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Influence of a b-learning model to improve perceived stressors in final-year nursing students during clinical placements: a quasi-experimental study

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Abstract

Background Clinical placements are essential for nursing students' competence development but represent one of the most stressful components of their training. High levels of perceived stress may hinder learning, undermine confidence, and negatively affect clinical performance. Evidence on pedagogical strategies to mitigate these stressors remains inconsistent, and the potential of blended-learning models during placements is not well established. This study evaluated the effect of a tutored blended-learning model (i-MHA) on perceived stressors among final-year nursing students.

Methods A prospective quasi-experimental pre–post study with a control group was conducted across three campuses of the Rovira i Virgili University (Spain) during the 2021–2022 academic year. The intervention group received a structured blended-learning model incorporating moderated online forums, guided reflection, and weekly tutor-led supervision. The control group followed the traditional supervision approach. Perceived stress was assessed before and after placements using the Kezkak questionnaire. Between-group differences were analysed using the Mann–Whitney U test, and within-group changes using the Wilcoxon test. Effect sizes (Cohen's d) and attrition analyses were performed to validate internal consistency.

Results A total of 126 students participated (86.89% women; mean age 23.64 years). No significant baseline differences were found between groups across any Kezkak dimensions. After the intervention, the only significant between-group difference emerged in Factor 3 (Relationship with tutors and peers), with lower stress scores in the intervention group ($p = 0.030$). In the paired intragroup analysis ($n = 61$), the intervention group showed a significant improvement in the same dimension ($p = 0.032$), while no significant changes were detected in the control group. No

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sex-related differences emerged, and baseline comparisons between paired and unpaired participants indicated no systematic attrition bias.

Conclusions The tutored b-learning model improved students' perceived relationship with tutors and peers during clinical placements, reducing stress associated with supervisory interactions. Although other stress dimensions did not change, the model strengthened communication and academic support, offering a promising strategy to enhance student well-being and learning during clinical practice. Further research with larger and diverse samples is warranted to explore its long-term impact on academic performance, psychological well-being, and transition to professional practice.

Clinical trial number Not applicable.

Keywords Clinical skills, Education, Nursing, Psychological, Stress, Student nursing, Blended-learning

Background

Clinical placements constitute a cornerstone in the training of nursing students, bridging the gap between theoretical knowledge and practical application in real-world healthcare settings. This stage offers students an essential opportunity to develop critical professional competencies and transition from academic to clinical practice. However, it also presents significant challenges. The demanding nature of clinical placements, combined with the responsibility for patient care, decision-making under pressure, and the need to demonstrate competence, can make this period highly stressful for students [1, 2].

Research consistently identifies clinical placements as one of the most stressful phases of nursing education. Students often report experiencing intense stress due to factors such as fear of making mistakes that could harm patients, adapting to unfamiliar environments, and meeting high expectations from supervisors and peers [3, 4]. This stress not only impacts their emotional well-being but can also hinder learning, reduce academic performance, and compromise the quality of care provided during placements. Prolonged exposure to such stress may lead to burnout, anxiety, and other health issues, with potential long-term effects on students' careers and the healthcare system [5].

Despite its importance, many nursing education programs lack adequate strategies to mitigate stress during clinical practice. Traditional approaches often fail to address the multifaceted nature of the stress experienced by students, highlighting the need for innovative and effective solutions. While some institutions have introduced emotional support programs or mentorship models, these interventions have produced inconsistent results [6, 7].

Blended learning (b-learning) methodologies, which combine digital tools with face-to-face instruction, have shown promise in enhancing learning outcomes and reducing stress in educational settings. This model creates a dynamic and reflective environment where students can share knowledge, collaborate with peers, and engage in guided reflection [8]. By integrating theoretical learning with practical application, b-learning fosters critical thinking, builds confidence, and strengthens clinical competencies, potentially alleviating the stress associated with clinical placements [9].

The tutored b-learning model, in particular, offers structured guidance through virtual forums moderated by tutors, face-to-face sessions, and peer-to-peer interactions. This approach not only enhances academic performance and motivation but also provides continuous support during internships. By encouraging reflection and the application of clinical judgment, the model equips students with tools to manage stress effectively and transform challenges into professional growth opportunities [9, 10].

This study investigated the impact of a tutored b-learning model on perceived stress among final-year nursing students during clinical placements. By evaluating its effectiveness in reducing stress and improving key competencies, this research aims to provide evidence-based insights for integrating such methodologies into nursing education, ultimately supporting students in their transition to professional practice.

Methods

The hypothesis of this study is that the implementation of the b-learning model will significantly improve stress management in these students, thus reducing perceived stress levels during clinical placements.

Study design

A prospective quasi-experimental pre-post study with control group was conducted during the clinical placement cycle for final-year nursing students at Rovira i Virgili University (Tarragona, Spain) between January and June of the 2021–2022 academic year.

Sampling

The sample size was calculated via the GRANMO Sample Size Calculator (free software, IMIM, Barcelona, version 7.12, April 2012) for two independent means with an alpha risk of 0.05 and a beta risk of 0.2 in a two-tailed

test, with a 10% attrition rate. The required total sample size was 130 students ($n = 65$ intervention group, $n = 65$ control group) from the final-year nursing program enrolled in the clinical placement courses of the second block of the 2021–2022 academic year, as per the 2009 Curriculum Plan. The participation rate was 96.9%.

All eligible students enrolled in the clinical placement courses at the three URV campuses during the recruitment period were invited to participate and were included by consecutive sampling (i.e., all consenting, eligible students were recruited). For logistical and administrative reasons, the two campuses were used as natural clusters: the Terres de l'Ebre Campus (Tortosa) functioned as the intervention cluster (i-MHA) and the Catalonia and Baix Penedès Campuses were grouped as control clusters (c-MT). This allocation was not randomized; thus, the study is best described as a quasi-experimental design with non-random assignment by campus.

Data collection

Data were collected at the Faculty of Nursing, Rovira i Virgili University (URV), across three campuses: Terres de l'Ebre Campus in Tortosa (intervention group: application of the hybrid learning model (i-MHA)), Catalonia Campus, and Baix Penedes Campus (control groups: without the hybrid learning model (c-MT)). The clinical placements lasted for 5 weeks, comprising 4 placement cycles (Fig. 1). All participants were fully informed about the study objectives and data confidentiality; informed consent was obtained electronically prior to questionnaire completion. Participant flow and attrition (clarification added): A total of 130 students were initially invited (planned sample n = 130). Of these, 126 students provided baseline data and were included in the baseline/post aggregated analyses (participation rate 96.9% of invited). Four invited students did not contribute baseline data and therefore were not included in subsequent analyses (reasons: 2 declined participation; 2 submitted incomplete baseline questionnaires). A TREND [11] low diagram (Fig. 1) has been added to the manuscript to summarise invitation, enrolment, baseline completion, postintervention completion, and number of paired (pre/post) records available for intragroup analyses.

The present study was approved by the Ethics Committee of the Pere Virgili Health Research Institute under approval number 121/2020. The participants were fully informed about the study's objectives, and

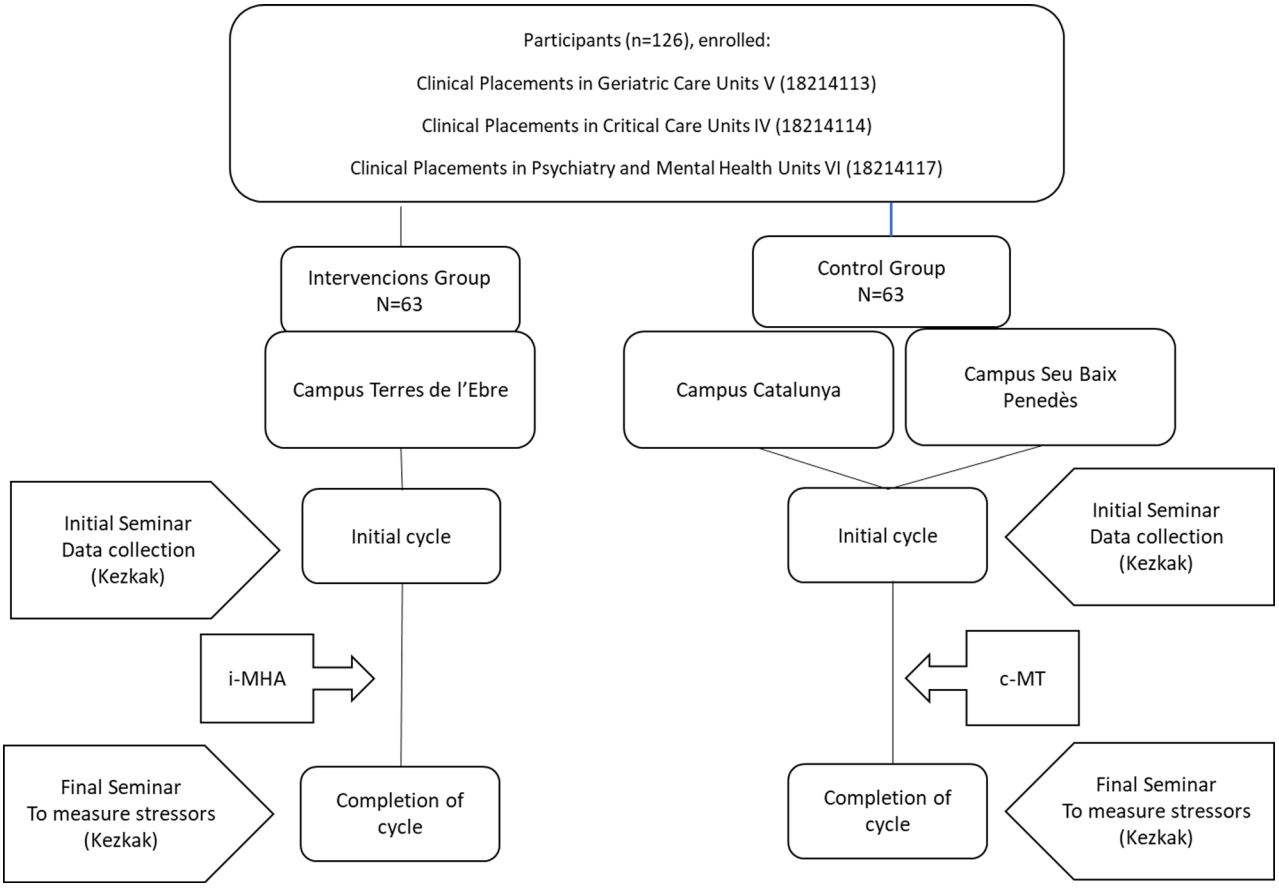

Fig. 1 Participant flow diagram according to the TREND group

the confidentiality and anonymity conditions were thoroughly explained to them.

Procedure

The study procedure and recruitment during the nursing clinical placements:

a) Traditional Model (c-MT), implemented in the control group:

- Assignment of students to clinical placement centers and to an academic tutor.
- Initial seminar addressing the evaluation and specific characteristics of the placement centers for the second specialty.
- Weekly tutoring sessions ($n = 4$) for the evaluation of competencies and development during clinical placements.
- The final seminar focused on individual student evaluations.

b) Hybrid learning model (i-MHA), implemented in the intervention group:

- Assignment of students to clinical placement centers and to an academic tutor.
- Initial seminar addressing the evaluation and specific characteristics of the placement centers for the second specialty.
- The virtual forum was moderated by the academic tutor, allowing the tracking of real cases and linking them with professional competencies.
- Weekly tutoring sessions ($n = 4$) for the evaluation of competencies and development during clinical placements.
- The final seminar focused on individual and group evaluations of forum contributions and the competencies acquired by the students, with a final presentation, triangulation, evaluation, and submission that encouraged critical thinking.

The virtual forum in the i-MHA group comprised weekly prompts (1–2 themes/week), required at least one substantive student post and one reply per student per week, and was actively moderated by an assigned academic tutor (moderation included weekly feedback and thematic synthesis). The final seminar for the i-MHA group lasted 3 h, included group presentations of forum cases, tutor feedback, and an integrated evaluation of participation and competencies. In the c-MT group the final seminar was limited to individual competency evaluation without structured forum contributions.

Fidelity and adherence tracking: Attendance at weekly tutor sessions, activity in the forum (number of posts per student), and attendance at the final seminar were recorded to document adherence to the intervention protocol. These process measures were used to describe implementation and to explore dose–response in sensitivity analyses.

Variables collected: Sociodemographic variables (birth year, sex), placement center to i-MHA and c-MT were collected.

Kezkak questionnaire details: The Kezkak questionnaire [10] was used to measure stressors during clinical placement. This questionnaire aligns perfectly with the objectives of the study and consists of 41 items assessing the level of concern for each described situation (0: not at all; 1: a little; 2: quite a bit; 3: a lot). These items are grouped into 9 factors: lack of competence (11 items), contact with suffering (10 items), relationship with tutors and peers (6 items), helplessness and uncertainty (11 items), inability to control the relationship with patients (8 items), emotional involvement (4 items), being Harmed by the patient relationship (5 items), seeking an intimate relationship (2 items), and workload. High total scores indicate the aspects that most concern students and the extent to which situations during clinical placements are stressful. Factorial scores indicate specific highly stressful aspects. The total scores range from 0 to 123.

An overall score was obtained, representing the level of stress experienced by students during their work tasks, as was a score for each of the nine factors. The psychometric characteristics of the sample for the present study were assessed via Cronbach's alpha for these items at the beginning of the clinical placements ($\alpha = 0.92$) and at the end of the clinical placement cycle ($\alpha = 0.88$).

Administration: The Kezkak questionnaire was distributed to all participants via the Moodle academic platform for the respective courses across the three campuses, both prior to the commencement and upon completion of the clinical placements. All participants received the online questionnaire along with an invitation containing detailed information about the study's objectives, anonymity, and confidentiality. Informed consent was provided and had to be accepted before participants could proceed to complete the questionnaire.

Statistical analysis

Descriptive analysis of qualitative variables was conducted using absolute frequency and the corresponding percentage. Quantitative variables are presented as the means, standard deviations and medians. The Mann–Whitney U test was used to analyse differences between student groups (intervention group (i-MHA) versus control group (c-MT)). To detect statistically significant differences before and after intervention, the nonparametric Wilcoxon test was used, and to quantify this difference, the effect size was calculated via Cohen's d test. All

analyses were performed via SPSS v.27 software (IBM) with a licence from URV, and the statistical significance level was set at $p < 0.05$.

Results

A total of 126 students were included in the study, with a mean age of 23.64 years (SD: 5.29), of whom 86.89% were female. Originally, 130 students were invited to participate (65 per group); however, 4 students did not provide complete baseline data and were excluded from the comparative analysis. Therefore, the analyses presented in Table 1 correspond to the 126 students with valid preintervention and postintervention data at the group level.

At the beginning of the intervention (preintervention), no statistically significant differences were observed in any of the nine Kezkak dimensions between the two groups (Table 1).

After the intervention (postintervention), the only statistically significant difference observed between the groups was in Factor 3 – Relationship with tutors and peers ($p = 0.030$), indicating a lower perceived stress level in that dimension.

However, due to difficulties linking preintervention and postintervention questionnaires (mainly missing or inconsistent participant identifiers), only a subset of 61 participants (40 control, 21 intervention) could be paired for within-subject analysis.

A comparison between participants with paired data and those without showed no statistically significant differences in age, sex, or baseline Kezkak scores (all $p > 0.05$), suggesting that attrition was random and unlikely to introduce systematic bias.

Among the paired participants, 13.11% were male ($n = 8$), and 86.89% were female ($n = 53$), with a mean age of 23.64 years (SD: 5.29).

At baseline, the median scores were similar across groups, and none of the differences reached statistical significance. After the intervention, the median scores remained largely unchanged across most dimensions, with the exception of Factor 3 (Relationship with tutors and peers), where a statistically significant improvement was observed in the intervention group ($p = 0.032$). (Table 2).

Discussion

The literature [12–14] consistently demonstrates that the stress experienced by nursing students during clinical placements not only causes significant distress but

Table 1 Comparative analysis of the Kezkak scores obtained between groups (c-MT vs. i-MHA)

***N* Total = 126**	**c-MT (*n* = 63)**			**i-MHA (*n* = 63)**			
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**	**p value**
Factors at the beginning of clinical placements							
Factor 1. Lack of skills and abilities	29.05	7.45	29	30.62	7.74	31	0.429
Factor 2. Contact with human suffering	26.67	5.15	27	27.71	4.86	27	0.428
Factor 3. Relationship with tutors and peers	16.85	3.63	17	17.14	4.30	18	0.521
Factor 4. Impotence and uncertainty	30.98	5.90	32	32.48	5.77	32	0.407
Factor 5. Inability to manage the relationship with patients	21.05	3.19	22	21.95	3.07	22	0.396
Factor 6. Emotional involvement	10.35	2.08	10	11.33	2.27	12	0.113
Factor 7. Distress caused by relationship with patients	13.08	3.55	13.5	13.33	3.55	14	0.843
Factor 8. Patient seeking an intimate relationship	5.28	2.10	5.5	5.24	2.07	6	0.945
Factor 9. Overload	13.45	2.99	14	14.24	2.28	15	0.346
Factors at the end of clinical placements							
Factor 1. Lack of skills and abilities	28.19	8.85	28	28.24	8.45	28	0.920
Factor 2. Contact with human suffering	26.16	4.10	27	24.86	5.46	25	0.278
Factor 3. Relationship with tutors and peers	16.41	3.55	17	14.14	4.48	15	0.030
Factor 4. Impotence and uncertainty	30.69	6.77	31	30.81	5.91	30	0.899
Factor 5. Inability to manage the relationship with patients	20.94	3.00	21	20.33	4.40	20	0.425
Factor 6. Emotional involvement	10.16	1.44	10	10.33	2.15	10	0.824
Factor 7. Distress caused by relationship with patients	12.84	4.04	13	13.19	3.71	14	0.777
Factor 8. Patient seeking an intimate relationship	5.28	2.04	6	5.76	1.89	6	0.397
Factor 9. Overload	13.31	2.22	13.5	13.86	2.92	14	0.388

The score for each factor of the Kezkak instrument is expressed as the mean, standard deviation (SD) and median. The p value was calculated via the Mann–Whitney U test to analyse the differences between the student-dependent groups (c-MT/i-MHA), with a p value < 0.05.*p value

Factor 1: Lack of skills and abilities Items 15, 16, 13, 4, 2, 6, 26, 1, 3, 17 and 5 (maximum score 33); Factor 2: Contact with human suffering Items 27, 39, 18, 10, 9, 31, 32, 29, 14 and 34 (maximum score 30); Factor 3: Relationship with tutors and peers Items 12, 28, 19, 25, 1 and 20 (maximum score 18); Factor 4: Impotence and uncertainty Items 23, 38, 14, 41, 36, 6, 32, 3, 17, 2 and 20 (maximum score 33); Factor 5: Inability to manage the relationship with patients Items 5, 33, 7, 30, 29, 39, 17 and 20 (maximum score 24); Factor 6: Emotional involvement Items 21, 8, 22 and 31 (maximum score 12); Factor 7: Distress caused by relationship with patients Items 11, 24, 26, 15 and 14 (maximum score 15); Factor 8: Patient seeking an intimate relationship Items 40 and 37 (maximum score 6); Factor 9: Overload Items 35, 36, 34, 30, and 31 (maximum score 15)

Table 2 Intragroup comparative analysis of Kezkak scores between (c-MT) and (i-MHA)

***N* Total = 61**	**Preintervention**			**Post Intervention**				
c-MT (*n* = 40)	**Mean**	**SD**	**Median**	**Mean**	**SD**	**Median**	**p value**	***d**
Factor 1. Lack of skills and abilities	29.05	7.45	29	28.19	8.85	28	0.757	0,083
Factor 2. Contact with human suffering	26.67	5.15	27	26.16	4.10	27	0.934	-0,029
Factor 3. Relationship with tutors and peers	16.85	3.63	17	16.41	3.55	17	0.837	0,043
Factor 4. Impotence and uncertainty	30.98	5.90	32	30.69	6.77	31	0.757	0,000
Factor 5. Inability to manage the relationship with patients	21.05	3.19	22	20.94	3.00	21	0.753	-0,072
Factor 6. Emotional involvement	10.35	2.08	10	10.16	1.44	10	1.000	-0,066
Factor 7. Distress caused by relationship with patients	13.08	3.55	13.5	12.84	4.04	13	0.990	0,017
Factor 8. Patient seeking an intimate relationship	5.28	2.10	5.5	5.28	2.04	6	0.460	-0,126
Factor 9. Overload	13.45	2.99	14	13.31	2.22	13.5	0.882	-0,043
i-MHA (*n* = 21)								
Factor 1. Lack of skills and abilities	30.62	7.74	31	28.24	8.45	28	0.334	0,210
Factor 2. Contact with human suffering	27.71	4.86	27	24.86	5.46	25	0.067	0,447
Factor 3. Relationship with tutors and peers	17.14	4.30	18	14.14	4.48	15	0.032	0,481
Factor 4. Impotence and uncertainty	32.48	5.77	32	30.81	5.91	30	0.365	0,228
Factor 5. Inability to manage the relationship with patients	21.95	3.07	22	20.33	4.40	20	0.163	0,308
Factor 6. Emotional involvement	11.33	2.27	12	10.33	2.15	10	0.132	0,341
Factor 7. Distress caused by relationship with patients	13.33	3.55	14	13.19	3.71	14	0.965	0,033
Factor 8. Patient seeking an intimate relationship	5.24	2.07	6	5.76	1.89	6	0.297	-0,211
Factor 9. Overload	14.24	2.28	15	13.86	2.92	14	0.392	0,120

The score for each factor of the Kezkak instrument is expressed as the mean, standard deviation (SD) and median. The pre- and postintervention comparisons within each group (c-MT/i-MHA) were performed via the Wilcoxon test, and the effect size was calculated with Cohen's d. p value < 0.05.*d Cohen

Factor 1: Lack of skills and abilities Items 15, 16, 13, 4, 2, 6, 26, 1, 3, 17 and 5 (maximum score 33); Factor 2: Contact with human suffering Items 27, 39, 18, 10, 9, 31, 32, 29, 14 and 34 (maximum score 30); Factor 3: Relationship with tutors and peers Items 12, 28, 19, 25, 1 and 20 (maximum score 18); Factor 4: Impotence and uncertainty Items 23, 38, 14, 41, 36, 6, 32, 3, 17, 2 and 20 (maximum score 33); Factor 5: Inability to manage the relationship with patients Items 5, 33, 7, 30, 29, 39, 17 and 20 (maximum score 24); Factor 6: Emotional involvement Items 21, 8, 22 and 31 (maximum score 12); Factor 7: Distress caused by relationship with patients Items 11, 24, 26, 15 and 14 (maximum score 15); Factor 8: Patient seeking an intimate relationship Items 40 and 37 (maximum score 6); Factor 9: Overload Items 35, 36, 34, 30, and 31 (maximum score 15)

also impedes their learning process. The fear of causing harm to patients remains one of the most prevalent concerns among students. Stress is an intrinsic component of clinical practice and is influenced by a combination of sociodemographic, academic, and emotional competence factors [12, 15–17]. Additionally, some studies [6] have highlighted those higher scores for stress-related factors are associated with a lack of self-confidence, which is understandable given that the student population is still in training, which amplifies their fear of inadvertently causing harm to patients.

In the present study, the factor that exhibited the most significant improvement in the intervention group was the relationship with the tutor, as evidenced by both the pre- and postintervention analyses and the intragroup analysis. This finding suggests that the model effectively facilitates the exchange of experiences and knowledge between the university and the students, particularly when students are placed in external, clinical environments.

In contrast to other studies [1, 12, 18, 19], no significant sex differences were observed in any of the factors analysed. Importantly, however, the sample was predominantly female, which may have influenced the characteristics of the interventions.

Given the significant stress identified among nursing students during clinical placements, the literature emphasizes the need to develop university-based programs designed to improve the emotional and psychological well-being of students [2, 18, 19]. Studies conducted in Spain [20] suggest that while the duration of clinical placements is deemed sufficient, the collaboration between tutors and students remains fragile, with weak coordination and limited guidance in professional practice. The results of this study indicate that the i-MHA group is associated with a reduction in stress levels during clinical placements, primarily due to improved supervision by university tutors. This suggests that the hybrid learning model supports real-time clinical practice, enabling students to interact with their peers and share their experiences in different clinical environments.

This study successfully applied the hybrid learning model to both teaching and academic practice, resulting in a comprehensive improvement across all evaluated items. This achievement serves as a step toward validating a model that could facilitate the creation of intellectual property, ultimately resulting in an open-access tool that can be quickly implemented in teaching and academic practices.

Finally, the identification of stressors in clinical practice provides an essential foundation for the development of targeted teaching strategies that can be integrated into academic curricula. These strategies have the potential to improve learning outcomes, competency development, and the transfer of skills to professional practice.

Limitations of the study

This study focused on final-year nursing students, which may limit the generalizability of the results to other academic years. Although both male and female participants were included, the sample predominantly consisted of females, which may have influenced the characteristics of the interventions. Another limitation arises when comparing the intragroup results of stress perception, as the number of evaluations for each participant was limited. This could affect the statistical power, leading to potential instability in the results. Finally, further studies are needed to apply the same method in other clinical practice courses. Increasing the number of evaluations or participants could improve the reliability and validity of the results, allowing for better comparison of the depth and management of b-learning, as well as assessing the impact of the mentorship model on reducing secondary stress in clinical practice.

Conclusions

The i-MHA model was developed in response to a need identified by clinical practice coordinators and instructors working with nursing students. Participating in clinical practices and having direct and frequent contact with patients generates uncertainty and stress among students, findings that are well supported by the literature. Therefore, the i-MHA model helps to improve the relationship with the academic tutor and allows an exchange of experiences and knowledge between the university and students at a time when students are in environments outside the university. This model is anticipated to enhance the quality of education and foster a more student-centered approach, potentially leading to improved patient care and smoother transitions into professional practice. To date, no studies have explored the stress experienced by nursing students during clinical placements from a gender perspective. Given the significant female predominance in the healthcare workforce, investigating potential gender differences would provide valuable insights for the development of more individualized academic support strategies. Finally, considering the crucial importance of psychological well-being in students' learning processes, it is imperative that faculty members receive specialized training in this area to better support their students' academic and emotional development.

Author contributions
SRV, EGM, JFS, MAMP, RRT, and JBP contributed to the study conception and design and material preparation. All the authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The present study was approved by the Ethics Committee of the Pere Virgili Health Research Institute under approval number 121/2020. All participants provided written informed consent prior to their involvement in the study. In the course of the study, we strictly abide by the basic principles of the Declaration of Helsinki, respect and protect the rights and privacy of the participants, and ensure the confidentiality of their personal information. The participants were fully informed about the study's objectives, and the confidentiality and anonymity conditions were thoroughly explained to them.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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