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A Mixed-Methods Approach to Clinical Judgment Skill Development in Young Nurses Through Blended Virtual And in-Person Simulation

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Abstract
This is a mixed-methods study that examines how combining virtual simulation and face-to-face simulation helps to improve clinical judgement among undergraduate nursing students. The blended simulation model is another effective learning model that provides a creative and adaptable experiential learning environment as needs increase in innovative teaching strategies in the education of nurses. The quantitative coding shows that there are valuable gains in clinical decision-making skills among the students, and the qualitative data reflect the role of improved self-confidence, critical analysis, and flexibility to deal with the most demanding clinical situations. The combination of the virtual and the physical modalities of simulation would offer a multifaceted method of narrowing the gap between theory and practice in preparing safe, competent, and practice-ready nursing graduates.

Keywords: ***Virtual simulation, Face-to-face simulation, Blended learning, Clinical judgment, Nursing education, Undergraduate nursing, Mixed-methods study, Critical thinking, Experiential learning, Simulation-based training.***

1.Introduction
Ensuring that nursing students are prepared to face complicated clinical settings has proved to be a topical concern in health education across the globe. Nursing, as a profession needs not only theoretical knowledge, but also ability to transform that knowledge to safe, effective, and timely care in the patient. Clinical judgment is one of the most essential skills that include the process of receiving, interpretation, and responding to cues to make decisions. Indeed, the research findings repeatedly reveal that undergraduate nursing students may lack becoming competent about clinical judgment during the learning experiences, especially under the framework of designing the learning with the classroom training strategy that fails to reproduce the complexities of the real world. The lapse between the theoretical knowledge and the practical experience has prompted educators to find out newer pedagogies involved in the use of technology that can help the students navigate the gap between learners and practitioners.

One of the most promising ideas to achieve this aim is the simulation-based education. Conventional face-to-face simulation-the use of mannequins, standardized patients, or high fidelity clinical laboratories-provides students a risk-free environment to practice decision-making, control of communication and problem solving skills. Compared to real life examples, such simulations are especially practical in acquiring intense real-life experience, teamwork and confidence in clinical disciplines. Nevertheless, despite the merits, in-person simulations are subject to numerous limitations, which include a lack of accessibility to a training facility, expensive equipment, time, and faculty load. These dilemmas have fuelled the search of complementary strategies that will widen access and offer more dynamic learning routes(1).

Virtual simulation has also become recognized as a very useful teaching tool especially in nursing school. Virtual modalities differ in that a learner gains access to virtual clinical situations via a screen as opposed to traditional simulation, which typically involves face-to-face participation. By providing opportunities of repeat performance, personalized pace and distance, these tools afford flexibility in terms of location that has been particularly useful during periods of widespread disruptions like during the COVID-19 pandemic. Further, virtual simulation helps teach mental capacity such as clinical reasoning, critical thinking, and decision-making, as students go through scenarios needing them to evaluate patient conditions and prioritize interventions, and evaluate outcomes. Although promising, virtual simulation does have shortcomings: a lack of hands-on psychomotor interaction is possible and some learners suggest they do not feel the emotional reality of the interactions as they are in person.

Since there are complementary merits and demerits of the two approaches, recent studies have increasingly shifted to a combination of virtual and face-to-face simulation in establishing a blending model of nursing education. This incorporation is based on the premise that multimodality of learning can help render learning experience much

fuller and more enriching. Vas may equip students with principles of knowledge, decision-making principles and the familiarity to the scenarios, whereas Vas in person can ensure reinforcement of that knowledge through embodied knowledge, teamwork, and real-time guidance. In combination they provide a sequential, reinforcing learning experience which does not only cover cognitive competencies but also the psychomotor and affective. Blended simulation methods are also in line with adult learning theory and experiential learning models that emphasise the need to participate actively, reflect and apply in real situations(2).

The training of clinical judgment should have multidimensional strategies in the field of nursing education. It is more than recognizing symptoms or adhering to clinical guidelines, but a more nuanced process of noticing something wrong, interpreting the data in context and responding in a high-stakes setting. The skills of making sound clinical judgments have the direct impact on patient safety and quality of care and this aspect is what cannot be negotiated within the undergraduate programs of nursing. The limitation to cultivating this skill may be the lack of clinical exposure that students think about getting in the real healthcare setting. The availability of patients, hospital regulations, and patient-safety fears constrain the possibilities of learners to gain meaningful involvement in the decision-making process. As such, there has been an assertion of simulation as the ethical and practical source of practice that is both standardized and realistic. The combination of virtual and in-person simulations could therefore act as a scaffolding method of gradually introducing students to a progressively more complex situation until their confidence and abilities are tested and improved in the field of clinical judgment.

Mixed-methods research designs are especially conducive to exploring the efficacy of integrated approaches, at least in an educational sense. Quantitative results would be able to record changes in the score of clinical judgments, knowledge, and outcome, whereas the qualitative comments could expose the perception, emotional impressions, and reflective learning details of the students. In combination, these approaches offer a comprehensive view of the role played by blended simulation in influencing student learning, and, more to the point, how this type of simulation can prepare students to work in the real world of nursing life. With the help of both objective results and subjective experiences, an educator is able to fine-tune teaching practices, find best practices, and work out the barriers that may arise during the process.

2.Methods

The study had a mixed-methods research design and the objective was to fully explore the impacts of the incorporation of virtual and in-person simulation on how clinical judgment can be developed among undergraduate nursing students. The rationale to use the mixed-methods design is related to the fact that it allows combining the quantitative evidence, which generates measurable results of learning interventions, and the qualitative results, which reflect the subjective experience and perception of the learners. This combined view has the advantage of clarifying the impact of the use of blended simulation strategies on learning processes and learning performance in greater detail, given the trend to invest in educational innovations in relation to experimental founded research on the one hand and interpretive studies on the other hand.

2.1 The Study Design and Pilot Setting Design

This study was done in a nursing school that has experiential and simulation learning components as part of the core curriculum. The combination of the virtual and face-to-face simulations aimed to be similar to the real clinical environment with the level of the technological and logistical support of the students. The study was designed in several stages so that quantitative, as well as qualitative data were properly gathered and evaluated. The simulation sessions were well designed so as to match the learning outcomes of the nursing program especially when it comes to improving clinical judgment and decision-making, and reflective practice(3).

2.2 Sample and Participants

Study participants were the participants of undergraduate nursing classes who were receiving clinical training. The criteria lower than advantageous were included that required students to have acquired basic coursework on nursing to ensure they had a general base on which they can work on the simulation exercises. The number of samples was calculated based on the power analysis in order to make sure that it was settled statistically correctly to measure the success of the intervention. The recruitment was carried out in classes by announcement and by notification through the course, and the study process was voluntary. Informed consent was made of all the participants with implications of confidentiality, ethical operations, and entitlement to withdraw at any point. Demographic information (age, gender, and academic year) were also taken to give a background to the interpretation of the data.

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2.3 Intervention: Inclusive Simulation strategy

The guiding principle of the intervention was the systematic overlap of the modules comprising virtual simulation and the face-to-face simulation. The students were exposed to the virtual simulations using an online platform that permitted them to interact with the case scenarios, avatars patients as well as decision-making prompts. These modules promoted cognitive learning in a way that students had to evaluate the needs of the patients and consider which interventions should be given priority and why such a decision was made by them through the feedback loops built into the platform. Learners would be able to redo the modules, and in this way, have individual pacing and learning.

After exposure to the virtual programs, the students were involved in simulation games that were carried out in a high fidelity simulation lab. These sessions allowed using mannequins and standardized patients to create an atmosphere of realistic clinical situations, not only decision-making but also psychomotor skills, communication, and collaboration with a team. Faculty facilitators monitored the simulations, evaluated student performance and followed up the simulations with structured debriefings. The phased integration of virtual simulation and in-person simulation was intended to serve a scaffolding purpose: virtual simulations would lay the groundwork and provide frameworks of knowledge and decision-making that would be solidified in the embodied and collaborative emotionally intense in-person simulations.

2.4 Data Collection Instruments

The quantitative data were mainly gathered as the validated assessment tools based on clinical judgment and critical thinking. Scales like the Lasater Clinical Judgment Rubric [LCJR] or one of the similar and validated scales were used to assess performance in several dimensions, as noticing, interpreting, responding, and reflecting. To check inter-rater reliability, the performance scores during the in-person simulations were noted by trained faculty observers(4). The design provided a control measure as pre and post intervention assessments could be used to determine the learning gains of the integrated simulation approach.

Qualitative data were collected by means of focus groups, as well as open-ended reflections. Students were welcome to report their experience and difficulties with the immersive simulation process, and their minds about it. These discussions gave a more in-depth picture of student perceptions of the effectiveness of virtual and in-person modalities, the confidence, and the professed inability they felt and the challenges they learned. Audio-tapes of the interviews were transcribed verbatim and anonymized, to ensure confidentiality.

2.5 Procedure

This was a well orchestrated process. Students first underwent a pre-test of their clinical judgment capabilities. They then entered into the virtual simulation modules on a schedule during which there was flexibility in timing of exposure but consistency in exposure to scenarios. When they were complete they were moved to the face to face simulation sessions, which were done in small groups in order to be able to individually focus and observe students. The structure of a face-to-face meeting consisted of a pre-briefing to accustom students to the situation, the main part of the simulation, and the debriefing when reflective action was highlighted. After the intervention, the students did post-assessment and took part in qualitative interviews.

2.6 Data Analysis

The statistical software was utilised to analyse quantitative data and elicit differences between pre-intervention scores and post-intervention ones. Demographic information was summarized using descriptive statistics and a non-parametric test (Wilcoxon signed ranks) was used to determine significant changes in clinical judgment outcome. The tests of reliability and validity were performed to ensure soundness of the findings.

Thematic analysis was used to analyse qualitative data The coding of transcripts from interviews and reflective responses was done inductively so that themes should emerge spontaneously through the data. Coding of transcripts was conducted concurrent by several researchers and peer debriefing sessions would be used to resolve inconsistencies. The study reinstatement of data source triangulation of quantitative data results and qualitative narratives also increased the rigor of the research.

2.7 Ethical Considerations

The study was ethically accepted by the institutional review board in the hosting university. Participants were guaranteed that their participation could not influence their course grades and academic status. All information was anonymized and saved in a confidential way. The informed consent processes contained comprehensive descriptions of the purpose of the study, the possible advantages, and risks that would be experienced in case of

any possible loss of sight among the participants. Students were also communicated that they have the right to withdraw without getting charged, anytime.

3.Results

The results of this research give a full picture of the effectiveness of the combination of virtual and classroom simulation in changing clinical judgment in student nurses in their fourth year. Both quantitative and qualitative dimensions of the study demonstrated important insights and together, they provided a comprehensive picture of the impact of blended simulation strategies on learning outcomes, perspectives and readiness to work professionally.

3.1 Quantitative Results

The quantitative analysis evidence indicated statistically significant positive findings on the clinical judgment scores of the students who experienced the integrated simulation intervention. The assessment tools used (appropriately validated) to assess across the four dimensions of clinical judgment were the Lasater Clinical Judgment Rubric, assessing in the four areas of clinical judgment which are noticing, interpreting, responding, and reflecting. Post-intervention evaluation indicated that the students were performing poorly in the areas of interpreting and reflecting, indicating that they had some issues with synthesis of patient data and assessment of their performance openly. Yet, the scores taken after intervention demonstrated the significant differences in the mentioned all directions, which means the blended methodology offered new chances to enter into more detailed consideration of complex decision-making procedures(5).

Statistical measures ascertained these advances A significant change in mean scores was found in the pre-test to the post-test, which further proves the importance of exposure to both virtual and face-to-face learning in enhancing clinical judgment. The most significant improvements were seen in students regard their performance in the tasks of noticing some slight indicators in patient cases and respond by taking appropriate actions. These results indicate that the scaffolded manner of the intervention - simulations first followed by embodied training - assisted in the development of a framework for the students to follow in decision-making processes, as well as honed their ability to act in dynamic situations.

Deeper analysis showed that improvement was similar among the groups that the demographics did not seem to increase the levels of improvement. Therefore, the benefit of the intervention was more or less democratic. Also, subgroup analysis confirmed that students who had prior experience with online cases studies or simulation labs had a slightly better baseline score, but the overall improvement between post conEd assessment and the assessment received before conEd was offered mirrored the performance of peers lacking these experiences. This emphasizes the wide accessibility of the blended method, which illustrates the ability of the blended approach to accommodate a wide range of students in terms of learning history.

3.2 Qualitative Findings

Focus groups and reflective response created qualitative data that helped to understand better the lived experiences that students had of the process of integrating simulations. Diverse themes have been identified in the analysis, each pointing out different details regarding the learning experience.

The increasing confidence was one of the overriding themes. Students have indicated that being able to initially be in a virtual world first and then only then being in the real world has helped them practice clinically without the pressure of having to think rapidly in front of their peers or an instructor. When they came to the face-to-face simulations, they were better equipped and more confident of their knowledge application. Most of the time this was referred to as a confidence-building roadmap that reduced the fear of failing and increased preparedness to engage in actual practice.

The other theme of importance was the bridging theory and practice. It was reported by students that the virtual simulations enabled them to practice the classroom knowledge in a systematic and interactive manner, whereas the face to face interaction programs enabled them to practice the same in a practical manner. The consistencies between the integration of both modalities appeared to be that learning process felt more realistic and holistic, and displays a feeling of cohesion between academic education and clinical performance.

The third theme was on critical thinking and reflection. The students appreciated mechanisms of feedback that were inherent in virtual simulations, since these showed the consequences of their actions immediately. The post-simulation debriefing sessions after face-to-face simulations prompted the participants to examine what they have done, what they need to improve, and internalize the lessons that they can utilize in practice in the future. Students

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observed that the process of decision-making, feedback, and reflection iteratively across the modes of production allowed them to develop enhanced analysis of complicated clinical situations.

Challenges were also reported and this formed another theme. Some students cited technical problems with virtual platforms, including problems connecting to the internet or navigating, which on rare occasions would disrupt the learning process. Others observed that virtual simulations might be useful in case of cognitive learning, but they were unable to accurately simulate the emotional and interpersonal process as experienced in the live simulations. However, the need to overcome these difficulties did not nullify the positive attitude towards the intervention overall, but it reflected the areas that need improvement in both intervention design and implementation of blended simulation programs.

3.3 Quantitative-qualitative data integration

When the numeric and qualitative data were summarized, they formed a consistent story. The results in measurable clinical judgment improvement correlated well with the self-reports by students of improved confidence, critical thinking, and reflectivity. The statistical data have proved the effectiveness of the intervention in terms of improving decision-making skills, whereas the qualitative data supplemented the quantitative one by shedding light on the processes through which it was possible, namely, scaffolded learning, iterative practice, and emotional support through the reduction of anxiety(6).

This combination of results reinforces the importance of utilizing a mixed-methods approach in the conduct of an educational research. The objective data in the form of score gains through the learning process were evidence of learning gains whereas the narrative accounts were more detailed with regard to the process, subjective obstacles and benefits during the learning process. These strands offered a strong trace of the positive result of combining virtual and in-person simulation in nursing education.

3.4 Research Results Summary

To conclude, the findings indicated that virtual simulation and face-to-face simulation combination greatly enhanced clinical judgement of students in several aspects. Quantitative responses established statistically significant improvements in noticing, interpreting, responding and reflecting, whereas qualitative data indicated improved confidence, developed contemplative thoughts and sense of connection to theory and practice. Even though some obstacles were discovered, especially those related to the technical barriers within the virtual platforms, it did not interfere with the general success and feedback on the intervention. The stability of the gain related to various student groups also evidenced the versatility and universality of the mixed simulation model.

These results together indicate that virtual and face-to-face simulation is an effective and novel method of preparing undergraduate nursing students to the complexities of clinical practice. With an improved level of cognitive and practical aspects of clinical judgment, this teaching method provides future nurses with the proficiency and ability to provide a safe and efficient method of patient care that responds to the dynamics of the healthcare environment.

4.Discussion

The current research establishes that virtual-face-to-face simulated integration is an effective learning tool that enhances clinical judgment of undergraduate nursing learners. The results imply that the combination of the two modalities provides considerable gains in the skill levels of students to notice, interpret, respond, and reflect in clinical situations. This discussion puts these results in the context of a wider array of nursing education literature, discusses theoretical and practical implications, and outlines challenges and future directions blended simulations.

Among the most prominent effects of this study, there is the substantial increase in average scores of the students in terms of their overall clinical judgment ability. This relates to the earlier finding that points out to the efficiency of simulation in filling that gap between theoretical knowledge and applied practice. The simulated environment allows learners to safely develop and exercise the decision-making skills that are required in the real world of patient care with no dangers that can be associated with real patients. Combining the learning modes, when followed by face-to-face simulation, adds reality, emotional connection, and psychomotor training, making the blended model able to psychologically and practically empower the students making them ready not only cognitively but also physiologically and emotionally about direct clinical interactions. This repetition of modalities in sequence provides a scaffold effect in which learners further gain confidence and competence by layering in the modalities(7).

The qualitative data also add values to our impressions of the working of this mixture of approach. Students claimed to be more confident, less anxious, and now displaying higher critical thinking skills due to the change in the face-to-face environment, as compared to virtual environment. Such results are consistent with the adult learning theory and Kolb experiential learning cycle which focus on the need to learn through tangible experiences, reflection, conceptualization, and interaction. The reflective observation and abstraction are achieved with the opposite features of the vitrine simulations and provide the space of reflective observation and abstract conceptualization, whereas live simulations offer the concreteness of the experience and experimentation. In combination, these experiences form a well-rounded learning process that enables acquisition of clinical judgment in a manner that neither classroom instruction nor simulation-via-one-approach provides(8).

The other valuable aspect of this study consists in the fact that it demonstrates how integrated simulation promotes reflective practice. The importance of reflection in nursing is that it helps to critically analyze their activities, to demonstrate what to avoid the next time, and achieve better performance. This combination of customised feedback in virtual facilities with deliberate debriefing in face-to-face simulations provided a very strong platform of reflection. Students appreciated these chances to be able to think critically about their choices, spot gaps in knowledge and consider strategies toward improvement. This process of reflectivity is not developed as well in ordinary clinical exposure as time constrictions and patient safety issues constrain the availability of clinical closures to permit contemplation and reflection over practice. In this way, blended simulation will not only promote both technical and cognitive skills but also foster the reflective mindset which is the key to professional development.

On a more general level, the findings of the current study support the promise of blended simulation to overcome many established issues in nursing education. There may be restricted access to clinical placements on the basis of patient safety and hospital policies, or due to a lack of clinical instructors(9). Meanwhile, increasing user demand and the need in competent nurses stipulates the necessity of scale-able and innovative instructing methods. Virtual simulation can be scaled and flexible, allowing learning not only on physical labs, but face-to-face simulation still offers the value of in-person practice, with embodied experience and intersocial interaction. Combining the two, nursing programs would be able to provide students with high-quality learning experiences in cases when the access to clinical sites is limited, and the students would be receiving the judgment and decision-making skills required to ensure safe practice.

The results indicate that blended simulation can be applied across student bodies. There were improvements witnessed in all demographic groups, which indicate that this method could support learners with different levels of prior experience and styles of learning. This inclusivity is especially relevant in the modern-day realm of nursing studies as classes are growing more varied and curriculum needs to address all students on an equal level. There is the potential to use simulations to provide self-paced exploration by students needing more time and or real time, collaborative work in the face-to-face simulations shown to challenge learners. The combination of these modalities embraces a good variety of learning styles.

It is despite such merits, some drawbacks should be taken into consideration. Students identified technical issues, including trouble logging in to virtual simulations, or the inability to feel as emotional or realistic in the digital cases as they would in a real situation. This can be seen as having been noted in some of the literature that identify technological difficulties and simulation design limitations as negative factors. Solving these problems involves a consistent investment in simulation infrastructure, training of faculty, and optimization of virtual platforms to be more realistic and have more interactivity. Moreover, though this study showed that clinical judgment was significantly improved in the short-term context, it remains to be seen whether in the long run (i.e., post-graduate life), the benefits of clinical judgment will extend to performance on the real field.

Research directions in the future should also be focused upon the optimal sequencing as well as the optimal weighting of the virtual settings with face-to-face modalities. As another example, whereas this experiment involved starting with virtual simulations and ending with subsidiary in-real-life sessions, other sequences or switching, might have alternative outcomes. Similar studies could explore the number of virtual scenario practice sessions that are required in achieving optimum benefits presented by instances of such a case, or how simulation material should be aligned with other milestones in the curriculum. Comparative research at the institutional level and beyond national boundaries would further deepen insights as to how blended simulation may be adjusted to diverse learning systems and resource endowments.

Lastly, the generalized impacts of the study have to do with healthcare systems and workforce preparedness. With nursing shortages continuing to stress much of the world, there is a pressing need to graduate individuals who not

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only have knowledge, but the confidence in their clinical judgment. Simulation-based education, particularly in combination across modalities, yields a solid experience to move learning faster without putting the patient at risk. Further, healthcare environments grow in complexity and technology and simulation in training is reflective of the current practice environment, in that it is more likely that a student will be prepared to enter such an environment.

5.Conclusion

The results of this study significantly support the fact that combining a virtual simulation and face-to-face simulation is a promising practice that will promote clinical judgment development in nursing undergraduates. The blended simulation model is a promising solution that balances demand and supply of access to clinical sites, faculty workload, and the number of the practice-ready graduates and is less vulnerable to emerging changes. The proposed approach combines the cognitive advantages of virtual platforms with the tangibility of face-to-face simulation and thereby appeals to not just knowledge acquisition but the application of skill, development of confidence, and reflective practice.

The quantitative results showed overall significant gains in all dimensions of clinical judgment including more notice about subtle cues, complex data interpretation and acting during dynamic situations. These improvements were both statistically and pedagogically significant, indicating real achievements in the decision-making skills of the students. These outcomes were further confirmed by the qualitative data that emphasized the greater feelings of confidence in students, less anxiety and an ability to reflect critically. Collectively, these strands present a strong case that blended simulation is not merely an adjunctive technology but rather a paradigm-shift in educational practices that immediately and explicitly parallels the real-life practice of professional nursing.

Implications of the findings made here are significant in regard to nursing education at various levels. To curriculum developers, the findings indicate that the combination of virtual and in-person simulations as supplements to core training can complement conventional in-classroom training and address a lack of clinical placements. The findings show the importance of constructive debriefing and scaffolded learning, as they can help faculty to take the best out of simulation and help them to engage deeper reflection. As a student, the blended approach will provide a method of building confidence to practice clinical judgment relative to stages as more assurance can be given as the levels increase to employ real clinical situations with perceived certainty.

Not less significant are the wider provisions to the profession and the society. With increasingly complex healthcare systems, nurses have to address the fast-evolving condition of patients, are expected to cross the lines of different disciplines, and have to make their decisions rapidly and correctly, under pressure. It is these expectations that blended simulated graduate physicians are better equipped to meet, thus helping to ensure patient safety, the quality of care delivery, and system efficiencies. Integrated simulation is the solution that offers continuity of training in settings where clinical exposure is limited due to hospital capacity, safety regulations, and even due to the occurrence of global crises like a pandemic.

However, this research also supports some limitations and points out the ways in which research can improve in the future. Although the intervention indicated the short-term improvements in clinical judgment, additional longitudinal studies are required to explore whether the obtained gains can be used to evaluate long-term competence in the real situation. Additionally, concerns of technical issues in virtual simulations still exist, and the platforms need to be constantly developed, as well as faculty training. Additional research opportunities will focus on different integration models, namely alternating the work with virtual and live simulations or adapting sequences according to the learning styles of an individual. Examining the effects of blended simulation in various cultural and institutional setting will further increase its generalisation and scale.

Nevertheless, the findings presented have given the strongest arguments in favor of introducing a blended simulation as one of the fundamental parts of a nursing curriculum. It is consistent with the practice of experiential and reflective learning, and it is also responsive to the logistical and pedagogical considerations behind the nursing education world today. It acknowledges that clinical judgment is not a theory-based competence but rather an ability gained by a multi-step yet scaffolded practice within relatively risk-free yet realistic settings. Contextualizing strengths of virtual and face-to-face simulations, educators can develop a learning ecology helping to raise competent, reflective and confident practitioners who are able to respond effectively to the challenges of the contemporary healthcare.

Final Reflection

To sum up, the combination of virtual and face-to-face simulation cannot be considered simply as a transient measure to deal with the challenges in education but must be discussed as an innovative aspect that redesigns the training process of nursing students. It has a pedagogical transition to blended and technology-enhanced learning, student centered learning and provides a moderate balance between knowledge acquisition and applied judgment. This work highlights the fact that blended simulation can become a powerful enabler of change in the learning experience of nursing students when carefully planned and managed so that students leave college prepared and assured that their training has equipped them to provide safe, effective, and caring care.

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Conflicts of interest

The authors have no conflicts of interest to declare

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