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How Emotion Nurtures Mentality: The Influencing Mechanism of Social-Emotional Competency on the Mental Health of University Students

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ABSTRACT

Social-Emotional Competency (SEC), regarded as a critical psychological resource for individuals to adapt to social environments, is an effective protective factor for students' mental health, impacting their future success and well-being. Analyzing the impact of SEC on university students' mental health can offer valuable insights for nurturing talents with healthy psychological and physical development. Based on data from two large-scale surveys of Chinese university students, this study designed two comprehensive Multiple Mediation Models involving SEC, stress, coping strategies, and stress reaction to explore the pathway of emotion nurturing mentality. **Study 1** utilized a parallel mediation model to examine the relationships between SEC, academic stress, interpersonal stress, and stress reactions. The results indicated that SEC negatively predicted academic stress, interpersonal stress, and stress reactions. Additionally, academic and interpersonal stress mediated the relationships between SEC and stress reactions in parallel. Extending these findings, **Study 2** further investigated the role of coping strategies. By constructing a multiple-chain mediation model, it examined the predictive relationships among SEC, academic stress, interpersonal stress, three types of coping strategies, and stress reactions. The findings indicated that SEC negatively predicted stress, problem-avoiding strategy, and stress reactions, while positively predicting problem-solving and assistant-seeking strategies. Furthermore, the two stress types and three coping strategies significantly mediated the relationship between SEC and stress reactions. This indicated that higher SEC was associated with reduced stress and more adaptive coping strategies and subsequently contributed to more favorable stress reactions. This research explored the impact of university students' SEC on mental health and its relational mechanisms, aiming to provide theoretical reference and practical insights for future efforts in cultivating SEC among university students to adjust academic and interpersonal stress, to enhance problem-solving and stress resistance capabilities, and to maintain their mental health.

KEYWORDS

Social-Emotional Competency; academic stress; interpersonal stress; stress reaction; coping strategies; Multiple Mediation Model

Introduction

As the economy rapidly evolves and societal structures undergo dramatic changes, university students encounter unprecedented uncertainties and complexities, which may incur psychological pressures [1]. Academic stress, interpersonal challenges, and adapting to university life collectively cause a heavy burden on students' mental and physical health [2]. Particularly since the outbreak of COVID-19 in 2019, the mental health problems of university students have become increasingly severe with notable rises in anxiety and depression [3,4], which further

intensify their academic and social difficulties [5]. Social-Emotional Competency (SEC) is increasingly recognized as a key psychological resource essential for enhancing the mental health and overall well-being of university students [6,7]. However, despite widespread acknowledgement of the close relationship between SEC and mental health, the specific mechanisms by which SEC affects the mental health of university students remain unclear and need further exploration.

External stressors are primary triggers for mental health issues, and negative physical and mental stress reactions triggered by these stressors are fundamental expressions of mental health problems. Moreover, the coping strategies individuals employ in stressful situations are crucial in influencing the outcomes of stress. All these factors are closely linked to mental health [8]. This study is grounded in the Cognitive Theory of Stress and Coping. It examines stress reactions as indicators of mental health, with a particular focus on the psychological processes of both physical and mental stress reactions experienced by students in stressful situations. Anchored in empirical data and model analysis, this study comprehensively examines the impact of SEC on students' stress, coping strategies, and stress reactions.

Literature Review

The cognitive theory of stress and coping: stressors, stress reactions, and coping strategies

Psychological stress is generally understood from two aspects: stressors and stress reactions. Stressors refer to external stimulatory events that trigger stress reactions, which describe a state of continuous mental and physical tension that arises when external demands exceed an individual's capacity and resources [9]. However, not all stressors necessarily lead to stress reactions; their emergence is closely tied to the individual's subjective perception of the stressor and the adopted coping strategies. According to the Cognitive Appraisal Theory, the impact of stressors largely depends on the individual's subjective perception of the stressor rather than the objective stressor itself [8]. Primary appraisal focuses on whether a specific event affects the individual's well-being, i.e., whether the event itself has potential threat, loss, or challenge. Secondary appraisal involves the individual's assessment of their psychological, physical, or social resources to manage the stressor successfully. In the secondary appraisal, if the individual perceives insufficient resources to meet the challenge, negative stress reactions such as tension and anxiety may arise. Conversely, if the secondary appraisal is positive, and the individual believes they have adequate resources to face the challenge, negative stress reactions may not occur. Moreover, if individuals adopt effective coping strategies, they may experience less stress reactions [10].

University students' stressors arise from various aspects such as academic tasks, interpersonal relationships, and career planning, among which academic stress and interpersonal stress are considered the primary sources of psychological issues [11–13]. On one hand, with the widening participation in higher education, university students inevitably face diverse academic tasks, including exams, presentations, and report writing. These tasks are not only varied but often highly challenging. Academic stress arises when these external academic demands and challenges exceed the student's coping resources and capabilities. Students under prolonged high academic stress are prone to symptoms such as burnout, persistent lack of energy, loss of appetite, headaches, or sleep disorders, which can lead to a range of psychological health issues [14–16]. On the other hand, interpersonal interactions hold a significant place in university life where students are in a critical period of self-exploration and social adaptation. Interactions with roommates, classmates, teachers, romantic partners, and family become the main pathways for them to develop individual social skills. Unfavorable interpersonal experiences during this critical growth period, such as conflicts, neglect, or unfair treatment, are likely to lead to interpersonal stress [17], frequently triggering tense and painful emotions [18], a lack of psychological safety [19], anxiety [10,20], insomnia [21], and other physical and mental stress reactions.

When encountering external stressors, university students employ different coping strategies to reduce or eliminate the adverse effects brought by the stressors. Coping strategies refer to cognitive and behavioral strategies individuals use to improve the adverse consequences of stressful events, encompassing behaviors and psychological efforts to control, tolerate, or reduce the impact of stressors [22]. Coping strategies can be divided into problem-focused and emotion-focused categories based on their goals and content [22]. The former mainly involves solving problems and changing the status quo, such as focusing on tasks and exploring problem-solving solutions, while the latter focuses on managing or adjusting emotions related to stress, such as seeking emotional support, emotional venting, and avoidance. Endler et al. further categorized coping strategies into task-oriented, emotion-oriented, and avoidance-oriented types [23]. In the Chinese context, Wei et al. [24] found that university students primarily adopted four coping strategies when facing stressful situations: problem-solving, assistance-seeking, problem-avoiding, and acceptance. Problem-solving and assistance-seeking were more common among Chinese university students compared to problem-avoiding and acceptance [25,26].

Different coping strategies lead to varying stress reactions. Research shows that using positive coping strategies, such as confronting and solving problems and seeking help, is usually associated with lower levels of depression, while negative coping strategies, like avoidance and drinking to escape, are positively correlated with depressive emotions [27,28]. Furthermore, the literature indicates a broad consensus on the role of coping as a crucial mediator between stress and stress reactions [29,30]. For instance, Chou et al. [31] identified that passive coping strategies mediated the relationship between stress and depressive symptoms in overseas Chinese university preparatory students. Similarly, a longitudinal study conducted by Evans et al. [32] on adolescents demonstrated that both problem-focused and avoidance coping strategies played a mediating role between stressors and depressive symptoms.

The positive impact of SEC on mental health
SEC refers to an individual's ability to identify and manage emotions, set and achieve positive goals, appreciate others' perspectives, build and maintain supportive relationships, make responsible decisions, and constructively handle personal and interpersonal matters [33]. Based on the characteristics of Chinese university students in the Chinese education context, Chen et al., defined SEC as the capability to construct triple relationships with oneself, others, and the collective in a university learning environment. It includes making responsible decisions for oneself, others, and the collective, regulating emotions, building positive interpersonal relationships, fostering a love for the collective and teamwork, and making ethically responsible decisions [34].

SEC is widely regarded as a key psychological resource for students' adaptation to social environments, significantly benefiting mental health. As early as 1957, Professor Farnsworth from Harvard University emphasized the importance of social and emotional development in this aspect when introducing the topic of "Mental Health in College" [35]. He advocated that university students needed to appropriately develop social and emotional skills, such as self-awareness, creative ability, the capacity to love and be loved, and interpersonal perspective-taking abilities, to meet their psychological health needs and enhance their mental health status [36]. Researchers like Chernyshenko et al. also highlighted that SEC was an important factor affecting mental health, significantly impacting subjective well-being, life satisfaction, and anxiety [37]. SEC becomes even more crucial when students are in stressful situations. Santos proposed that SEC could provide internal support for students in adversity, reducing psychological distress such as anxiety and depression, thereby maintaining mental health [38,39]. Furthermore, several factors of social emotional ability, such as emotion regulation and relationship skills [33], have been demonstrated to effectively assist students in alleviating stress and negative emotions. For example, a study by de Castella et al. [40] found that proficient emotion regulation could improve students' stress levels, psychological distress, and increase life satisfaction. Ando [41] showed that interventions focusing on self-relationships and interpersonal relationships helped to reduce university students' anxiety, depression, and psychosocial distress. Overall, existing studies have confirmed the positive role of SEC in alleviating anxiety, depressive symptoms, improving sleep quality, and enhancing happiness in various mental health outcomes [7,33]. Students with higher SEC typically experience fewer negative stress reactions. However, few studies explore how SEC contributes to reducing stress reactions.

According to the Cognitive Theory of Stress and Coping, as a key psychological resource in stressful situations, SEC significantly affects the individual's cognitive appraisal process of stress. Individuals with higher SEC are better at identifying and utilizing resources and effectively managing emotions. When facing complex challenges in learning and social contexts, these individuals can maintain a composed attitude and positively appraise challenges, thereby perceiving lower stress. For example, Kauts's study found that students with higher emotional intelligence perceived lower academic stress than those with lower emotional intelligence [42]. Similarly, a study by Ciarrochi et al. emphasized the importance of specific SEC in predicting students' self-reported mental health, including stress, depression, anxiety, and feelings of helplessness [43].

SEC also significantly affects students' choice of coping strategies in stressful situations. Students with higher SEC are more likely to adopt positive coping strategies while avoiding ineffective or avoidant methods. Related research indicates that students with higher emotional intelligence or emotional quotient tend to use adaptive coping strategies, such as problem-focused coping and seeking social support, and are less likely to use maladaptive strategies, like avoidance [44–46]. This positive strategy selection helps students better manage and alleviate stress reactions, thus positively impacting their mental health.

In summary, this study aims to explore the relationship between SEC and stress among university students drawing on the Cognitive Theory of Stress and Coping. To further understand the connection between SEC and university students' mental health, this study analyzes the impact of SEC on stress, coping strategies, and stress reactions, and the mechanisms through structural equation modeling. Based on data from two large-scale surveys of Chinese university students, Study 1 uses a parallel mediation model to examine the relationship between SEC and academic stress, interpersonal stress, and stress reactions. Study 2 further focuses on the role of coping strategies, examining the impact of SEC on academic and interpersonal stress, the three coping strategies of problem-solving, assistance-seeking, and problem-avoiding, as well as stress reactions, through a multiple-chain mediation model. The study proposes the following hypotheses:

H1: SEC negatively predicts academic stress, interpersonal stress, and stress reactions, and indirectly negatively predicts stress reactions through academic and interpersonal stress.

H2: SEC positively predicts problem-solving and assistance-seeking behaviors, negatively predicts problem-avoiding, and indirectly negatively predicts stress reactions through these three coping strategies.

H3: SEC indirectly negatively predicts stress reactions through the chained mediating pathway of stress and coping strategies.

Study 1

Participants
The survey for this study was conducted in 2021 using an online platform. The research design and procedures had been examined and approved by the administrative committee of the project. The Ethics Committee at Xiamen University supports the practice of protection of human participants in this research. Eligible participants were undergraduate students enrolled in Chinese institutions of higher education with valid student IDs. All participants read and agreed with the online informed consent in this study. To ensure data accuracy, we excluded invalid questionnaires that were completed in less time than required and those that answered screening questions incorrectly. This process yielded a sample of 95,439 university students from 107 universities across mainland

China. The participant composition was diverse: 33.9% male and 66.1% female students, with an average age of 20.58 years (SD = 1.38). The sample distribution across academic years was as follows: first-year students formed the largest group at 41.3%, followed by second-year students at 27.6%, third-year students at 23.2%, and those in their fourth year or above at 7.9%. In terms of academic disciplines, the sample was nearly evenly split, with 49.0% from humanities and social sciences, and 51.0% from science, technology, agriculture, and medicine. The students' university types varied, with 7.8% from top universities, 51.8% from general universities, and 40.4% from newly established or independent colleges.

Measures

SEC. The scale was adapted from the Chinese College Students' Social-Emotional Competency Scale developed by Chen et al. [34]. The SEC scale was unidimensional, capturing a holistic view of SEC as it pertains to our research objectives. It comprises fourteen items focusing on a broad spectrum of competencies in self-relations, relations with others, and collective relations, as well as their ability to make responsible decisions. For instance, statements such as "I respect myself and also hope to be respected by others" and "I am responsible not only for myself but also for others and the collective" are included. The scale employs a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), asking students to choose based on their perception of the items, with higher scores indicating higher social emotional competencies.

Stress. The scale, adapted from Solberg et al.'s College Stress Inventory [47], includes dimensions of academic stress and interpersonal stress. Academic stress consists of five items assessing students' perceived stress from course exams, academic tasks, and qualification exams, e.g., "I find it difficult to complete academic tasks within the allotted time", "Course exams put a lot of pressure on me". Interpersonal stress includes three items assessing stress perceived from peers, parents, and teachers, e.g., "I struggle to manage relationships with classmates" and "I can't deal with my relationship with teachers". The scale used a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), with higher scores indicating greater stress.

Stress Reaction. The scale includes seven items, adapted from Gadzella's Student-Life Stress Inventory-Stress Reaction dimension [48]; it investigates negative psychophysical stress reactions like tension, moodiness, fatigue, and sleep difficulties under stress stimuli, e.g., "I often have poor sleep quality" and "I feel anxious all the time". The scoring used a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), with higher scores indicating more severe stress reactions.

In adapting these scales, we meticulously selected items that resonate with the learning experiences of Chinese university students and align closely with the objectives of our research. Furthermore, we refined the wording of these items to improve clarity and enhance comprehension for the intended demographic.

Data analysis

Initially, confirmatory factor analysis was performed to test the reliability and validity of the scales. This was followed by descriptive statistics and correlational analysis of the variables. Finally, mediation models were constructed to explore the relationships between the variables. In the model analysis, to control for potential confounding factors such as gender, grade, subject category, and university type, these categorical variables were dummy-coded and included in the model to control potential interference effects. Additionally, to prevent common method bias, Harman's single-factor test was conducted before formal data analysis, indicating no significant common method bias in the data. Analyses were primarily conducted using Stata MP 17.0 and Mplus Editor 8.0 software.

Results

Construct validity and reliability

The result of the CFA(Confirmatory Factor Analysis) showed that the fit indices for the construct of four primary factors were appropriate for further analysis (χ^2 [59] = 23799.726, $p < 0.001$, RMSEA = 0.065, SRMR = 0.037, NNFI = 0.961, CFI = 0.971). The Cronbach's alpha coefficients and composite reliability for each factor exceeded 0.80, indicating that each subscale was up to an acceptable internal consistency. Additionally, factor loadings for each item were greater than 0.50, with t-values significant at the 0.001 level, suggesting solid construct validity. The Average Variance Extracted (AVE) values for each factor were above 0.70, and the square root of the AVE was greater than the inter-correlations among factors, indicating good convergent and discriminant validity. Overall, every scale in this study has good reliability and validity (Table 1).

Descriptive statistics and correlational analysis

Table 1 presents means, standard deviations, and correlation coefficients for each variable. In terms of SEC, students scored an average of 3.79, indicating that students had the middle level of proficiency in SEC. Regarding stress, the average scores for Academic Stress and Interpersonal Stress were 2.94 and 1.76, respectively, while the average score for Stress Reaction was 2.30. These scores were below 3.0, suggesting that students generally experienced low levels of stress and negative stress reactions. However, a more detailed analysis revealed that 18.33% of students scored more than 4 in Academic Stress, indicating significant pressure related to academic tasks and exams; 5.94% scored more than 4 in Interpersonal Stress, finding it challenging to manage relationships with family, teachers, and peers; 11.6% scored more than 4 in Stress Reaction, indicating that some students experienced considerable tension, lethargy, and sleep disturbances.

The correlational analysis showed significant relationships ($p < 0.001$) between SEC, Academic Stress, Interpersonal Stress, and Stress Reaction. There was a very weak correlation between SEC and Academic Stress ($r = -0.07$), while SEC had a weak correlation with Interpersonal Stress and Stress Reaction ($-0.27 \leq r \leq -0.19$); moderate to strong correlations were observed between Academic Stress, Interpersonal Stress, and Stress Reaction ($0.43 \leq r \leq 0.62$).

TABLE 1

Correlation matrix, reliability, and descriptive statistics of SEC, academic stress, interpersonal stress, and stress reaction (N = 95,439)

Variables	1	2	3	4	Cronbach's α	CR	AVE	CFA loadings range (mean)
1. SEC	0.84				0.91	0.91	0.71	0.82–0.87 (0.84)
2. Academic stress	−0.07	0.75			0.79	0.79	0.56	0.64–0.82 (0.75)
3. Interpersonal stress	−0.19	0.43	0.88		0.91	0.91	0.78	0.85–0.92 (0.88)
4. Stress reaction	−0.27	0.49	0.62	0.86	0.89	0.89	0.73	0.80–0.89 (0.86)
Mean	3.79	2.94	1.76	2.30	—	—	—	—
SD	0.80	0.95	0.98	1.11	—	—	—	—

Note: The lower triangle matrix below the table represents the Pearson correlation coefficients between each variable. The diagonal represents the square root of the Average Variance Extracted (AVE). All coefficients are significant at the 0.001 level. The scale average value is the sum of the scores of each item in the variable divided by the number of items. The average scores of each scale range from 1–5 points.

Structural equation modeling analysis

The study initially analyzed the relationships among SEC, Academic Stress, Interpersonal Stress, and Stress Reaction using Structural Equation Modeling. The model demonstrated good fit indices: χ^2 [139] = 29027.922, $p <$ 0.001, RMSEA = 0.047, SRMR = 0.031, NNFI = 0.954, CFI = 0.965, indicating that it adequately explained the data. The variables in the model accounted for 58.8% of the variance in Stress Reaction, 1.5% of the variance in Academic Stress, and 6.8% of the variance in Interpersonal Stress.

Fig. 1 displays the path coefficients of the model, all significant at $p <$ 0.001. When controlling for gender, grade, subject category, and university type, the results showed that SEC negatively predicted Academic Stress (β = −0.11), Interpersonal Stress (β = −0.23), and Stress Reaction (β = −0.15). It implies that stronger SEC in students is associated with weaker stress and reactions to it. Additionally, Academic Stress positively predicted Stress Reaction (β = 0.33), and Interpersonal Stress also positively predicted Stress Reaction (β = 0.49), indicating that higher levels of these stresses are associated with stronger psychological and physical stress responses in students.

Further analysis of mediation effects (using a bias-corrected bootstrap method with 5000 resamples) revealed that Academic Stress and Interpersonal Stress played significant mediating roles between SEC and Stress Reaction. Specifically, in the impact of SEC on Stress Reaction, the

mediation effect of Academic Stress was −0.050, and that of Interpersonal Stress was −0.152. The total indirect effect of both stressors was −0.203, accounting for 49.63% of the total effect. It indicates that SEC cannot only directly negatively predict Stress and Stress Reaction but also indirectly predict Stress Reaction by mitigating stress, thus supporting Hypothesis 1 (Table 2).

Discussion

This study explored the relationship between SEC, stress, and stress reaction of university students by constructing a parallel mediation model. The empirical results indicated a protective role of SEC in the psychological health of university students.

Firstly, SEC was found to directly negatively predict academic and interpersonal stress, as well as stress reaction of university students. This agreed with previous research that noted a negative correlation between students' SEC and perceived stress [49]. Similarly, SEC assisted students in more effectively managing academic stress [50]. Further, SEC also demonstrated a negative predictive effect on students' stress reaction, which was consistent with previous findings that individuals with higher SEC exhibited lower psychological distress [38].

Secondly, there appeared to be an association between SEC and a decrease in stress reactions, mediated through lower levels of academic and interpersonal stress. This finding underscores the vital role of SEC in assisting students to cope with adversities and external challenges. As
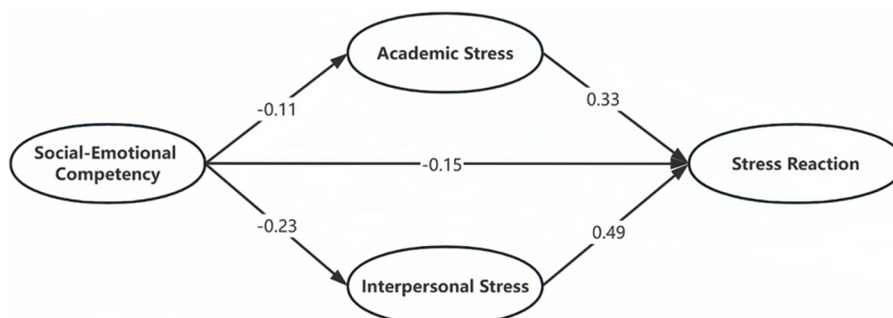

FIGURE 1. Mediation model among university students' SEC, stress, and stress reaction (N = 95,439).
Note: All path coefficients are significant at the $p <$ 0.001 level. Control variables and observed indicators for each latent variable are omitted in the figure.

TABLE 2

Significance test of mediation effect through bootstrap analysis (N = 95,439)

Path of impact	Effect value	95% CI		Effect size
		Lower	Upper	
Direct effect				
SEC → Stress reaction	−0.206	−0.214	−0.198	50.37%
Indirect effect				
SEC → Academic stress → Stress reaction	−0.050	−0.055	−0.047	12.22%
SEC → Interpersonal stress → Stress reaction	−0.152	−0.157	−0.147	37.16%
Total indirect effect	−0.203	−0.210	−0.200	49.63%
Total effect				
SEC → Stress Reaction	−0.409	−0.418	−0.399	100.00%

Note: All effect values are significant at the $p < 0.001$ level. Effect size = effect value of a specific path/total effect value.

a crucial psychological resource, SEC encompasses abilities in emotion regulation, relationship skills, and responsible decision-making [33]. These abilities enable individuals to conduct primary appraisals more accurately, assessing whether situations pose a genuine threat. Subsequently, in the secondary appraisal phase, individuals with high SEC are more inclined to believe they possess adequate resources and strategies to face these challenges. This potentially more effective appraisal process could be linked to a lessened negative perception of stressful situations, which in turn might be associated with decreased stress reactions.

Thirdly, among the two types of stress, interpersonal stress was more significantly predicted by SEC and played a more prominent mediating role between SEC and psychophysical stress reactions compared to academic stress. This outcome highlights the importance of SEC in alleviating interpersonal stress, possibly due to its key competencies, such as identifying and managing emotions, appreciating others' perspectives, and maintaining supportive relationships [37,51]. In the face of interpersonal conflicts or stress, emotional intelligence skills, such as better emotion recognition and regulation, and communication abilities, can effectively help individuals manage these conflicts [52]. Studies have shown that positively developing SEC impacts individuals' efficiency in verbal and non-verbal communication, conflict management, and teamwork skills [53,54]. These abilities aid students in better navigating complex situations in interpersonal interactions, reducing misunderstandings and conflicts, and hence, effectively lowering interpersonal stress.

Study 2

Participants

The survey for this study was executed in 2022 using an online platform, targeting undergraduate students from a wide range of universities across China. The research design and procedures had been examined and approved by the administrative committee of the project. Eligible participants included those who were actively enrolled in Chinese higher education institutions and possessed valid student IDs. To ensure the accuracy of the data, we excluded any questionnaires that were completed in a shorter time than the minimum required or had incorrect responses to screening questions. A total of 150,098 valid questionnaires were collected from 391 universities, offering a comprehensive overview of the student population. The gender distribution within the sample was 30.5% male and 69.5% female, with an average age of 20.73 years (SD = 1.44). The academic year breakdown showed 39.3% of respondents were first-year students, 24.6% second-year, 23.0% third-year, and 13.1% in their fourth year or higher. Regarding academic disciplines, students from the humanities and social sciences represented 59.1% of the sample, while those from science, technology, agriculture, and medicine constituted 40.9%. The participants' university affiliations included 8.4% from elite institutions with top-ranked academic programs, 52.7% from standard universities, and 38.9% from newly established or independent colleges.

Measures

The instruments used in this survey are the same as those in Study 1, with the addition of the university student coping strategies scale.

Coping Strategies. The scale was mainly adapted from Carver et al.'s COPE Inventory [55]. It covers three dimensions to examine coping strategies adopted by university students under stress: problem-solving, assistance-seeking, and problem-avoiding. The problem-solving dimension includes three items, with higher scores indicating a more proactive attitude and effort in resolving stress or problems, e.g. "When I experience stress or problems, I take a positive attitude towards them", "When faced with stress or problems, I actively seek ways to solve them". The assistance-seeking dimension consists of three items, with higher scores indicating more frequent seeking of social support from teachers, family, classmates, and friends, e.g. "When faced with stress or problems, I seek help from others (such as teachers, family, classmates, friends)", "When I am stressed or have problems, I talk to others about my worries". The problem-avoiding dimension includes four items, with higher scores indicating more frequent adoption of avoidance, self-blame, giving up, or fantasizing as coping strategies, e.g. "When faced with stress or problems, I tend to give up" and "When I encounter stress or problems, I will pretend that nothing has happened". The scale used a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), with higher scores indicating more frequent adoption of a particular coping strategy.

In terms of data analysis, Study 2 employed the same analytical procedure as Study 1.

Results
Construct validity and reliability

To ensure the reliability and validity of each scale, the authors applied a confirmatory factor analysis with seven primary

factors initially conducted. The main fit indices of the measurement model were favorable: χ^2 [681] = 330185.151, $p < 0.001$, RMSEA = 0.057, SRMR = 0.038, NNFI = 0.939, CFI = 0.9244. The Cronbach's alpha coefficients and Composite Reliability for each factor were all above 0.80, indicating that each subscale had an acceptable reliability. Furthermore, factor loadings for each item were greater than 0.50, and t-values were significant at the 0.001 level, suggesting strong construct validity. Additionally, the Average Variance Extracted (AVE) for each factor was above 0.50, and the square root of AVE exceeded the inter-correlations among factors, indicating satisfactory convergent and discriminant validity. Overall, the research instruments demonstrated ideal reliability and validity, suitable for further analysis (Table 3).

Descriptive statistics and correlational analysis
Table 3 displays means, standard deviations, and correlation coefficients for each variable. The average score of SEC was 4.24, revealing students' better level of SEC. In terms of stress perception, the average scores for Academic Stress and Interpersonal Stress were 2.72 and 1.99, respectively, with the average score for Stress Reaction being 2.32. These scores were below 3.0, suggesting that students generally experienced low levels of stress and negative stress reactions. However, a detailed analysis found that 11.52% of students scored more than 4 in Academic Stress, indicating their significant stress from academic tasks and exams; 7.24% of students scored above 4 in Interpersonal Stress, implying their difficulties in managing relationships with family, teachers, and peers; 7.38% of students scored more than 4 in Stress Reaction, indicating that some students experienced considerable tension, moodiness, fatigue, and sleep disturbances. The average scores for problem-solving, assistance-seeking, and problem-avoiding were 3.63, 3.64, and 2.27, respectively. It implied that students adopted positive strategies like actively solving problems and seeking social support but less frequently resorted to avoidance or giving up.

The correlational analysis results showed significant relationships ($p < 0.001$) between SEC, the two types of stress, three coping strategies, and stress reactions. SEC showed weak or very weak negative correlations with Academic Stress, Interpersonal Stress, problem-avoiding, and Stress Reaction ($-0.25 \leq r \leq -0.07$), while moderate positive correlations with problem-solving and assistance-seeking ($0.38 \leq r \leq 0.39$). Academic Stress had strong positive correlations with Interpersonal Stress, problem-avoiding, and Stress Reaction ($0.49 \leq r \leq 0.62$), while very weak positive correlations with problem-solving ($r = 0.07$) and assistance-seeking ($r = 0.06$). Interpersonal Stress showed strong positive correlations with problem-avoiding and Stress Reaction ($0.54 \leq r \leq 0.68$), while very weak negative correlations with problem-solving and assistance-seeking ($-0.09 \leq r \leq -0.08$). Problem-solving and assistance-seeking were strongly positively correlated ($r = 0.83$), but both showed very weak positive correlations with problem-avoiding ($r = 0.01$, $r = 0.03$). In their relationships with Stress Reaction, problem-solving and assistance-seeking had very weak negative correlations ($r = -0.07 \leq r \leq -0.04$), while problem-avoiding showed a strong positive correlation ($r = 0.60$).

Structural equation modeling analysis
This study analyzed the relationships among SEC, Academic Stress, Interpersonal Stress, Coping Strategies, and Stress Reaction through a structural equation model. The results showed that the model had good fit indices: χ^2 [948] = 474623.010, $p < 0.001$, RMSEA = 0.058, SRMR = 0.063, NNFI = 0.911, CFI = 0.920, indicating a satisfactory data fit. The variables in the model accounted for 63.4% of the variance in Stress Reaction, 17.8% in problem-solving, 19.4% in assistance-seeking, 37.4% in problem-avoiding, 1.9% in Academic Stress, and 8.0% in Interpersonal Stress.

After controlling variables of gender, grade, subject category, and university type, the results showed that all path coefficients were significant at the 0.001 level. Firstly, SEC negatively predicted Academic Stress ($\beta = -0.10$),

TABLE 3

Correlation matrix, reliability, and descriptive statistics of SEC, academic stress, interpersonal stress, coping strategies, and stress reaction ($N = 150,098$)

Variables	1	2	3	4	5	6	7	Cronbach's α	CR	AVE	CFA loadings range (mean)
1. SEC	0.86							0.98	0.98	0.74	0.81–0.90 (0.86)
2. Academic stress	−0.07	0.75						0.86	0.86	0.56	0.55–0.86 (0.74)
3. Interpersonal stress	−0.25	0.62	0.90					0.92	0.92	0.80	0.88–0.93 (0.90)
4. Problem-solving	0.38	0.07	−0.08	0.94				0.96	0.96	0.88	0.91–0.95 (0.94)
5. Assistance-seeking	0.39	0.06	−0.09	0.83	0.88			0.92	0.91	0.78	0.85–0.91 (0.88)
6. Problem-avoiding	−0.18	0.49	0.54	0.01	0.03	0.81		0.88	0.88	0.66	0.69-0.88 (0.81)
7. Stress reaction	−0.23	0.60	0.68	−0.04	−0.07	0.60	0.85	0.95	0.95	0.72	0.72–0.92 (0.85)
Mean	4.24	2.72	1.99	3.64	3.64	2.27	2.22	—	—	—	—
SD	0.66	0.88	0.96	0.98	0.96	0.93	0.96	—	—	—	—

Note: The lower triangle matrix below the table represents the Pearson correlation coefficients between each variable. The diagonal represents the square root of the Average Variance Extracted (AVE). All coefficients are significant at the 0.001 level. The scale average value is the sum of the scores of each item in the variable divided by the number of items. The average scores of each scale range from 1–5 points.

Interpersonal Stress (β = −0.26), problem-avoiding (β = −0.06), and Stress Reaction (β = −0.04), and positively predicted problem-solving (β = 0.39) and assistance-seeking (β = 0.41). This suggests that students with higher SEC perceive lower academic and interpersonal stress, being more inclined to adopt problem-solving and assistance-seeking strategies while less likely to use problem-avoiding strategies. Also, they exhibit lower stress reactions. Secondly, Academic Stress positively predicted Stress Reaction (β = 0.23) and all three Coping Strategies: problem-avoiding (β = 0.34), problem-solving (β = 0.20), and assistance-seeking (β = 0.23). Interpersonal Stress positively predicted Stress Reaction (β = 0.39) and problem-avoiding (β = 0.30) but negatively predicted problem-solving (β = −0.12) and assistance-seeking (β = −0.13). Finally, both problem-solving (β = 0.04) and problem-avoiding (β = 0.29) positively predicted Stress Reaction, while assistance-seeking negatively predicted Stress Reaction (β = −0.09). Notably, the predictive effect of problem-avoiding on Stress Reaction was significantly stronger than that of problem-solving and assistance-seeking (Fig. 2).

Mediation effect analysis conducted through the Bootstrap method further revealed the complexity of these relationships. The results showed the effects of each mediation path were statistically significant and the 95% confidence intervals did not include zero. This alluded to possible associations between SEC and Stress Reaction, both directly and indirectly, through various mediation paths involving stress and coping strategies. Specifically, on simple mediation paths, SEC indirectly negatively predicted Stress Reaction by reducing Academic Stress and Interpersonal Stress, further supporting the findings of Study 1. Moreover, SEC indirectly negatively predicted Stress Reaction by promoting assistance-seeking and reducing problem-avoiding, while positively predicting Stress Reaction through the promotion of problem-solving. This partially supported Hypothesis 2. SEC negatively predicted stress reactions through a chained mediation path, which combined Interpersonal Stress with the three Coping Strategies.

Although the "SEC—Academic Stress—Coping Strategies—Stress Reaction" chained mediation paths are statistically significant, their path coefficients are almost zero. This leads to the conclusion that their impact is minimal and can be disregarded, partially supporting Hypothesis 3 (Table 4).

Comparing the total effects exerted by each mediator, it was found that, in terms of stress, SEC's association with reduced Stress Reaction seemed more strongly linked to a decrease in Interpersonal Stress rather than Academic Stress. Additionally, there seemed to be an association between SEC and a decrease in problem-avoiding behaviors while an increase in assistance-seeking behaviors. However, an unexpected association was noted with problem-solving strategies, where an increase in these strategies correlated with a slight increase in Stress Reaction. Overall, the total indirect effects generated by Stress and three Coping Strategies in the relationship between SEC and Stress Reaction accounted for 84.85% of the total effect. It implied that while there might be a direct association between SEC and Stress Reaction, the predominant associations seemed to be mediated through changes in Academic Stress, Interpersonal Stress, and Coping Strategies, particularly in decreasing problem-avoiding behaviors and increasing assistance-seeking behaviors. Among these, the association with alleviating Interpersonal Stress appeared to be particularly notable. The association with problem-solving strategies might at times show a contrary association.

Discussion

By constructing a multiple-chained mediation model, Study 2 delved deeper into the relationships among SEC, stress, coping strategies, and stress reactions. Meaningful results were revealed. First, consistent with Study 1, Study 2 further confirmed that SEC could negatively predict academic and interpersonal stress and stress reactions. It also indirectly negatively predicted stress reactions through these stresses. It is noteworthy that both Study 1 and Study 2 were conducted during the COVID-19 pandemic. During that period, Chinese university students faced challenges such as
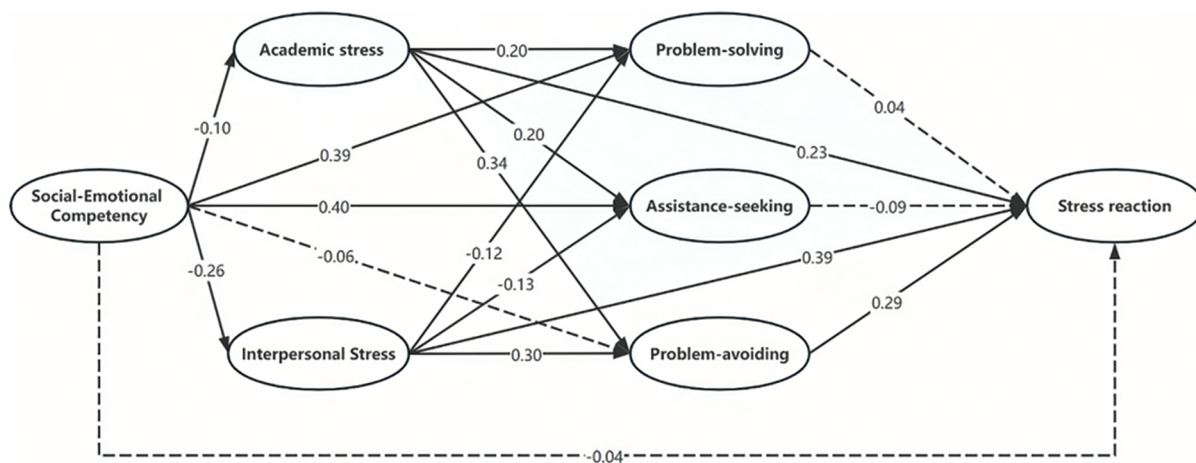

FIGURE 2. Chain mediation model among SEC, academic stress, interpersonal stress, coping strategies, and stress reaction (N = 150,098). Note: All path coefficients are significant at the $p < 0.001$ level. Control variables and observed indicators for each latent variable are omitted in the figure.

TABLE 4

Significance test of mediation effects using bootstrap analysis ($N = 150{,}098$)

Path of impact	Effect value	95% CI		Effect size
		Lower	Upper	
Direct effect				
SEC → Stress reaction	−0.035	−0.039	−0.031	15.15%
Indirect effect				
SEC → Academic stress → Stress reaction	−0.024	−0.025	−0.022	10.39%
SEC → Interpersonal stress → Stress reaction	−0.101	−0.104	−0.098	43.72%
SEC → Problem-solving → Stress reaction	0.017	0.014	0.019	−7.36%
SEC → Assistance-seeking → Stress reaction	−0.035	−0.038	−0.032	15.15%
SEC → Problem-avoiding → Stress reaction	−0.018	−0.020	−0.017	7.79%
SEC → Academic stress → Problem-solving → Stress reaction	−0.001	−0.001	−0.001	0.43%
SEC → Academic stress → Assistance-seeking → Stress reaction	0.001	0.001	0.002	−0.43%
SEC → Academic stress → Problem-avoiding → Stress reaction	0.002	0.002	0.002	−0.87%
SEC → Interpersonal stress → Problem-solving → Stress reaction	−0.003	−0.003	−0.003	1.30%
SEC → Interpersonal stress → Assistance-seeking → Stress reaction	−0.010	−0.011	−0.010	4.33%
SEC → Interpersonal stress → Problem-avoiding → Stress reaction	−0.023	−0.024	−0.022	9.96%
Total indirect effect	−0.196	−0.200	−0.191	84.85%
Total effect				
SEC → Stress reaction	−0.231	−0.236	−0.226	100.00%

Note: All effect values are significant at the $p < 0.001$ level. Effect size = effect value of a specific path/total effect value.

reduced outings, home isolation, and online learning, which led to a general increase in their stress and anxiety levels [56]. Despite these challenges, SEC significantly negatively predicted stress and its reactions, demonstrating its robust value. These findings further support the critical role of SEC as a positive psychological resource in aiding individuals to cope with stress and promote adaptive behavior [50].

Secondly, SEC positively predicted problem-solving and assistance-seeking, and negatively predicted problem-avoiding. It suggests that students with higher SEC are more inclined to adopt positive coping strategies like problem-solving and assistance-seeking, and less likely to engage in negative strategies such as problem-avoiding. This result agrees with previous studies where emotional intelligence significantly positively predicted coping strategies like problem-solving and assistance-seeking [57], and negatively predicted problem-avoiding [58]. Salovey et al. also posited that individuals who could accurately perceive, understand, and manage their own and others' emotions possessed more effective coping skills for stressful events [59]. Individuals with high SEC are usually better at managing relationships with self, others, and collectives, and making wiser and more responsible decisions, which allow them to choose positive coping strategies and reduce adverse reactions in the face of stress.

Thirdly, existing research indicates that in higher education environments, students who use more adaptive coping strategies, such as problem-solving and assistance-seeking, perform better in the face of stress and challenges, and experience fewer negative stress reactions like anxiety,

insomnia, and somatic symptoms [60]. Conversely, university students with maladaptive coping strategies often experience more negative stress reactions, especially avoidance behaviors, which can result in greater psychological distress [61]. This study supports this view by verifying that SEC reduces students' stress reactions via promoting assistance-seeking and decreasing problem-avoiding. It is likely that students with high levels of SEC believe they have sufficient resources and capabilities to handle stressful situations during the cognitive appraisal process. Their better emotion recognition and management skills help them remain composed in stressful situations, and good interpersonal skills encourage them to seek help from friends, teachers, and family. Additionally, their responsible decision-making reduces their tendency to avoid problems. These adaptive coping strategies can decrease psychophysical stress reactions like anxiety.

Notably, in a counterintuitive finding, SEC was found to exacerbate students' stress reactions by promoting problem-solving skills. This exacerbation is directly linked to the positive predictive effect that problem-solving typically has on stress reactions. This finding presents a contrast to traditional views that problem-solving is a positive coping strategy to reduce stress reactions. For example, Zeidner et al. highlighted that problem-centered coping strategies were usually associated with positive psychological outcomes. They were effective in providing individuals with a sense of control and in reducing stress, particularly in situations where the individual could actively ameliorate the threatening circumstances [62]. However, Folkman et al.

pointed out that the effectiveness of coping depended not only on specific coping behaviors but also on the specific challenges individuals faced [63], meaning that a coping strategy effective in one situation might not be suitable in another. When the source of stress is unclear, unresolvable, or beyond the individual's capacity to change, problem-solving strategies may not effectively alleviate tension and anxiety. In fact, individuals might increase their anxiety due to an eagerness to resolve problems. In Horiuchi's study, problem-solving coping also showed a positive predictive effect on anxiety and depression responses [64]. Overall, this suggests that problem-solving coping strategies may have complex effects in different stress situations and require further exploration.

Additionally, SEC further predicted students' stress reactions through a chained mediation path of decreasing interpersonal stress, promoting assistance-seeking, and reducing problem-avoiding. This result highlights the prominent role of interpersonal stress in stress management, consistent with the findings of Study 1. Particularly in the Chinese educational context, utilizing interpersonal support is one of the most effective emotional regulation strategies for Chinese university students [65]. Given the generally low awareness of mental health among them, Chinese university students urgently need knowledge and guidance in interpersonal communication and emotional regulation [65]. With its key competencies and significant impact on interpersonal stress, SEC could be a crucial factor in improving the psychological health of Chinese university students.

Conclusions and Implications

This research delved empirically into the interconnected dynamics between SEC, stress, coping strategies, and stress reactions. When integrating the results of the two sub-studies, we observe that SEC is linked to various aspects of university students' psychological health. The analysis suggests an association between SEC and lower levels of students' academic stress, interpersonal stress, and stress reactions. Furthermore, SEC appears to be linked with changes in stress reactions, potentially mediated by variations in academic and interpersonal stress, and shifts in coping strategies, such as increased assistance-seeking and decreased reliance on problem-avoiding approaches. Drawing from these observations, we propose several implications to support university students' stress management, enhance their psychological health, and foster overall well-being.

First, it is crucial to value and cultivate the SEC of university students. Traditionally, higher education in China has focused more on the mastery of knowledge and cognitive skills, with relatively less emphasis on students' social-emotional development. This imbalance may limit students' holistic growth and healthy development. To address this and enhance the psychological health of university students, universities are advised to create a social-emotional learning environment and foster the development of students' SEC. Universities shoud make efforts to recognize the importance of SEC for student development and incorporate it into their educational programs. Secondly, in terms of curriculum structure, universities had better design and implement specialized social-emotional learning courses or integrate social-emotional learning elements into other academic courses. This approach will help students enhance self-awareness, interpersonal interaction, teamwork, and responsible decision-making across various disciplinary contexts. Thirdly, educators had better explore and utilize diverse teaching methods, such as project-based, service-based, or collaborative learning, to foster students' communication and collaboration skills. Finally, universities should create a positive, open, and encouraging campus culture, where educators serve as role models and mentors to foster an enthusiastic teaching and learning culture. Additionally, universities should promote peer support programs to encourage friendly interactions and mutual growth among students.

Secondly, universities reasonably control the academic workload of students and strive to create a supportive campus interpersonal atmosphere. Academic and interpersonal stresses are the primary sources of stress for university students during their academic term, and are major contributors to negative emotions such as anxiety, tension, and fatigue. In China, university students often devote most of their time and energy to academic pursuits, with less involvement in extracurricular practical activities. This tendency not only may increase the weight of academic stress and related stress reactions but also potentially hinder the development of interpersonal and communication skills. Universities manage to take measures to allocate academic workload appropriately, avoiding excessive academic pressure. Additionally, guiding students to participate more in extracurricular practical and internship activities can promote positive student-student and teacher-student interactions and create a conducive interpersonal environment. Furthermore, given the significant role of interpersonal stress, universities need to place greater emphasis on cultivating students' interpersonal skills. This can be achieved through lectures and courses that empower students to develop interpersonal skills and reduce interpersonal distress.

Thirdly, it is imperative for universities to guide students towards adopting adaptive strategies to cope effectively with stress. Universities should counsel students to embrace a proactive stance when facing challenges and difficulties. This includes encouraging direct engagement with problems, actively seeking solutions, and soliciting support and assistance from teachers, peers, and family members. Simultaneously, universities should educate students to avoid negative coping strategies like problem avoidance, which may lead to the accumulation of problems and exacerbate stress reactions. Given that some stressors may be difficult and complex and sometimes not resolvable in the short term, students should be taught to flexibly choose appropriate coping strategies according to the specific stress situation, avoiding hasty attempts to resolve problems that can intensify stress. Additionally, universities can assist students in correctly assessing stress situations and effectively coping with academic and interpersonal stresses through improved psychological counseling services, individual mentoring, stress-relief activities, and relevant adaptive courses.

This study has some limitations. Firstly, it relies mainly on self-reported scales to measure SEC, stress, and related variables, exploring the mechanisms affecting stress reactions through large-sample quantitative analysis. This approach has limitations in terms of data types and research methods. Future studies could enrich data sources through diverse means such as assessments, observations, and interviews to enhance the validity of research. Qualitative research methods could also be used to explore the internal mechanisms of interaction between SEC and stress reactions more deeply. Secondly, this study mainly focuses on academic and interpersonal stresses. Other important aspects of stress, such as career planning and adapting to the university environment, may also impact the psychological health of university students. Thus, future research could further incorporate these stressors into the model to explore their roles. Lastly, this study is based on cross-sectional data, so it is impossible to determine causal relationships between variables definitively. Stress reactions could also potentially impact SEC, stress sources, and coping strategies. Future research should utilize longitudinal follow-up surveys or experimental research designs to elucidate these causal relationships more effectively.

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Availability of Data and Materials: The data will be provided upon request to the corresponding author.

Ethics Approval: The Ethics Committee at Xiamen University supports the practice of protection of human participants in this research. Informed consent was obtained from all individual participants included in the study in accordance with the Declaration of Helsinki. Before the survey, all participants were explicitly told that they would be asked to fill out questionnaires and answer some questions. The participants were solicited, yet strictly voluntary.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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