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Blended learning and simulation in nursing education: A quasi-experimental study on a nursing institute

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Abstract:

BACKGROUND: The nursing module teaches basic nursing principles and procedures to undergraduate nursing students. This course is important for the acquisition of procedural and psychomotor skills. The aim of the present study is to evaluate the influence of blended training on the acquisition of practical skills related to gastric insertion tubes.

MATERIALS AND METHODS: A quasi-experimental study was undertaken, containing three groups: The blended group benefited from e-learning, followed by simulation), while the two groups benefited from theoretical teaching and procedural simulation. Then, the degrees of acquisition of declarative and procedural knowledge and the time of completion were measured.

RESULTS: The declarative knowledge grade was higher in the Simulation (16.07) and Blended (15.21) groups than in the Traditional Group (11.66), with a statistically significant difference ($P < 0.001$). The results also showed a statistically significant difference between the procedural knowledge grades of the three groups ($P < 0.001$). A statistically significant correlation was detected between declarative and procedural knowledge scores ($r = 0.58$, $P < 0.001$) and a negative correlation between procedural knowledge and the time of completion ($r = -0.422$, $P < 0.001$).

CONCLUSIONS: The results of this experimentation confirm the positive effect of the blended learning approach on the acquisition of declarative and procedural knowledge as well as the time management allocated to teaching.

Keywords:

Blended learning, moodle platform, nasogastric tube insertion, nursing education, simulation

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Introduction

One of the aims of nursing education is to lead to professional competence. The introduction of new active learning methods (simulation, case studies, role play, etc.) has facilitated the acquisition of this complex and evolving know-how^[1].

Simulation has been widely recognized in the healthcare sector as a powerful tool to reinforce the learning of technical gestures and promote communication between

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teams.^[2] Thus, simulation appears to be one of the techniques that can assure these expectations. Revealing positive effects on the acquisition of knowledge and practical skills.^[3] However, this simulation has some limitations,^[4,5] such as organizational, human, material or communication issues that can lead to an under or aberrant utilization.

The simulation aims to develop knowledge to act of variable complexity, during which it is necessary to mobilize the various types of knowledge: the “know how”, hence the

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use of the procedural simulation for the development of the competence.^[6] However, in our context, an underestimation of the didactics of a procedural course had been noted. However, like any teaching technique, a procedural course must respect standards of good conduct. Thus, it must respect the recommendations favoring the acquisition, organization, and integration of information.^[7] However, due to time constraints, human resources, and high student numbers, professors are sometimes forced to skip certain steps.

Technology in nursing education can be used to make educational content faster, more efficient, and economical while also developing autonomy, flexibility, organization, and learning speed.^[8] E-learning is used not only to change learning and training methods but also as one of the complementary methods to traditional training. By applying e-learning, different training methods can be used, thus time and cost would be saved.^[9]

From the above, and given the particularity of nursing courses and the importance of procedural simulation, blended learning (BL) could be a promising alternative for nursing education, combining face-to-face and e-learning in a balanced way.^[10] The e-learning activities are used as a prerequisite during and/or between the face-to-face sequences. This approach enriches “traditional” training methods by using the strengths of the different Information and Communication Technologies (ICTs).^[11] Thus, this method consists of the thoughtful integration of classroom learning experiences with online learning experiences. There are a large, varied, and growing number of BL approaches currently used in nursing education to teach a wide range of nursing content and skills.^[12] In accordance with the existing literature, our concept generates satisfactory results compared to traditional models. Indeed, the use of BL has a positive effect on reducing school dropout rates and improving exam scores.^[11] In effect, BL demonstrated consistently better effects on knowledge outcomes when compared with traditional learning in health education.^[13] Likewise, few high-quality studies were found to evaluate the role of BL in clinical education, and those that were found provide only rudimentary evidence that integrating technology-enhanced teaching with traditional approaches has a potential to improve clinical competencies among health students.^[14]

This study examines the impact of three teaching approaches on knowledge acquisition and time management related to naso-gastric tube insertion. These approaches are traditional, procedural, and BL, with the latter being a mixed training course incorporating pre-recorded video capsules on a Moodle platform. The student’s satisfaction with the simulation-based learning is assessed.

Materials and Methods

Study design and setting

The current study compares three models of teaching: the traditional method, which simply consists of theoretical lectures, teaching by simulation, and finally BL. The comparison will focus on the theoretical and practical learning outcomes of students as well as the time allotted to the procedure. The independent variable is the teaching/learning approach, which contains three levels: traditional approach, simulation approach, and blended approach.

Study participants and sampling

The participants of this study were students of the nursing care section enrolled in the second year of a bachelorsindegree in nursing education: polyvalent nurse (IP); Anesthesia-Resuscitation Nurse (IAR); emergency and intensive care nurse (ISUSI); Neonatology and Pediatric Nurse (INP); and Mental Health Nurse (ISM), representing 168 students [Figure 1]. Re-enrolled students were excluded from the study because they have already benefited from the naso-gastric tube insertion course. After stratified sampling, 118 students were retained (dressing a confidence level of 95% with a margin error of 5%).

Data collection tool and technique

Before Course: Three groups were formed. Then all students completed a questionnaire to collect their socio-demographic information, such as age, gender, and option (specialty). Then, the students completed multiple choice questions (MCQ) to assess their basic declarative knowledge related to nasogastric tube insertion.

Course Sessions Process: For the control group (TG), students received an interactive presentation on the nasogastric tube insertion technique. During the course session, the technique was read and discussed.

The simulation group (SG) received an interactive presentation on the theoretical aspects related to the nasogastric tube insertion technique. Afterwards, a practical demonstration of the procedure was primarily performed by the professor, followed by students under the professor’s supervision.

For the BL, a preliminary preparation was started during the study initiation to prepare the content. Then, video capsules of about five minutes each were produced holding the course content and segmented into: definition of the technique, brief anatomical reminder, indications, frequently faced incidents and accidents of the technique, and then a presentation of the technique. During the session in the simulation room, the professor started by brainstorming the content of the videos

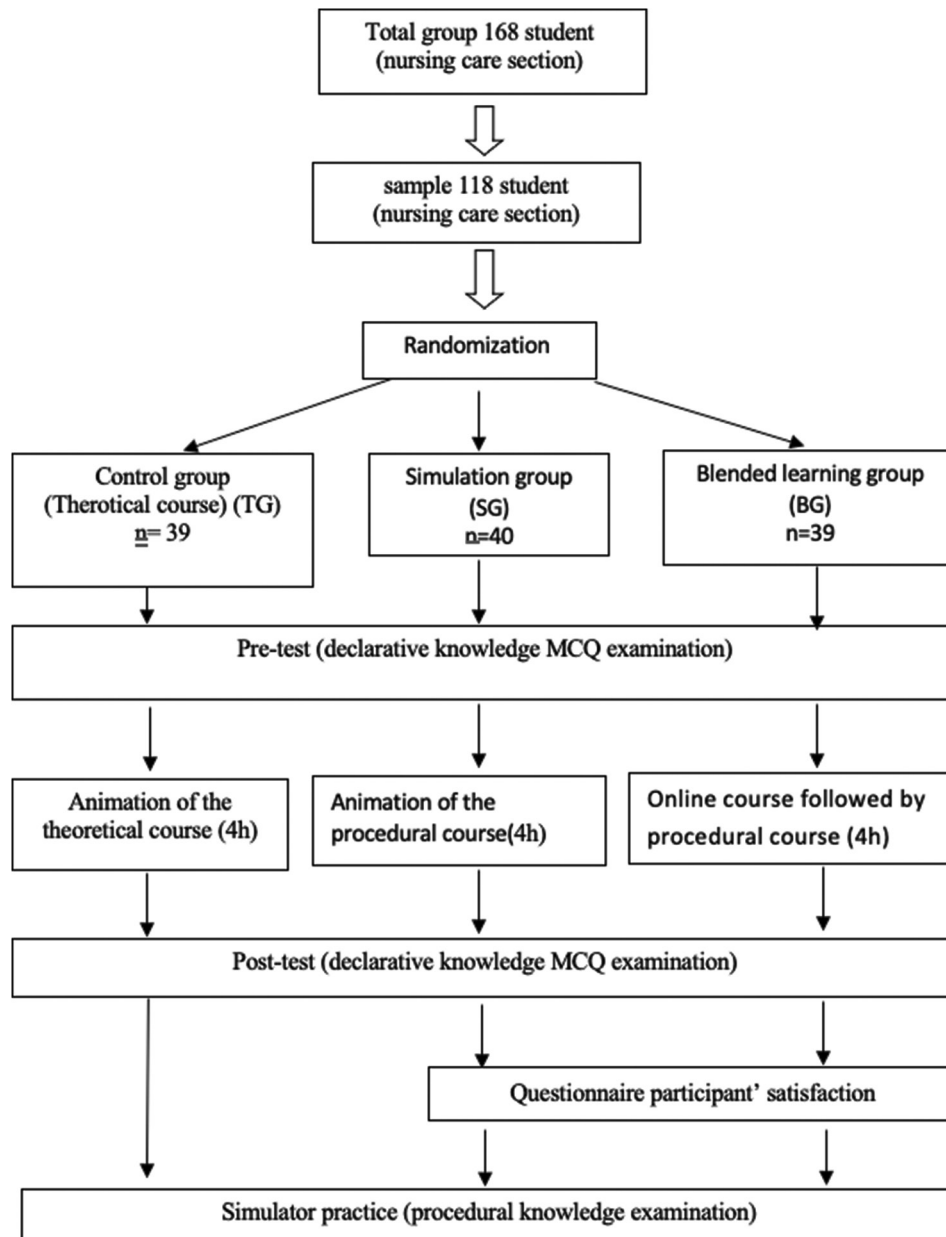


Figure 1: Protocol of the study

and inviting students to perform the technique on the simulator.

Declarative Knowledge Assessment: At the end of the course session, the acquisition of declarative knowledge was measured using the same MCQ in the pretest, and then a satisfaction test about the simulation as a teaching method was distributed to the two groups (SG and BG) who benefited from the study.

Procedural Knowledge Assessment: One week after the course, students had a practical assessment, a practical performance of the nasogastric tube insertion. An evaluation grid based on the procedure of the technique

was used during the assessment, allowing to mark the practice from 0 to 20.

Data were analyzed using descriptive statistics (mean, standard deviation) and inferential statistics: one-way Multivariate Analysis of Variance (MANOVA) method, and then a Tukey's post-hoc test.

Ethical consideration

Participation in the study was voluntary and anonymous. Oral consent of all participants was obtained, and the research was approved by the institutional ethical committee (CCBE-FSA Ref. No: ER-CS-10/2022-000).

Results

The study aimed to determine which teaching approach is most effective in teaching nasogastric tube insertion based on declarative and procedural knowledge and realization time.

Participants' grades

The independent variable is the teaching/learning approach, which contains three levels: traditional approach, simulation approach, and blended approach (simulation + e-learning).

The hypothesis of the study is as follows:

H1: There is an association between the teaching approach and the type of knowledge; there is an association between the teaching approach and the time to complete the technique.

Table 1 presents the participantssation between the tcharacteristics; more than 75% of the participants were female. The average age of all participants was 18.08 years.

The result of the statistical analysis confirms the alternative hypothesis (*H 1*). Therefore, the teaching approach effects positively towards types of knowledge and times for realization of the technique. Based on this significant result obtained from MANOVA, we conducted a series of univariate ANOVA tests to determine the significant group differences.

Declarative knowledge

First, we conducted a descriptive analysis of the grades obtained by participants. We began by analyzing the grades obtained during the pre-tests and post-tests in order to evaluate the impact of the approach used on the acquisition of declarative knowledge. The results obtained are represented in graphs 2 and 3. They show the average performance of learners in both tests: pre-test (2) and post-test (3).

In the pre-test, the average grades were distributed as follows: 1.98, 2.23, and 2.32 between the TG, SG, and BG, respectively. The statistical analysis showed no statistical difference ($P > 0.05$) [Figure 2a].

In the post-test, we noted an improvement in all groups; the average grades are as follows: TG = 11.661, SG = 16.071,

and BG = 15.214. However, we noted a clear improvement in the grades in favor of the simulation-based learning approach and the BL approach ($P < 0.001$). In fact, the difference is statistically significant between the traditional versus SGs ($P < 0.001$), as well as for the traditional versus blended groups ($P < 0.001$). However, no significant difference was observed between the simulation and blended groups ($P > 0.05$) [Figure 2b].

In order to refine the previously drawn conclusion from the MANOVA test and to specify for which teaching approach significant differences are observed. The Tukey test was realized and showed a significant difference between the results of learners who followed the traditional approach and those who followed BL ($P < 0.001$), as well as between the groups of the traditional approach and those of simulation ($P < 0.001$). No significant difference between the grades of learners who followed the simulation and those who followed BL was observed ($P > 0.05$).

Procedural knowledge

From Figure 3, we can see that there is a difference between the means of the three approaches in favor of the blended approach, followed by the SG, and then the traditional approach group ($P < 0.001$). To see if these differences are significant, a one-way analysis of variance (ANOVA) was used to test the effect of the approaches used on the acquisition of procedural knowledge. Thus, the test revealed a significant difference ($F = 117.23, P < 0.001$). In order to determine which of the three teaching approaches has a significant impact on learners' grades, we applied Tukey's post-hoc test, which showed a significant difference between the blended vs. traditional groups ($P < 0.001$), blended vs. SGs ($P < 0.001$), and traditional vs. simulation ($P < 0.001$) groups [Figure 3a].

These results can be justified by the fact that the blended group was able to benefit from more practice during

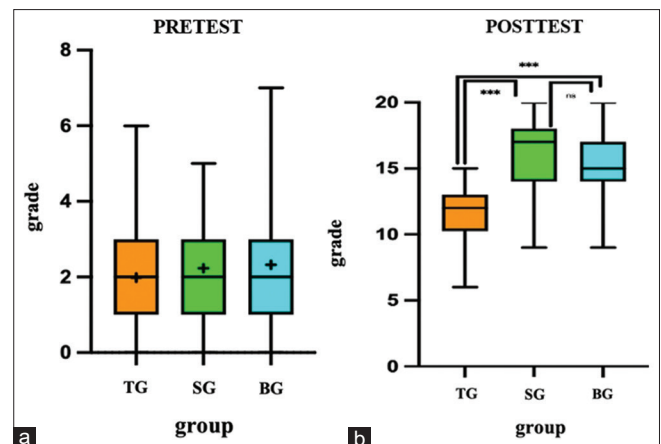


Figure 2: Participants declarative knowledge in seconds (a) Pre-test grades (b) post-test grades (grades are represented as mean, *** $P < 0.001$)

Table 1: Participants' socio-demographic characteristics

Variable	Modality	TG (n=39)	SG (n=40)	BG (n=39)
Age		18.12 (±0.33)	18.06 (±0.24)	18.07 (±0.26)
Gender	Male	17	10	02
	Female	22	30	37

the face-to-face course session since almost the entire session was reserved for performing the technique on the simulator. In addition, those students had the possibility to visualize the capsules whenever they want.

Technique completion time

The average time needed to perform the technique by students of the TG was 12 min, for the SG it was 11.4 min, and for the BG it was 6.37 min. A one-way analysis of variance (ANOVA) was used to see the effect of the approaches used on the technique completion time, which showed a significant difference ($F = 106.28$). Tukey's HSD post-hoc test showed a significant difference between the blended vs. traditional group ($P < 0.001$), blended vs. simulation ($P < 0.001$), and no significant difference between the traditional versus SG ($P > 0.05$) [Figure 3b].

PearsonFs correlation showed a statistically significant difference between declarative and procedural knowledge grades ($r = 0.58$, $P < 0.001$). And a negative correlation between procedural knowledge and completion time ($r = -0.422$, $P < 0.001$).

On a five-point Likert scale, ranging from not at all satisfied to very satisfied; offered to students to rate their satisfaction with the simulation as a teaching method, more than 70% of the students were very satisfied and the rest of students were satisfied [Figure 4].

Discussion

This study presents a conception of a BL approach; its main players are simulation and e-learning. It processed a procedural nursing course (nasogastric tube insertion) and its impact on student grades. It took 118 participants; three groups of 39 were formed. One group received a

course using the traditional theoretical course (control), the second group received a procedural simulation course, and the third group received a BL course (video capsules on the platform, followed by procedural simulation).

Traditionally, nursing training is organized according to the alternating teaching method. Declarative knowledge is taught in the classroom, while procedural knowledge is mainly addressed in real-life clinical situations.^[15] However, this approach is far from respecting the ethical principle of "never the first time on the patient". In addition, students will be exposed to stress during their contact with patients, which, therefore, exposes them to several risks. The nursing course teaches the main principles and procedures of nursing to undergraduate nursing students. This course is basic for the development of procedural and psychomotor skills. In order to ensure that nursing students are sufficiently prepared for real clinical settings through appropriate training strategies. The education of clinical nursing skills involves the use of low- to high-fidelity simulators.^[16] Simulation-based education enhances the declarative knowledge of nurses and reduces the stress of implementing a new technique.^[17]

Our study revealed the positive impact of procedural simulation on the technique of nasogastric tube insertion. It was clear that the results of the declarative and procedural knowledge grades were in favor of teaching by simulation compared to traditional teaching by a large margin. Simulation promotes students' learning because they use their knowledge in experiences that are close to reality and then facilitate connections to their understanding.^[18] In addition, students were very satisfied with simulation-based learning and expressed a desire to expand the use of this method in other courses. The simulation-based learning sessions proved to be an effective method of bridging

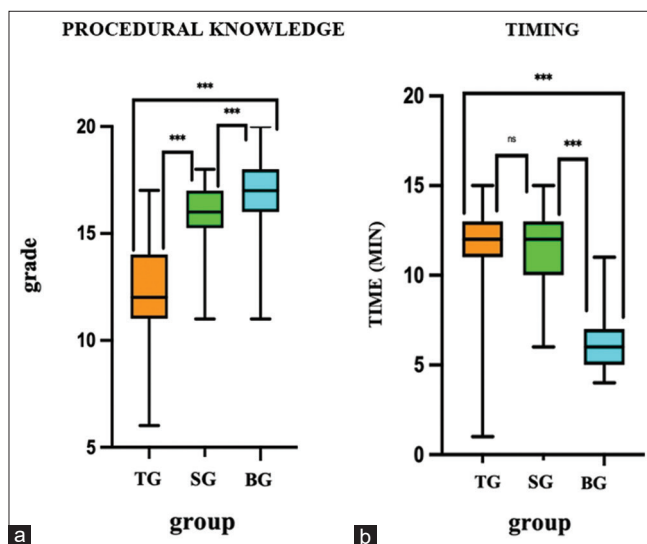


Figure 3: Participants (a) procedural knowledge (b) technique completion time (grades are represented as mean, *** $P < 0.001$)

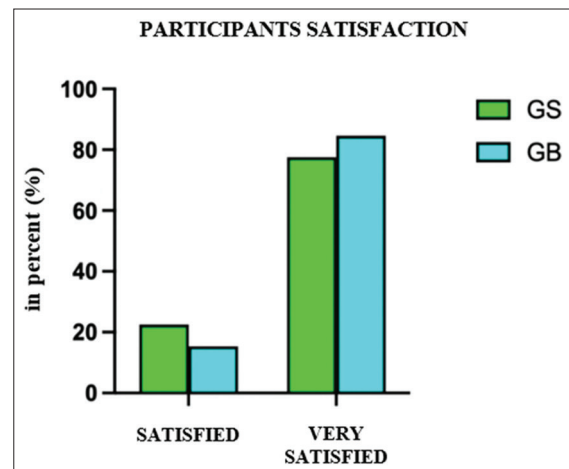


Figure 4: Participants satisfaction with the simulation

the gap between the academic and clinical learning environments. Students are satisfied with their learning experience and recommend incorporating this type of simulation into nursing education.^[19] On the other hand, simulation-based learning has some limitations, such as time and resources: it remains quite time-consuming, and with a large number of students, the objectives of teaching may not be achieved.^[20]

BL is a pedagogical approach that reorganizes space/time to teach and learn.^[21] Relying on ICT, the BL model proposed in the current study is an appropriate approach to face the low student experience with nursing procedural courses. In accordance with the existing literature, we have shown that the concept generates satisfactory results compared to traditional models, especially with better time management. As a matter of fact, after implementing this model, we implemented a notable advantage: the introduction time could be significantly minimized, allowing an immediate start to the practical learning content.

This observation corresponds well with our finding, which showed that students used e-learning via our platform to view the video capsules and required less time during their practices. This can be explained by the fact that students in the BL group came well prepared. These students also declared gaining knowledge, suggesting a positive effect of our model design on the learning experience. In the majority of research, regardless of discipline, a positive impact on outcomes in terms of higher grades is reported when BL is employed.^[22] Similar results have been described in other studies on the implementation of BL in education.^[23,24] We agree that at least some of these results emanated from the increase in teaching and learning activities.^[25]

Thus, the BL approach can help motivate students to have preparation before the course. The results of the present study showed that the combination of online learning and face-to-face simulation-based learning methods could slightly improve the learning outcomes of nursing students but, more importantly, allow for better time management and satisfaction. According to Bloomfield and Jones,^[26] students considered online learning an invaluable experience for developing clinical nursing skills. In fact, they preferred a combined learning method (BL). Additionally, Sung and Colleagues^[27] indicated that the combination of e-learning and face-to-face learning is useful.

As for Ariana and Colleagues,^[28] they indicated that combining e-learning with traditional learning methods of lectures and tutorials could improve students' grades and satisfaction compared to those who experienced traditional learning alone.

Although the application of a learning method involving e-learning is considered an invaluable experience that can be used as a source for lecture courses, it may have limitations for some students, for instance, those who do not have access to computers and the Internet.

Conclusion

This study found that the education of nursing techniques using a simulator improves the technical performance of students. BL, which integrates video-assisted resources, was found to be a useful tool to teach procedural skills to nursing students with more enhanced time management. It was also preferred by students due to its flexibility. This suggests that BL can be applied to support traditional teaching methods and can be translated into other nursing courses where teaching time is limited.

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Conflicts of interest

There are no conflicts of interest.

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