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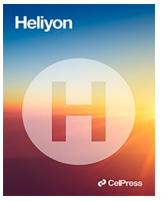

Research article

Effects of dance movement therapy on compassionate flow in nursing students: An experimental study

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ABSTRACT

Purpose: Only a few studies have explored how compassion is taught to nursing students. This study aimed to investigate the differences in compassionate flow among nursing students both before and after an educational intervention.

Materials and methods: This study employed a cluster randomised controlled trial design in medical schools in Taiwan. We enrolled first- and second-year nursing students. The intervention group underwent dance movement therapy, while the control group received yoga training. Compassionate flow was assessed using the Compassionate Engagement and Action Scale and the Fears of Compassion Scale.

Results: A total of 59 participants (31 in the experimental group and 28 in the control group) were included in the final statistical analysis, and an 82 % response rate was recorded. Statistically significant differences were observed in total scores on the Compassionate Engagement and Action Scales, along with compassion for self and compassion from other subscales between the experimental and control groups ($p < .05$). The η^2 effect levels were 0.12, 0.12, and 0.09.

Conclusions: Educational training employing dance movement therapy demonstrated enhancements in self-compassion and compassion for others among first- and second-year nursing students.

1. Introduction

Compassionate flow refers to the dynamic, reciprocal processing of compassion [1]. According to the Cambridge Dictionary, compassion is defined as "a strong feeling of sympathy and sadness for the suffering or bad luck of others, and a wish to help them". However, there remains debate regarding the definition and nature of compassion. For instance, within the Christian tradition, compassion is reflected through narratives of self-sacrifice, courage, and the Good Samaritan [2,3]. Likewise, the Buddhist tradition's concept of bodhicitta shares similarities with compassion, encompassing the desire to liberate all sentient beings from suffering and its causes [3,4]. Building on the notion of compassion as sensitivity to one's own and others' suffering, as well as a commitment to alleviate it, Gilbert et al. [3] developed new compassion competency scales. These scales assess compassion for others, compassion

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experienced by others, and self-compassion. However, some individuals with high levels of self-criticism and shame may exhibit negative reactions, such as fear and avoidance, when confronted with compassion, a phenomenon termed the "fear of compassion" [5,6]. In healthcare applications, empathy is metaphorically described as a quality that comes from the head, sympathy from the heart, and altruism from the hands, all three blended in a compassionate attitude as clinical care [7]. Through cognitive empathy, the feeling of being touched in sympathy, and the motivation to alleviate suffering in altruism, the professional understanding of compassion is the basis for an encounter with the suffering of others, and therefore serves as a buffer for negative reactions [7,8]. Several scholars assert that compassion is not merely a feeling of affection or closeness towards others who are suffering but also a vital component of patient care [9,10]. Consequently, compassion is often integrated into training programs [10–13] due to its potential impact on compassion-based strategies for enhancing physician-patient interactions and communication [9]. For instance, the development of compassionate competencies in nursing students prior to entering clinical settings may enhance their interactions with patients. However, limited studies have explored how compassion is taught to nursing students [14]. Compassion, being a complex concept, can be influenced by biological, psychological, social, and environmental factors [15]. Thus, considering these factors is imperative when developing training programs to support nursing students in enhancing their compassion competence.

The American Dance Therapy Association (ADTA) defines Dance Movement Therapy (DMT) as a psychotherapeutic process fostering the emotional, social, cognitive, and physical integration of individuals. DMT can also be viewed as a form of psychotherapy that utilises movement based on the assumption of mind-body interconnection and the healing power of dance [16]. Particularly, DMT-based programs have been shown to stimulate different brain areas associated with neurocognitive function, mood, and dynamic balance [17–19]. For instance, the arrangement of improvisational dance in DMT can stimulate frontal lobe function, with movement correlating to path integration and visual tracking. These components activate entorhinal and hippocampal networks associated with spatial memory [19,20]. A meta-analysis by Koch et al. [16] consisting of 21 studies demonstrated the effects of DMT on health-related psychological outcomes and its impact on various populations. However, limited literature exists on the impact of DMT on compassion, with only three articles related to nursing students and their compassion. A previous qualitative study of nursing students learning interpersonal skills from a DMT perspective suggested that learning occurs through the body, highlighting its role as a learning medium in DMT games [21]. In a semi-experimental pilot study involving eight nurses, compassion satisfaction levels increased, and burnout and compassion fatigue levels decreased after DMT training [22]. Moreover, findings from another pilot study involving higher education teachers provided evidence of contributions to self-knowledge, communication, and kinesthetic empathy [23].

Despite the importance of self-care and compassionate care in stressful learning environments for nursing students, there is a paucity of studies on this topic, probably because the development of more effective teaching materials requires greater commitment. Some scholars have created digital learning and teaching environments to cultivate compassion in nursing students [24]. However, body pedagogy, which emphasizes learning as a process of physical embodiment, is a core principle of health professions education [25]. A previous systematic review noted that yoga appeared to be effective in managing stress and burnout in healthcare workers [26]. One study has shown yoga had positive effect on self-compassion in nursing students [27]. Based on empirical data and ethical considerations, yoga should be one of the options considered for educational training. Supportive and resourceful training environments are important for students' professional development [28]. For the above reasons, the compassionate training (DMT or yoga) have been incorporated into the course called Complementary and Alternative Therapies at the study college. Therefore, this study aimed to examine the differences in compassionate flow in nursing students before and after the DMT intervention and to compare the differences between the DMT group and the yoga group.

2. Materials and methods

2.1. Research design

This study employed a cluster randomised controlled trial design. Two courses focusing on complementary and alternative therapies were offered to nursing students at a research college during the study period. Students were free to choose either course or neither. To minimize cross-contamination and for practical reasons, a random selection process was utilized. One arm (course) was randomly designated as the control group, while the other arm was assigned to the experimental group. Finally, the control group was scheduled on Sunday afternoon and the experimental group on Tuesday afternoon of the same week. Both types of training are either/or choices. Due to research ethics, instructors gave all participants the freedom to choose whether or not to participate in the other training after the study.

2.2. Participants

In this study, we enrolled junior students at a medical college in northern Taiwan. Approval for student recruitment was obtained from the college director, principal, and experts at the college, and students voluntarily participated in accordance with Heppner and Heppner's recommendations [29]. The minimum required sample size was determined to be 52 participants, considering an effect size of 0.35, a power of 0.8, two repeated measurements, and two groups. However, we considered a nonresponse rate of 10 %, yielding the required sample size of 58. The inclusion criteria were as follows: (1) freshmen or sophomore nursing students, (2) those taking a course in Complementary and Alternative Therapies, and (3) willingness to participate and agreeing to complete the questionnaire. As the intervention included dance and music, the exclusion criteria were deafness or a diagnosis of a limb disorder based on information sources such as school health records and parental notifications. The detailed flow diagram of the study is presented in Fig. 1. Ultimately, 59 students completed the study. It is worth mentioning that some participants withdrew from the experimental group due to

the novelty of the DMT experience. Data employed for analyses were collected between September and December 2023.

2.3. Teaching and learning program

In the experimental group, the DMT was led by a dance movement therapist with a Ph.D. from the Institute of Counseling Psychology. The DMT design aimed to improve participants' mood and vitality, foster imagination, creativity, and personal expression, and enhance communication and social exchange. Typically, DMT comprises four main elements: simple group dance, movement games, improvisational dance movement, and interactions among group members [20]. Our DMT program was adapted from an integrated somatic dance and visual arts program previously applied to the older population [30]. The intervention was scheduled in the afternoon and lasted for approximately 2 h. As previously recommended, rhythmic and contralateral movements on both sides of the body were emphasized in this study to enhance coordination and stimulation between the left and right cerebral hemispheres [31]. The experimental groups were then subdivided into six groups. Balloons half-filled with water were used as the game in this study to guide individual and grouping rhythms and movements. Additionally, painting was incorporated to help participants understand their bodies and psychological states [32]. Finally, group discussions and mutual support, along with verbal sharing after the DMT exercise, were encouraged. All participants were encouraged to engage in self-practice twice a week according to online-guided recordings.

In contrast, the control group underwent yoga training based on the program designed by Kinchen et al. [27], led by a college teacher with 14 years of experience in yoga instruction. The yoga program included breathing exercises, Asanas, eye focus, body lock, and meditation. Participants were instructed to adjust their positioning based on their skill level to mitigate the risk of injury. The yoga intervention was scheduled at 2 p.m. and lasted for approximately 2 h. All participants were encouraged to practice independently twice a week.

2.4. Measurements and data collection

Participant variables explored in the structured questionnaire included demographics, the Compassionate Engagement and Action Scales (CEAS), and the Fear of Compassion Scales (FCS). Demographic information included sex, high school level, and household area. A study of Taiwanese adolescents showed good reliability and validity for both the CEAS and FCS scales [33]. Notably, the initial data collected before the training included information on demographics, CEAS, and FCS. Subsequently, CEAS and FCS data were collected a second time one week after training.

The CEAS, developed by Gilbert et al. [3], comprises three subscales assessing different aspects of compassion: compassion for self, compassion for others, and compassion from others, each consisting of 13 items. These subscales measure various facets of engagement and action. The CEAS employs a 10-point Likert scale, where a score of 1 indicates "never", and 10 indicates "always". Higher scores indicate a higher frequency of compassionate engagement and action, and the data can be analysed individually or collectively. In their study, confirmatory factor analysis demonstrated good model fits for compassion for self (χ^2/df = 3.66; CFI = 0.94; TLI = 0.91; RMSEA = 0.092; SRMR = 0.049), compassion for others (χ^2/df = 3.89; CFI = 0.96; TLI = 0.95; RMSEA = 0.096; SRMR = 0.036), and compassion from others (χ^2/df = 3.92; CFI = 0.96; TLI = 0.95; RMSEA = 0.098; SRMR = 0.033) in the US sample. Likewise, the CEAS traditional Chinese version also exhibited robust internal consistencies (Cronbach's α: 0.83 for compassion for self, 0.88 for compassion for others, and 0.91 for compassion from others) [33].

The FCS consists of three subscales designed to assess the fear of compassion: fear of compassion for others (10 items), fear of compassion from others (13 items), and fear of compassion for oneself (15 items) [5]. Responses are recorded on a standardised scale

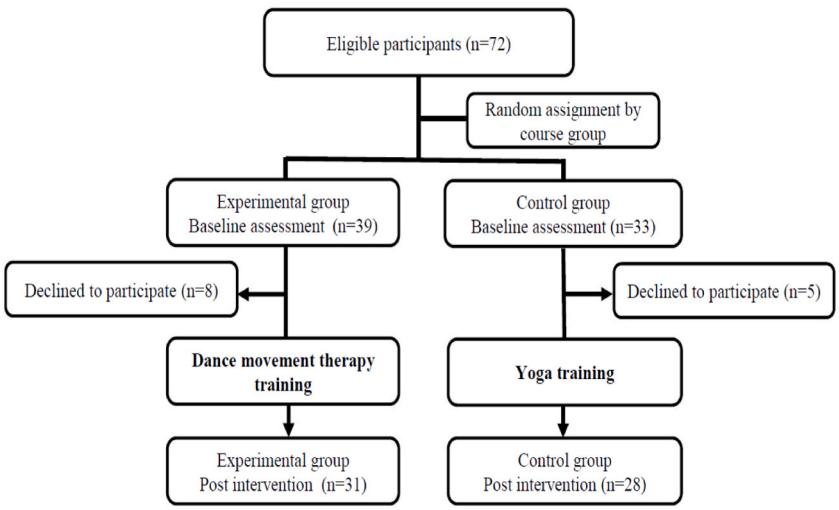

Fig. 1. Flow chart of nursing student selection.

ranging from 0 (do not agree at all) to 4 (completely agree) using a five-point Likert scale. Higher scores indicate a greater agreement with fears of compassion. Cronbach's alpha for the subscales ranged from 0.72 to 0.83 in the original study [5], while in the traditional Chinese version, Cronbach's alpha ranged between 0.84 and 0.92 (FCS compassion for self, $\alpha = .92$, FCS compassion for others, $\alpha = .84$, FCS compassion from others, $\alpha = .89$) [33].

2.5. Data analysis

All analyses were performed using SPSS software (SPSS 26.0, IBM Corp., Somers, New York, USA). Data are presented as percentages, means, and standard deviations. Differences between the two groups were analysed using the χ^2 test, and a paired *t*-test was employed to compare the pre-and post-test mean scores of the two groups. To ensure the validity of the results, the data were initially analysed to verify adherence to hypotheses of randomness, independence, normality, and homogeneity of variance. Subsequently, an analysis of covariance (ANCOVA) was performed. The Levene's test was used to test the homogeneity of variance. A univariate ANCOVA test was conducted to compare differences between the pre- and post-test scores of the two groups. The effect size was calculated using the partial η^2 value, indicating the proportion of variance. Results were categorised based on Cohen's classification scheme [34], where 0.01 suggests a small effect, 0.06 denotes a small to medium effect, and 0.14 signifies a large effect.

3. RESULTS

3.1. Participant characteristics

A total of 72 first or second-year college students were initially recruited for this study. However, 13 students opted out of the study, citing a lack of time. Ultimately, 59 participants (31 in the experimental group and 29 in the control group) were included in the final statistical analysis, resulting in an 82 % response rate. Baseline demographic variables, including gender ($\chi^2 = 2.54$, $p = .11$, Table 1) and family area ($\chi^2 = 4.62$, $p = .20$, Table 1), showed no significant differences between the two groups. However, bivariate analysis revealed a a noteworthy disparity in the distribution of students from public and private high schools. Specifically, a significantly higher percentage of students in the experimental group attended public high schools, whereas a significantly higher percentage of students in the control group attended private high schools ($\chi^2 = 37.63$, $p < .01$, Table 1).

3.2. Effects of DMT on CEAS

The paired *t*-test results revealed that participants in the experimental group exhibited significantly higher mean scores for various measures. Specifically, there was a notable increase in the CEAS total score (pretests vs posttest: 204.94 ± 31.21 vs 217.65 ± 36.63, $t = -3.95$, $p < .01$, Table 2), the compassion for self subscale (pretests vs posttest: 71.10 ± 10.66 vs 76.23 ± 12.68, $t = -3.38$, $p < .01$, Table 2), and the compassion from others subscale (pretests vs. posttest: 65.29 ± 14.54 vs. 70.32 ± 13.63, $t = -2.99$, $p < .01$, Table 2) post-intervention. On the other hand, in the control group, although there was an increase in the mean CEAS scores and all subscales after the intervention, these changes did not reach statistical significance.

In bivariate analysis, a remarkable difference in high school students was observed between the control and experimental groups (Table 1). Consequently, a univariate covariance analysis, adjusted for high school attributes in both groups, was performed. The pretest score variable was included to control for overall variance, resulting in a significant difference in the average posttest values after adjustments for both the intervention and control groups. The outcome for between-group effects on the CEAS total score yielded $F = 7.23$, $p < .01$, which was statistically significant. The effect size, indicated by η^2, was 0.12 (Table 3), suggesting that DMT had a moderate impact on the CEAS total score [34]. Additionally, the between-group effects for the two subscales also reached significance ($F = 7.60$, $p < .01$ for compassion for oneself and $F = 5.46$, $p = .02$ for compassion from others). The η^2 effect levels were 0.12 and 0.09,

Table 1
Demographic characteristics between control and experimental groups (n = 59).

	All (n = 59)		Group				χ^2	*p*
			Experimental (n = 31)		Control (n = 28)			
	n	(%)	n	(%)	n	(%)		
Gender							2.54	0.11
Male	6	(10.2)	5	(22.5)	1	(9.4)		
Female	53	(89.8)	26	(77.5)	27	(90.6)		
High School							37.63	<0.01
Private	30	(50.8)	4	(12.9)	26	(92.9)		
Public	29	(49.2)	27	(87.1)	2	(7.1)		
Household Area							4.62	0.20
Northern Taiwan	41	(69.5)	18	(58.1)	23	(82.1)		
Central Taiwan	6	(10.2)	5	(16.1)	1	(3.6)		
Southern Taiwan	7	(11.9)	5	(16.1)	2	(7.1)		
Eastern Taiwan and Outlying Islands	5	(8.4)	3	(5.1)	2	(7.1)		

Note. χ^2 value is the respective statistical value from the Pearson chi-square test; the significance level was set at $p < .05$.

Table 2
Pretests and posttests on Compassionate Engagement and Action Scale and Fears of Compassion Scale using the paired *t*-test.

Variable	Time				*t*	*p*
	Pretest Mean ± SD		Posttest Mean ± SD			
CEAS (Total Score)						
Control group	203.82	±27.59	208.18	±33.24	−1.09	0.28
Experimental group	204.94	±31.21	217.65	±36.63	−3.95	<0.01**
Compassion for self						
Control group	72.54	±10.88	74.04	±11.97	−0.87	0.39
Experimental group	71.10	±10.66	76.23	±12.68	−3.38	<0.01**
Compassion for others						
Control group	67.75	±10.34	69.25	±12.90	−0.98	0.33
Experimental group	68.55	±15.82	71.10	±15.20	−1.78	0.09
Compassion from others						
Control group	63.54	±13.79	64.89	±13.87	−0.65	0.52
Experimental group	65.29	±14.54	70.32	±13.63	−2.99	<0.01**
FCS (Total Score)						
Control group	55.04	±23.44	52.43	±24.30	0.80	0.43
Experimental group	65.84	±24.01	62.84	±28.82	0.99	0.33
Fear of compassion for others						
Control group	17.50	±6.26	16.18	±6.86	1.79	0.09
Experimental group	20.26	±6.13	17.97	±7.01	2.88	<0.01**
Fear of compassion from others						
Control group	20.32	±10.68	19.43	±10.87	0.54	0.60
Experimental group	21.23	±11.50	20.16	±12.74	0.73	0.47
Fear of compassion for self						
Control group	17.21	±12.13	16.82	±12.16	0.20	0.85
Experimental group	24.35	±12.83	24.71	±12.34	−0.21	0.84

Abbreviations: CEAS, The Compassionate Engagement and Action Scale; FCS, Fears of Compassion Scale; SD, standard deviation; *p < .05. **p < .01.

Table 3
Experimental and control groups on Compassionate Engagement and Action Scale and Fears of Compassion Scale using the Univariate ANCOVA.

	Sum of Squares	Mean Square	F	p	η^2Partial Eta Squared
CEAS					
Intercept	217.16	217.16	0.60	0.44	0.01
Pretest score	46783.12	46783.12	128.35	<0.01**	0.70
Group	2636.00	2636.00	7.23	<0.01**	0.12
Error	20046.82	364.49			
Compassion for self					
Intercept	289.16	289.16	4.17	0.05	0.07
Pretest score	4563.09	4563.09	65.80	<0.01**	0.55
Group	527.20	527.20	7.60	<0.01**	0.12
Error	3813.97	69.35			
Compassion from others					
Intercept	1265.69	1265.69	14.62	<0.01*	0.21
Pretest score	5729.64	5729.64	66.20	<0.01**	0.55
Group	472.77	472.77	5.46	0.02*	0.09
Error	4760.355	86.552			
FCS					
Intercept	173.99	173.99	0.61	0.44	0.01
Pretest score	24762.22	24762.22	87.31	<0.01**	0.61
Group	147.85	147.85	0.52	0.47	0.01
Error	15598.29	283.61			
Fear of compassion for others					
Intercept	0.02	0.02	0.00	0.98	<0.01
Pretest score	1776.29	1776.29	100.97	<0.01**	0.65
Group	21.07	21.07	1.20	0.28	0.02
Error	967.61	17.59			

Abbreviations: ANCOVA, Analysis of covariance; CEAS, The Compassionate Engagement and Action Scale; FCS, Fears of Compassion Scale; η^2, partial eta squared. Adjusted by the high school attribute.
*p < .05. **p < .01.

respectively.

3.3. Effects of DMT on FCS

The paired *t*-test results showed that participants in the experimental group had significantly lower mean scores for the fear of compassion for others subscale after the intervention (pretests vs posttest: 20.26 ± 6.13 vs 17.97 ± 7.01, t = 2.88, p < .01, Table 2). However, while the mean FCS total scores in both the control and experimental groups decreased after the intervention, this difference did not achieve statistical significance.

Table 3 presents the results of the univariate covariance analysis, adjusted for high school attributes in both groups. The inclusion of the pretest score variable to control for overall variance resulted in a significant difference in the average post-test values after adjustments for both the intervention and control groups. However, the between-group effects for the fear of compassion for others subscale did not reach significance (F = 1.2, p = .28). The η^2 effect level was 0.02 (Table 3), indicating that DMT had a minimal impact on the fear of compassion for others subscale [34]. Moreover, the between-group effect on the total FCS score also did not reach significance (F = 0.52, p = .47, Table 3).

4. Discussion

Our findings suggest that training interventions targeting compassionate flow through DMT are both feasible and acceptable to nursing students. During DMT, a balloon filled halfway with water was used as an important tool for fostering compassionate flow. The potential distress caused by a broken balloon during transfer underscores its significance. Individual rhythmic activities provided a focal point for students to enhance their body balance, thereby promoting compassion for themselves. The incorporation of group games, such as passing water balloons, not only encourages mutual physical interaction but also establishes a flow of compassion among participants. This process facilitates peer learning and the development of robust partnerships among students.

The teacher in charge seamlessly integrated live music into the delivery of feedback during DMT sessions. While previous studies have utilized writing for reflective purposes [35,36], our current study introduced creative drawing to not only increase students' motivation to learn but also assist them in comprehending their current mental and physical states through the use of colour [32,37]. The adoption of teaching micro-skills consistent with Beck and Kulzer's recommendations [38] contributes to high levels of course participation. Both groups were pre-deployed, ensuring minimal disruption to the course's smooth progression. No harm occurred during the study.

Participants undergoing DMT intervention showed improved mental health, symptom alleviation, reduced fatigue, and reported a better quality of life [16,39]. The overall mediating effect was found to be small, significant, and homogeneous [16]. Based on Cohen's classification scheme [34], our findings suggest that DMT training had a small to moderate impact on CEAS total scores, as well as subscales related to compassion for self and others among junior nursing students. These results are not only consistent with previous research but also suggest the importance of considering compassionate flow in the design of DMT interventions. It is worth noting that while our results showed a slight increase in the compassion scores for others in the experimental group, the differences were not statistically significant. This could be attributed to the fact that field training was conducted only once. Additionally, DMT after-school practice, which only had online recording guidance, might primarily focus on self-compassion [40] and lack the interpersonal interaction necessary for fostering compassion for others. Future studies could explore the potential improvements by increasing the number of on-site DMT training sessions.

Fear of compassion is a psychological variable particularly relevant in nursing activities. Our findings revealed slight decreases in FCS total scores in the experimental group, even though these changes were not statistically significant. Previous studies have suggested a positive association between fear of compassion and difficulties in emotion regulation [41]. The lack of significant differences in our study might be explained by the generally positive adjustment of nursing students, resulting in lower levels of fear of compassion. Considering the young age and early stage of their nursing education, the participants in our study had not yet undergone clinical practicums, especially in settings that could potentially trigger high levels of self-criticism and shame. Moreover, the DMT activities conducted in this study involved familiar classmates. Potential reasons for the lack of significant improvement could also be the intensity and duration of the intervention. Thus, further research is warranted to investigate these issues more comprehensively in the future.

This study explored a method for stimulating compassionate flow among nursing students through the use of DMT as an instructional approach. The incorporation of DMT offers advantages to educational institutions, administrators, instructors, and students. Our research specifically delved into the design of DMT, emphasising the utilization of water-balloon tools to facilitate the transition from individual to group rhythms. Additionally, we encouraged students to reflect on the process through creative drawing, fostering active participation and offering valuable insights for future research endeavours.

5. Limitations of the study

Despite dedicating considerable effort to the study design and achieving noteworthy results, this study has some limitations. First, the sample size estimation relied on a repeated-measures formula, potentially leading to an underestimation of the required size by not considering the effect of the cluster design. Second, both the experimental and control groups participated in training programs, featuring only one on-site training session and two online training sessions per week. Other complementary therapies (e.g., art therapy or horticultural therapy) were arranged after 1 week of those trainings. In order to minimize possible interference from other therapy

sessions, the analysis in this study was based on collected data from participants before and one week after the training course. The study only collected short-term effects and may have underestimation the long-term effects. The selection of yoga-trained rather than untrained individuals in the control group may also have contributed to the underestimation of the effectiveness of DMT. A longer follow-up and no other training program might provide more insight into the sustainability of the intervention effects.Third, data on actual learning performance were not collected. Thus, future longitudinal studies are required to assess the consistency of the intervention with learning performance. Fourth, there were constraints in time and space to support more extensive compassionate interventions due to the diverse course schedules of each student. Finally, the implementation of certain methods, such as the use of water balloons, requires additional time, effort, and financial resources from the instructor.

6. Conclusion

Our findings indicate that educational training based on DMT improved nursing students' compassionate flow, particularly in fostering compassion for oneself and others. These results provide valuable insights for educators, shedding light on the influence of both individual and group interactions on the development of students' compassion. Additionally, the use of painting creation as a method not only reflects students' mood colours but also stimulates their proactive engagement in learning. These findings contribute to a deeper understanding of the role of interpersonal and collaborative dynamics in shaping students' compassion. It is hoped that higher education institutions will integrate such innovative curricula, fostering core competencies in compassionate behaviour among students. This, in turn, can empower students to empathise effectively with patients or their families, thereby enhancing their commitment to the nursing profession. Further research, incorporating longitudinal measures and the tracking of actual academic performance outcomes, warrants further investigation to ensure the sustained effectiveness of the intervention.

CRediT authorship contribution statement

Yin-Hui Hong: Supervision, Resources, Conceptualization. **Chen-Jung Chen:** Project administration, Methodology, Investigation. **Shu-fen Shen:** Project administration, Methodology, Investigation. **Su-Chen Fang:** Project administration, Methodology, Investigation. **Mei-Ling Lin:** Methodology. **Sheng-Miauh Huang:** Investigation, Data curation, Conceptualization.

Ethics statement

Approval was granted by the Institutional Review Board of MacKay Memorial Hospital (22MMHIS402e). Authors comply with all relevant ethical regulations. Written consent was obtained for all participants. There were no participant names on all questionnaires, only alternative codes.

Data availability statement

The data that support the findings of this study are available from the corresponding author, Sheng-Miauh Huang, upon reasonable request.

Trial registration number

This study was registered at ClinicalTrials.gov Protocol Registration and Results System (NCT06220708).

Declaration of generative artificial intelligence

All authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscrip.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Sheng-Miauh Huang reports article publishing charges, statistical analysis, and writing assistance were provided by MacKay Medical College. If there are other authors, they 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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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e40811.

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