

# Hybrid Learning Model Integrated Into Critical Care Practice in Nursing Students A Mixed Study.

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## Research Article

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# Abstract

**Background:** Active learning methodologies have been widely adopted into undergraduate healthcare, and a strategic framework that guides learning to the students, being blended-learning which combines the best of face-to-face and virtual learning. Therefore, this study aimed to identify the key elements from a virtual forum in achieving competencies in clinical practice in critical care, and to evaluate the b-learning process of undergraduates nursing through a virtual forum on Moodle Platform.

**Methods:** Mixed research conducted. A qualitative descriptive phenomenological methodology informed by virtual forum and quantitative descriptive method from self-reported questionnaire. An intentional sample of nursing students of clinical practice in critical care units from fourth-year undergraduate in Rovira Virgili University (Spain) was employed. Data source included virtual forum (sixteen weeks) and final seminar classroom included face-to-face. Sociodemographic and forum variables were evaluated questionnaire ad hoc (fifty questions): learning, tutoring, satisfaction, and self-evaluation about virtual forum with Likert scores 1:(strongly disagree) to 4:(strongly agree).

**Results:** It was observed 51 nursing students, 70.6% of students were women (n.36) with an average of age of 21.18 years (standard deviation 2,186). In the qualitative analysis of the forums, six main categories were extracted: The humanization of care (n=93), Communication (n=69), Learning (n =92), Professional knowledge (n=55), Clinical Safety (n=66), Complexity (n=101). The analysis of the questionnaire shows: The evaluation learning, tutoring, self-evaluation about virtual forum, and satisfaction. The items that have presented significant differences ( $p<0.05$ ) are six items and by ( $p<0.01$ ) one item.

**Conclusion:** The dynamized forum allows accompanying the students while their clinical practice in critically ill patients in their learning process to develop critical thinking. It's also a useful tool for achieving results, in scenarios that have become the result of social confinements, which will lead to a paradigm change in universal education.

## Background

Clinical practices occupy a prominent place in the student's academic curriculum; they take place in a complex social context. They constitute the place where the transfer of theoretical and methodological knowledge of nursing studies occurs intrinsically [1]. To be able to perform this transfer, one of the main players is the clinical tutor, who must guide the constructive mental activity of the students, who will provide them pedagogical help adjusted to their competences, which will promote autonomous understanding and performance by the students [2].

There are studies that indicate that in clinical practice, nursing students feel vulnerable, especially in a changing clinical environment such as the areas of criticism, which generate a high level of stress and uncertainty about the knowledge acquired to perform patient care [3].

The nursing degree education model is based on 4 basic principles: Personalized attention, academic training, cooperation, and interaction that provides a more critical and experiential learning. This link, with professional support and flexibility in the organization of learning, contributes to training throughout life.

Achieving the practical learning outcome is based on the development of six axis: (1) professional values, attitudes, behaviours, and ethics of caring, (2) the scientific foundations of the biological, human, and social sciences, (3) social, critical, logical, and creative thinking, (4) information and knowledge management, (5) clinical communication and relationship skills and (6) clinical procedural skills.

Currently one of the challenges of university teaching is to promote student participation. Learning according to Silva and Maturana is generated when the student is actively involved in the process, building meaning, and developing proposals based on the collaboration of the teachers and their peers. You learn when generating contexts that propel the student to guide this process from a deeper approach, that is, to approach a certain task in a meaningful way beyond just a qualification [4]. In order for the students to acquire this reflection, it is necessary to transit from a teacher-centered to a student-centered education. Achieving this deep learning needs the teacher to value and plan their methods considering this transformation [5].

Moodle facilitates a student-centred virtual learning environment (VLE). It allows the incorporation of computerized information and communication techniques (ICT), and the use of active methodologies [6]. Its use has increased in teaching to introduce electronic learning (e-learning) modalities or models that combine face-to-face with virtual learning: a blended learning (b-learning) model [2, 5, 7].

Nowadays the importance of e-learning is no longer questioned as students belong to a generation that understand ICT as part of their usual environment and take advantage of the use of mobile devices. Students live in a culture of interaction and their communicative paradigm is based on interactivity [4, 8, 9]. Education, as well as organizations, must innovate and make continuous improvements tailored to the needs of a changing syllabus, with continuous training in the virtual learning environment [6, 10–12].

But there are authors [13] that question the efficacy of a totally virtualized model. That is the reason why we have mixed models: The B-Learning, a way to learn that combines the online methods with the presential ones. In between them we find the Flipped Learning: It is a pedagogical model based on transferring work from outside the classroom (clinical practices) to inside it. We also have the collaboration learning, that works with teams. And, as a third method, there is the learning based on competences, where the student must show the results and control of the capacities in his discipline. All of these develop activities that benefit the practical work, in teams and linked to concrete situations [11, 14].

The kind of student, contents, ubication of the participants in the process, and the available electronic media, are the factors that determinate the model that must be put in practice. But, in all of them, it's very important to create a learning community: A place to build knowledge, where students and tutors can interact.

So, to reach the skills, but also to reduce the stress, the classes for the nursing students, needs to help them with reflexion and critical thinking. Based on the affirmation from Alfaro-Lefevre it isn't a method to be learnt, but a changing process, that needs skills, knowledge and some attitudes or dispositions; it is contextual, has a target and looks for a self-improvement [15, 16].

In the forums, the tutor is the reference for the student, that guarantees that the course continues. He supports every participant in his training process and helps them overcoming obstacles and reaching their expectations. The virtual tutor offer support, encourages, orientates, and follows the learning process of each one in the online training activities. So, the tutor should develop the academic, pedagogical and orientation work. And he needs to be a moderator, motivator and helper in the training process [17].

Purpose: The aims of the study are (a) to identify the key elements from the virtual forum in archiving competencies in clinical practice in a critical care, and (b) to evaluate the b-learning process of undergraduates nursing through a virtual forum on Moodle Platform.

## **Materials And Methods**

The design of the study was conducted by a mixed research. A qualitative descriptive phenomenological methodology informed by virtual forum and quantitative descriptive method from self-reported questionnaire.

Purposive sampling of nursing students of clinical practice in critical care units from fourth year undergraduate in URV. The study included 51 nursing students, divided into four training cycles. Data was collected from January to June 2019.

Data sources included a virtual forum during four or five weeks and a final classroom seminar face-to-face. Three methodologies are defined in this seminar; flipped learning, collaborative learning and the one skill-based that converge now of self-directing the student to identify the problems and the solutions. The forum was carried out using a guide developed by the research team and nursing students were kept informed.

The basis of the model is the forum. This resource is offered by the Moodle platform, and it is the place where knowledge and experiences are gathered, so it is the active element of the model.

At the end of the cycle, the students attended the seminar conducted by tutors, they worked and reviewed all the shared information generated in the environment of the dynamic forum. Each student gave a code to his/her contributions to the Forum and in small groups of 3-4 students gathered the codes in subjects (categories) and subtopics (subcategories) [18].

The students contrasted the information with the tutor. They synthesized and prepared a presentation for the rest of groups through conceptual mapping [19]. Finally, all the groups presented and shared the

information they have developed. They discussed and debated among groups, and when it was finished, the tutor collected the material generated.

Participants completed a brief questionnaire (48 questions) which included sociodemographic and forum variables. The ad-hoc questionnaire evaluated learning, tutoring, virtual forum self-evaluation and satisfaction with Likert scores from 1 “strongly disagree”; 2 “disagree”; 3 “agree” to 4 “strongly agree”.

## Ethics

The study obtained the approval from the Ethics Committee *Institut Investigació Sanitaria Pere Virgili* (Code 121/2020), the Department of Education, and participants provided their personal consent. The investigation was developed following the guidelines of the Helsinki Declaration [20].

## Qualitative analysis

The data was managed using Weft-QDA free software and analyzed using the content analysis [21]. A detailed reading of the forums was performed, and the texts were encoded with signification units; the codes are regrouped with a wider level of meaning: subcategories. Moreover, these, at the same time, are grouped into categories which represent the topics of the discourse. In short, the codes, categories and subcategories provide the structuring of the discourse and, in order to validate the research, the information is analyzed by the students in the seminars.

## Statistical analysis

All data obtained from the questionnaire were analyzed using SPSS version 26.0 (Statistical software, IBM Corp., Armonk, NY, USA). Significance level was established by  $p<0.05$ . A descriptive statistic of sociodemographic characteristic was carried out, followed by the mean and the standard deviation of the 4 groups. Normal distribution of the data was evaluated using to Shapiro-Wilk Normality Test. The Anova was used to compare the 4 groups the correlations existing within the satisfaction variables (intergroup analysis).

## Results

It was observed that 70.6% of students were women (n.36) with an average of age of 21.18 years (standard deviation 2,186).

In the qualitative analysis of the forums, six main categories were extracted (Additional file 1): The humanization of care ( $n = 93$ ) including two subcategories, professional relationship with the patient and with family ( $n = 65$ ) and holistic care ( $n = 28$ ). In communication ( $n = 69$ ) two subcategories are identified: communication skills ( $n = 35$ ) and the experiences existing in communication ( $n = 34$ ). The third category,

learning ( $n = 92$ ) is divided into lack of preparation ( $n = 57$ ) and the practice unit where they develop their learning ( $n = 35$ ). Professional knowledge ( $n = 55$ ) is presented as a fourth category with a single subcategory, skills, and knowledge ( $n = 55$ ). Clinical Safety ( $n = 66$ ) was the fifth category, there were two subcategories in relation to the professional ( $n = 32$ ) and with the infrastructure ( $n = 34$ ). Finally, the complexity ( $n = 101$ ) is divided into professional performance complexity ( $n = 54$ ) and the complexity of the urgent care system ( $n = 47$ ).

The analysis of the questionnaire shows that the items that have presented significant differences ( $p < 0.05$ ) are six (4, 22, 30, 44, 46) and by ( $p < 0.01$ ) item 34 (Table 1). In relation to the evaluated learning, tutoring, self-evaluation about virtual forum and satisfaction: item 4 ( $p = 0.041$ ) obtained differences between the groups, they agree on the approach of clear and specific objectives of the forum. Items 22 ( $p = 0.025$ ) and 30 ( $p = 0.021$ ) are noted that students refer to good scores in relation to the activities proposed by the tutor to develop collaborative learning and that the tutor performs a synthesis of the interventions. In item 44 ( $p = 0.035$ ) related to satisfaction, differences were observed between the groups, indicating that the forum accompanies clinical practices. Item 46 ( $p = 0.014$ ) of the self-assessment, presented the best score with a narrow interval indicating that the objectives of the subject. were well thought out. Item 34 ( $p = 0.000$ ) showed that the forum discussions provide guidance for achieving the objectives. Finally, items 13 and 21 although not significant show a tendency to positively assess the relationship between objectives and content, as well as interaction with the tutor.

Table 1  
Questions

Questions (n = 51)	Mean (SD)	Lower limit – Upper Limit	p-value (IC 95%)
In relation to the virtual learning environment and the debate forum.			
1. The didactic material has clearly explained the operation of the virtual learning space where the tutoring discussion forum is located.	3.27 (0.53)	[3.12–3.42]	0.256
2. There are materials and/or guides that contain information about the formation of objectives, content, activities to develop and evaluation.	3.28 (0.60)	[3.11–3.45]	0.549
3. The presentation has indicated the technical prerequisites.	3.27 (0.56)	[3.11–3.43]	0.504
4. The goals have been explicit and realistic.	3.37 (0.56)	[3.21–3.52]	0.041
5. There is a chronogram.	3.58 (0.64)	[3.40–3.76]	0.257
6. The supervised debate forum allows sharing ideas and knowledge.	3.38 (0.80)	[3.15–3.61]	0.097
7. The virtual space of learning Moodle (has been an easy to use environment).	3.45 (0.61)	[3.28–3.62]	0.743
8. I have felt comfortable using space.	3.39 (0.66)	[3.20–3.58]	0.300
9. The forum organisation has allowed you to organize your time in a flexibly way.	3.00 (0.69)	[2.81–3.19]	0.246
10. The subjects of the forum have been topical and of academic interest.	3.22 (0.75)	[3.00–3.43]	0.098
11. Virtual resources (URLS, etc.) have been relevant for the learning process.	2.67 (0.73)	[2.46–2.87]	0.379
12. The contents have justified to the objectives set.	3.02 (0.64)	[2.84–3.20]	0.334
13. The topics dealt with in the debate forum presented a common thread and they have related to each other.	3.33 (0.76)	[3.12–3.55]	0.056
14. I have felt comfortable using the discussion forum.	3.12 (0.90)	[2.86–3.37]	0.150

Variables are presented as Mean ± standard deviation (SD) and Anova test is used to assess differences between groups. \*p < 0.05\*\* p < 0.01. Own ad-hoc and virtual questionnaire for Moodle.

Questions (n = 51)	Mean (SD)	Lower limit – Upper Limit	p-value
	(IC 95%)		
15. Access to external links has been viable from any device.	3.10 (0.75)	[2.89– 3.31]	0.669
16. The information provided in the virtual space has been useful to me for my correct development	2.90 (0.70)	[2.70– 3.10]	0.666
In relation to the Forum's motivational tutor.			
17. The tutor indicates how to contact him/her.	3.61 (0.53)	[3.46– 3.76]	0.704
18. The tutor made me feel good.	3.67 (0.47)	[3.53– 3.80]	0.270
19. I have established a trust relationship with my tutor.	3.37 (0.72)	[3.17– 3.58]	0.338
20. The frequency of interaction with the tutor has been as frequent as I have needed.	3.35 (0.55)	[3.20– 3.51]	0.950
21. The tutor took account of consolidation strategies and knowledge transfer.	3.14 (0.66)	[2.95– 3.32]	0.054
22. The tutor has proposed activities to develop collaborative learning.	3.20 (0.72)	[2.99– 3.40]	0.025*
23. The tutor has facilitated terminology or query sources.	2.80 (0.80)	[2.58– 3.03]	0.404
24. The tutor has proposed the co-evaluation among the students.	3.02 (0.78)	[2.80– 3.24]	0.466
25. The tutor has detailed the criteria of each activity.	3.29 (0.57)	[2.81– 3.13]	0.493
26. The tutor has clearly described the methodology and the time of delivery of the evaluation activities.	3.43 (0.60)	[3.26– 3.60]	0.279
27. Tutor sent clear and short messages.	3.65 (0.52)	[3.50– 3.79]	0.151
28. The tutor has used a language adapted to the forum and is understandable.	3.75 (0.52)	[3.60– 3.89]	0.265
29. The tutor has redirected dialogues in the forum, reformulating or deepening the interventions.	3.31 (0.70)	[3.11– 3.51]	0.657

Variables are presented as Mean ± standard deviation (SD) and Anova test is used to assess differences between groups. \*p < 0.05\*\* p < 0.01. Own ad-hoc and virtual questionnaire for Moodle.

Questions (n = 51)	Mean (SD)	Lower limit – Upper Limit	p-value
	(IC 95%)		
30. The tutor has carried out interventions as a synthesis discussion in the forum.	3.20 (0.77)	[2.98– 3.41]	0.021*
31. The tutor provided individual retroactions to the discussion forum.	2.65 (0.86)	[2.40– 2.89]	0.647
32. In case of doubts posed in the forum, the tutor has answered.	3.02 (0.78)	[2.80– 3.24]	0.088
33. The tutor has motivated the common spaces of communication.	3.22 (0.61)	[3.04– 3.39]	0.183
34. The discussions proposed by the lecturer to the Forum have been aimed at achieving goals.	3.20 (0.66)	[3.01– 3.38]	0.000**
35. With the discussion forum motivated by the tutor, the quality of the practices has improved.	2.98 (0.78)	[2.76– 3.20]	0.074
In relation to the satisfaction			
36. Tutoring programs are essential for a proper development of practices.	3.31 (0.73)	[3.11– 3.52]	0.286
37. I am satisfied with the quality of the support received from the tutor.	3.43 (0.60)	[3.26– 3.60]	0.110
38. I am satisfied with my participation in the tutoring program.	3.29 (0.72)	[3.09– 3.50]	0.475
39. The work done in the forum has helped me to confront the demands of the professional world.	2.75 (0.74)	[2.54– 2.95]	0.247
40. The work done in the forum has greatly influenced my motivation.	2.84 (0.85)	[2.60– 3.08]	0.452
41. The work done has influenced me to increase my degree of personal safety.	2.90 (0.85)	[2.66– 3.14]	0.228
42. The work done in the forum has helped increase my competence level.	2.76 (0.79)	[2.54– 2.99]	0.420
43. The work done in the forum has helped to reduce the level of stress produced in the training	2.29 (0.90)	[2.04– 2.55]	0.628
44. Indicate your assessment of the discussion forum dynamized as support of your clinical practices.	2.84 (0.78)	[2.62– 3.06]	0.035*

Variables are presented as Mean ± standard deviation (SD) and Anova test is used to assess differences between groups. \*p < 0.05 \*\* p < 0.01. Own ad-hoc and virtual questionnaire for Moodle.

Questions (n = 51)	Mean (SD)	Lower limit – Upper Limit	p-value
	(IC 95%)		
45. In general, what degree of satisfaction have you had regarding learning?	3.18 (0.72)	[2.98– 3.38]	0.444
Self-evaluation			
46. Do you think you have achieved the objectives of the course?	3.45 (0.54)	[3.30– 3.60]	0.014*
47. Do you think you have achieved your expectations?	3.37 (0.59)	[3.20– 3.54]	0.128
48. The duration of the training has allowed you to achieve the objectives.	2.76 (0.81)	[2.54– 2.99]	0.208

Variables are presented as Mean ± standard deviation (SD) and Anova test is used to assess differences between groups. \*p < 0.05\*\* p < 0.01. Own ad-hoc and virtual questionnaire for Moodle.

## Discussion

On the basis of Alfaro Le-Fevre theory, critical thinking has to be a key ingredient in the professional training and part of the job of educators is to work to create openness in a culture where critical thinking has to be an integral part of the workshop [15, 16, 22]. The reality is the moment when the student arrives in a professional situation and faces intense life experience, related to disease, pain, suffering and death of patients and their relatives. In addition, students must react to requirements coming from the institutional environment and a high number of patients and the complexity of critical services. These negative and positive experiences Bonfill et al show the impact in their personality [23].

The practical training resembles very much, a work environment. Therefore, the implementation of educational strategies searching for critical thinking is highly recommended so as to make a good transition from the academic to the professional world [24].

## Care humanization

The students have been thinking over nursing as a therapeutic relation, a skill that sometimes has not been associated with practice. They debate about critical service humanization, observing deficiencies in emergencies, and contrasting them with the ones in intensive care units, where it seems that humanization has been incorporated [25]. They describe emergencies as a space shared by professionals and patients, with trolleys from patients piling up everywhere in the corridors, depersonalized places without privacy conditions, where patients often stay twenty-four hours. In that context, the respect for intimacy, people's autonomy, the gestions of emotions, the spirituality and the importance of a proper

communication in between patient and professional, are very difficult to apply, due to the physical conditions, the rapid interventions and the urgency of the situation [26–28].

## Communication

In the context of emergency services, the relation with the family appears as an aspect to be improved. Cohesion and communication from the health team are determining, and it's stated that to help with patient's autonomy, it is necessary to work with communications skills, such as empathy, therapeutic relation, and active listening. There are studies [29, 30] that show greater communication skills, and less emotional exhaustion and depersonalization in the professionals of the intensive medicine units, compared to the emergency services. Communication experiences experienced by the students, show the difficulties in applying those skills. For them, that emotional complexity and the gestion of bad news, appear as an important communication barrier in their professional future.

## Clinical safety

Our results show the risk of an incorrect patient identification, the lack of procedural understanding and the deficiency of resources in certain moments, in personnel and in infrastructure. They are aspects related to the ones that Moure mentions in his study, where he was showing the emotional impact of the professionals when they make a mistake [31]. What is of concern to the students, that impact has been identified with the worry for the mistakes and bad practice, where the complexity of the services (decision making, actuation speed, priority, and prevention) appears as another difficulty in their practice.

## Learning, professional knowledge and complexity

The students debate the importance to apply a critical thinking in front of a service that has been defined as complex. Knowledge, nursing competences, techniques, professional experience, actuation efficiency and mainly teamwork, have been presented in the forum, as the necessary factors to carry on with the care of the critical patient in complex units. Jiménez and Montero state that knowledge in critical patient care demands a specific training, effective and efficient competences. They define the emergency care system as complex, due to the fact that it is multidisciplinary, it has hierarchical dependency, their patients are acute, it demands continuous availability, it concerns the whole population and its care is transversal [32].

Students recognize a set of procedures, in the actuations of the unit professionals: Theoretical, practical and experience. They realize about the need of a theoretical and specific training base, they show a lack of knowledge although they are satisfied with the level of learning that has been reached. Basically, they are afraid to confront practice with the reality of their knowledge. Zuriguel was also showing in his thesis,

that intensive care nurses have a higher level of critical thinking, confirming that this skill is contextual [24].

On the other hand, Uriarte, Ponce & Bernal stress that knowledge that the student acquires in clinical spaces, reflects a repetitive, mechanical, and cyclic practice. This doesn't allow that students to reflect about a change in the practice, so that limits their professional development, precisely when the students need greater help and assessment. They say that reflexion and critical thinking are not innate, but they are skills gained by specific learning, ability to adapt and practice [33]. The forum appears as this necessary space for the students, where they can think about their experiences.

## Forum satisfaction

Forums with small groups have become a place to share and debate experiences between colleagues. It is a space to contribute, with a deep reflexion, about the experiences, as the described categories show, allowing that university education to train competent, critical, creative, and thoughtful students.

The general results of the questionnaire give evidence that there is a tendency to a high level of satisfaction in the forum. In agreement with the results from other studies [17], forum and virtual space have been satisfactorily valued by the students. One can point out that there are some points of disagreement in between groups, concerning the tutor and the perception of the debate contents. These differences lead to thinking that the students' motivation is crucial for the tool to be correctly used, and to achieve the goal. Buil et al. say that social motivations like the wish to share knowledge and altruism, personal motivations like the recognition of colleagues and teacher, and technological motivations like the use and facility of the platform, develop a key role for the success of the discussion forums [34].

Regarding the tutor, there are some points that could be improved: To help with a collaboration learning, to contribute with more reference sources, to make individual feedback and to synthesize the contents. Literature [35] has already put in evidence that one of the greater challenges for teachers proposing a forum, is to encourage the participants and to keep them motivated, giving importance to create ambiences where students can be stimulated.

This motivation comes when what is wanted to debate becomes relevant, proposing friendly and challenging spaces, that create conceptual discussions or cognitive imbalances, so the participant looks for knowledge [36]. So, it is important to highlight the tutor's role as a person that encourages the platform and creates a secure space. Therefore, the forum becomes a professional and personal grow factor. The fact that it is organized in small groups, helps with the encouragement and motivation of the students to share their experiences.

So, we observe that the implementation of a virtual space with easy access and without timing restrictions, in small groups, where one can share and expose situations associated to the debate, impacts in the accompaniment, and personalizes the supervision of the nursing students in their clinical

training. Chang's study, in between other revised strategies to work in critical thinking, concludes that the forum is a space that allows to interact with a professional. The tutor, that is constantly with them in this learning process, gives security, encouraging reflexion and growing the student [37]. Here is a space to recognize and learn from previous experiences, being a call to the practice which, makes you believe and think about the situations.

Finally, the combination of the dynamized forum with the last seminar, becomes a virtual assistance model, an ICT resource for the interchange of knowledge in between the participants, an educational strategy to incentivise critical thinking in the world of clinical practices which occupies an important part of the academical curriculum, where students often feel alone and do not perceive belonging to a group. The model has helped the student to reach three of the six axis that incorporate the learning results in the clinical training: Axis 1 – Professional values, attitudes, behaviours, and caring ethics; axis 3 – critical, social, logical, and creative thinking; and axis 4 – information and knowledge management. The model has some points to be improved in the role of the motivational tutor, to reach the enthusiasm of the group, facilitating cooperation and collaboration in the learning process. Here we have a tool with great potential, in front of scenarios arising with lock down situations, that will provoke a change in the universal teaching model.

## **Study limitations**

The study is aimed at senior nursing students, which may limit the transfer of results. Although both men and women have been included, the female sex predominates, an aspect that may have influenced the characteristics of interventions. Finally, future studies are needed that can apply the same method in other practice subjects, to be able to compare the level of depth and management of b-learning and to study the impact of the accompanying model in the reduction of secondary stress in clinical practice.

## **Conclusion**

Using techniques such as the dynamic forum to strengthen the use of mixed methods is a good starting point for encouraging nursing students to develop critical thinking; it inspires them to generate reflection, analysis, and criticism. However, it is necessary to inform them by properly participating in the forum, so they know that it has a clear and defined objective within the learning process.

Therefore, the forum model is a tool for students to be actively interested in the learning process and not just as passive participants. It is a reflective, pragmatic, and active space. It becomes a student-centered virtual learning environment, where they can share knowledge, favoring collaborative learning and between peers. Finally, in the context of critical patient practice, the forum is an intervention to help students achieve learning outcomes (axis 1, 3, and 4).

## **Abbreviations**

## Declarations

## Acknowledgments

The students of the Universitat Rovira Virgili who have participated in the study.

## Authors' contributions

EG, SR, NA collected data, EG, SR, NA and GC performed the analyses and literature search, and drafted the text as thesis. SR conceptualized and designed the study. EG, GC coordinated, supervised and analyzed the data, and assisted in final write-up of the manuscript. EG, SR, NA and GC participated in conceptualizing and interpretation, and provided critical review of drafts. Then all read and approved the final manuscript.

## Availability of data and materials

The raw data supporting the findings presented in this study will be available from the corresponding author upon request.

## Ethics approval and consent to participate

The study obtained the approval from the Ethics Committee *Institut Investigació Sanitaria Pere Virgili* (Code 121/2020), the Department of Education, and participants provided their personal consent. The investigation was developed in accordance with the Declaration of Helsinki (World Medical Association, 2013), that their participation was voluntary and that they could withdraw their participation at any time without any negative consequences or risk. The participants were also informed both orally and in writing about the aim of the study before they gave their consent to participate. *All participants provided informed consent.*

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

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