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Research Paper

Evaluating the feasibility and preliminary effects of an online compassion training program for nursing students: A pilot randomized controlled trial

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ABSTRACT

Objectives: This study aimed to assess the feasibility of an online compassion training program for nursing students and preliminarily investigate its effects on mindfulness, self-compassion, and stress reduction.
Methods: This study employed a randomized controlled trial design. Second-year students from a nursing college in Guangzhou, China, were recruited as research participants in August 2023. The intervention group participated in an 8-week online compassion training program via the WeChat platform, comprising three stages: mindfulness (weeks 1–2), self-compassion (weeks 3–5), and compassion for others (weeks 6–8). Each stage included four activities: psychoeducation, mindfulness practice, weekly diary, and emotional support. Program feasibility was assessed through recruitment and retention rates, program engagement, and participant acceptability. Program effectiveness was measured with the Mindful Attention Awareness Scale, Self-Compassion Scale - Short Form, and Perceived Stress Scale.
Results: A total of 28 students completed the study (13 in the intervention group, 15 in the control group). The recruitment rate was 36.46%, with a high retention rate of 93.3%. Participants demonstrated high engagement: 69.2% accessed learning materials every 1–2 days, 93.3% practiced mindfulness at least weekly, with an average of 4.69 diary entries submitted per person and 23.30 WeChat interactions with instructors. Regarding acceptability, all participants expressed satisfaction with the program, with 92.4% finding it "very helpful" or "extremely helpful." In terms of intervention effects, the intervention group showed a significant increase in mindfulness levels from pre-intervention (51.54 ± 10.93) to post-intervention (62.46 ± 13.58) ($P < 0.05$), while no significant change was observed in the control group. Although there were no statistically significant differences between the two groups in post-intervention self-compassion and perceived stress levels, the intervention group showed positive trends: self-compassion levels increased (35.85 ± 8.60 vs. 40.85 ± 5.54), and perceived stress levels slightly decreased (44.77 ± 8.65 vs. 42.00 ± 5.77).
Conclusions: This pilot study demonstrated the feasibility of an online compassion training program for nursing students and suggested its potential effectiveness in enhancing mindfulness, self-compassion, and stress reduction. Despite limitations such as small sample size and lack of long-term follow-up, preliminary evidence indicates promising prospects for integrating such training into nursing education. Further research is warranted to confirm these findings and assess the sustained impact of this approach on nursing education and practice.

What is known?

- Embedding compassion into nursing education can mitigate the stresses associated with the nursing curriculum and has been linked to improved mental health outcomes.

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- Online delivery of compassion training offers a flexible, cost-effective, and scalable approach, with studies indicating it can be as effective as in-person training.
- There is a lack of compassion training interventions designed specifically for nursing students and a scarcity of research exploring online methods for such training.

What is new?

- This study implemented a low-dose, continuous online compassion training model, which was effectively integrated into the schedules of nursing students.
- The intervention framework intentionally developed a continuum from mindfulness to self-compassion, progressing naturally to cultivating compassion towards others, thus nurturing a holistic development of compassionate abilities.
- The preliminary effects of the intervention were marked by enhancing mindfulness and reducing negative self-compassion, with a modest contribution to stress reduction.

1. Introduction

Compassion is significant in healthcare and is widely recognized as a key attribute for healthcare professionals. Care rooted in compassion benefits patients by enhancing the patient-caregiver relationship and overall healthcare experience [1] and plays a vital role in supporting healthcare professionals' well-being [2]. In nursing practice, compassion motivates nurse to deliver sensitive care by deeply understanding patient suffering, actively inquiring about their concerns, and fulfilling their inherent needs [3]. Furthermore, the practice of compassion has been linked to decreased burnout and increased job satisfaction among nurses [4].

Nursing education plays an essential role in shaping competent and compassionate nurses. Embedding compassion into nursing education empowers nursing students to embrace and practice this critical virtue early, securing its role as a cornerstone in their development as healthcare professionals. Moreover, fostering compassion has been identified as a protective factor against the pressures within the typical nursing curriculum, such as heavy course loads, rigorous examinations, the expectation to excel in a competitive environment, and the concurrent demands of didactic instruction with clinical training [5,6]. Studies have shown that compassion is associated with reductions in depression, anxiety, and perceived stress, as well as enhancements in resilience [5,7].

In healthcare settings, compassion training is essential for developing self-compassion and compassion towards others, which is foundational to delivering holistic patient care. Mindful Self-Compassion (MSC) and Compassion Cultivation Training (CCT) represent standardized approaches to developing these abilities. MSC, which emphasizes enhancing self-compassion by combining mindfulness practice with targeted self-compassion exercises [8]. This self-directed approach significantly supports personal emotional resilience [9]. However, an excessive focus on self-compassion might not fully encourage the development of other-focused compassion [10], a critical skill in healthcare settings where understanding and responding to others' feelings is essential. On the other hand, CCT takes a broader approach, it emphasizes a more inclusive view of compassion that considers both self and others [11]. It allocates more time to mindfulness practices, fostering a compassionate mindset [12]. Although this broad approach benefits interpersonal skills, it might not emphasize self-compassion. This can be particularly challenging for nursing students, often young adults still developing a sense of self [13]. Therefore, to effectively balance self-compassion and other-focused compassion, compassion programs in nursing education settings need to be more tailored to accommodate individual differences and contextual needs.

Current compassion training programs, typically 8-week in-person courses with weekly sessions lasting 2–2.5 h, are often impractical for healthcare trainees due to their demanding schedules [14]. This challenge is particularly acute for nursing students, who frequently report difficulty attending face-to-face compassion training due to their heavy academic workloads [15]. Online training formats have emerged as a promising solution, offering flexibility, cost-effectiveness, and the potential for broad dissemination, making them ideal for university health promotion initiatives [16]. Despite the promise shown by online interventions in fostering compassion, as evidenced by studies such as those by Eriksson et al. (2018) [17] and Krieger et al. (2019) [18], research specifically targeting compassion training for nursing students remains scant. A review by Durkin et al. [19] identified only three interventions focused on compassion training for nursing students, while another review by Hagerman et al. [20] found just two empirical interventions specifically addressing self-compassion within this group. This highlights a significant gap in nursing students' general compassion and self-compassion training.

Given the scarcity of tailored online compassion training and the preliminary evidence supporting its potential effectiveness, our study aimed to develop and test a new online compassion training program specifically designed for nursing students. Characterized by its low-dose, continuous model, this program enables brief daily activities that can be seamlessly integrated into students' busy schedules. This frequent, manageable engagement is crucial for the gradual and consistent development of compassion skills, ensuring that students can apply these in their professional and personal lives without feeling overwhelmed. In this preliminary study, our first objective was to assess the feasibility of implementing this newly developed program among nursing students. The second objective was to explore the program's initial effects on various outcomes, including mindfulness, self-compassion, and stress reduction. By addressing these objectives, the study responds to the crucial need for accessible, effective, and flexible training methods that support nursing students' mental health and professional preparation.

2. Methods

2.1. Study design and participants

The study was designed as a pilot randomized controlled trial and registered with the Chinese Clinical Trial Registry under the identifier ChiCTR2400081056. The reporting of this study adheres to the Consolidated Standards of Reporting Trials (CONSORT) [21].

Participants were recruited from a nursing school in Guangzhou, China, in August 2023. Second-year nursing students were selected as the participant pool because of their similar educational stage and more flexible schedules, promoting active study involvement. Inclusion criteria encompass individuals who are currently enrolled as students in an accredited nursing program, aged 18 years and above, have regular access to the Internet, and are available to complete the study assessments and activities within the designated timeline. Exclusion criteria include individuals with a history of severe mental health disorders or those currently receiving ongoing mental health treatment that could significantly interfere with participation in the study. This trial employed a two-arm design, randomly assigning participants to either an intervention or control group. Participants in the intervention group engaged in online compassion training, while those in the control group did

not receive any intervention during the study period, continuing with standard educational practices.

In the pilot investigation, we followed the sample size recommendations outlined by Whitehead et al. (2016) [22] based on standardized effect sizes. They suggested recruitment of 75, 25, 15, and 10 participants per treatment arm for studies anticipated to detect extra small (0.1), small (0.2), medium (0.5), and large (0.8) effects, respectively. Based on the effect sizes of 0.525–0.691 reported by Kirby et al. [23], which indicate medium to moderately large effects; we aimed to enroll 15 participants per group (30 total). Initially, we recruited 35 participants, aligning with our target. However, 5 declined participation due to the randomization process, leaving us with the intended 30 participants (15 per group) who completed the baseline assessment. Following the intervention, we experienced 2 additional dropouts, resulting in a final sample of 28 participants. While this slightly reduced sample size may limit generalizability, it still falls within Whitehead et al.'s recommendations for detecting medium to large effects in pilot studies.

2.2. Randomization

Following recruitment, participants were allocated to either an intervention or a control group using simple randomization. The randomization sequence was generated using Python's random module in a 1:1 ratio to ensure equal distribution between the groups. To maintain the integrity of the process, several key measures were taken. Firstly, participants were kept unaware of their group assignment after recruitment but before randomization, preserving impartiality. Secondly, the allocation was conducted by an independent researcher not involved in recruitment or data collection, ensuring a fully unbiased and concealed process. Thirdly, randomization details were withheld from the recruitment team, further reinforcing the blinding process. To minimize potential response bias, all participants, irrespective of their group assignment, were administered questionnaires with identical wording and timing. While the interactive nature of the intervention precluded the blinding of participants and instructors, these stringent randomization procedures were designed to maximize the study's internal validity and robustness of results.

2.3. Procedure

2.3.1. Establishment of the research team

A multidisciplinary research team was established, blending academic expertise and practical experience to ensure a comprehensive and deeply integrated program. The team consists of three professors in mental health care and nursing education, accompanied by a professional counselor and two registered nurses with extensive meditation experiences. Additionally, two team members are qualified mindfulness teachers, enhancing the program's educational scope. The program delivery was led by a registered nurse with extensive experience in meditation, who was further supported by the broader team throughout the program's implementation.

2.3.2. Program development

Drawing from an extensive literature review, our team developed a compassion training program tailored specifically for nursing students. The program's framework was primarily drawn from two sources: the MSC model [8], which emphasizes self-kindness, common humanity, and mindfulness, and the CCT model developed at Stanford University, which focuses on developing greater compassion for oneself and others [11].

Our program progresses through a three-phase developmental pathway: starting with mindfulness, advancing to self-compassion, and expanding compassion to include others. It initiates with mindfulness practices to establish a strong foundation of awareness and presence [24]. This foundation then supports the next phase, which incorporates self-compassion exercises, encouraging students to develop a supportive and understanding relationship with themselves. This includes self-kindness, where students are encouraged to be gentle and understanding with themselves rather than harshly critical; common humanity, which helps students recognize that suffering and personal failure are part of the shared human experience rather than isolating events; and maintaining a balanced, non-judgmental awareness of one's emotions and experiences, as emphasized by Neff & Germer [8]. The final phase broadens the scope to include compassion towards others; students are encouraged to cultivate a compassionate approach that recognizes and acts upon the mutual dependencies that define our social and professional interactions [12].

We consulted an independent expert panel for external review to ensure scientific validity and practical applicability. This panel comprised three experts: a professor and an associate professor specializing in nursing education and mindfulness teaching, along with a registered nurse with more than ten years of experience in mental health practice. We provided each panel member with the study protocol and program content for in-depth, independent review. The experts then offered extensive qualitative feedback, detailing their observations on several key aspects: content adaptability for nursing students, clarity of instructions for mindfulness and compassion exercises, appropriateness of language and terminology used, and effectiveness of teaching strategies for engagement. The research team thoroughly considered and discussed the expert panel's suggestions after this external review. This collaborative process of external review and internal consideration allowed us to refine the program further, ensuring it remained relevant, effective, and grounded in scientific evidence and practical expertise.

2.3.3. The intervention group

Participants in the intervention group engaged in an 8-week online compassion training program delivered via the WeChat platform. The program consisted of three main phases. Phase 1 (weeks 1–2) focused on cultivating mindfulness, which entails sharpening internal awareness - recognizing thoughts, emotions, and body sensations - and external awareness - being fully attentive to the present environment. Phase 2 (weeks 3–5) transitioned to self-compassion, where students learned to observe their thoughts and emotions without reacting impulsively, fostering a more nurturing and compassionate attitude toward themselves, especially in times of personal hardship. Phase 3 (weeks 6–8) expanded compassion practices to include others, integrating the empathetic understanding developed in earlier phases into broader human interactions.

The compassion training program was delivered entirely through the WeChat platform, where both learning materials and detailed information about activities were sent directly to students to guide their engagement and learning. The program was organized into four main types of activities: psychoeducation, mindfulness practices, weekly diary writing, and ongoing emotional support. The psychoeducation content was structured around weekly themes, identifying essential content and broken down into smaller, digestible segments. These segments, presented through text and visuals, allowed for quick review in just 2–3 min and were distributed daily. For example, the first weekly theme focused on external awareness, encouraging students to notice their surroundings and recognize 'autopilot' modes of consciousness. A visual prompt featuring the day's sky with a caption asking, "Have

you noticed the sky above your head?" was used. Students were invited to pause, look up, and truly see the sky - noting its colors, patterns, and changes from previous days. The sky photos they shared were then compiled into a WeChat post to represent mindful observation collectively. Mindfulness practices, enhanced through audio-guided sessions lasting 5–10 min each, were supported by regular reminders sent every other day at 8:00 p.m. to foster daily consistency. Participants were encouraged to integrate these practices into their daily routines. Students were tasked with writing a diary entry about an event over the past week each week. The instructor reviewed these entries and provided personalized feedback to facilitate self-reflection. Additionally, the program emphasized the importance of emotional safety by providing ongoing emotional support. This was especially crucial as the training often explores emotionally complex and potentially distressing subjects. Table 1 provides an overview of the program.

2.3.4. The control group

Participants in the control group did not receive any specific interventions during the study period. They maintained their regular academic schedule, which included standard courses such as Nursing Psychology. It's important to note that the intervention group followed this same regular academic schedule while undergoing this intervention. The control group was informed about the general nature of the study and that they would receive access to the same training program after completing the study period.

2.4. Data collection

The recruitment process began with distributing electronic invitations, including a recruitment link and an e-poster, to four faculty members within the school. The faculty members assisted in circulating these recruitment materials among the nursing students. Interested students were encouraged to contact the program coordinator directly for additional information.

The intervention period ran from September 4 to October 29, 2023. During this time, the intervention group engaged in an 8-week online compassion training program, whereas the control group did not receive any immediate training. Data collection was facilitated using a web-based questionnaire via the Questionnaire Star platform, administered at two-time points: baseline and immediately after the intervention. Both the intervention and control groups completed the same questionnaire at the start of the study, which included demographic information, previous exposure to compassion-related training, and standardized scales. Upon completion of the intervention, both groups were invited to fill out the follow-up survey, which was identical to the initial questionnaire, to ensure comparability of the data. Additionally, the intervention group provided feedback on the training program's acceptability and their levels of engagement. To maintain consistency and reduce potential bias without a blinded assessor, the survey administration was rigorously standardized regarding terminology and timing for both groups.

2.5. Measures

2.5.1. Feasibility

Feasibility was assessed through multiple quantitative process indicators: recruitment rate, retention rate, program engagement, and participant acceptability. The recruitment rate was evaluated based on the achievement of the target sample size, while participants' sustained enrollment measured the retention rate throughout the 8-week intervention period. Program engagement was monitored by tracking access to course materials, regular practice of mindfulness exercises, participant-instructor communication, and weekly diary submissions. Participant acceptability was evaluated using a post-intervention questionnaire that covered various aspects of the training program. Participants rated their overall satisfaction with the learning experience, perceived benefits of the intervention, adequacy of the training duration, and their preferences for material delivery via WeChat.

2.5.2. Mindfulness

The Mindful Attention and Awareness Scale (MAAS) is a 15-item self-report scale that captures mindfulness by inversely measuring the prevalence of mindless states in day-to-day life [25]. Participants reported their agreement with each term on a 6-point Likert scale from 1 (almost always) to 6 (rarely), with higher scores indicating greater mindfulness. The Chinese version of the MAAS, translated by Chen et al. [26], has shown good reliability and

Table 1
Overview of the 8-week online compassion training program.

Week (s)	Phase	Learning activities			
		Theme/psychoeducation	Meditation/experiential exercises	Weekly diary writing	Ongoing emotional support
1–2	Phase 1: Mindfulness foundation	•External awareness •Internal awareness	Mindful eating/walking, sensory exercises, audio-guided mediation exercises (e.g. mindful breathing and siting)	Reflect on both external experiences and internal responses.	Include a daily chat for check-ins and emotional guidance to enhance mindfulness practice.
3–5	Phase 2: Cultivating self-compassion	•Mindfulness in the face of difficult emotions •Embracing kindness towards yourself •Connecting with shared humanity	Self-appreciation reflections, self-compassion break, audio-guided mediation exercises (e.g. body scan, loving-kindness meditation)	Reflect on how self-compassion is being cultivated in daily life.	Enhance the initial emotional guidance by further encouraging the sharing of self-compassion experiences.
6–8	Phase 3: Extending compassion to others	•Nurturing interpersonal connections • Cultivating gratitude and forgiveness • Growing love within and beyond	Compassionate action, such as a kind word, a supportive gesture, daily acts of kindness, audio-guided meditation exercises (e.g. mindful breathing, loving-kindness/compassion meditation).	Reflect on moments where compassion/love naturally arose and how it was expressed or could be expressed in daily interactions.	Explore how interdependence strengthens emotional bonds, fosters forgiveness and love.

validity, with a Cronbach's α coefficient of 0.89. In the present study, the Cronbach's α coefficient for the measure was 0.84.

2.5.3. Self-compassion

The Self-Compassion Scale - Short Form (SCS-SF) is a 12-item self-report scale that assesses three dichotomous facets of self-compassion: self-kindness vs. self-judgment, common humanity vs. isolation, and mindfulness vs. over-identification [27]. Positive self-compassion scores were determined by the self-kindness, common humanity, and mindfulness subscales, with higher scores indicating a stronger presence of these positive attributes. Conversely, scores for the negative self-compassion subscales - self-judgment, isolation, and over-identification were calculated in reverse, such that higher scores reflected lower levels of negative self-compassion. The division of self-compassion into positive and negative dimensions aligned with approaches adopted in prior research [28]. The Chinese version of the SCS-SF demonstrates satisfactory internal consistency, with Cronbach's α coefficients ranging from 0.77 to 0.80 [29]. In this study, the Cronbach's α coefficient was found to be 0.89 for the total scale, 0.87 for positive self-compassion, 0.75 for negative self-compassion.

2.5.4. Perceived stress

Perceived Stress Scale (PSS) is a 14-item self-report scale that measures how much the individual perceives events as uncontrollable and overwhelming [30]. Participants rated the level of stress they experienced on a 5-point Likert scale from 0 (never) to 4 (very often), with higher scores indicating greater stress. The Chinese version of the PSS showed good reliability and validity, with a Cronbach's α coefficient of 0.85 [31]. In this study, the Cronbach's α coefficient was calculated to be 0.84.

2.6. Data analysis

Data analysis was performed using IBM SPSS Statistics, Version 26.0. Continuous variables were reported as means and standard deviations, while categorical variables were reported as frequencies and percentages. Sociodemographic differences between the intervention and control groups were analyzed using *Chi*-squared tests for nominal variables and independent samples *t*-tests for continuous variables.

For the outcome variables - mindfulness, self-compassion, and perceived stress, descriptive statistics (means and standard deviations) were calculated at two-time points: baseline and post-intervention. Independent samples *t*-tests were used to examine differences between the intervention and control groups at both baseline (to ensure initial comparability) and post-intervention (to assess the program's effect). Within-group changes in outcomes from baseline to post-intervention were analyzed using paired samples *t*-tests for both groups. Statistical significance was set at $P < 0.05$ using a two-tailed test. Effect sizes were computed using Cohen's d and interpreted as follows: $d = 0.2$, $d = 0.5$, $d = 0.8$, considered small, medium, and large effect sizes, respectively [32].

2.7. Ethical considerations

Ethical approval for the study was obtained from the Research Ethics Committee at Hong Kong Metropolitan University (reference number: HE-SF2022/17). The study proposal, including the approved ethical considerations, was further reviewed, and the dean's office granted permission at the participating nursing school to recruit participants. Before participation, prospective participants received an electronic information sheet detailing the study's objectives, procedures, expected time commitment, and potential risks and benefits. They were encouraged to carefully review the information and address any inquiries they may have had. Subsequently, participating individuals were invited to provide their agreement voluntarily by electronically signing the consent form. It was explicitly stated that participants had the right to withdraw from the study at any time without consequences. All data collected during the study were anonymized to ensure participant confidentiality and uphold data integrity.

3. Results

3.1. Participants characteristics

A total of 28 nursing students were included in the data analysis, with 13 in the intervention group and 15 in the control group. The participants were predominantly young adults, ranging from 19 to 21 years. Both groups were predominantly female and had similar distributions regarding religious affiliation and prior experience with mindfulness meditation. Statistical analysis showed no significant differences between the intervention and control groups across all demographic characteristics. Detailed demographic information for both groups is presented in Table 2.

3.2. Feasibility

3.2.1. Recruitment, retention, and program engagement

From the initial pool of 96 nursing students approached the study achieved an initial recruitment rate of 36.5%. Following the randomization and intervention phases, the intervention group maintained a retention rate of 86.7%, while the control group achieved 100% retention, resulting in an overall study retention rate of 93.3%.

Participant engagement was active and consistent throughout the program. A significant proportion, 69.2% of participants, accessed learning materials every 1–2 days, followed by 23.1% who did so every 3–4 days, and 7.7% weekly. Adherence to mindfulness practices was diverse yet regular, with 7.7% engaging every 1–2 days, 46.1% every 3–4 days, 38.5% weekly, and 7.7% biweekly. On average, each participant submitted 4.69 diary entries and exchanged 23.30 messages with instructors throughout the program.

3.2.2. Participant acceptability

The program was favorably received, evidenced by 69.2% of participants reporting being 'very satisfied' and 30.8% 'satisfied' with their experience. Perceived helpfulness was rated 'extremely helpful' by 46.2%, 'very helpful' by another 46.2%, and 'somewhat helpful' by 7.7%. The majority (53.8%) considered the training duration appropriate, and there was unanimous favorability towards using WeChat to distribute program materials.

Table 2
Demographic characteristics of the participants.

Demographics	Intervention group ($n = 13$)	Control group ($n = 15$)	$t/\chi 2$	P
Age (years)	19.31 ± 0.75	19.53 ± 0.74	−0.797	0.432
Gender				
Female	12 (92.3)	14 (93.3)	0.011	0.722
Male	1 (7.7)	1 (6.7)		
Prior experiences with mindfulness meditation				
No	10 (76.9)	12 (80.0)	0.039	0.600
Yes	3 (23.1)	3 (20.0)		
Religion				
No religion	11 (84.6)	13 (86.7)	-	0.417*
Buddhism	0	1 (6.7)		
Christianity	2 (15.4)	1 (6.7)		

Note: Data are *Mean* ± *SD* or *n* (%). *Fisher's exact test.

3.3. Effects on mindfulness, self-compassion, and perceived stress

We analyzed the program's effects on mindfulness, self-compassion, and perceived stress. Initial comparisons showed no significant differences in these outcome measures between the intervention and control groups at baseline.

3.3.1. Mindfulness

In the intervention group, a significant increase in mindfulness scores was observed from baseline to post-intervention ($t = -3.599$, $P < 0.05$), with a Cohen's d effect size of 0.81, indicating a large intervention effect. Conversely, the control group did not significantly change mindfulness scores over the same period ($t = 1.950$, $P > 0.05$). Despite these within-group differences post-intervention, no statistical difference was found between the intervention and control groups' mindfulness scores ($P > 0.05$). Table 3.

3.3.2. Self-compassion

Analysis of self-compassion scores revealed noteworthy trends despite the absence of statistical significance. The intervention group exhibited a modest improvement in overall self-compassion from baseline (35.85 ± 8.60) to post-intervention (40.85 ± 5.54), with consistent patterns across both positive and negative dimensions. At post-intervention, the intervention group's scores (40.85 ± 5.54) were relatively higher than those of the control group (36.40 ± 8.05), although the difference did not reach statistical significance ($P > 0.05$). Table 3.

3.3.3. Perceived stress

The intervention group showed a promising decrease in perceived stress levels from baseline (44.77 ± 8.65) to post-intervention (42.00 ± 5.77), while the control group exhibited a slight increase in perceived stress scores from baseline (42.27 ± 9.22) to post-intervention (44.67 ± 6.66). Although these changes did not reach statistical significance, the diverging trends suggest a potential stress-reducing effect of the intervention. Table 3.

4. Discussion

Our study demonstrated the feasibility of implementing an online compassion training program for nursing students. Despite initial recruitment challenges, potentially influenced by the summer break and the absence of face-to-face interactions, our program achieved a notable retention rate of 87.0%. This rate was significantly higher than the retention rates reported for online compassion programs by Johansson et al. [33] and Eriksson et al. [17]. We utilized the WeChat platform, already familiar to the participants, to deliver a rich multimedia learning experience. Through WeChat, students accessed daily bite-sized content, including text, voice, video, and images, allowing for a flexible integration into their busy schedules. This variety of interactive formats was instrumental in maintaining high engagement levels and satisfaction among students, aligning with findings from Choe et al. [34], highlighting multimedia environments' effectiveness in learning scenarios.

Significant enhancements in mindfulness and increasing trends in self-compassion and stress reduction were observed. These findings echo trends from studies such as Jaiswal et al. [35], which noted similar benefits from brief digital mindfulness sessions for healthcare professionals. The adaptability and ease of access provided by the WeChat app were crucial for ensuring continuous exposure to the training material. This regular engagement not only reinforced key concepts and practices, making them easier to apply in real-world situations [36], but also played a critical role in internalizing and deepening compassionate attitudes [37]. Nonetheless, the effect sizes for mindfulness observed in our online compassion training program were comparable with other compassion programs, as indicated in the systematic review and meta-analysis conducted by Kirby et al. [23].

Our program's diverse activities, including psychoeducation, mindfulness practices, weekly diary writing, and emotional support, collectively contributed to the improvements. Psychoeducation utilizes multimedia tools to engage students actively, providing clear, accessible information that lays a solid foundation for understanding mental health concepts. Mindfulness practices are crucial, with even brief, regular sessions leading to significant improvements in mindfulness. This is supported by Bostock et al. [38], who noted that frequent, short guided meditations via smartphone can effectively promote well-being. Weekly diary writing promotes self-reflection and emotional processing, allowing participants to track and analyze their emotional journey. This technique is bolstered by findings from MacIsaac et al. [39], which highlight that journals with positive prompts can significantly boost self-regulation. Additionally, the program's ongoing emotional support is critical for addressing deep psychological needs and providing a safe environment for participants to manage emotional difficulties [40]. The observed reduction in negative self-compassion underscores our program's effectiveness in addressing internal stressors such as self-criticism and perfectionism.

Implementing a low-dose, continuous training model using WeChat presents a compelling strategy for enhancing nursing education and practice within healthcare settings. This model, leveraging the widespread popularity and accessibility of WeChat, ensures that training interventions are both scalable and adaptable to the demanding schedules of nursing professionals. Consistent with findings from Zayas-Cabán et al. [41], who emphasize the importance of integrating learning opportunities into daily clinical workflows, our model proposes using WeChat to deliver training

Table 3
Comparison of the score of the MAAS, SCS-SF and PSS between two groups among students

Variables	Intervention group ($n = 13$)		t_1	P	Control group ($n = 15$)		t_2	P	t_3	P	t_4	P
	Baseline	Post-intervention			Baseline	Post-intervention						
Mindfulness (MAAS)	51.54 ± 10.93	62.46 ± 13.58	−3.599	0.004	60.27 ± 12.17	54.47 ± 12.51	1.950	0.072	−1.983	0.058	1.621	0.117
Self-compassion (SCS-SF)	35.85 ± 8.60	40.85 ± 5.54	−1.907	0.081	36.80 ± 7.90	36.40 ± 8.05	0.361	0.723	−0.306	0.762	1.675	0.106
Positive Self-compassion	20.31 ± 4.31	21.62 ± 5.17	−0.661	0.521	20.93 ± 5.02	20.00 ± 4.42	1.522	0.150	−0.351	0.729	0.891	0.381
Negative Self-compassion	15.54 ± 5.33	19.23 ± 5.20	−2.053	0.063	15.87 ± 4.45	16.40 ± 5.36	−0.597	0.560	−0.178	0.860	1.414	0.169
Perceived Stress (PSS)	44.77 ± 8.65	42.00 ± 5.77	1.205	0.252	42.27 ± 9.22	44.67 ± 6.66	−0.882	0.392	0.737	0.468	−1.123	0.272

Note: Data are *Mean* ± *SD*. t_1: Intervention group from baseline to post-intervention; t_2: Control group from baseline to post-intervention; t_3: Comparison of intervention and control groups at baseline; t_4: Comparison of intervention and control groups at post-intervention. MAAS = Mindful Attention and Awareness Scale. SCS-SF = Self-Compassion Scale - Short Form. PSS = Perceived Stress Scale.

modules in manageable, low-dose segments. Furthermore, the encouraging outcomes observed in mindfulness, self-compassion, and stress reduction are noteworthy, as these aspects are vital for mental health and overall well-being, potentially as significant protective factors. These enhancements may help reduce work-related stress and prevent burnout among healthcare professionals, a benefit supported by Conversano et al. [42]. However, despite these promising aspects, only the changes in mindfulness reached statistical significance, while the outcomes related to self-compassion and stress reduction did not, indicating a need for further investigation to confirm these preliminary findings.

5. Limitations

The pilot study had several limitations that should be acknowledged. Firstly, the small sample size, although adequate for initial explorations, may have restricted the direct generalizability of the results to the broader nursing student population. Additionally, the sample predominantly consisted of students from a single institution, which might not fully represent the diversity found across different nursing schools that vary in demographic compositions, curricula, and cultural contexts. Another significant limitation was the absence of a longitudinal follow-up. As such, the long-term effects and sustainability of the compassion training program remained unexamined. Lastly, the sample exhibited limited gender diversity, with most participants being female nursing students. While a higher representation of females is often observed in nursing-related research due to the field's demographics, it is important to acknowledge that gender differences may influence the reception and impact of compassion training. Despite these constraints inherent to the pilot study due to limited resources and time, the findings provided critical initial insights. These findings can inform larger-scale studies and indicate trends that may be observable in similar educational settings. Building on this foundation, future research should include larger and more diverse samples and incorporate multiple follow-up assessments at various intervals post-intervention to better evaluate the persistence of the intervention's effects. Additionally, efforts should be made to ensure a more balanced gender distribution to address the potential influence of gender on the outcomes of compassion training.

6. Conclusions

The pilot study demonstrated the feasibility and potential benefits of the online compassion training program for nursing students. While the recruitment rate was lower than anticipated, those enrolled exhibited high completion rates, active engagement, and favorable program acceptability. Preliminary effects of the program were promising, marked by significant enhancements in mindfulness and self-compassion and trends toward reduced stress levels. The program's low-dose, continuous design facilitated the seamless integration of practices into daily routines, while the flexible nature of the WeChat platform augmented accessibility and ensured consistent involvement. Integral to the program's design is a structured yet dynamic framework that intertwines mindfulness, self-compassion, and compassion for others. This approach is designed to cultivate a comprehensive sense of compassion among nursing students holistically. However, given the limitations of small sample size, the absence of longitudinal data, and a limited gender representation, Future research should focus on expanding the sample size, broadening the gender diversity of participants, and extending follow-up durations to validate these findings and assess the long-term impact of the training. Further adaptation of this training framework for broader application in health care education could also enhance its reach and effectiveness.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Zhi Yang: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Project administration. **Mimi Mun Yee Tse:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing, Supervision, Project administration. **Huiting Huang:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing – review & editing. **Haiyun Fang:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing – review & editing. **Joanne Wai Yee Chung:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing, Supervision. **Doris Yin Kei Chong:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing. **Thomas Kwok Shing Wong:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2024.08.007.

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