Journal of Contextual Behavioral Science 35 (2025) 100868

Contents lists available at ScienceDirect

Journal of Contextual Behavioral Science

journal homepage: www.elsevier.com/locate/jcbs

Confucian-informed ACT for psychological flexibility, mental health, and sleep in college students: A randomized controlled trial

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ARTICLE INFO

Keywords:
Transdiagnostic
Internet-based ACT
Cross-cultural
Mental and sleep health

ABSTRACT

College students are susceptible to psychological and sleep problems in the face of interpersonal, academic, financial, and uncertain pressures, which are exacerbated by the limited resources available at universities for psychological or sleep interventions and the negative help-seeking attitudes of college students. Therefore, there is a need to design and apply university-based interventions that are easily accessible to college students. Transdiagnostic Internet-based Acceptance and Commitment Therapy (TACT) has been widely utilized due to its low cost and scalability; however, to date, its effectiveness and cross-cultural adaptation in mainland China remain to be studied. University students were recruited and randomly assigned to either a) the intervention group (n = 48, Student COMPASS Enhanced Course), which received the I-ACT intervention course with cross-cultural adaptation modifications, or b) the control group (n = 48, Student COMPASS Course), which received the Student COMPASS Course, in a randomized controlled trial design. The Student COMPASS Enhanced Course is a program that has undergone cultural adaptation improvements. The course utilizes the Theoretical Model of Confucian Self-Development as the ethical guideline, while mapping Zeng Guofan's (1811–1872) experience of self-cultivating to the six sub-processes of psychological flexibility and become the essential part of the course. Participants all received a post-intervention assessment after 7 weeks and a follow-up assessment after 15 weeks. The results indicated time effects across all symptom measures (ISI, GHQ-12, PPFI, ESS, DASS-21, and AAQ-II), suggesting significant improvements in mental health, sleep health, and psychological flexibility over time in both the intervention and control groups. Additionally, between-group main effects were observed for PPFI, ESS, DASS-21, and AAQ-II scores. However, the Generalized Estimating Equations (GEE) analysis revealed no group by time interaction effects for scores on any of the measures. Therefore, the Student COMPASS Enhanced Course is an effective Transdiagnostic Internet-based Acceptance and Commitment Therapy for college students in mainland China, with cross-cultural adaptation modifications to the I-ACT and incorporation of the Social workers and counselors are important for the design of psychological intervention programs and subsequent research on I-ACT in mainland Chinese universities.

1. Introduction

The occurrence of psychological problems and sleep issues among college students is on the rise and growing concern (Edmonds et al., 2024; Karatekin, 2018). The college years are characterized by a high prevalence of mental illness and sleep disorders (Levin et al., 2017; Räsänen et al., 2016), during which college students experience unique stages of psychosocial development and face multiple challenges and stressors (Larsson et al., 2022). Interpersonal relationships, academic, economic, and uncertainty stressors all further increase the complexity of the threat of mental illness and sleep disorders faced by college students (Wu et al., 2020). Stress, anxiety and depression are relatively common mental health problems among college students (Räsänen et al., 2016), and without timely intervention or treatment of mental health problems or sleep problems among college students during that period, it can increase the risk of college students' mental illnesses and

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https://doi.org/10.1016/j.jcbs.2024.100868
Received 4 August 2024; Received in revised form 14 December 2024; Accepted 16 December 2024
Available online 17 December 2024

even bring significant damages such as an increase in the rate of suicide (Drapeau et al., 2012; Takebayashi et al., 2018); at the same time, the damages of life such as dropping out of school, declining grades, strained interpersonal relationships, and reduced ability to develop their careers also can occur (Cuijpers et al., 2019). Currently, about 10–20% of the youth population worldwide is affected by mental health problems (Lappalainen et al., 2021), and the Report on the Development of China's National Mental Health (2021–2022) points out that the youth population, including the college student population, is a high-risk group for mental illness (Fu et al., 2023). Therefore, mental and sleep health intervention programs should be rapidly developed and mental health or sleep health services should be provided for the university student population.

In college, stress, anxiety, and depression mental health problems are generally comorbid with sleep problems (Gardani et al., 2022) and are reciprocal risk factors (Vargas & Perlis, 2020), which further adds to the urgency of psychological interventions for the college population. However, the reality is that college students may have negative attitudes when seeking help or may even give up seeking professional psychological help, which may be related to subjective perceptions such as the fear of stigmatization or the belief that they do not need help (Kim, 2023; Räsänen et al., 2016); furthermore, limited resources on college campuses or in the community to provide psychological services to college student populations are likewise an equally important barrier to accessing psychological interventions or services (Eustis et al., 2018; Gunawan & Oriza, 2022). Online web-based treatments with transdiagnostic approaches have gained popularity due to their ease of use, cost-effectiveness, and efficiency in addressing participants' comorbid psychological symptoms (Barlow et al., 2017; Sheikhzadeh et al., 2021) and have demonstrated favorable mental health and sleep problem improvement effects (Edmonds et al., 2024). Thus, web-based treatments with transdiagnostic approaches can go some way to alleviating the urgency of the challenges posed by college students' lack of motivation to seek psychological and sleep help and limited resources for the school or community mental health services (Enrique et al., 2019).

Internet-based Acceptance and Commitment Therapy (I-ACT) is considered to be a representative transdiagnostic approach to treatment for treating or improving psychological and sleep problems in college students (Han & Kim, 2022). Meta-analyses have been conducted to show that I-ACT can significantly improve mental health problems such as stress, anxiety, and depression as well as sleep problems in college students (Harrer et al., 2019; Wang & Fang, 2023). I-ACT was developed based on Acceptance and Commitment Therapy (ACT), which focuses on six core processes: acceptance, cognitive defusion, self-as-context, being present, values, and committed action. These processes aim to enhance psychological flexibility, mindfulness, valued living, and cognitive defusion to improve college students' mental health and address sleep issues (Han & Kim, 2022; Hayes et al., 2006). I-ACT, based on Acceptance and Commitment Therapy (ACT), emphasizes six core processes: acceptance, cognitive defusion, self-as-context, being present, values, and committed action. These processes aim to enhance psychological flexibility, promoting mindfulness and valued living, which can improve college students' mental health and address sleep issues (Han & Kim, 2022; Hayes et al., 2006). Furthermore, the high prevalence of digital technology use among college students allows them to readily access and benefit from I-ACT's efficiency and convenience (Sasaki et al., 2021). This accessibility can transform how students seek to improve their mental health and sleep, influencing their help-seeking attitudes and ultimately enhancing the effectiveness of mental health and sleep interventions (Lappalainen et al., 2015; Zakiei et al., 2021). Further, rates of adherence to study protocols and completion were higher overall for I-ACT, suggesting that this treatment may be more accessible to college students (Witlox et al., 2018).

I-ACT's lower dropout rate and higher compliance stems from its use of individual counseling or guided intervention formats (Krokos et al., 2024; Pauley et al., 2023), especially the coach-led I-ACT sessions that blend the strengths of both face-to-face sessions and Internet-supported ACT programs, offering novel ideas to understand the underlying mechanisms of changes in participants' stress, anxiety, depression, sleep, and psychological flexibility in I-ACT programs (Räsänen et al., 2016, 2020). ACT program, in particular, the advantages of a coach-led I-ACT program that combines face-to-face sessions with an Internet-supported ACT program provide novel insights into the underlying mechanisms of changes in stress, anxiety, depression, sleep, and psychological flexibility among participants in the I-ACT program (Räsänen et al., 2016, 2020). Currently, there is a limited number of Randomized Controlled Trial (RCT) studies incorporating face-to-face and online ACT sessions with coaches, especially for college students in mainland China (Zhao et al., 2023), and cross-cultural adaptation modifications for the I-ACT need to be pursued to further exploit the potential of potential therapeutic or ameliorative mechanisms of psychological flexibility improvement and values advancement in the ACT approach (Rickardsson et al., 2020). Therefore, this limited application of I-ACT increases the need to develop and implement a brand new I-ACT program for Chinese university students in mainland China to test the validity and applicability of the program's approach.

Confucianism is widely recognized as one of the most influential philosophical and ethical systems in East Asian societies, including mainland China. Its core values are predominantly grounded in the principles of benevolence (仁/ren), righteousness (义/yi), and propriety (礼/li), which collectively aim to establish a robust social and moral framework by delineating virtues and governing interpersonal relationships (Hwang, 2012, pp. 159–185). Historically, when confronted with psychological challenges, ancient Chinese scholars often employed Confucian "internal sagehood" (内圣/nei sheng) practices to alleviate their mental distress. These practices have been generalized as the Theoretical Model of Confucian Self-Development (Yongli & Yiping, 2021). In contemporary psychological research, Confucian values and ethics are emerging as a unique construct, similar to religious affiliation, contributing significantly to the evolution of psychological theory and practice (Ding et al., 2022). Currently, cross-culturally applicable modifications of psychological interventions have begun in mainland China, with Taoist Cognitive Therapy (TCT) (Chang et al., 2016) based on Chinese Taoist ethics and Tranquil Sitting Therapy (WEN et al., 2023) based on Confucian ethics showing good effects on mental health or sleep improvement. In addition, online Virtual Reality (VR)-based cognitive behavioral therapy based on Confucian ethics also showed equivalent mental health or sleep improvement effects (Zhou et al., 2024). In summary, the cross-cultural improvement and program design of I-ACT for college students in mainland China has a certain research foundation and a wide range of potential applications. In view of this, we developed an I-ACT program "Student COMPASS Enhanced" for Chinese university students based on the existing I-ACT program (The Student COMPASS) (Räsänen et al., 2016), with the aim of improving psychological and sleep conditions and increasing psychological flexibility in a Chinese university student population.

Overall, this RCT investigated the following: 1) whether the incorporation of Confucian ethics and intervention techniques into the existing Student COMPASS I-ACT intervention program for university students can improve the mental health levels of stress, anxiety and depression and sleep health in the Chinese university student population; 2) whether the Student COMPASS Enhanced cross-cultural adaptation I-ACT intervention can improve the psychological flexibility of college students in mainland China; 3) whether the Student COMPASS Enhanced program shows better performance than the original Student COMPASS program after cross-cultural adaptation. This study aims to design, present, and evaluate a promising intervention model for the Chinese college student population to prevent and improve their mental health and sleep health problems. In order to prevent and improve the mental health and sleep health problems that have emerged or may emerge in the current college student population in mainland China, it is important to develop and validate models that can be effectively utilized

and readily accepted in China, which not only can replace or supplement the existing campus or community-based psychosocial service delivery models in China, but also can further alleviate the urgent need to improve the mental health or sleep health of college students in China. This study designed, presented, and evaluated such a promising intervention model.

2. Method

2.1. Study design

This study adopted a two-group randomized controlled trial design with post-intervention and 15-week follow-up to evaluate the data collected. Employing a randomized controlled trial design, 96 university students were allocated to either an intervention group (n = 48), receiving the Student COMPASS Enhanced Course, or a control group (n = 48), receiving the Student COMPASS Course. Both interventions were provided at no cost to the participants. The intervention course took place between February and June 2024 and was delivered via Tencent Meeting (an online video conferencing software developed by Tencent), with the aim of determining and comparing the effectiveness of the intervention group with the control group over the course of the intervention course (from baseline to 15-week follow-up).

Given that we could not determine the number of participants a priori based on a power analysis, a sensitivity analysis was conducted using G*Power 3.1 (Faul et al., 2007, 2009). This analysis aimed to calculate the minimum effect size detectable with a 95% probability and an alpha error probability of 0.05, utilizing the "ANOVA: Repeated measures, between factors" option. We inputted 68 for the total sample size, 2 for the number of groups, and 2 for the number of measurements, derived from the study by Räsänen et al. (2016). The sensitivity analysis indicated that our study was adequately powered to detect medium effect sizes (d = 0.384). Furthermore, a post-hoc power analysis was performed with G*Power 3.1, utilizing the final sample size of 96 participants (n = 48 for both the intervention and control groups). This power analysis revealed a power of 0.99 for the test.

The current study was approved by the Ethics Committee of Lanzhou University No.1 Hospital (Approval No.: LDYYLL-2023-534). And this study was registered at www.chictr.org.cn, registration number [ChiCTR2400090851]. In addition, all procedures in this study complied with the ethical standards of the relevant national and institutional human experimentation committees and the Helsinki Declaration.

2.2. Participants

This study was conducted in a multidisciplinary university that encompasses a wide range of academic disciplines and knowledge areas in Lanzhou City, western China, and participants were recruited through various social media channels such as WeChat and QQ groups, as well as through posters. Participants were recruited through various social media channels such as WeChat and QQ groups, as well as through posters. The recruitment advertisements included information such as a brief description of the project and contact information of the project organizer. Interested individuals could apply to join the study by contacting the project organizer via WeChat, QQ, or phone to be added to the participant recruitment social network group. They were also required to provide their name and phone number. Subsequently, project staff would contact the participants by phone to verify their identity and confirm their willingness to participate. The recruitment advertisement also includes the purpose of the intervention (to improve psychological health issues such as stress, anxiety, and depression among college students), a brief introduction to the main courses (the Student COMPASS Course and the Student COMPASS Enhanced Course based on the Theoretical Model of Confucian Self-Development), and the inclusion criteria.

The participants were required to fulfill the following criteria: (a) were at least 18 years old; (b) were college students; (c) had a cell phone or computer with Internet access; (d) were willing to participate in a free online intervention course; (e) currently not receiving any form of psychological intervention, including ACT intervention; (f) had no pathological mental disorders or sleep disorders (self-reported hospital diagnosis results); and (g) participants were not religiously affiliated (given the potential inconsistencies between religious concepts and Confucian thought). It should be noted that because this study was a pilot study of cross-cultural adaptation based on I-ACT, participants were not informed of assessment results or possible mental health abnormalities. Participants were informed of this as part of the study information. However, if participants encountered significant difficulties or symptoms during the course of the project, they were encouraged to seek professional individual therapy. CONSORT flow was outlined in further detail in Fig. 1.

Participants were randomly assigned to the intervention and control groups and randomly matched to a coach for each group. The intervention program is conducted in a group-form. Participants were divided into eight groups, each randomly matched with two coaches, with four groups in the Student COMPASS Enhanced Course and four groups in the Student COMPASS Course, each with 12 participants. In addition, the Student COMPASS Enhanced Course and Student COMPASS Course were assigned a sub-coach to supervise the coaches and to handle specific tasks during the intervention process. The Coach is a registered social worker or counselor who has received training in the Basic ACT, Student COMPASS Enhanced Course, and Student COMPASS Course. The Coach is an experienced licensed senior counselor and licensed senior social worker. After the intervention program began, the coach would be responsible for tutoring participants in internet-based ACT for 7 weeks and completing a post-intervention assessment; after 15 weeks, participants were required to complete a follow-up assessment.

2.3. Coaches support

During the 7-week program intervention, participants received counseling and support from 16 ACT-trained social workers and counselors (Puolakanaho et al., 2019; Räsänen et al., 2016), The coaches were required to have experience in group intervention or psychological intervention and to have obtained a professional level certificate of social worker and a certificate of mental health guidance issued by the Ministry of Human Resources and Social Security of the People's Republic of China. Prior to the start of the intervention program, the coaches received 20 h of training in ACT methodology and 20 h of training in Confucianism. In addition, after the start of the intervention, the coaches received group supervision from two experienced psychologists with in-depth knowledge of the ACT methodology and participant issues during the intervention process (7 weeks*2 h, 14 h in total). Coaches also collaborated with two experts in Confucianism on the ethics of the intervention and the techniques of body cultivation and were responsible for introducing key concepts of Confucian ethics, providing guidance on the techniques of body cultivation, evaluating the participants' situation, guiding the participants to achieve the intervention goals on a daily basis, and reinforcing the effectiveness of the intervention program. For details, please see Tables 1 and 2.

2.4. Interventions

2.4.1. Student COMPASS course

The Student COMPASS Course is a 7-week ONLINE ACT intervention course designed to improve the mental health of university students and reduce possible psychological distress and symptoms of stress, anxiety, and depression (Räsänen et al., 2016). The program consists of 2 face-to-face sessions with 5 online sessions over a 7-week period. The course is conducted once a week, lasting 1.5 h each session. Online classes are delivered live via Tencent Meeting. Accompanying value and

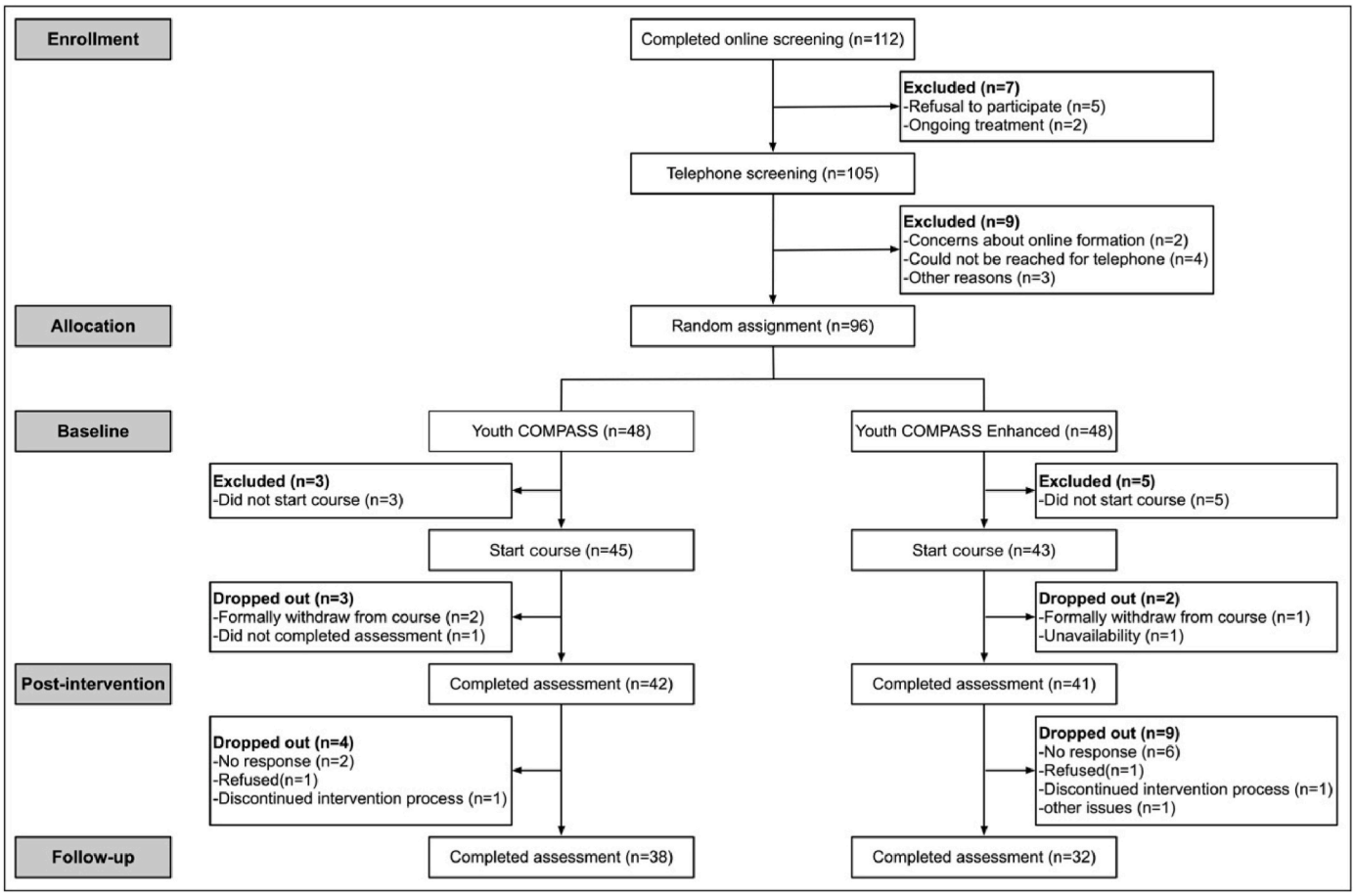


Fig. 1. CONSORT flow chart of the study design.

Table 1
Structure and Content of the Student COMPASS Course: Modules, Aims, Coach's Role and Examples of daily exercises.

Core modules	Aims	Coach's role	Examples of daily exercises
1.Face-to-face session: Introductory	Baseline measurements. Semi-structured interview aiming at mapping the participant's current situation, problems, and level of functionality. Brief orientation to the online intervention.	Interview the participant. Record the basic information and situation of the participants.	A brief introduction to the Student COMPASS program.
2.Online session: Clarifying values	Values. Clarifying one's own values. Difference between values and goals.	Provide written feedback to the client on their values, encourage them on their progress, provide further recommendations and personalized exercises.	Video on values; ACT weekly diary; Weekly wellbeing exercise: Clarifying and reflecting on one's values.
3. Online session: Taking action	Taking values-based action and concrete steps towards them. Examining possible obstacles to taking action based on values.	Focus on possible obstacles to taking concrete action	Video on values and goals; ACT weekly diary; Weekly wellbeing exercise: Defining goals and committing to take values-based action; Mindful breathing, eating, sitting.
4. Online session: Being present	Contact with the present moment. Learning how to be mindful in the here and now.	Point out the importance of mindfulness and its practical application in daily life	Video on being present; ACT weekly diary; Weekly wellbeing exercise: Being mindful in daily activities. Taking action according to values; Observer (exercise).
5.Online session: Watching one's thinking	Cognitive defusion. Taking an observer's perspective towards one's own thoughts and feelings.	Focus on the participants' thinking patterns and their usability/functionality	Video on noticing and naming thoughts; ACT weekly diary; Weekly wellbeing exercise: You are not the same as your thoughts (exercises); Taking action according to values. Continuing with mindfulness activities.
6. Online session: Awareness and Acceptance	Developing awareness of the self-as-context. Acceptance of thoughts, feelings, memories as they are, changing what can be changed through action.	Provide further guidance on the concepts of acceptance and awareness, prepare for face-to-face meeting.	Video on expansion and self-awareness; ACT weekly diary; Weekly wellbeing exercise: What I would need to accept (exercise); Taking action according to values. Continuing with mindfulness activities.
7.Face-to-face session: Concluding	Wrapping up the intervention. Relapse prevention. Post-measurements.	Evaluate, on the basis of a semi-structured interview, the client's situation and wrap up the intervention.	A brief concluding to the Student COMPASS program.

Table 2
Structure and Content of the Student COMPASS Enhanced Course: Modules, Aims, Coach's Role and Examples of daily exercises.

Core modules	Aims	Coach's role	Examples of daily exercises
1. Face-to-face session: Introductory	Baseline assessment. Semi-structured interview aiming at mapping the participant's current situation and needs.	Interview the participant. Record the basic information and situation of the participants.	A brief introduction to the Student COMPASS Enhanced program.
2. Online session: Abiding in reverence	Experiential acceptance, Acceptance of thoughts and feelings so that self-thought does not deviate from rationality.	Introduces the meaning of abiding in reverence, encourages participants to make progress, and provides guidance for daily practice.	Video on Confucian values: abiding in reverence; C-ACT weekly diary; Weekly exercise: tranquil sitting; Taking action according to values. Continuing with abiding in reverence.
3. Online session: Abiding in stillness	Contact with the present moment, Pay attention to current life, and sharpen yourself in daily life and ethical practices.	Introduce the meaning of abiding in stillness as an illustration of the difficulties that can be encountered in everyday life.	Video on Confucian values: abiding in stillness; C-ACT weekly diary; Weekly exercise: calligraphy; Taking action according to values. Continuing with abiding in stillness.
4. Online session: Personal cultivation	Defusion and self-as-context, Separate events from thoughts, view problems from an observer, and reduce the impact of thoughts on yourself.	Introducing the meaning of Personal cultivation, pointing out the role of thinking as a guide to behavior, and the importance of Tranquil sitting in separating events from ideas.	Video on Confucian values: personal cultivation; C-ACT weekly diary; Weekly exercise: early rising; Taking action according to values. Continuing with personal cultivation.
5. Online session: Sincerity	Values, Self-worth, contemplating the nature of life and the meaning of life.	Introduces the meaning of Sincerity and provides guidance on embracing and reinventing values.	Video on Confucian values: sincerity; C-ACT weekly diary; Weekly exercise: exercising; Taking action according to values. Continuing with sincerity.
6. Online session: Putting into practice	Committed action, Knowledge, and action go hand in hand, Take meaningful action consistent with Confucian values.	Introduce the meaning of Putting into practice and encourage participants to act on the values.	Video on Confucian values: putting into practice; C-ACT weekly diary; Weekly exercise: history reading; Taking action according to values. Continuing with putting into practice.
7. Face-to-face session: Concluding	Wrapping up the intervention. Relapse prevention. Post-intervention assessment.	Evaluate the participant's situation and summarize the intervention. Provide further recommendations.	A brief concluding to the Student COMPASS Enhanced program.

exercise instructional videos for the intervention are uploaded to a dedicated social network group platform, allowing participants to access them at any time. In the first week, a face-to-face introductory session was held to understand participants' current problems and level of functioning through a baseline assessment and Semi-structure interview; in the second week, the first module of the online ACT course, Clarifying values, was conducted, focusing on clarifying personal self-worth; and in the third week, the second module of the online ACT course, Taking action, focuses on examining possible obstacles to taking action based on values; The fourth week of the online ACT program, Module 3: Being Present, focuses on learning how to be mindful in the here and now; the fifth week of the online ACT program, Module 4: Watching One's Thinking, the focus was on taking a bystander's perspective on one's thoughts and feelings; The fifth module of the online ACT course, Awareness and Acceptance, was conducted in week six, focusing on developing awareness of the self-as-context; a face-to-face wrap-up session was held in week seven, with a major post-intervention assessment and a course summarizing the course. Throughout the course, participants are required to engage in weekly journaling and complete weekly wellbeing exercises (e.g., mindful breathing, eating, sitting; distinguishing oneself from one's thoughts; identifying needs for acceptance). Participants are also encouraged to incorporate mindfulness activities into their daily lives. For specific content of the intervention course, please refer to Table 1.

2.4.2. *Student COMPASS enhanced course*

The Student COMPASS Enhanced Course is a culturally competent course based on the online ACT intervention course and Student COMPASS Course, with the aim of improving the mental health, sleep health, and psychological flexibility of university students. The Student COMPASS Enhanced Course is based on the Traditional Chinese Confucian Theoretical Model of Confucian Self-Development, and with reference to the experience of Zeng Guofan (1811–1872), a famous Confucian scholar and meritorious official of the Qing Dynasty (1638–1912), the Student COMPASS Enhanced Course aims to improve the mental health and psychological flexibility of college students. It has been cross-culturally adapted to the current situation and needs of the psychological development of college students in mainland China (WEN et al., 2023; Zhou et al., 2024). Psychological flexibility is at the core of ACT and is a protective factor against various psychological problems such as stress, anxiety and depression, as well as sleep problems (Hayes et al., 2006; Larsson et al., 2022). The six sub-processes of flexibility (experiential acceptance, contact with the present moment, defusion, self-as-context, values, and committed action) are related to the Theoretical Model of Confucian Self-Development have some interoperability (Mou, 2005, p. 309; Yongli & Yiping, 2021). Therefore, this course creatively maps Zeng Guofan's practical experience to the six sub-processes of psychological flexibility (See Fig. 2).

The Student COMPASS Enhanced Course is inspired by the Student COMPASS Course and the Youth COMPASS Course (Lappalainen et al., 2014; Räsänen et al., 2016). The Student COMPASS Enhanced Course consists of 2 face-to-face sessions and 5 online sessions, spanning a total duration of 7 weeks. Similar to the Student COMPASS Course, the enhanced course is conducted once a week, with each session lasting 1.5 h. The online sessions are delivered live via Tencent Meeting. Additionally, the value and exercise instructional videos accompanying the intervention are uploaded to a dedicated social network group platform, allowing participants to access them at their convenience. The first week consisted of a face-to-face introductory session with a baseline assessment and semi-structural interview to understand the participants' psychological and sleep status and related issues; the second week consisted of the first module of the course, Abiding in Reverence, which focused on guiding college participants to accept ideas and feelings in the process of Experiential acceptance so that their ideas do not deviate from reason; in the third week, the second module of the course, Abiding in stillness, focuses on guiding college participants to pay attention to the present moment in the process of Contact with the present moment and sharpen themselves in daily life and ethical practice. In the fourth week, the third module of the program, Personal cultivation, focuses on guiding college participants to separate events and thoughts in the process of Defusion and self-as-context in order to reduce the impact of negative thoughts and thinking on themselves; in the fifth week, the fourth module of the program, Sincerity, focuses on guiding college students to think about the essence of life and the meaning of life in the process of discovering self-worth; in the sixth week, the fifth module of the course, Putting into practice, focuses on guiding university students to achieve Knowledge and action go hand in hand in the process of Committed action and to take meaningful actions in line with Confucian values. A face-to-face wrap-up meeting was held in the seventh week to complete the post-intervention assessment and summarize the course.

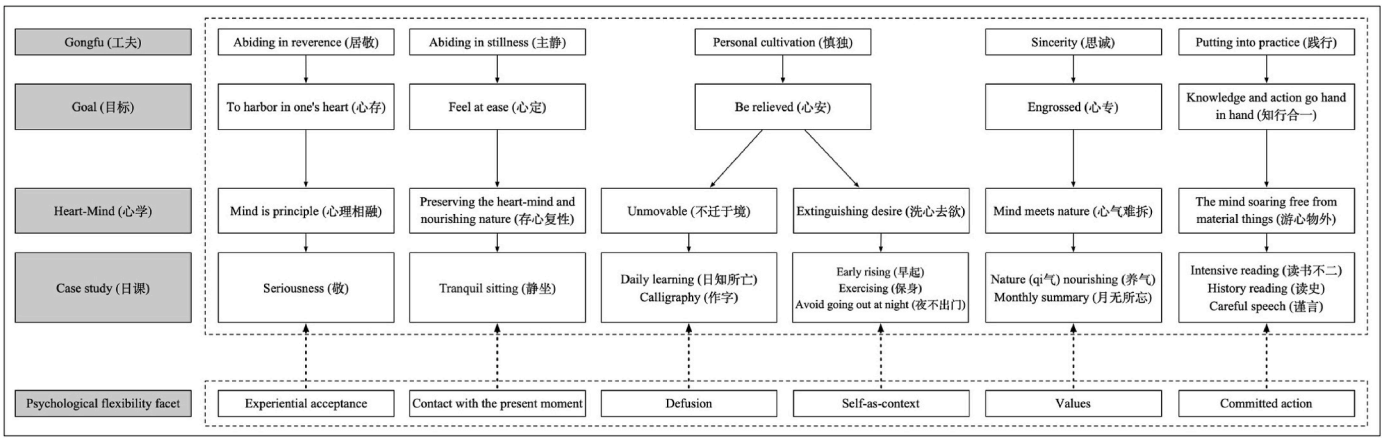


Fig. 2. Theoretical Model of Zeng's Self-Cultivation in Confucian psychology.

During the intervention course, participants were required to engage in weekly Confucian moral practice exercises (e.g., tranquil sitting, calligraphy, exercising, history reading) and conduct reflective activities on Confucian moral practices (e.g., C-ACT weekly diary, taking action according to values, review of thoughts and values). Additionally, participants were provided with supplementary resources to facilitate a deeper understanding of Confucian values and moral practice patterns, thereby promoting further comprehension and completion of the course content (e.g., video on Confucian values). Moreover, participants were instructed to compose weekly diaries and were encouraged to act in accordance with Confucian values. For detailed information regarding the intervention course content, please refer to Table 2.

2.5. Measures

2.5.1. Primary measures

2.5.1.1. Insomnia Severity Index. The Insomnia Severity Index (ISI) is a seven-item self-report scale of insomnia symptoms that assesses the severity of insomnia symptoms (initial, middle, and terminal), satisfaction with sleep, the degree of interference with daytime functioning, noticeability of impairment, and concern caused by the sleep problems. Each entry on the scale was scored on a 5-point Likert scale ranging from 0 = not at all to 4 = extremely. the total ISI score ranges from 0 to 28, with higher scores indicating greater insomnia severity (Morin et al., 2011), In a previous study of Chinese university students, the internal consistency of the ISI was 0.740 (Chung et al., 2011), in the current study it had an internal reliability of Cronbach's α = 0.787.

3.5.1.2. General Health Questionnaire-12. The General Health Questionnaire-12 (GHQ-12) is a 12-item self-report measure of mental health status that consists of six positively worded items (e.g., Have you been able to concentrate on whatever you are doing?), and six negatively worded items (e.g., Have you lost much sleep over worry?). The scale is scored on a 0-0-1-1 scale, with a total score of 0–12, with higher GHQ-12 scores indicating poorer mental health (Goldberg & Williams, 1988). In a previous study of Chinese university students, the Chinese version had an internal reliability of Cronbach's α = 0.790 (Qin et al., 2023). In the current study, it had an internal reliability of Cronbach's α = 0.852.

3.5.1.3. Personalized Psychological Flexibility Index. The Personalized Psychological Flexibility Index (PPFI) is a 15-item self-report measure of psychological flexibility that assesses an individual's psychological flexibility in three areas: avoidance (e.g., I avoid the most different goal-related tasks), acceptance (e.g., I accept the setbacks when pursuing this goal), and harnessing (e.g., When faced with obstacles related to this goal, my frustration serves to energize me). It asks participants to rate on a scale of 1 = strongly disagree to 5 = strongly agree. Higher scores represent higher psychological flexibility (Kashdan et al., 2020). In previous studies of Chinese college students, the PPFI had good internal reliability (Fang et al., 2023). In the current study, it had an internal reliability of Cronbach's α = 0.791.

2.5.2. Secondary measures

2.5.2.1. Epworth Sleepiness Scale. The Epworth Sleepiness Scale (ESS) is an 8-item self-administered questionnaire that assesses an individual's overall level of recent daytime sleepiness. The ESS consists of eight common situations in daily life, and subjects are asked to answer the likelihood of falling asleep in these situations, giving a score from 0 = would never doze to 3 = high chance of dozing. Thus, the total score of the ESS ranges from 0 to 24. The higher the total score, the greater the likelihood that an individual will fall asleep during the day (Johns, 1991). In a study of Chinese residents, the ESS had an internal reliability of Cronbach's α ranged from 0.760 to 0.800 (Wu et al., 2012). In the current study, it had an internal reliability of Cronbach's α = 0.806.

3.5.2.2. Depression Anxiety and Stress Scales-21. The Depression Anxiety and Stress Scales-21 (DASS-21) is a 21-item, 4-point Likert-type scale (0 = did not apply to me at all) to 3 = applied to me very much). It consists of three subscales, depression, anxiety, and stress, and is a self-report measure of general psychological distress, with a higher score indicating more severe levels of distress (Lovibond & Lovibond, 1995). In a study of Hong Kong university students in China, the internal consistency coefficients (Cronbach's α) for depression, anxiety, and stress were 0.841, 0.798, and 0.849, respectively, with 0.929 for the overall scale (Cheung et al., 2020).In the current study, the depression, anxiety, and stress scales had internal reliability of Cronbach's α = 0.896, 0.787, and 0.836, respectively, with 0.920 for the overall scale.

3.5.2.3. Acceptance and Action Questionnaire-II. The Acceptance and Action Questionnaire -II (AAQ-II) is a general measure of psychological inflexibility, which consists of seven items on a seven-point Likert-type scale ranging from 1 = never true to 7 = always true, with higher total scores indicating lower levels of psychological inflexibility (Bond et al., 2011). In a study of Chinese university students, the AAQ-II demonstrated good internal reliability of Cronbach's α = 0.870 (Li et al., 2021). In the current study, it had an internal reliability of Cronbach's α = 0.912.

We employed the Personalized Psychological Flexibility Index (PPFI) and the Acceptance and Action Questionnaire-II (AAQ-II) to assess participants' psychological flexibility. The PPFI provides a multidimensional assessment of psychological flexibility in relation to specific

goals, aligning with the theoretical framework of ACT and the goal-oriented nature of our intervention. The AAQ-II offers a complementary measure of psychological inflexibility. Both measures have demonstrated good reliability and validity in Chinese contexts, making them suitable for use with Chinese university students.

2.6. Analyses

Data were analyzed using SPSS 26.0 software, we performed descriptive statistics, and chi-square analyses and independent t-tests were conducted to determine whether there were any statistically significant differences between the two courses with respect to participant characteristics of Student COMPASS Course, Student COMPASS Enhanced Course participants and the overall sample. To analyze participants' symptomatic changes, we followed intention-to-treat principles and used fully conditional multiple interpolations for missing data from follow-up assessments (McCall et al., 2023). A total of 20 interpolations with 50 iterations were performed (participant age, gender, grade, specialty, achievement ranking, ISI, GHQ-12, PPFI, ESS, DASS-21, and AAQ-II score at all three-time points were included in the model used to interpolate the model for missing data). All data for replicating both sets of analyses can be found at: https://osf.io/zgqhx/.

Consistent with previous research (e.g., Edmonds et al., 2024; Kayrouz et al., 2016), we used the Generalized Estimating Equation (GEE) model to analyze changes in symptom assessment over time (from baseline to 15-week follow-up): First, all GEE analyses were performed using an unstructured working correlation and maximum likelihood estimation, alone with robust error estimation. Second, to compare the results of between-group differences between the intervention group (Student COMPASS Enhanced Course) and control group (Student COMPASS Course), the marginal models included time, group, and their interaction (time*group). A significant interaction would indicate a significant difference between groups over intervention time; third, the percentage change in symptom scores across time points was calculated using the GEE analysis of the estimated marginal means, and further using the GEE analysis of the estimated marginal means and pooled standard deviation to calculate the Cohen'd effect sizes and associated 95% confidence intervals for each outcome measure; finally, pairwise comparisons were used to determine changes between specific time points and groups, and use a Bonferroni correction to adjust for multiple comparisons.

3. Results

3.1. Sample characteristics

Participants' demographic characteristic data collected for the two groups (n = 96) is displayed in Table 3. Approximately half of the participants were male (55.2%, n = 53), with Freshman (39.6%, n = 38) and Junior (28.1%, n = 27) making up the majority, with Freshman (39.6%, n = 38) and Junior (28.1%, n = 27) making up the majority. In specialty, art and human sciences students were overwhelmingly represented (42.7%, n = 41), with a similar proportion of participants ranked Top 20% (30.2%, n = 29), 21–40% (34.4%, n = 33) and 41–60% (26.0%, n = 25) students, and only a small number of participants grades ranked Bottom 61% (9.4%, n = 9). Independent samples t-tests indicated that the Student COMPASS Course group and Student COMPASS Enhanced Course group did not differ significantly between mean age and baseline symptom scores (i.e., ISI, GHQ-12, PPFI, ESS, DASS-21and AAQ- II). In addition, chi-square analysis results also indicated no significant differences between the two groups in demographic variables (i.e., gender, grade, specialty, and achievement ranking). For the rest of the detailed results, please see Table 3.

Table 3
Participants characteristics.

Characteristics	Total (N = 96)	Intervention group (n = 48)	Control group (n = 48)	Group comparison (t or χ^2, p)
Mean age in years (SD)	20.31 (2.16)	20.44(2.53)	20.19 (1.73)	0.565, 0.573
Gender				0.042, 0.837
Male	53 (55.2%)	26(54.2%)	27(56.3%)	
Female	43 (44.8%)	22(45.8%)	21(43.7%)	
Grade				3.370, 0.338
Freshman	38 (39.6%)	17(35.4%)	21(43.8%)	
Sophomore	12 (12.5%)	5(10.4%)	7(14.6%)	
Junior	27 (28.1%)	13(27.1%)	14(29.2%)	
Senior	19 (19.8%)	13 (27.1%)	6(12.5%)	
Specialty				2.236, 0.327
Art and human sciences	41 (42.7%)	21(43.8%)	20(41.7%)	
Sciences	23 (24.0%)	14(29.2%)	9(18.8%)	
Study of medicine	32 (33.3%)	13(27.1%)	19(39.6%)	
Achievement ranking				1.943, 0.584
Top 20%	29 (30.2%)	13(27.1%)	16(33.3%)	
21–40%	33 (34.4%)	15(31.3%)	18(37.5%)	
41–60%	25 (26.0%)	14(29.2%)	11(22.9%)	
Bottom 61%	9(9.4%)	6(12.5%)	3(6.3%)	
Mean (SE) of scores at baseline assessment				
Primary outcomes				
ISI	5.16 (3.53)	5.02(3.27)	5.29(3.80)	−0.374, 0.709
GHQ-12	6.89 (5.15)	7.52(4.47)	6.25(5.74)	1.211, 0.229
PPFI	65.26 (11.15)	66.15 (10.80)	64.38 (11.53)	0.777, 0.439
Secondary outcomes				
ESS	5.17 (3.57)	5.69(3.15)	4.65(3.90)	1.440, 0.153
DASS-21	13.57 (6.97)	13.23(7.08)	13.92 (6.92)	−0.481, 0.631
AAQ-II	25.61 (5.04)	24.98(4.98)	26.25 (5.07)	−1.239, 0.218

Note: ISI = Insomnia Severity Index; GHQ-12 = General Health Questionnaire-12; PPFI = Personalized Psychological Flexibility Index; ESS = Epworth Sleepiness Scale; DASS-21 = Depression Anxiety and Stress Scales-21; AAQ-II = Acceptance and Action Questionnaire-II. Continuous variables were compared using Independent-samples t-tests; categorical variables were compared using the χ^2 test. All differences were $p > 0.05$.

3.2. Symptom measures

Intentions analysis using Generalized Estimating Equation (GEE) showed medium effect sizes for reductions in symptoms on the ISI and large on the AAQ-II. Reductions in symptoms on the GHQ-12 were large for participants of the Student COMPASS Enhanced Course and small for participants of the Student COMPASS Course. Meanwhile, in the ESS, we observed a large reduction effect in symptoms for the intervention group, while the control group exhibited a medium reduction effect in symptoms. Moreover, in the PPFI and DASS-21, it was observed that participants in the Student COMPASS Enhanced Course increased their scores to a medium effect, while participants in the Student COMPASS Course increased their scores to a small effect. Across both courses,

percentage changes in symptoms or scores ranged from 6.83 % (PPFI) to 42.36 % (ESS). Mean scores on symptom measures for each group and time, as well as effect sizes and percentage changes in symptoms, are detailed in Table 4 below. The spaghetti plots showing individual-level trajectories for each significant outcome are presented in Figs. 3 and 4.

An effect of time was observed for all symptom measures (i.e., the ISI, GHQ-12, PPFI, ESS, DASS-21, and AAQ-II), such that symptom declined over time across both two courses. Pairwise comparisons showed that participants of the Student COMPASS Enhanced Course experienced a statistically significant reduction in symptoms between baseline assessment and follow-up assessment on the ISI, GHQ-12, PPFI, ESS, DASS-21 and AAQ-II (PPFI: $p = 0.008$, DASS-21: $p = 0.001$, ISI, GHQ-12, ESS and AAQ-II: $p < 0.001$). Further pairwise comparisons showed that participants of the Student COMPASS Course experienced a statistically significant reduction in symptoms between baseline assessment and follow-up assessment on the ISI, GHQ-12, ESS, and AAQ-II (all p's $<$ 0.028), and no significant reduction in symptoms on the PPFI ($p =$ 0.110) or DASS-21 ($p = 0.277$).

Pairwise comparisons showed no significant differences between participants who chose the Student COMPASS Enhanced Course and those who chose the Student COMPASS Course on all measures at baseline assessment. The results of the GEEs showed no group by time interactions effects for scores on all measures. However, there were group main effects on PPFI, ESS, DASS-21, and AAQ-II scores (all p's $<$ 0.037). Additional details pertaining to the results of the GEE analyses are shown in Table 5.

4. Discussion

This randomized, controlled trial compared the effectiveness of an existing I-ACT intervention (Student COMPASS Course) with a cross-culturally adapted I-ACT intervention (Student COMPASS Enhanced Course or Student COMPASS Course) in improving the mental health, sleep health, and psychological flexibility of a college student participant population by delivering a low-threshold, efficient, and cross-culturally adapted I-ACT intervention. The results of the existing I-ACT intervention (Student COMPASS Course) were compared with the cross-culturally adapted I-ACT intervention (Student COMPASS Enhanced Course) on a Chinese college student population. In addition, participants in the Student COMPASS Enhanced Course reported improvements in sleep status, mental health status, and psychological flexibility levels, while participants in the Student COMPASS Course did not report significant improvements in psychological flexibility. The absence of reported changes in psychological flexibility among participants in the Student COMPASS Course may be attributed to two potential factors. Firstly, participants may have encountered difficulties in fully comprehending the standard ACT course methodology and ideology, particularly in integrating the six sub-processes of psychological flexibility—experiential acceptance, contact with the present moment, defusion, self-as-context, values, and committed action—with the core modules of the curriculum (Lappalainen et al., 2014; Räsänen et al., 2016). Secondly, participants may have experienced discomfort with the underlying values of the mindfulness activities incorporated into the course. This discomfort could be especially pronounced among the college student population, who may struggle to deeply understand and internalize the value core of mindfulness within the traditional Chinese Confucian cultural context (WEN et al., 2023; Zhou et al., 2024).

Overall, the above results are consistent with the results of recent online ACT intervention RCTs of college students' mental health and sleep health (Lappalainen et al., 2019, 2021; Levin et al., 2017), and similar to the results of meta-analyses of I-ACT mental health and sleep health consistent with (Han & Kim, 2022; Kelson et al., 2019; Thompson et al., 2021). Meanwhile, the mental health and sleep health levels of college student participants in this I-ACT program not only showed improvement in the post-intervention assessment but also maintained this effect in the follow-up assessment, which fully demonstrated the good applicability of the I-ACT method in the college student population in mainland China (Wang et al., 2017; Zhao et al., 2023). Of course, this may also be related to the inherently efficient and cost-effective advantages of I-ACT (Sasaki et al., 2021). Of note, the drop-out rate of 27.09% for the present research experiment is at a low level compared to previous randomized controlled trials of guided online interventions (Atefi et al., 2024). The availability of coaching guidance and support from a social worker specializing in group work and a counselor specializing in psychological issues, supplemented by two face-to-face meeting support sessions, may have been an important factor in

Table 4
Means, standard errors, percentage change, and effect sizes.

Measure	Mean (SE)			Change from baseline (%)		Cohen's d effect size [95% CI]		
	Baseline	Post	Follow-up	To Post	To Follow-up	Base → Post	Base → Follow	Post → Follow
Primary outcomes								
ISI								
Intervention group	5.02 (0.47)	4.13 (0.40)	3.12 (0.33)	17.73	37.65	0.30 [0.02,1.76]	0.69 [1.10, 2.68]	0.30 [0.02, 1.76]
Control group	5.29 (0.55)	4.25 (0.47)	3.46 (0.36)	19.66	34.59	0.30 [0.03,2.05]	0.59 [0.92, 2.74]	0.28 [-0.04, 1.62]
Overall	5.16 (0.36)	4.19 (0.31)	3.29 (0.24)	18.80	36.24	0.42 [0.30,1.64]	0.90 [1.27, 2.47]	0.47 [0.35, 1.45]
GHQ-12								
Intervention group	7.52 (0.65)	5.71 (0.54)	4.29 (0.43)	24.07	42.95	0.44 [0.63, 2.99]	0.88 [2.16, 4.30]	0.43 [0.45, 2.39]
Control group	6.25 (0.83)	5.06 (0.66)	4.10 (0.54)	19.04	34.40	0.23 [-0.29, 2.67]	0.46 [0.79, 3.51]	0.23 [-0.23, 2.15]
Overall	6.89 (0.53)	5.39 (0.43)	4.20 (0.34)	21.77	39.04	0.44 [0.51, 2.49]	0.86 [1.79, 3.59]	0.43 [0.39, 1.99]
PPFI								
Intervention group	66.15 (1.56)	67.96 (1.46)	71.44 (1.26)	2.73	8.00	0.17 [-1.19, 4.82]	0.55 [2.49, 8.09]	0.19 [-0.89, 4.51]
Control group	64.38 (1.66)	64.85 (1.70)	68.00 (1.58)	0.73	5.62	0.04 [-2.87, 3.81]	0.33 [0.39, 6.85]	0.28 [-0.11, 6.41]
Overall	65.26 (1.14)	66.41 (1.12)	69.72 (1.02)	1.76	6.83	0.15 [-1.11, 3.41]	0.60 [2.32, 6.60]	0.45 [1.19, 5.43]
Secondary outcomes								
ESS								
Intervention group	5.69 (0.46)	4.06 (0.36)	3.23 (0.38)	28.65	43.23	0.58 [0.82, 2.44]	0.86 [1.63, 3.29]	0.33 [0.09, 1.57]
Control group	4.65 (0.56)	3.40 (0.48)	2.73 (0.34)	26.88	41.29	0.35 [0.21, 2.29]	0.62 [1.02, 2.82]	0.24 [-0.15, 1.49]
Overall	5.17 (0.36)	3.73 (0.30)	2.98 (0.26)	27.85	42.36	0.62 [0.76, 2.12]	1.01 [1.56, 2.82]	0.38 [0.18, 1.32]
DASS-21								
Intervention group	13.23 (1.02)	10.00 (1.00)	8.98 (0.87)	24.41	32.12	0.47 [1.22, 5.24]	0.65 [2.36, 6.14]	0.16 [-0.84, 2.88]
Control group	13.92 (1.00)	14.02 (1.21)	12.31 (1.11)	0.70	11.57	0.01 [-2.30, 2.10]	0.22 [-0.49, 3.71]	0.22 [-0.59, 4.02]
Overall	13.57 (0.71)	12.01 (0.81)	10.65 (0.72)	11.50	21.52	0.29 [0.01, 3.11]	0.58 [1.45, 4.39]	0.25 [-0.22, 2.94]
AAQ-II								
Intervention group	24.98 (0.72)	21.19 (0.76)	18.13 (0.79)	15.17	27.42	0.75 [2.32, 5.30]	1.33 [5.35, 8.35]	0.58 [1.52, 4.60]
Control group	26.25 (0.73)	22.90 (0.75)	20.27 (0.84)	12.76	22.78	0.66 [1.88, 4.82]	1.11 [4.42, 7.54]	0.49 [1.06, 4.20]
Overall	25.61 (0.51)	22.04 (0.54)	19.20 (0.58)	13.94	25.03	1.00 [2.53, 4.61]	1.72 [5.33, 7.49]	0.75 [1.74, 3.94]

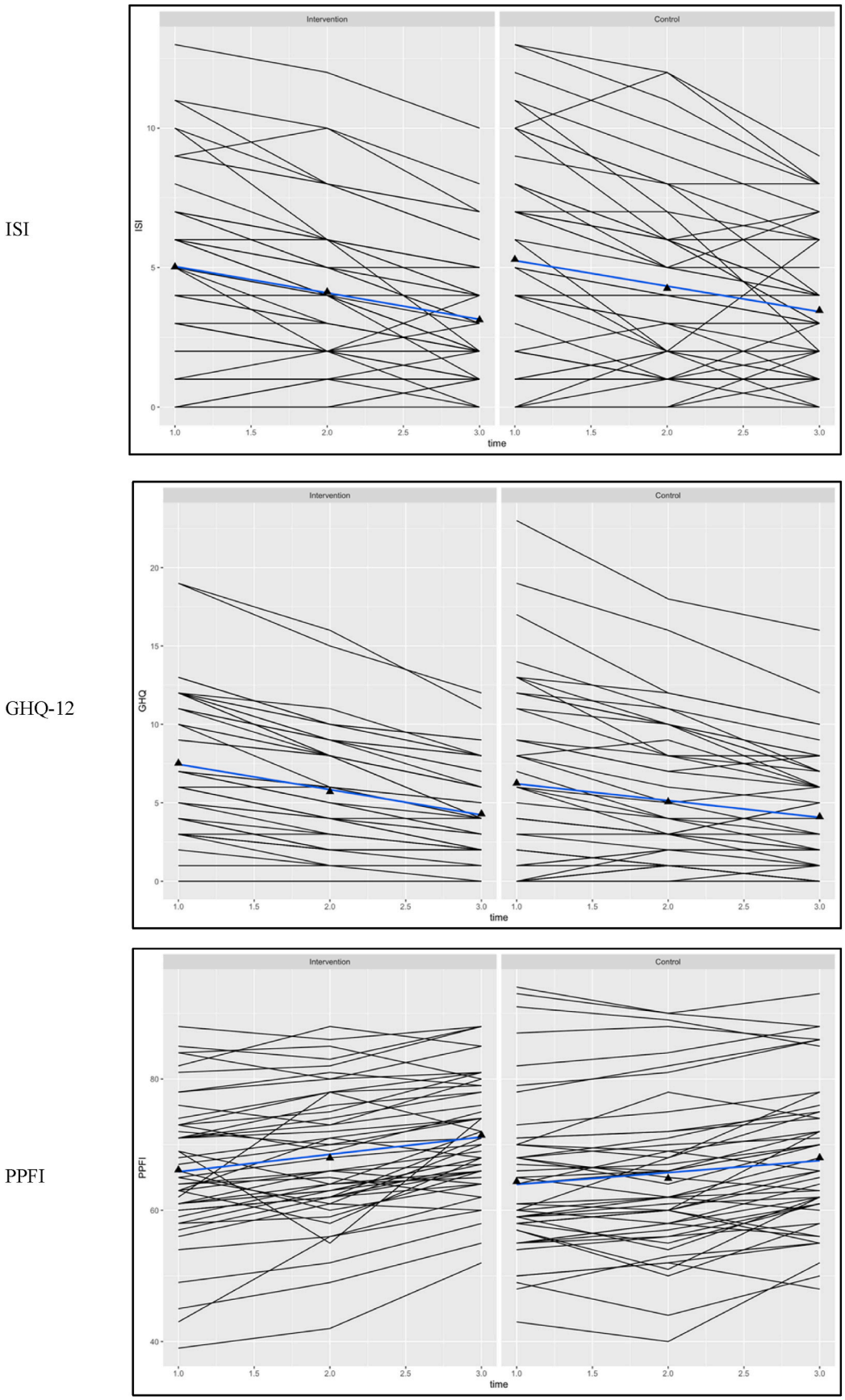
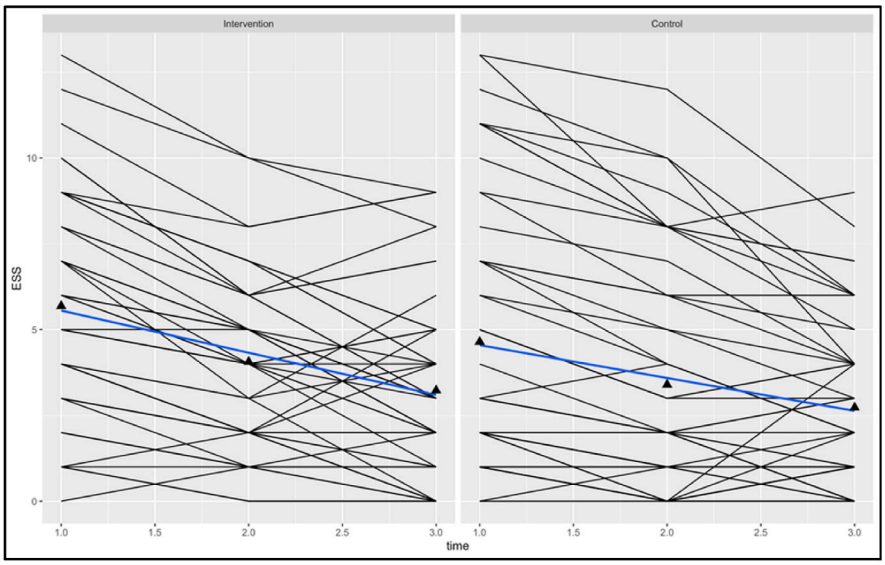
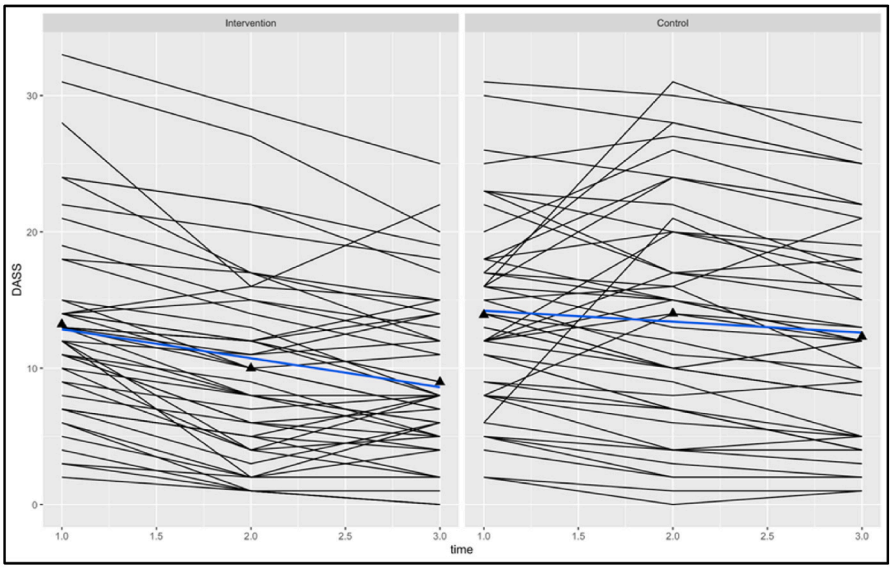


Fig. 3. Spaghetti plots of primary outcomes.
Note. N = 96. Plots are derived from raw data. Blue lines indicate the linear fitted model. The black lines are individual level trajectories from baseline (time 1.0) to the follow-up (time 3.0). The distribution of the lines demonstrates heterogeneity in participant trajectories.

ESS



DASS-21



AAQ-II

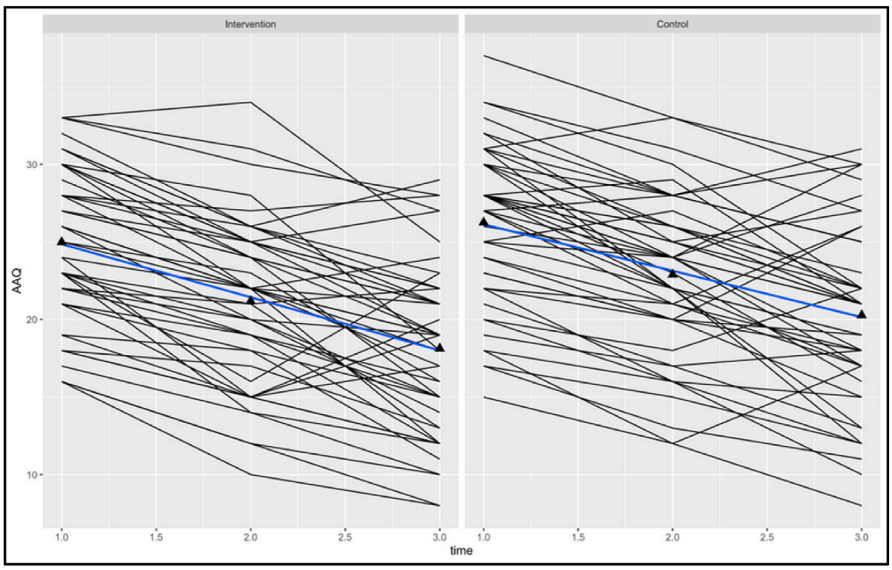


Fig. 4. Spaghetti plots of secondary outcomes.
Note. N = 96. Plots are derived from raw data. Blue lines indicate the linear fitted model. The black lines are individual level trajectories from baseline (time 1.0) to the follow-up (time 3.0). The distribution of the lines demonstrates heterogeneity in participant trajectories.

Table 5
Statistical effects and comparisons.

Measure	GEE effects			p values from pairwise comparisons			
	Time	Group	Time * Group	Baseline (between)	Inter. Base→Follow	Follow-up (between)	Contr. Base→Follow
Primary outcomes							
ISI	$\chi^2 = 19.37$, $p < 0.001$	$\chi^2 = 0.48$, $p = 0.491$	$\chi^2 = 0.07$, $p = 0.965$	0.705	<0.001	0.490	<0.001
GHQ-12	$\chi^2 = 19.28$, $p < 0.001$	$\chi^2 = 1.97$, $p = 0.161$	$\chi^2 = 0.78$, $p = 0.678$	0.221	<0.001	0.783	0.028
PPFI	$\chi^2 = 9.79$, $p = 0.007$	$\chi^2 = 4.94$, $p = 0.026$	$\chi^2 = 0.33$, $p = 0.849$	0.433	0.008	0.085	0.110
Secondary outcomes							
ESS	$\chi^2 = 24.87$, $p < 0.001$	$\chi^2 = 0.35$, $p = 0.037$	$\chi^2 = 0.38$, $p = 0.826$	0.146	<0.001	0.324	0.003
DASS-21	$\chi^2 = 8.69$, $p = 0.001$	$\chi^2 = 10.18$, $p = 0.001$	$\chi^2 = 2.95$, $p = 0.229$	0.627	0.001	0.017	0.277
AAQ-II	$\chi^2 = 72.08$, $p < 0.001$	$\chi^2 = 7.66$, $p = 0.006$	$\chi^2 = 0.33$, $p = 0.848$	0.211	<0.001	0.059	<0.001

facilitating or attracting college student participants to complete the Student COMPASS Enhanced Course or Student COMPASS Course. Compared to the original Student COMPASS program developed by Räsänen et al. (2016), this study utilized a group intervention format and demonstrated positive outcomes. The group format may enhance intervention efficiency and provide more opportunities for interaction and support among participants. Furthermore, this study integrated Chinese cultural values, which may contribute to the program's cultural adaptability and effectiveness. Future research could further explore the differences between group and individual intervention formats, as well as the role of cultural values in psychological interventions.

Furthermore, while the findings of this study did not reveal a significant interaction effect, they nonetheless indicate that the Student COMPASS Enhanced Course exerted a meaningful influence on participants' enhancement of psychological flexibility. The observed improvements in psychological flexibility may be substantially attributed to the integration of Confucian values and body cultivation techniques within the course content: on the one hand, Tranquil Sitting Therapy (WEN et al., 2023), which is based on Confucian values, is similar to VR-based cognitive behavioral therapy (Zhou et al., 2024) based on Confucian values have been shown to be effective in improving mental health and sleep health; on the other hand, the core idea of the Confucian self-development theoretical model aims to emphasize the focus on the "internal saintliness" of the work in order to allow individuals to be in touch with the present moment and to change or adhere to behaviors based on the status quo in order to serve their own Confucian values (Hayes et al., 2006; Yongli & Yiping, 2021), which greatly enhances the level of psychological flexibility of university students. Psychological flexibility is at the core of ACT, and even more so, it is a protective factor against various mental health and sleep health problems (Larsson et al., 2022) and an important process for the favorable outcome of RCT psychological interventions (Nissling et al., 2023). In addition, the findings demonstrated by the control group in this study reaffirm the conclusion that the I-ACT has less impact on psychological flexibility during follow-up assessment (Han & Kim, 2022).

The present study is significant in several ways. First, to the best of our knowledge, this is the first experiment to directly test the effectiveness of incorporating Confucian values into the I-ACT, and importantly, this study also designed a control group of a pre-existing I-ACT course in the West (Student COMPASS Course) to test its effectiveness. The results of the study demonstrate the feasibility and effectiveness of incorporating the Confucian self-development theoretical model and ethical practice model into I-ACT. On the other hand, the study also demonstrates the unique improvement of Confucian values on the psychological flexibility of the core component of ACT. To a certain extent, this complements the limitations of the current mainland Chinese ACT research in terms of a single intervention program and the lack of culturally adapted improvement (Wang et al., 2017; Zhao et al., 2023), and becomes the most effective way to improve the psychological flexibility of the core component of ACT following Tranquil Sitting Therapy and VR-based cognitive behavioral therapy, which is another successful example of culturally adapted psychological interventions based on indigenous Chinese Confucian ethics (WEN et al., 2023; Zhou et al., 2024), and expands the scope of the values-based outreach of the ACT approach, which is in line with the mainstream trend of the third wave of behavioral cognitive therapy (Hennemann et al., 2022; Pan et al., 2023); Second, the intervention program in this study adopted a combination of online and offline course modes, and included registered social workers and counselors as coaches, expanding the online web-based transdiagnostic approaches to take advantage of the current I-ACT approach, which is inexpensive and easy to access (Sasaki et al., 2021), enhancing the organization and improving the efficiency of the intervention,giving full play to the organizational ability of social workers and the professional ability of counselors (Klimczak et al., 2023), and providing a new model of psychological intervention for Chinese university students that has great potential for development; and lastly, the results of the present study demonstrate the differences in psychological flexibility and mental health improvement between the intervention group and the control group, once again demonstrating the applicability of I-ACT in mainland China and the necessity of cross-cultural adaptation of I-ACT, as well as verifying that cross-cultural adaptation of psychological interventions based on the local cultural context is the mainstream direction of the third wave of behavioral cognitive therapies, including the ACT approach (Wang & Fang, 2023).

There are some limitations to this study. First, participants were not screened for mental health and sleep health at the time of course participant inclusion, so that on the one hand, it was not possible to make judgments about the effectiveness of the Student COMPASS Enhanced Course or Student COMPASS Course given to participants with severe symptoms, and on the other hand, it may also cause response bias between the intervention group and control group, especially the inability to accurately determine whether withdrawing participants is related to the ineffectiveness of the intervention sessions; secondly, the intervention process of this study may cause interference with the results of the study, mainly because the participants may communicate with each other offline while the intervention process is in progress, which may cause intergroup contamination, affecting the independence of the intervention results; third, the data collection in this study may have been affected by the individual subjectivity of the participants, i.e., the data were mainly obtained by self-reporting, which may affect the objectivity of the intervention outcome data; fourth, although the level of

dropout rate in this study was low (Atefi et al., 2024), compared to other I-ACT intervention programs for college students there is still there is more room for improvement (Räsänen et al., 2016), which may be related to the fact that the Confucian self-development theoretical model and its associated cultivation techniques are more difficult to understand; finally, the results of this study did not reveal significant group-by-time interaction effects, a finding that may be linked to limitations in the study's design. Therefore, future research should be strengthened in the following aspects: (a) screening and diagnosis of participants and further collaboration with hospitals to determine the clinical effectiveness of this intervention program or curriculum; (b) more refined intervention curriculum design based on Confucian ethics, with particular emphasis on disassembled intervention curriculum constructs to strictly divide the intervention group from the control group; (c) invoking diversified measurement modalities for participants' outcomes, such as the use of wearable devices, the application of biochemical data or auxiliary qualitative methods for data collection and analysis; (d) the development and design of a Confucian ethics intervention manual for I-ACT, as well as the use of case studies to compare and contrast Confucian ethics or body cultivation techniques, to continue to promote the adaptive modification of I-ACT and to expand it to the psychological and sleep health interventions for a wider range of populations; (e) A more rigorous deconstruction study of the existing Student COMPASS Enhanced Course was conducted, incorporating different intervention components for each thematic area in order to delve deeper into the impact of the various intervention content modules on a range of outcome measures.

5. Conclusions

Our findings suggest that a cross-culturally adapted version of the Student COMPASS Enhanced Course's I-ACT program can alleviate mental health and sleep health problems among Chinese college students, while also substantially increasing psychological flexibility. Further, cross-cultural adaptation of the existing I-ACT will increase the level of psychological flexibility and improve mental health more quickly, demonstrating the great potential of cross-cultural adaptation of psychological interventions, which is worthy of replication in future work. Meanwhile, applying counselors and social workers to provide organizational and professional support for the intervention program and adopting a combination of online and offline intervention modes further enhances the efficiency and effectiveness of the intervention program, which can be integrated into the work plan of Chinese university counseling centers. It is noteworthy that this trial is the first attempt at the I-ACT cross-culturally modified in mainland China, and while proving the value of the Student COMPASS Enhanced Course as an important component of the transdiagnostic approaches ACT model, it also generates a wealth of experimental data, opening up the way for future research on similar cross-culturally modified psychological interventions, and providing inspiration for the practice of I-ACT based on Confucian values.

Funding

This study was supported by the Interdisciplinary Project of Lanzhou University First Hospital (ldyyyn2021-99) and the Fundamental Research Funds for the Central Universities of Lanzhou University (2023jbkyjd005).

CRediT authorship contribution statement

Yaping Zhou: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Xiaochen Wen:** Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Yinan Li:** Supervision, Software, Project administration. **Lu Liu:** Investigation. **Qiushan Li:** Project administration.

Data availability

Data will be made available on request. All data for replicating both sets of analyses can be found at: https://osf.io/zgqhx/.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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