notable negative aspect was the teachers' apparent difficulties and insecurities in implementing the program in their classes. Many teachers expressed feeling overwhelmed with online classes, which was a common complaint among them.

	SEELOT (*N* = 48)		WLC (*N* = 94)		*P*-value	F-value
	T0	T1	T0	T1	Interaction	Interaction
PANAS positive						
Mean (*SD*)	30.0 (5.80)	30.7 (4.79)	29.5 (6.91)	29.2 (6.64)	0.22	*F* (1, 46.81)
Median [min, max]	30.0 [20.0, 45.0]	31.0 [20.0, 41.0]	30.0 [11.0, 44.0]	30.0 [13.0, 43.0]		1.24
PANAS negative						
Mean (*SD*)	19.7 (6.63)	18.9 (7.62)	19.9 (7.10)	20.7 (7.40)	0.076	*F* (1, 48.05)
Median [min, max]	18.5 [10.0, 40.0]	17.5 [10.0, 46.0]	18.0 [10.0, 40.0]	19.0 [10.0, 41.0]		3.29
WHO-5						
Mean (*SD*)	15.0 (4.61)	15.7 (4.59)	14.9 (5.70)	13.2 (5.73)	0.002	*F* (1, 55.14)
Median [min, max]	15.5 [5.00, 24.0]	17.0 [5.00, 25.0]	16.0 [3.00, 25.0]	13.0 [0, 25.0]		10.71
PSS-10						
Mean (*SD*)	19.7 (6.83)	16.7 (6.78)	19.0 (6.47)	18.4 (6.30)	0.018	*F* (1, 43.93)
Median [min, max]	20.0 [4.00, 34.0]	16.0 [2.00, 34.0]	19.0 [5.00, 34.0]	18.0 [3.00, 33.0]		6.01
Stress						
Mean (*SD*)	4.23 (2.78)	4.13 (2.53)	4.38 (2.78)	5.66 (2.89)	0.008	*F* (1, 50.77)
Median [min, max]	3.00 [0, 10.0]	4.00 [0, 10.0]	5.00 [0, 10.0]	6.00 [0, 10.0]		7.70
Well-being						
Mean (*SD*)	7.04 (2.08)	7.63 (1.47)	7.06 (2.12)	6.63 (2.13)	0.014	*F* (1, 55.48)
Median [min, max]	8.00 [2.00, 10.0]	8.00 [4.00, 10.0]	7.00 [1.00, 10.0]	7.00 [0, 10.0]		4.81
Attention						
Mean (*SD*)	6.85 (1.88)	7.21 (1.62)	6.91 (2.02)	6.81 (2.11)	0.167	*F* (1, 57.37)
Median [min, max]	7.00 [2.00, 10.0]	7.00 [3.00, 10.0]	7.00 [1.00, 10.0]	7.00 [0, 10.0]		1.96
Frustration						
Mean (*SD*)	4.10 (3.01)	3.00 (2.18)	4.16 (2.92)	4.88 (3.15)	0.007	*F* (1, 48.60)
Median [min, max]	3.50 [0, 10.0]	3.00 [0, 8.00]	4.00 [0, 10.0]	5.00 [0, 10.0]		7.97
Motivation						
Mean (*SD*)	6.69 (2.13)	7.75 (1.83)	6.86 (2.30)	6.20 (2.70)	< 0.001	*F* (1, 51.99)
Median [min, max]	7.00 [2.00, 10.0]	8.00 [3.00, 10.0]	7.50 [0, 10.0]	6.50 [0, 10.0]		14.85
Literacy score						
Mean (*SD*)	4.55 (1.81)	6.49 (2.07)	3.87 (1.94)	4.49 (1.89)	0.012	*F* (1, 45.08)
Median [min, max]	4.00 [1.00, 8.00]	7.00 [2.00, 10.0]	4.00 [0, 8.00]	5.00 [1.00, 8.00]		6.87
Missing	4 (8.3%)	3 (6.3%)	3 (3.2%)	8 (8.5%)		

Table 4. Summary of all variables, by group and time for randomized participants. $^{*}p < 0.05$. *WLC* waiting list control, *SEELOT* SEE-learning online training intervention group, *PANAS* positive and negative affect schedule; *WHO-5* world health organization well-being index, *PSS-10* perceived stress scale 10-item; literacy score - score of the questionnaire on social and emotional learning literacy.

Discussion

The aim of this study was to assess the impact of the SEELOT program on perceived stress, well-being, social and emotional learning literacy, positive and negative affect, attention, motivation, and frustration in schoolteachers within the Brazilian public school system. The study also evaluated the teachers' perception of the training program and its effects on their teaching abilities and personal life.

The results showed improvements in the scores of the SEELOT group in relation to well-being, positive and negative affect, stress, attention, frustration, and motivation before and after the intervention. These findings are significant, especially given reports of declining mental health among teachers worldwide during the pandemic[30].

Concerning the worsening of the positive affect in WLC (TO = 29.4; T1 = 28.5) and the worsening of the frustration indicator (T0 = 4.60; T1 = 5.17) in the same group, they may be associated with the pandemic and political scenario in Brazil, which directly affects public school teachers[31]. As we can see in Tables 3 and 4, randomized and non-randomized SEELOT samples had significant results, positive improvements, or the maintenance of well-being, from T0 to T1.

The results indicate that the SEELOT protocol is a viable and low-cost alternative, with promising outcomes in enhancing well-being and reducing stress, as well as increasing awareness leading to more compassionate and pro-social attitudes, which are essential for a more connected and diverse society[32]. However, SEL is not without criticism, as some educators worry that the values taught, such as resilience, equanimity, and kindness, may simply "tame students" negative emotions, hindering their ability to use them as tools for criticism and social development, and failing to contribute to the creation of active and socially conscious citizens[33]. The developers of SEELOT and the original SEEL program assert that these programs are specifically designed to promote ethical values and active compassion, with the goal of raising awareness and encouraging social engagement

among students and teachers in the communities they serve[15]. Our study was unable to explore these aspects, so further medium to long-term research is necessary to track the effects of SEELOT on teachers and students.

Practices within contemplation systems were widely applied in educational systems during the pandemic[34–36] offering an alternative to the emotional and psychological distress society was experiencing at various levels. The application of Mindfulness programs in university environments showed timid but satisfactory indicators of improvement among volunteers, based on a survey that evaluated the practice of online Mindfulness in German university students during social isolation, as a way of alleviating symptoms of loneliness, depression, and sadness[37].

When considering the expressiveness of the results, the general average improvement in the indicators appears to be modest based on the effect sizes. However, some factors must be taken into account. Being a teacher, especially in public schools, is considered one of the most stressful and strenuous professions[38]. Achieving an improvement in all indicators related to well-being within 4 weeks is significant, given the context of the pandemic and the general worsening of the mental state of teachers and students due to stress, loneliness, depression, and anxiety[39,40].

The sample was mostly made up of middle-aged women (90.1% with an average age of 42.6 years), college graduates (81.4%), having an income higher than that of most of the population (79.5%)[41]. Most of the participants were concentrated in the country's Southeast region, the most economically developed region in Brazil. During the qualitative interviews, most of the participants stated they were familiar with the themes (such as suggestions for a new modal of education) and open to them. This may explain the good results of the participants in the literacy tests and also their enthusiastic responses during qualitative interviews. It is important to consider a study of the program applied to teachers in less privileged regions of the country, which would be a challenge in terms of online application, due to difficulties on the internet and access to technology.

Conversely, even though the online version of the training program was well received, in 2021 and 2022 when the courses were given and data were collected, the teachers largely complained of a saturation with online classes during the Covid-19 pandemic. The shift to online classes was poorly assisted and done hastily due to the urgency required[31]. According to another study, "teachers and students are experiencing difficulties with the structure and provision of services for educational activities through school systems, and they have, for this reason, faced mental health problems, such as anxiety, emotional stress, sleep deprivation, social distancing, and social isolation"[42]. During this training, although the teachers reported feeling tired from attending online classes, 156 out of the 398 teachers who began the SEELOT protocol and finished the T0 questionnaires completed the course after one month. This represents a retention rate of 39.19%, which falls within the acceptable range for clinical trials (< 40%)[43]. Moreover, modern practices that utilize technology to disseminate, monitor, and promote self-care and contemplative practices, such as mobile applications, show promise as tools for maintaining well-being, preventing self-destructive tendencies, and reducing stress. This was demonstrated in a study on the use of a specific meditation application over 8 weeks, which revealed a 17% improvement in the perception of well-being (WHO-5) in the intervention group by the end of the program[44].

A limitation of the study was the impossibility of performing physiological tests on teachers, such as a measure in cortisol levels presented in the results obtained in a study about emotional balance through meditation, attention training and emotional management among North American teachers[45]. Because of the pandemic, it was also not possible to interview the teachers in person or have access to their students. Therefore, we had limited data about the impact of the program in their classes.

Based on the interviews, it is necessary for educational institutions, coordinators, and school directors to support the implementation of SEELOT. All participants spoke positively about the training program and expressed satisfaction in discovering that the primary emphasis was on the mental and emotional health of the teachers, rather than solely focusing on their work with students.

Future studies about the SEELOT effects on students, would be crucial to understand how and by which means these programs could be applied on a scaled basis in Brazilian schools. Further research should also be conducted to evaluate the impact of the program, the long-term adherence of teachers to the practices, and the utilization of SEEL pedagogical materials.

In conclusion, the Social Emotional and Ethical Learning Online Training improved the well-being, attention, motivation, and decreased frustration and stress levels in public school teachers. Additionally, they reported developing new skills and knowledge related to human values, emotional management, and the ability to handle the challenges of education. Therefore, SEELOT appears to be a promising protocol to implement for public school teachers, and it may also contribute to achieving a more equitable and accessible education.

Data availability

Data is provided within the manuscript or supplementary information files, and any additional information may be available upon reasonable request to the corresponding author.

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Author contributions

NVCJC and ESP were responsible for the idealization, development of the online model of SEELOT training and reviewed the manuscript. EHK was responsible for the design of the study, reviewed the manuscript and supervised the project. PRB and GVSR were responsible for collecting the study's quantitative data, both in the

elaboration of the questionnaire shots via REDCap, its maintenance and organization, as well as in its analysis and presentation. GVSR was also responsible for the qualitative interviews, their transcriptions, analysis and presentation, in addition to writing the text of the present study. JRS, PRB and SSL contributed to the design of the study, in addition to reviewing the manuscript. TF, co-advised the present study, reviewed the manuscript. FCK organized the qualitative analysis and reviewed the manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Additional information

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