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Evaluating the effectiveness of a social emotional learning intervention in alleviating academic stress: A sequential explanatory mixed-methods study among college students

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Abstract: Academic stress remains a major concern for college students in China in the post-COVID-19 context. This study examined the effectiveness of an eight-week Social Emotional Learning (SEL) intervention in reducing academic stress and enhancing selected social-emotional competencies among first-year students in a Chinese higher education institution. A sequential explanatory mixed-methods design was employed. Participants were 196 first-year students assigned to an experimental group (n = 98) and a control group (n = 98) in a quasi-experimental study. Quantitative data were collected through validated pre- and post-intervention measures of academic stress, self-esteem, emotional intelligence, and problem-solving skills, complemented by semi-structured interviews with a purposive subsample of intervention participants. Results indicated that students receiving the SEL intervention demonstrated significantly reduced academic stress and significant improvements in social-emotional competencies compared with the control group ($p < 0.001$). Qualitative findings further revealed that SEL intervention enhanced emotion regulation, reconstructed self-worth beyond academic performance, strengthened problem-solving confidence, and culturally embedded peer support contributed to these outcomes, so higher education should integrate social emotional learning into student development programs. Overall, the findings support the effectiveness and cultural relevance of SEL interventions in Chinese higher education and highlight their value for student development and curriculum design.

Keywords: academic stress; social emotional learning (SEL); quasi-experimental design; higher education; mental health; mixed-methods research

Introduction

Academic stress has emerged as a critical psychological concern in higher education, particularly in societies characterised by intense academic competition and high performance expectations (Pérez-Jorge et al., 2025; Ross et al., 2023). In recent years, growing empirical evidence has demonstrated that sustained academic pressure can significantly undermine students' psychological well-being, contributing to emotional dysregulation, maladaptive coping, and increased vulnerability to mental health problems (Benítez-Agudelo et al., 2025; Shin, 2024). In China, where academic achievement is closely tied to personal identity formation and future socioeconomic mobility, academic stress has become especially salient among university students (Chen et al., 2025; Han et al., 2024). The psychological burden associated with prolonged exposure to academic demands has been linked to adverse outcomes such as anxiety, burnout, and depressive symptoms, raising urgent concerns regarding students' mental health in the post-pandemic era (Sarfika et al., 2025). These developments highlight the need for psychologically grounded interventions that can effectively alleviate academic stress and promote adaptive emotional and cognitive functioning among university students (Frausing et al., 2025; Liu et al., 2025).

Academic stress as a psychological stressor in higher education

Academic stress is widely conceptualised as a psychological stressor arising from students' perceptions of academic demands exceeding their available coping resources. Previous studies have shown that academic stress is associated with a range of negative psychological outcomes, including emotional dysregulation, impaired cognitive functioning, maladaptive behavioural patterns, and mood disturbances (Pascoe et al., 2019; Haikalis et al., 2021). When such stressors persist over time, they may escalate into academic burnout and anxiety-related conditions and, in more severe cases, contribute to depressive symptomatology (Okechukwu et al., 2022).

The experience of academic stress is shaped by a complex interaction between individual psychological characteristics and contextual factors, including peer relationships, institutional expectations, and sociocultural norms. In the Chinese higher education context, academic success is often perceived as a primary determinant of self-worth and future opportunity, intensifying the psychological impact of academic challenges (Lei et al., 2021). Although family and peer influences play a role, school-related factors, such as academic workload, performance evaluation, teacher–student relationships, and peer dynamics, have been identified as more proximal determinants of academic stress among university students (Wong et al., 2021). These findings underscore the importance of institution-based psychological interventions that strengthen students' emotional regulation and coping capacities.

Social emotional learning as a psychological intervention

Social Emotional Learning (SEL) has been increasingly recognised as a structured psychological intervention aimed at enhancing individuals' socio-emotional competencies and adaptive coping skills (Luna et al., 2021).

SEL refers to a systematic educational and psychological process through which individuals develop essential competencies such as emotional awareness and regulation, empathy, interpersonal communication, ethical decision-making, and problem-solving abilities (Mahoney et al., 2020; Howard & Ferrari, 2021). These competencies enable individuals to understand and manage emotions, establish supportive relationships, and make responsible decisions in challenging situations.

A substantial body of research has examined the effectiveness of SEL interventions across mul-tiple contexts and populations. In educational contexts, SEL programmes have been most widely implemented in primary and secondary schools, where they have been shown to improve emotional regulation, social competence, behavioural adjustment and academic functioning among children and adolescents (Durlak et al., 2022). Meta-analytic evidence further suggests that structured SEL interventions can significantly enhance students' social-emotional skills while reducing behavioural difficulties and psychological distress. Beyond school settings, SEL-informed interventions have also been applied in community and youth development programmes, particularly for adolescents facing social or environmental risk, with the aim of fostering resilience, interpersonal competence, and adaptive coping (Cipriano et al., 2023). In addition, clinical and psychological support programmes have increasingly incorporated SEL-related components, such as emotional awareness training, self-regulation strategies, and cognitive coping techniques, to promote mental health and psychosocial adjustment among vulnerable populations.

Despite this growing body of evidence, the application of SEL in higher education remains comparatively limited. Most SEL research has focused on school-age populations, especially children and adolescents in primary and secondary educational settings, whereas university students have received far less attention (Durlak et al., 2022). This imbalance is important because university students face a distinct set of developmental and academic pressures, including heightened academic competition, identity-related transitions, career uncertainty, and increased demands for self-regulation. These challenges make socio-emotional competencies particularly important for maintaining psychological well-being and academic functioning during emerging adulthood. This limitation is especially evident in non-Western higher education contexts. Although SEL has shown promise across diverse intervention settings, relatively few studies have systematically examined its use as a structured psychological intervention among university students in China. Existing discussions in this area remain limited, and insufficient attention has been paid to the psychological mechanisms through which SEL may influence outcomes such as academic stress, self-esteem, emotional regulation and problem-solving. Moreover, because many established SEL models were developed in Western cultural contexts that emphasise individual emotional expression and autonomy, their applicability in collectivist university settings such as China cannot be assumed without empirical investigation.

From a psychological perspective, SEL interventions are grounded in emotional intelligence theory, social learning theory, and social cognitive theory, which collectively emphasise the role of emotional processing, observational learning, and cognitive appraisal in shaping behaviour and psychological adjustment (Wood, 2020). In summary, these perspectives provide an integrated framework for understanding how SEL interventions may enhance social-emotional competencies and ultimately reduce academic stress.

Through structured group-based activities, reflective exercises, and collaborative problem-solving, SEL interventions seek to modify individuals' emotional appraisal processes and behavioural responses to stress (Raisch et al., 2024). By fostering supportive social interactions and enhancing problem-focused coping strategies, SEL may reduce perceived academic stress and promote psychological resilience (Belaire et al., 2024). Rather than functioning solely as an educational programme, SEL can be conceptualised as a preventive psychological intervention that targets key mechanisms underlying stress regulation and emotional well-being in academic contexts (Blewitt et al., 2024). Accordingly, the present study examines SEL as a structured psychological intervention in Chinese higher education, with particular attention to both intervention effectiveness and the psychological mechanisms underlying change.

Empirical evidence and research gaps in non-western contexts

A substantial body of empirical research conducted primarily in Western educational settings has demonstrated the effectiveness of SEL interventions in improving emotional intelligence, self-regulation and coping strategies, while reducing stress, anxiety, and depressive symptoms among students (Cipriano et al., 2023; Durlak et al., 2022). Meta-analytic findings further indicate that SEL interventions produce both short-term and long-term psychological benefits, extending beyond academic outcomes to encompass broader aspects of psychosocial adjustment and emotional stability (McCormick et al., 2020).

However, developments in non-Western contexts have received comparatively less systematic attention. Existing international evidence suggests that SEL and related social-emotional interventions are increasingly being implemented across development and humanitarian settings in Africa, Asia and other Global South regions, but this evidence base remains uneven in quality, population coverage and contextual adaptation. For instance, a large systematic review of SEL and soft-skills interventions in development and humanitarian settings found that, although the literature is expanding, much of the established evidence and many best-practice models still originate from the Global North rather than from locally theorised non-Western contexts (Li et al., 2024).

Related work in East African refugee education similarly shows that SEL interventions in non-Western settings often face challenges of contextualisation, including inconsistent understandings of SEL, limited coordination across programmes and the use of Western-designed materials with insufficient local adaptation (Fitzsimons et al., 2020). More broadly, recent scholarship on culturally responsive SEL has emphasised that there remains a lack of research on deliberate cultural adaptation, despite the pressing need to ensure that SEL frameworks are meaningful across diverse cultural settings (Heidelburg et al., 2024). In essence, these studies suggest that the key gap in non-Western contexts is not simply whether SEL is beneficial, but how SEL should be adapted, implemented, and interpreted within specific sociocultural environments.

Despite these advances, empirical research examining the psychological effects of SEL interventions in Chinese higher education remains limited. Existing domestic studies are largely exploratory, and the systematic implementation of SEL-based interventions within Chinese universities has been constrained by structural and institutional barriers, including the absence of standardised frameworks and limited professional training in SEL methodologies (Chen & Yu, 2022). More specifically, few studies have employed rigorous intervention designs to assess whether SEL could effectively alleviate academic stress and enhance social-emotional competencies among Chinese university students. In addition, most existing studies have focused primarily on intervention outcomes, while giving comparatively less attention to the psychological mechanisms through which SEL exerts its effects.

Meanwhile, China represents a particularly important non-Western context for extending this line of inquiry. Although China is increasingly visible in international work on social and emotional skills, cross-national evidence shows that opportunities for emotion regulation and interpersonal skill development vary substantially across sites, and teacher preparedness for socio-emotional teaching remains uneven (Zong et al., 2024). This reinforces the need to examine SEL in context-specific ways rather than assuming that findings from Western educational systems can be directly transferred.

Moreover, many established SEL models originate from Western cultural contexts that emphasise individual emotional expression and autonomy, which may not fully align with the collectivist values and relational norms prevalent in Chinese society. This cultural incongruence highlights the need for culturally responsive and empirically validated SEL interventions that are sensitive to the psychological needs of Chinese university students (Lim et al., 2024). This issue may be especially salient in Chinese higher education, where students' stress experiences are shaped not only by academic workload, but also by culturally specific pressures such as intense performance competition, social comparison, and "involution"-like academic climates. Recent evidence from Chinese university settings suggests that these pressures are closely linked to emotional exhaustion and poorer well-being, indicating that socio-emotional interventions in China must be understood against a distinctive cultural and educational backdrop (Jiang et al., 2025).

Accordingly, three specific gaps remain. First, although non-Western SEL research is growing, rigorous intervention studies in higher education settings remain scarce, especially outside Western school-based populations. Second, the literature has paid insufficient attention to how context-specific cultural factors shape the implementation and effectiveness of SEL interventions. Third, within Chinese higher education in particular, few studies have used mixed-methods designs to examine both intervention outcomes and the psychological mechanisms through which SEL may alleviate academic stress.

To address these gaps, the present study adopts a sequential explanatory mixed-methods design. The quantitative phase evaluates intervention effectiveness, while the qualitative phase explores students' lived experiences to clarify the psychological mechanisms and culturally embedded processes underlying the observed changes.

The present study

Against this background, the present study develops and evaluates a structured Social Emotional Learning (SEL)–based psychological intervention designed for Chinese college students. Rather than focusing solely on the reduction of academic stress, this study adopts a broader perspective by examining whether participation in the intervention also enhances key socio-emotional and adaptive competencies, namely self-esteem, emotional intelligence, and problem-solving skills. Grounded in emotional intelligence theory, social learning theory, social cognitive theory, and group dynamics theory. Emotional intelligence theory emphasises the role of emotional perception, understanding, and regulation in promoting adaptive behaviour and stress management (Mayer et al., 2004). Social learning theory highlights the importance of observational learning and social interaction in the acquisition of behavioural and emotional competencies (Pratt et al., 2009). Social cognitive theory further explains how individuals' cognitive appraisal processes and self-regulatory mechanisms influence behavioural change and psychological adjustment (Bandura, 1991). Group dynamics theory focuses on enhancing group cohesion, developing students'ability.

Each of the dependent variables examined in this study is theoretically and contextually relevant. Academic stress is a major concern in Chinese higher education, where academic success is closely linked to social evaluation and future opportunity. Self-esteem is equally important because students in competitive learning environments may base self-worth heavily on performance outcomes, making them vulnerable to self-criticism and stress. Emotional intelligence is a central SEL-related competency that supports emotion regulation, interpersonal functioning, and coping. Problem-solving skills are also critical, as they enable students to respond to academic demands in a more structured and adaptive manner. In the Chinese context, these outcomes may be shaped by collectivist norms, relational expectations, and strong performance pressures, making it necessary to examine SEL effects within this specific non-Western higher education environment rather than assuming direct transferability from Western findings.

Goal of the study

Base on the theoretical basis and empirical evidence reviewed, the study adopts a sequential explanatory mixed-methods design to examine both the effectiveness of the intervention and the psychological mechanisms underlying its outcomes (Sweet & Michaelsen, 2007). The quantitative phase employs a quasi-experimental design to assess

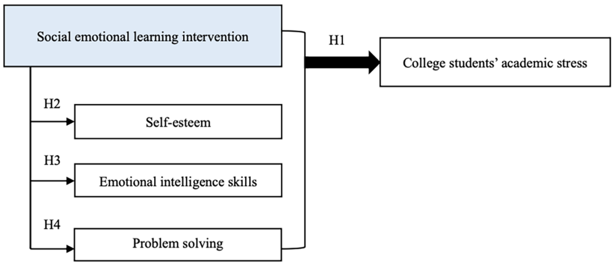

Figure 1. Conceptual framework

the impact of the SEL intervention on academic stress and key socio-emotional competencies, including self-esteem, emotional intelligence, and problem-solving skills. These competencies are widely recognised as core components of SEL and important psychological resources for coping with academic stress. To complement the quantitative results, a qualitative follow-up inquiry was conducted to explore students' lived experiences of the intervention and to provide deeper insight into how the program influenced their emotional regulation, self-perception, and coping strategies. By integrating quantitative outcome evaluation with qualitative explanations, this study aims to provide a more comprehensive understanding of how and why SEL interventions alleviate academic stress among college students in a non-Western higher education context. The conceptual framework is shown in Figure 1. Based on this framework,the following hypotheses were tested.

H1: Students who participate in the SEL intervention will report lower academic stress than those in the control group.

H2: Students in the SEL intervention group will report higher self-esteem than those in the control group.

H3: Students who receive the SEL intervention will demonstrate higher emotional intelligence than those in the control group.

H4: Students who participate in the SEL intervention will demonstrate stronger problem-solving skills than those in the control group.

Methods

Research design

This study adopted a sequential explanatory mixed-methods design, consisting of a quasi-experimental quantitative phase followed by a qualitative phase. Sequential explanatory mixed-methods designs are widely used to integrate quantitative outcomes with qualitative explanations (Ivankova et al., 2005). The quantitative component was used to evaluate the effectiveness of the Social Emotional Learning (SEL) intervention on academic stress, self-esteem,emotional intelligence skills, problem solving among college students. The qualitative phase was subsequently conducted to provide deeper explanations of the quantitative results. Specifically, qualitative interviews allowed the researchers to explore students' experiences of the intervention and to better understand the psychological processes underlying the observed changes. This mixed-methods approach enabled triangulation of findings, offered greater explanatory depth regarding intervention mechanisms, and provided contextual insights into how SEL interventions function within the cultural setting of Chinese higher education.

Participants and setting

This study was conducted at a mid-tier college in China and was officially approved by the institution. A non-probability sampling method (convenience sampling) was used to recruit participants. According to Lachenbruch and Lipsey (1990), a sample size of approximately 65 participants per group is typically required for a medium effect size (0.50) with 80% statistical power. A total of 208 first-year students from four different classes were recruited, representing both genders. There were initially 104 students in each group, and participants were randomised to either the experimental or control group. During the intervention, six participants from each group dropped out, resulting in a final sample size of 196 (98 in each group). These participants withdrew voluntarily due to schedule conflicts or personal reasons rather than exclusion based on eligibility criteria, and the equal attrition across groups occurred coincidentally. The age distribution of the participants was 18–20 years old, with 81.6% being 18 years old, 15.8% being 19, and 2.6% being 20 years old. There were 49 males and 49 females in the experimental group and 51 males and 47 females in the control group.

Following the quantitative phase, 20 participants from the experimental group were purposively selected for semi-structured interviews. This qualitative follow-up was included to explain and contextualise the quantitative results, allowing the researchers to gain deeper insight into the psychological processes and lived experiences underlying the observed intervention effects. A maximum variation sampling strategy was employed to capture diverse experiences of the intervention. Specifically, participants were selected based on varying degrees of change in academic stress scores, including students who demonstrated high reductions, moderate reductions, and minimal changes after the intervention. Participation in the interviews was voluntary and all interviewees provided informed consent. Table 1 presents the demographic characteristics of the participants, including age and gender distribution.

The homogeneity test showed no significant difference between the experimental and control groups on pre-test scores for all variables (all $p > 0.05$), indicating the group was equivalent before the intervention (see Table 2).

Measures

Demographic questionnaire

Basic participant data, such as age, gender, and major, were collected via the survey.

Educational stress scale for adolescents (ESSA)

The Chinese version's response format employed a 5-point Likert-type scale, where 1 meant strongly agree, and 5 meant strongly disagree, with a high score indicating less stress, the Chinese version of ESSA has demonstrated good construct validity and reliability among Chinese students (Sun et al., 2011). In the present study, the Cronbach's alpha coefficient for the scale was 0.87.

Table 1. Descriptive statistics of key demographic information

Variables	Total		Experimental group		Control group	
	N = 196	%	n = 98	%	n = 98	%
Age						
18	160	81.6%	92	93.9%	68	69.4%
19	31	15.8%	5	5.1%	26	26.5%
20	5	2.6%	1	1.0%	4	4.1%
Gender						
Male	100	51.0%	49	50.0%	51	52.0%
Female	96	49.0%	49	50.0%	47	48.0%

Table 2. Homogeneity test results for study variables

Variable	Source	Sum of squares	*df*	Mean square	*F*	Sig.
Academic stress	Between groups	0.86	1	0.86	0.02	0.90
	Within groups	9668.87	194	49.84		
	Total	9669.73	195			
Self-esteem	Between groups	0.02	1	0.02	0.001	0.98
	Within groups	5579.22	194	28.76		
	Total	5579.24	195			
Emotional intelligence skills	Between groups	0.74	1	0.74	0.01	0.92
	Within groups	13,869.10	194	71.49		
	Total	13,869.84	195			
Problem solving	Between groups	15.43	1	15.43	0.42	0.52
	Within groups	7136.13	194	36.78		
	Total	7151.56	195			

Note. Sum of Squares (SS) indicates the amount of variance explained by each source (between groups and within groups). df denotes the degrees of freedom associated with each variance component. Mean Square (MS) is obtained by dividing SS by df. The F statistic tests whether group variances differ significantly, and Sig. represents the probability value of the test. AS = Academic Stress; SE = Self-Esteem; EIS = Emotional Intelligence Skills; PS = Problem Solving.

Revised-positive version of rosenberg self-esteem scale (RSES-RPV)

RSES-RPV included 10 questions, all of which are positive statements, and is scored on a point scale from 1 (strongly disagree) to 5 (strongly agree). Previous research has confirmed the validity and reliability of the Chinese version of the scale among university students (Chen, 2015). In the present study,the test-retest reliability of the RSES-RPV in Chinese was 0.94.

Emotional intelligence scale (EIS)

The EIS of the Chinese version was 19 items total, and participants scored each one on a 5-point Likert scale (1 being strongly disagree and 5 being strongly agree) according to how they truly felt. Chinese version of the EIS has been validated in previous studies and shows good psychometric properties (Huang et al., 2008). In the present study,the Cronbach's alpha coefficient was 0.93.

Rational problem-solving scale (RPSS)

The RPSS, which had 13 questions with 5-point Likert ratings, was a part of the Chinese Social Problem-Solving Inventory Revised (C-SPSI-R). Previous studies have confirmed the construct validity and reliability of the Chinese version of the instrument (Siu & Shek, 2004). In the present study, the Cronbach's alpha coefficient was 0.91.

Intervention description

In this study, the researcher developed a novel social-emotional learning intervention aimed at alleviating psychological stress and enhancing academic stress management skills and adaptability among college students. The SEL intervention was based on an extensive literature review, incorporating the theory of emotional intelligence and the social-emotional learning model, based on theories of group dynamics, social cognition and social learning, and drawing on existing intervention methods and practical experience.

In the development stage, the SEL intervention was submitted to five experts with professional knowledge in the fields of educational psychology, social-emotional learning, and module design. To verify the effectiveness of the intervention. In the implementation stage, the SEL intervention is implemented by four instructors, all of whom hold master's degrees in educational psychology,

Table 3. SEL intervention overview

Week	Module	Objectives	Key activities	Targeted competencies
Week 1	Introduction to SEL intervention & academic stress	Introduce the SELintervention and help students recognize sources and impacts of academic stress	Program orientation; academic stress self-assessment; discussion of common stressors	Academic stress awareness; self-awareness
Week 2	Self-esteem development	Strengthen students' self-confidence and positive self-concept	Self-reflection exercises; strengths identification; self-affirmation activities	Self-esteem; self-confidence
Week 3	Emotional intelligence: emotional awareness	Help students identify and understand their emotional responses in academic contexts	Emotion recognition activities; emotional diary; guided discussion	Emotional awareness
Week 4	Emotional intelligence: emotional regulation	Develop strategies for managing negative emotions and stress	Mindfulness practice; relaxation training; cognitive reframing exercises	Emotional regulation; self-management
Week 5	Problem-solving skills (part 1)	Introduce structured problem-solving strategies	Problem identification exercises; group brainstorming; case study discussion	Problem solving
Week 6	Problem-solving skills (part 2)	Strengthen decision-making and solution evaluation skills	Scenario-based problem solving; collaborative decision-making activities	Problem solving; decision-making
Week 7	Coping with academic stress	Apply learned emotional and problem-solving skills to academic stress situations	Stress coping strategies workshop; time management exercises; peer sharing	Stress management; resilience
Week 8	Conclusion & integration	Integrate SEL competencies and develop future coping strategies	Program reflection; personal action plan; feedback session	Integrated SEL competencies

possess the National Counsellor II certification, have at least six years of teaching experience, and have both theoretical knowledge and practical experience in SEL.

The intervention lasts for eight weeks, with each 90-min session scheduled on Friday afternoons to ensure that students are able to participate successfully. Sessions are organised around a number of distinct themes, with each week focusing on a specific topic. Each session is divided into three parts: pre-session activities, classroom learning and post-session follow-up. Students are energised before class through warm-up games to create an engaging classroom atmosphere. The classroom portion focuses on interactive instruction designed to reinforce the week's theme through discussion, group work, and hands-on practice. The course uses a variety of group dynamic strategies to promote student participation and collaboration, including group discussions, role-playing, brainstorming, theatre performances, and other exercises as appropriate. Structured dialogue is also guided through targeted questions to encourage deeper thinking and communication among participants. At the end of each session, reflection and assessment are conducted to provide students with opportunities to review and consolidate what they have learnt, and students are required to write reflective reports. The specific interventions are as follows, see Table 3.

Research procedure and data collection

The research procedures are shown in Figure 2. Before the study started, the researcher informed the students of its purpose, its privacy protection policy, and obtained their written informed consent. All procedures performed in the study involving human participants adhered to the Declaration of Helsinki guidelines and were approved by the Institutional Ethics Committee (Reference code: IEC-2024-FOSSLA-0106). Under the instructor's guidance, all participants in the class completed the pre-test questionnaire consistently. While the control group received no help during the study, the experimental group went to weekly training sessions. Two weeks after the last training session, participants in both groups received the posttest. At the conclusion of the trial, the control group was given the identical intervention training. Semi-structured interviews were conducted two weeks after the post-test. Interview questions focused on students' experiences of academic stress, perceived changes in emotional interlligence, self-esteem, and problem-solving, and their reflections on culturally relevant aspects of the SEL intervention.

Data analysis

The data for this study were analysed using descriptive statistical analysis using SPSS 25.0. The sample's demographic characteristics were summarised using the mean, range (minimum and maximum values), and standard deviation (SD). In addition, the data set was checked for completeness for the presence; listwise deletion was used to address scenarios with limited missing data, and missing values were analysed. Less than 5% of the data was missing; its effect on the findings was deemed insignificant. And the data set was checked for potential outliers to ensure data completeness and accuracy.

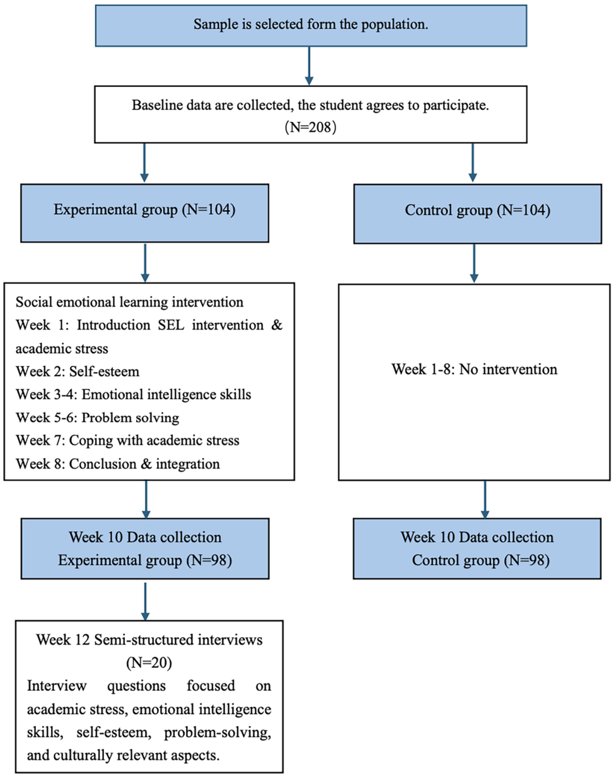

Figure 2. Research procedure

In addition to descriptive statistics, preliminary analyses using one-way analysis of variance (ANOVA) were conducted to determine if there was a statistically significant difference between the pre-test scores of the two groups of students. Inferential statistical analyses were also used to test the relationships and differences between the study variables. The differences between the two student groups on each outcome variable were evaluated using a one-way analysis of covariance (ANCOVA), which accounts for the covariates of interest. Differences between college students who participated in the social-emotional learning intervention and those who did not in terms of academic stress, self-esteem, emotional intelligence skills, and problem-solving skills were examined, controlling for pretest scores. Interview data were transcribed verbatim and analysed using thematic analysis following Braun and Clarke's six-step procedure. An inductive coding approach was employed to identify recurring patterns related to stress regulation mechanisms and socio-emotional development.

Results

Descriptive statistics

As shown in Table 4. Participants in the experimental group showed significant changes in the pre-test and post-test of academic stress, emotional self-esteem, emotional intelligence skills and problem-solving skills. Specifically, in terms of academic stress, participants in the experimental group had a mean score of 43.83 with a standard deviation of 6.10 on the pre-test and 51.11 with a standard deviation of 8.59 on the post-test, while those in the control group had a mean score of 43.69 with a standard deviation of 7.90 on the pre-test and 44.52 with a standard deviation of 7.93 on the post-test, and the post-test scores did not show any significant changes.

With respect to self-esteem, the experimental group's mean score was 34.27 with a standard deviation of 6.09 in the pre-test and rose to 40.37 with a standard deviation of 4.53 in the post-test; the control group's score was 34.24 with a standard deviation of 4.52 in the pre-test and 35.32 with a standard deviation of 4.09 in the post-test, and no discernible change was observed.

Regarding emotional intelligence skills, the experimental group scored M = 66.86 (SD = 9.23) in the pre-test, and the score increased to 72.02 with a standard deviation of 6.84 in the post-test, while the control group scored M = 66.73 (SD = 7.60) in the pre-test, and M = 67.34 (SD = 5.82) in the post-test, which did not show any significant difference.

In terms of problem solving ability, problem-solving scores increased from M = 45.00 (SD = 6.30) at pre-test to M = 50.84 (SD = 4.63) at post-test. In contrast, the control group showed only slight changes, with problem-solving scores increasing from M = 45.56 (SD = 5.82) to M = 46.48 (SD = 4.50). Overall, the experimental group exhibited greater improvements across all indicators, whereas the control group showed minimal change between pre- and post-test scores.

While the control group's score was 45.56 with a standard deviation of 5.82 in the pre-test and 46.48 with a standard deviation of 4.50 in the post-test, which was likewise not a significant change, the experimental group's mean score for problem-solving ability was 45.00 with a standard deviation of 6.30 in the pre-test and rose to 50.84 with a standard deviation of 4.63 in the post-test. Although the control group's pre and post-test scores for the four factors did not change significantly, the experimental group demonstrated considerable improvement in all indicators.

Table 4. Descriptive Statistics for all constructs (pretest and posttest scores)

	Pretest score		**Posttest score**	
	Experimental group (n = 98)	**Control group (n = 98)**	**Experimental group (n = 98)**	**Control group (n = 98)**
	M (SD)	M (SD)	M (SD)	M (SD)
Academic stress	43.83 (6.10)	43.69 (7.90)	51.11 (8.59)	44.52 (7.93)
Self-esteem	34.27 (6.09)	34.24 (4.52)	40.37 (4.53)	35.32 (4.09)
Emotional intelligence skills	66.86 (9.23)	66.73 (7.60)	72.02 (6.84)	67.34 (5.82)
Problem-solving	45.00 (6.30)	45.56 (5.82)	50.84 (4.63)	46.48 (4.50)

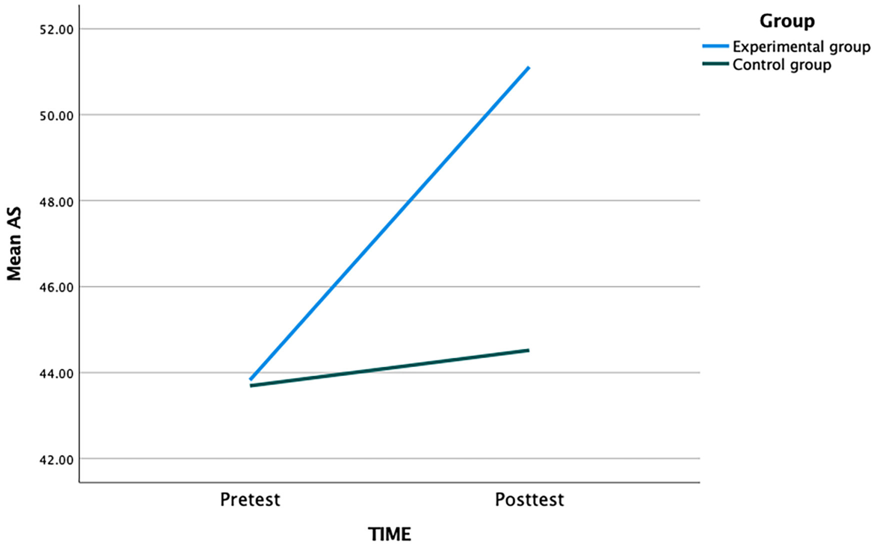

Figure 3. Academic stress means of both groups (pretest and posttest scores)

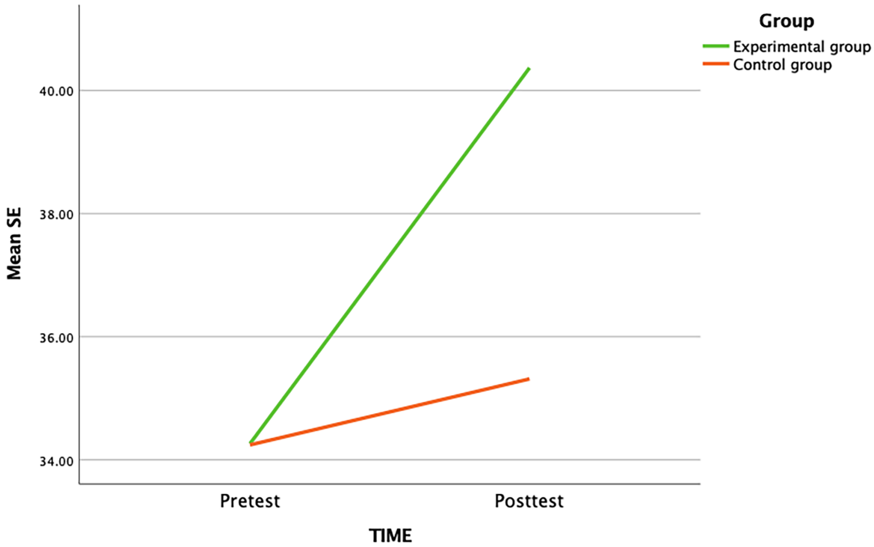

Figure 4. Self-esteem means of both groups (pretest and posttest scores)

The experimental and control groups' mean scores on academic stress during the pre-test and post-test are graphically displayed in Figure 3, the results showed that the experimental group's scores on the post-test of academic stress were significantly higher, and according to the scoring method, the high score indicating less academic stress level, so it indicates that the SEL intervention effectively reduces students' academic stress. Figure 4 displays the changes in the mean self-esteem score. Figures 5 and 6 display the changes in the mean emotional intelligence skills and problem-solving of both groups. The results show that the mean scores of the experimental group were significantly higher than those of the control group in these variables after the intervention, especially in the areas of self-esteem and problem-solving skills. This result indicates that the SEL intervention effectively enhances their self-esteem, emotional intelligence skills and problem-solving abilities in the experimental group, which further validates the positive effects of the present study's interventions and provides strong support for the promotion and application of the Social Emotional Learning (SEL) intervention.

SEL intervention outcomes

The study first tested the assumptions of normality, linear relationship, homogeneity of variance, homogeneity of regression slopes and reliable measurement of covariates to ensure that these assumptions were not violated. In order to compare the differences between the experimental group (students who received the SEL intervention) and the control group (students who did not receive the intervention) in terms of academic stress, self-esteem, emotional intelligence skills, and problem-solving skills, a one-way between-groups analysis of covariance (ANCOVA) was used. At the conclusion of the intervention, the four scores were the dependent variable, while the kind of intervention (SEL intervention or no intervention) was the independent variable. Participants' pre-intervention academic stress and emotional intelligence skills scores were used as covariates in the analyses.

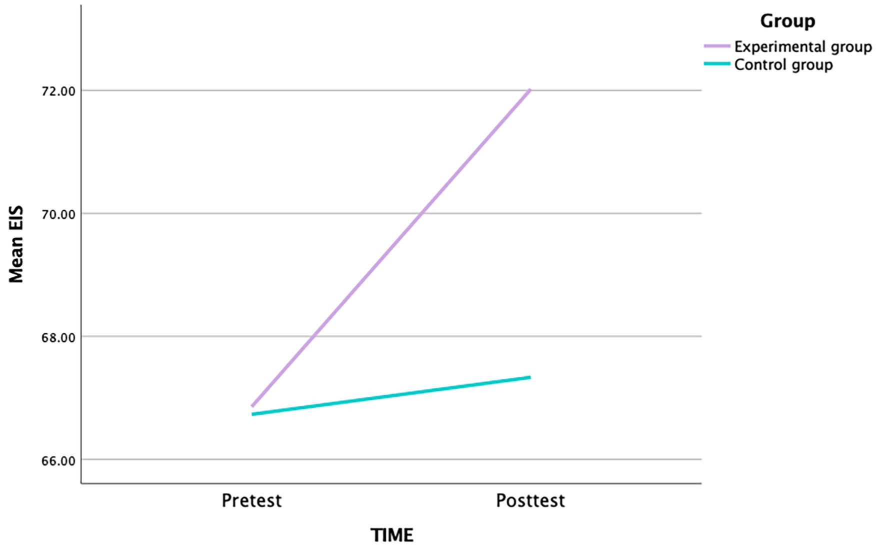

Figure 5. Emotional intelligence skills means of both groups (pretest and posttest scores)

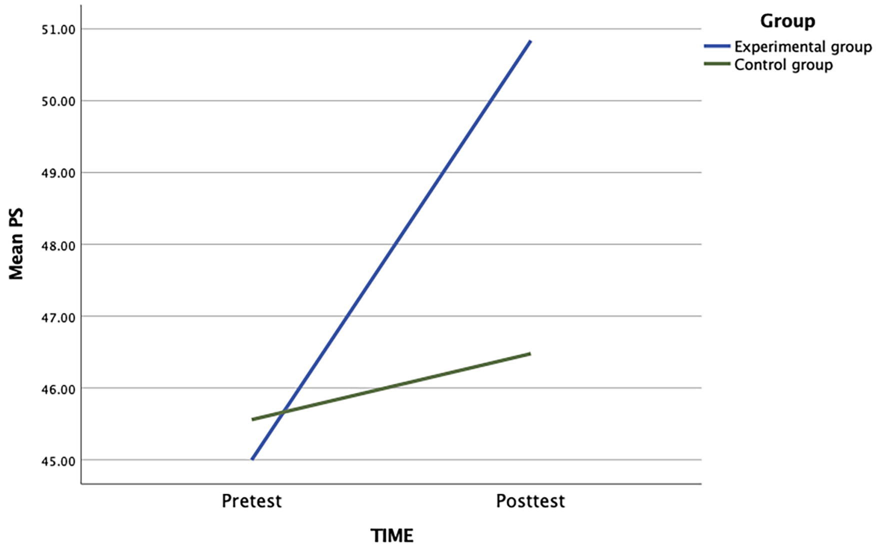

Figure 6. Problem solving means of both groups (pretest and posttest scores)

Table 5 presents the ANCOVA results comparing the experimental and control groups across the four study variables while controlling for pre-test scores. The regression coefficient (*B*) represents the adjusted mean difference between the two groups, and the standard error (*SE*) indicates the precision of this estimate. The F statistic with its associated degrees of freedom ($df = 1$) tests whether the adjusted group differences are statistically significant. The results show significant group effects for all variables: academic stress ($F = 43.71, p < 0.001, \eta_p{}^2 = 0.19$), self-esteem ($F = 91.05, p < 0.001, \eta_p{}^2 = 0.32$), emotional intelligence skills ($F = 38.38, p < 0.001, \eta_p{}^2 = 0.17$), and problem-solving ($F = 79.97, p < 0.001, \eta_p{}^2 = 0.29$). These findings indicate that the experimental group demonstrated significantly higher adjusted mean scores than the control group across all outcomes, with moderate to large effect sizes.

Qualitative findings: students' experiences of the SEL intervention

To further elucidate the mechanisms underlying the quantitative effects of the Social Emotional Learning (SEL) intervention, semi-structured interviews were conducted with a purposively selected subsample of students from the experimental group. Thematic analysis revealed four interrelated themes that collectively explain how participation in the SEL program contributed to reduced academic stress and enhanced socio-emotional competencies.

Theme 1: reframing academic stress through emotional awareness and regulation

A dominant theme across participants' accounts was a heightened awareness of emotional states and improved capacity for emotion regulation. Before the intervention, many students described academic stress as diffuse, overwhelming, and difficult to control. Through SEL activities such as emotional identification, guided reflection, and

Table 5. ANCOVA results for study variables

Variable	Group	M (SD)	*B*	*SE*	*df*	*F*	Sig.	η_p^2
Academic stress	Experimental Control	51.11 (8.59) 44.52 (7.93)	6.51	0.07	1	43.71	<0.001	0.19
Self-esteem	Experimental control	40.37 (4.53) 35.32 (4.09)	5.04	0.53	1	91.05	<0.001	0.32
Emotional intelligence skills	Experimental control	72.02 (6.84) 67.34 (5.82)	4.63	0.75	1	38.38	<0.001	0.17
Problem solving	Experimental control	50.84 (4.63) 46.48 (4.50)	4.62	0.52	1	79.97	<0.001	0.29

Note. B = Regression Coefficient; SE = Standard Error; df = Degrees of Freedom.

group discussion, students reported becoming more capable of recognising stress signals and understanding their emotional triggers. This increased emotional awareness enabled students to respond to academic stressors more deliberately and adaptively. Rather than reacting impulsively or engaging in avoidance behaviours, participants described using regulation strategies learned during the intervention to manage anxiety related to examinations, deadlines, and academic evaluations. As a result, academic stress was increasingly perceived as manageable rather than debilitating. These qualitative accounts provide experiential support for the statistically significant reduction in academic stress observed in the quantitative phase.

Theme 2: reconstruction of self-worth beyond academic performance

Participants consistently emphasised changes in how they evaluated their self-worth. Before participating in the SEL intervention, many students equated personal value almost exclusively with academic outcomes, such as grades and class ranking. This performance-contingent self-evaluation intensified academic stress and fear of failure. Through structured self-reflection, peer affirmation, and self-esteem-focused exercises, students described developing a more stable and internalised sense of self-worth. They began to recognise personal strengths, effort, and emotional growth as meaningful sources of self-evaluation, independent of academic performance. Several participants noted that this shift reduced excessive self-criticism and mitigated pressure associated with competitive academic environments. This theme aligns closely with the large effect size for self-esteem found in the quantitative analysis and suggests that enhanced self-esteem functioned as a key psychological mechanism through which academic stress was alleviated.

Theme 3: strengthened problem-solving confidence and adaptive coping

Another prominent theme concerned the development of problem-solving confidence and adaptive coping strategies. Participants reported that experiential activities, including role-playing, collaborative problem-solving tasks, and scenario-based discussions, helped them approach academic challenges more systematically. Students described a transition from emotion-driven reactions to more structured problem-solving approaches, such as breaking tasks into manageable steps, seeking peer or instructor support, and evaluating multiple solutions before acting. This enhanced sense of control and agency reduced feelings of helplessness and contributed to more proactive engagement with academic demands. These qualitative findings help explain the significant post-intervention gains in problem-solving skills identified in the quantitative results and illustrate how improved coping competence contributed to stress reduction.

Theme 4: cultural compatibility and the central role of peer support

Participants highlighted the cultural relevance of the SEL intervention, particularly its emphasis on group-based learning and peer interaction. Many students indicated that collective discussion and shared reflection created a psychologically safe environment that encouraged emotional expression and mutual support. Within this supportive group context, students felt less isolated in their academic stress experiences and were more willing to share difficulties and coping strategies. Peer learning was perceived as especially meaningful, as students could relate to others facing similar academic pressures. Participants noted that this collective approach resonated strongly with cultural values emphasising relational harmony, cooperation, and shared responsibility. This theme underscores the importance of culturally responsive SEL design and suggests that the intervention's effectiveness was partly attributable to its alignment with collectivist orientations prevalent in the Chinese higher education context. As summarised in Table 6, the qualitative themes provide explanatory insight into the psychological mechanisms underlying the statistically significant quantitative outcomes.

Integration of the key findings

Using a sequential explanatory mixed-methods design, this study integrated quantitative outcomes with qualitative insights to explain how the SEL intervention alleviated academic stress. The significant reduction in academic stress observed in the experimental group was qualitatively explained by students' enhanced emotional awareness and emotion regulation, which enabled them to perceive academic stressors as manageable rather than overwhelming. Similarly, the large quantitative gains in self-esteem were

Table 6. Summary of qualitative themes, interpretations and links to quantitative outcomes

Qualitative theme	Core interpretive meaning	Illustrative participant insight (paraphrased)	Corresponding quantitative outcome
Reframing academic stress through emotional awareness and regulation	Students developed the ability to identify emotional triggers and apply adaptive emotion regulation strategies, transforming stress from an overwhelming experience into a manageable psychological response.	*"I used to panic when assignments piled up, but now I can recognize my stress early and calm myself before it gets out of control."*	Significant reduction in academic stress
Reconstruction of self-worth beyond academic performance	Participants shifted from performance-contingent self-esteem to a more internalized and stable sense of self-worth based on effort, growth, and personal strengths.	*"I learned that my value is not only determined by my grades, but also by how I try and improve."*	Significant increase in self-esteem
Strengthened problem-solving confidence and adaptive coping	Students adopted structured, proactive approaches to academic challenges, enhancing their sense of control and reducing avoidance behaviors.	*"Instead of feeling helpless, I now break problems into steps and look for solutions or support."*	Significant improvement in problem-solving skills
Cultural compatibility and the central role of peer support	Group-based learning and peer interaction fostered psychological safety, normalization of stress experiences, and collective coping, consistent with collectivist cultural values.	*"Hearing classmates share similar pressures made me feel less alone and more supported."*	Improvement in emotional intelligence and overall intervention effectiveness

illuminated by participants' narratives describing a shift from performance-contingent self-worth toward a more internalised and stable sense of self-evaluation grounded in effort and personal growth. Improvements in problem-solving skills were supported by qualitative accounts of increased confidence, proactive coping, and structured approaches to academic challenges, which strengthened students' sense of control. In addition, qualitative findings highlighted the cultural compatibility of the group-based SEL intervention, with peer support and collective learning fostering psychological safety and normalising stress experiences within the Chinese higher education context. Taken together, the integration of quantitative and qualitative findings demonstrates that the SEL intervention reduced academic stress through interconnected psychological mechanisms involving emotion regulation, self-esteem reconstruction, problem-solving competence and culturally embedded peer support.

Discussion

This study designed and implemented a social-emotional learning (SEL) intervention grounded in social cognitive theory, social learning theory, emotional intelligence theory, and core SEL principles. Consistent with prior SEL research, students in the experimental group demonstrated significantly greater improvements than the control group in academic stress, self-esteem, emotional intelligence skills, and problem-solving abilities. These findings indicate that the SEL intervention not only effectively alleviated academic stress but also promoted key socio-emotional competencies that support students' personal growth and academic development.

Beyond establishing the effectiveness of the intervention, the mixed-methods design enabled a deeper examination of how and why these outcomes occurred. By integrating quantitative results with qualitative findings through a joint-display approach, the study provides a more comprehensive understanding of the psychological mechanisms underlying the observed statistical effects. The convergence between quantitative improvements and students' lived experiences strengthens the explanatory validity of the findings. What's more, the qualitative themes offer theory-based insight into the processes through which the intervention generated change, thereby connecting the empirical findings more closely to the conceptual framework introduced earlier.

According to the quantitative results, academic stress among college students was significantly reduced following participation in the SEL intervention. The intervention included modules on coping with academic stress, self-esteem, emotional intelligence, and problem-solving, among which the stress-coping component may have played a direct role in alleviating stress (Vestad & Tharaldsen, 2021). These findings are consistent with previous research indicating that SEL-based stress management strategies can effectively reduce perceived academic pressure.

Qualitative evidence further clarified this effect by revealing that students developed heightened emotional awareness and emotion regulation skills, allowing them to reinterpret academic stressors as manageable challenges rather than overwhelming threats. This integration suggests that emotion regulation functioned as a central mechanism linking the SEL intervention to reduced academic stress, complementing the statistically significant quantitative outcomes. This finding can be explained through the lens of Emotional Intelligence Theory, which emphasises the ability to perceive, understand and regulate emotions as a foundation for adaptive functioning. Students' accounts suggest that the intervention enhanced their capacity to identify emotional triggers and regulate stress responses more deliberately, thereby reducing the perceived intensity of academic stress.

Prior research has shown that enhanced self-esteem can mitigate academic stress (Michie et al., 2001), improved emotional intelligence facilitates stress perception and regulation (Verma et al., 2020), and strengthened problem-solving skills enable students to respond more effectively to academic difficulties (Aslan & Duruhan, 2020; Burke & Stewart, 2022). The present intervention incorporated these key components, and quantitative analyses confirmed significant gains across all corresponding variables in the experimental group. Thus, the reduction in academic stress appears to reflect not only the direct impact of stress-focused modules but also indirect effects arising from improvements in students' socio-emotional competencies.

This interpretation is strongly supported by qualitative findings indicating that students experienced a reconstruction of self-worth beyond academic performance, increased confidence in problem-solving, and greater perceived control over academic challenges. Together, these interrelated changes suggest a multidimensional pathway through which SEL interventions operate, reinforcing the complementary nature of quantitative and qualitative evidence. From a theoretical perspective, these changes are also consistent with Social Cognitive Theory, particularly its emphasis on self-evaluation, perceived agency and cognitive appraisal. As college students began to reassess their value beyond grades and developed stronger confidence in managing challenges, the intervention appeared to reshape both their self-beliefs and their coping orientations.

The effectiveness of the SEL intervention in alleviating academic stress aligns with previous empirical studies conducted in higher education contexts and further supports the applicability of SEL frameworks beyond Western settings. For example, Colomeischi et al. (2022) meta-analysis of 213 SEL-related studies reported significant gains in academic achievement, socio-emotional competencies, and mental health outcomes. The present findings extend this literature by providing mixed-methods evidence for the effectiveness of SEL interventions among Chinese college students.

In the specific context of Chinese higher education, the intervention demonstrated a particularly strong effect on self-esteem, with post-intervention scores increasing by an average of 6.10 units and a large effect size ($\eta_p^2 = 0.35$). This outcome reflects both developmental psychological needs and sociocultural influences embedded in the Chinese educational environment. Influenced by Confucian values, academic performance and social evaluation are often closely tied to self-worth, intensifying students' vulnerability to academic stress.

Qualitative findings revealed that SEL activities emphasising self-reflection, self-affirmation, and peer feedback helped students form a more internalised and stable sense of self-worth grounded in effort and personal growth rather than external evaluation alone. This culturally responsive shift provides an explanatory lens for the substantial quantitative gains in self-esteem observed in the experimental group. This theme is theoretically meaningful in relation to Social Cognitive Theory, which highlights the role of self-appraisal and internal belief systems in psychological adjustment. The intervention appears to have supported a shift from externally contingent self-worth toward more stable and self-directed forms of evaluation, thereby strengthening students' self-esteem in a culturally competitive academic environment.

Considering the highly competitive nature of the Chinese education system, where students often equate academic success with personal value (Wu et al., 2021), the SEL intervention plays a critical role in promoting healthier self-perceptions. These findings not only enrich the empirical evidence supporting SEL effectiveness but also offer culturally relevant insights for mental health education in Chinese higher education.

Students in the experimental group also showed significant improvements in emotional intelligence and problem-solving skills, with increases of 5.16 and 5.84 units, respectively. These results are consistent with previous studies highlighting the positive effects of SEL interventions on emotion regulation, interpersonal functioning, and psychological well-being (Alzahrani et al., 2019; Aghatabay et al., 2023; Hosokawa et al., 2024). The improvement in emotional intelligence is particularly consistent with Emotional Intelligence Theory, since SEL explicitly trains students to recognise, interpret, and regulate emotions in socially meaningful ways. In this sense, the increase in emotional intelligence was not only an intervention outcome, but also a theoretical confirmation that SEL functions through the development of emotional competencies central to psychological adaptation.

Qualitative data further indicated that experiential learning activities, group discussions, and peer collaboration enhanced students' confidence in applying problem-solving strategies and seeking support. This joint interpretation suggests that problem-solving competence functioned not only as an outcome but also as a coping resource that contributed to stress reduction. This finding aligns closely with both Social Cognitive Theory and Social Learning Theory. From a social cognitive perspective, students' greater confidence in solving problems reflects enhanced perceived efficacy and control over academic challenges. From a social learning perspective, the group-based structure of the intervention provided opportunities for modelling, observation, feedback, and collaborative learning, which likely supported the development of more adaptive problem-solving behaviours.

Implications for theory,research and practice

From a broader theoretical perspective, this study advances understanding of SEL mechanisms by integrating quantitative and qualitative evidence within the Chinese higher education context. The mixed-methods approach allowed for a nuanced examination of how social-emotional competencies interact with cultural values and academic pressures, thereby extending the cross-cultural applicability of SEL theory. More specifically, the four qualitative themes can be read as reflecting complementary theoretical pathways: emotional awareness and regulation support Emotional Intelligence Theory; reconstructed self-worth and greater perceived control reflect Social Cognitive Theory; and peer support, collaborative reflection, and shared learning experiences illustrate Social Learning Theory in practice. Taken together, these findings show that the intervention operated not through a single mechanism, but through interconnected emotional, cognitive and social processes.

On a practical level, the findings provide evidence-based guidance for developing culturally appropriate SEL interventions tailored to the needs of Chinese college students. Educational institutions may use these insights to design targeted SEL programs, strengthen mental health support systems, and incorporate social-emotional education into teacher professional development initiatives.

The qualitative findings further suggest that leveraging collectivist cultural strengths, such as peer support, cooperative learning, and relational harmony, can enhance the effectiveness and acceptability of SEL interventions in Chinese educational settings. In particular, the prominence of peer support in the qualitative data suggests that SEL may be especially effective in collectivist contexts when implemented through relational and group-based formats rather than purely individualised approaches. This further reinforces the importance of culturally responsive programme design in non-Western higher education settings.

Limitations and future directions

The present study has several limitations, including restricted sample representativeness, reliance on self-reported data, the absence of long-term follow-up and a relatively narrow theoretical framing. The study was conducted at a single university, limiting generalizability across regions and disciplines. In addition, self-report measures may be influenced by social desirability and subjective bias.

A further limitation concerns the study's theoretical scope. Although the intervention and interpretation were guided by emotional intelligence theory, social learning theory, social cognitive theory, and core SEL principles, these perspectives may not fully capture the complexity of academic stress in the Chinese higher education context. Academic stress in China is shaped not only by individual emotional and cognitive processes, but also by broader sociocultural influences, such as performance-oriented educational norms, family expectations, and collectivist values. Other theoretical perspectives, including Lazarus and Folkman's Coping Theory and Self-Determination Theory, may offer additional insight into how students appraise academic demands, regulate stress, and respond to their needs for autonomy, competence, and relatedness.

Although the inclusion of qualitative interviews partially addressed the limitations of methodological homogeneity by capturing students' lived experiences, future research should further strengthen mixed-methods designs by incorporating behavioural observations and longitudinal qualitative follow-ups and broader theoretical integration.

Future studies should expand sampling across diverse institutional and regional contexts, integrate multi-modal data sources, adopt longitudinal designs to examine the sustainability of SEL intervention effects, and draw on additional theoretical frameworks to provide a more comprehensive understanding of socio-emotional development and academic stress in non-Western higher education settings. Such efforts will enhance the robustness, generalizability, and practical relevance of SEL research in higher education.

Conclusion

This study provides strong evidence that Chinese college students benefit from an 8-week Social Emotional Learning (SEL) intervention that reduces academic stress and improves socio-emotional skills. The intervention, which was based on group dynamics, emotional intelligence, and cognitive-behavioural theories, improved the experimental group's self-esteem, emotional intelligence, and problem-solving abilities while also significantly reducing academic stress. These results highlight how SEL can be effectively adapted to the context of Chinese higher education, where academic success is frequently linked to one's sense of self-worth. The program gave students useful skills to deal with stressors by incorporating structured activities like role-playing, group problem-solving, and reflective exercises, thereby supporting both psychological well-being and academic adjustment. This was also consistent with the relational and collectivist orientations that shape student development in Chinese educational settings.

Beyond demonstrating intervention effectiveness, this study also contributes new knowledge by showing that SEL may operate through multiple interrelated mechanisms, including improved emotional regulation, more stable self-worth, stronger coping confidence, and supportive peer interaction. In this way, the study extends existing SEL research beyond its dominant Western and school-based focus and provides evidence for its relevance in non-Western higher education contexts.

The findings also have important practical implications. For teachers and student support staff, SEL-informed activities may be used to promote healthier coping patterns and socio-emotional growth. For campus administrators, the results suggest that group-based SEL modules could be incorporated into university orientation programmes, first-year experience courses, or broader student development initiatives. For policymakers in China, the study highlights the value of embedding preventive and development-oriented mental health strategies into higher education systems in order to better support student well-being in academically competitive environments.

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Availability of Data and Materials: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Ethics Approval: All procedures performed in the study involving human participants adhered to the Declaration of Helsinki guidelines and were approved by the Institutional Ethics Committee, UCSI University (Reference code: IEC-2024-FOSSLA-0106). Informed consent was obtained from all individual participants included in the study.

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