Teaching airway management with laryngeal mask: randomized controlled trial

Ensino do manejo da via aérea com máscara laríngea: estudo randomizado controlado

Enseñanza del manejo de la vía aérea con máscara laríngea: estudio randomizado controlado

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ABSTRACT

Objective: to teach airway management with laryngeal mask to nursing students through dialogic lectures along with laboratory activities or exclusively through simulation class. **Method:** randomized controlled trial. Population: eighth semester bachelor's degree students. Sample: 17 students randomized in the intervention group (IG: simulation class) or control group (CG: dialogic lecture along with laboratory activities). Elaborated and validated instruments: written test, simulation scenario, objective structured clinical examination (checklist). Data collected from workshop. Structured clinical examination in simulation scenario filmed and evaluated by 3 experts, and written tests were applied. **Results:** 24.4 ± 4.2 years old. Right answers percentage: CG: pre-test $66 \pm 10\%$; post-test $84 \pm 8\%$. IG: pre-test $65 \pm 5\%$; post-test $86 \pm 11\%$. Scenario: CG $78 \pm 5.2\%$; IG $84 \pm 8.9\%$. **Conclusion:** strategies allowed the development of knowledge, skills and decision-making, which are essential to achieve the scenario objectives. Knowledge was incorporated in airway management with laryngeal mask, shown by the increase in the scenario and written tests scores.
Key words: Nursing Students; Teaching; Simulation; Airway Management; Laryngeal Masks.

RESUMO

Objetivo: ensinar manejo da via aérea com máscara laríngea a estudantes de enfermagem mediante aula expositivo-dialogada acompanhada de atividade prática em laboratório ou exclusivamente aula simulada. **Método:** ensaio Clínico Randomizado Controlado. População: bacharelandos oitavo semestre. Amostra: 17 estudantes randomizados em grupo intervenção (GI: aula simulada) ou controle (GC: aula expositivo-dialogada e atividade prática em laboratório). Elaborados e validados instrumentos: avaliação escrita, cenário de simulação, avaliação clínica objetiva estruturada (*checklist*). Coletou-se dados em *workshop*. Aplicaram-se teste escrito e avaliação clínica estruturada em cenário de simulação filmada e avaliada por três *experts*. **Resultados:** idade 24.4 ± 4.2 anos. Acertos GC: pré-teste $66 \pm 10\%$; pós-teste $84 \pm 8\%$. GI: pré-teste $65 \pm 5\%$; pós-teste $86 \pm 11\%$. Cenário: GC $78 \pm 5.2\%$; GI $84 \pm 8.9\%$. **Conclusão:** estratégias proporcionaram aquisição de conhecimento, habilidades e tomada de decisão, indispensáveis para atingir objetivos do cenário. Houve incorporação de conhecimento em manejo da via aérea com máscara laríngea, evidenciado pelo incremento dos escores no teste escrito e cenário.
Descritores: Estudantes de Enfermagem; Ensino; Simulação; Manuseio das Vias Aéreas; Máscaras Laríngeas.

RESUMEN

Objetivo: enseñar manejo de la vía aérea con máscara laríngea a estudiantes de enfermería mediante aula expositiva-dialogada acompañada de actividad práctica en laboratorio o exclusivamente aula simulada. **Método:** ensayo Clínico Randomizado

Controlado. Población: universitarios del octavo semestre. Muestra: 17 estudiantes randomizados en grupo intervención (GI: aula simulada) o control (GC: aula expositivo-dialogada y actividad práctica en laboratorio). Instrumentos elaborados y validados: evaluación escrita, escenario de simulación, evaluación clínica objetiva estructurada (*checklist*). Datos colectados en *workshop*. Se aplicaron prueba escrita y evaluación clínica estructurada en escenario de simulación filmada y evaluada por tres *experts*. **Resultados:** edad 24.4 ± 4.2 años. Aciertos GC: pre-teste $66 \pm 10\%$; pos-teste $84 \pm 8\%$. GI: pre-teste $65 \pm 5\%$; pos-teste $86 \pm 11\%$. Escenario: GC $78 \pm 5.2\%$; GI $84 \pm 8.9\%$. **Conclusión:** estrategias proporcionaron adquisición de conocimiento, habilidades y toma de decisión, indispensables para alcanzar objetivos del escenario. Hubo incorporación de conocimiento en manejo de la vía aérea con máscara laríngea, evidenciado por el incremento de los scores en el teste escrito y en el escenario.
Palabras clave: Estudiantes de Enfermería; Enseñanza; Simulación; Manejo Aéreo; Máscaras Laríngeas.

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INTRODUCTION

Nursing professionals need to develop their skills before using them with real patients[1]. Such skills, along with knowledge, allow decision-making, critical thinking, and improvements in patient care[2]. Frequently, nurses are the first ones to assist seriously ill patients and, in case they are not able to perform interventions that preserve the airways, a precious time can be lost until a physician arrives[3-4].

To provide acquisition of critical situation skills, especially in airway management, technologies have been being incorporated into teaching[2,5]. An important tool that can be used in such situations, even during a cardiopulmonary arrest (CA), is the supraglottic device named laryngeal mask (LM). The LM provides a temporary airway, it is safe, allows effective ventilation, and usually succeeds at the first attempt of insertion. Therefore, it consists of an important procedure to be learned and practiced[6-7].

The acquisition of new knowledge, the development of skills and the change of behavior by human beings is called learning[8]. According to the constructivist model, subjects learn through interpersonal relations in an individual process of constructing knowledge, experiences, skills and perceptions of oneself and of the world[9-10].

To promote learning, many teaching strategies can be adopted. In the strategy named dialogic lecture, the presentation of the topic is combined with students' active participation. Teachers lead them to discuss the object of study taking reality into consideration[11]. The skills laboratory room, on the other hand, must be focused on techniques learning and emphasize students' work individually, or in small groups, under the supervision of an experienced tutor[12]. In turn, the simulation class involves the know-how, creating an environment similar to the professional practice, which gives the students an opportunity to experience practical situations in a simulated way[4,13].

The teaching-learning process requires evaluation results to be continually restructured and able to meet students' needs. One of the pertinent evaluations is students' performance, which can be accomplished, among other ways, through Objective Structured Clinical Examination (OSCE). In this model, students are exposed to real cases or simulated practical problems in which they must show their competences and skills[14-17].

This study is relevant for describing how an important theme in the urgency and emergency field, airway management, can be taught through different strategies. Besides, it includes the use of an extremely important tool in such management: the LM. It is believed that the formation of a nurse who is critically reflexive; capable of making decisions based on technical-scientific knowledge; provided with knowledge, skills and attitudes to perform in clinical practices should be the main focus of graduation courses.

OBJECTIVE

To teach the theme "Airway management in emergencies: the use of laryngeal mask" to nursing students through different strategies: dialogic-lectures along with activities in the skills laboratory room or exclusively simulation class.

METHOD

Ethical aspects
The study was approved by the institution's Research Ethics Committee (REC). Every judge, evaluator and student authorized their participation by signing a Free and Informed Consent Form. The research was registered in a specific platform for clinical trials (www.clinicaltrials.gov), under the code NCT 01659268.

Design, study setting and period
Study with experimental outlining, quantitative approach, of the randomized controlled clinical trial (RCCT) type. The experimental study involves the application of a treatment or intervention – independent variable – and the analysis of its clinical outcomes – dependent variable[18]. The independent variable was the simulation class whereas the dependent one (outcome) was the scores from the written test and from the simulation scenario named "OSCE Airway management in emergencies: the use of laryngeal mask". The study took place at the premises of a public university in the state of São Paulo's countryside – classroom and Nursing Practices Simulation Center – between the months of October, 2012 and February, 2013.

Population and sample: inclusion and exclusion criteria
The population comprised every student in the eighth semester of the nursing undergraduate program of a public institution in the state of São Paulo's countryside, which totalized 69 students officially registered. The recruitment strategy was

the workshop named "Airway management in emergencies: the use of LM", which took place in the institution's premises and was unrelated to the class schedule in order not to disturb the didactic activities. The sample was voluntary and composed by students who enrolled in the workshop and accepted to participate in the study. The adopted inclusion criteria were: to be over 18 years old and to be officially registered in the last semester of the undergraduate program. The exclusion criteria was: absence in any step of the workshop.

The researcher sent a common invitation to every student of the group via e-mail and later made direct contact during regular activities at the university. Promotional posters were made by the institution's Scientific Documentation Service and fixed in strategic spots. The enrollments, available within a period of 15 days, were performed electronically. Twenty-eight enrollments were registered, but, at the day the workshop was scheduled to start, only 17 students showed up. The process to get the final sample is shown in Figure 1:
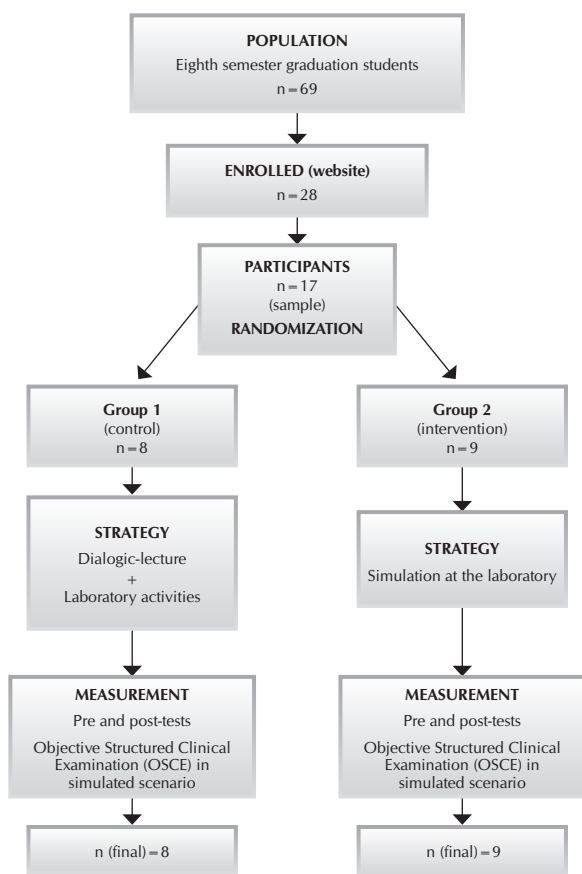

Figure 1 – Sample procedure, Ribeirão Preto, São Paulo, Brazil, 2013

After the workshop, a research assistant organized the names of the 17 students in alphabetical order assigning them a sequential number. The randomization sequence was generated by the program *Random Allocation Software*®, version 1.0.0 (developed by M. Saghaei, Anaesthesia Department, University of Medical Sciences Isfahan – Israel). This way, students were randomized in two groups: Control Group (CG), composed by eight individuals who were subjected to dialogic-lecture and then skills laboratory activities; and Intervention Group (IG), composed by nine individuals who were subjected to simulation class in the laboratory. It is important to highlight that during the workshop period there was no loss in any of the groups.

Study Protocol

Written pre-test and teaching strategies

On the workshop's first day, every student (CG and IG) did the written test for previous knowledge evaluation. Then, students from IG were dismissed.

The eight students from CG participated in the dialogic-lecture, which lasted one hour and included the projection of slides, elaborated in *Microsoft*® *PowerPoint* 2007 program, whose theme was "Airway management in emergencies: the use of LM". The class aimed to: present the initial approach to confirm/discard CA; recognize signs and symptoms of airway compromise and respiratory failure; show anatomical and physiological aspects related to airway and breathing; correlate pulse oximetry and partial pressure of oxygen (PaO_2); present maneuvers either manual or with devices to open the airway; describe ventilation techniques with bag-valve-mask unit (one or two people); recognize the LM device, its particularities, indications and contraindications, insertion techniques; evaluate the outcome of the intervention based on the patient's clinical and physiological parameters.

On the second day of the event for the CG students, they were split into two subgroups with four participants each. The institution's skills laboratory room was characterized as an emergency room, with materials and equipment used in airway management, along with the low-fidelity manikin specific for airway management activities. Each subgroup was lead towards the laboratory so that the could students carry out the learning goals designed for the activity, i.e., executing the manual airway opening maneuver; inserting oropharyngeal cannula; installing pulse oximeter; doing bag-valve-mask ventilation (one and two people); manipulating and preparing the LM device; inserting the LM in the manikin; checking intervention effectiveness. During the activity, which lasted 35 minutes in each subgroup, students individually executed the skills in the manikin, while the researcher oriented and corrected such skills when necessary.

On the second day of the workshop, the nine students from the IG, split into subgroups of four and five members, respectively, participated in the simulation class, which lasted one hour in each subgroup. The laboratory was properly characterized as an emergency room and equipped with low fidelity manikin, specific to airway management activities. The researcher guided the proposed topic based on a clinical case, using sign and symptoms simulation in the manikin and discussing the recommended clinical conducts for the case. Students were asked about the approach in the case, and, properly oriented by the researcher, they also performed the necessary interventions in the manikin.

The simulation class' learning goals were: promoting initial approach to confirm/discard CA; recognizing signs and symptoms of airway compromise and respiratory failure; discussing anatomy and physiological aspects related to airway and breathing; correlating pulse oximetry and partial pressure of oxygen (PaO_2); operating manual airway opening maneuvers; performing ventilation with bag-valve-mask unit (one and two people); recognizing LM devices, its particularities, indications and contraindications; operating the device insertion technique in the manikin under the researcher's orientation; evaluating the intervention's result based on the patient's clinical and physiological parameters.

In simulation class phase, the students were able to identify their previous knowledge, from examination, diagnosis, until intervention, by means of previous experiences either in real situations or college courses.

Written post-test and structured clinical examination (OSCE) in the simulation scenario

The workshop's third day for both groups was saved for students' skills and competence evaluation related to airway management in emergencies. Firstly, the written test was performed, and it lasted 40 minutes.

Later, in both groups, the structured clinical examination (OSCE) was performed in a simulation scenario. In this phase, the medium fidelity manikin Laerdal® *MegaCode Kelly* was used. It consists of an equipment designed for advanced life support training, whose particularities include airway adapted for advanced maneuvers, such as tracheal intubation and supraglottic devices insertion, besides the possibility of monitoring parameters insertion.

In groups, students were taken to the Simulation Laboratory to be familiar with the environment and the equipment involved in the scenario. Then, they were accommodated in the classroom and lead to the laboratory for individual evaluation.

Upon the student's arrival, the researcher would read the clinical scenario aloud, which was characterized by a patient who was irresponsive, in apnea, cyanotic, with 50% oxygen saturation ($satO_2$), 50bpm heart rate (HR) and palpable central pulses.

Such parameters were displayed on the monitor to be seen by the student, whose tasks were: to wear the personal protective equipment (glasses, surgical facial mask and procedure gloves); to open the airway (manual and oropharyngeal cannula techniques); to identify the hypoxemia and perform bag-valve-mask ventilation; to opt for the LM insertion and to perform device preparation, insertion and checking steps. All the items were described in the checklist to be fulfilled by the evaluator later.

About 10 seconds after the LM insertion followed by the ventilation with effective chest expansion, the monitoring parameters were altered by the researcher (HR=100bpm and $satO_2$=98%) and the scenario was closed. Later on, the students were gathered with the researcher to discuss and reflect about the activity (debriefing) and to clarify doubts.

Analysis of results and statistics

The evaluation was done through the confection instruments for results measurement, namely: written test, simulation scenario "Airway Management in Emergencies: use of laryngeal mask" and instrument of objective and structured clinical examination of the simulation scenario (checklist). Such elements went through face and content validation by a committee formed by 3 judges, who gave suggestions and pointed out necessary corrections for the instruments application.

The written evaluation (written test) was an instrument that consisted of 20 multiple choice questions, with 5 choices each, approaching themes related to airway management and ventilation approach in emergencies.

The simulation scenario construction started with the learning objectives definition: to promote initial approach, to recognize signs of airway compromise, to operate airway opening maneuvers (manual and with device), to perform bag-valve-mask ventilation, to operate LM utilization steps (preparation, insertion and checking), and to evaluate the results of such intervention.

The simulation scenario's evaluation checklist was composed of items related to essential activities to be performed by the student, as well as scores to each task. In total, it had 10 items with correct and incorrect answers, each corresponding to specific intervention and actions.

The study's masking was stablished in relation to the students' evaluators in the simulation scenario. Such evaluators were professionals, specialists in urgency and emergency, provided with the checklist, and they did not know to which group each student belonged.

The assistance performed in the simulation scenario was recorded, as well as edited and burned to a DVD (Digital Versatile Disk). The videos and the printed objective structured clinical evaluation instrument (checklist) were handed to three nurses evaluators. It is important to highlight that the evaluators previously went through calibration procedure done by the researcher to keep the evaluation standard.

The scores obtained in the written test and the global score from the simulation scenario were chosen for results analysis.

The data was organized in spreadsheets in the *Microsoft Excel®* 2007 program. The software used for statistical analysis was *Graphpad® Prisma* (version 5.01). The percentage of right answers obtained in the written test and in the structured clinical examination (OSCE) of the simulation scenario were described in bar chart and the comparisons between the groups were done through Student's t-test. The adopted significance level (α) was 5%.

RESULTS

The sample consisted of 16 female students (94.1%) whose ages were in average 22.6 ± 1.69 and median of 22 for the CG, while those in the IG were in average 26 ± 5.2 and median of 24.

Figure 2 shows the written test's right answers percentage by the eight students in CG. The pre-test aimed at evaluating students' previous knowledge upon starting the workshop. Whereas the post-test, which happened in the third day of the event, aimed at determining the knowledge that was incorporated during the activities planned for the workshop.

The average right answers percentage obtained in the pre-test was $66 \pm 10\%$ (median of 65%), whereas in the post-test it was $84 \pm 8\%$ (median of 85%).

The comparison between scores obtained by the CG students in both tests evinced a statistically significant difference (p=0.002).

Figure 3 shows the percentage of right answers to the written test obtained by students in IG.

The average right answers percentage obtained in the pre-test was $65 \pm 5\%$ (median of 65%), whereas in the post-test it was $86 \pm 11\%$ (median of 86%).

The comparison between scores obtained by IG students between the pre-test and the post-test evinced a statistically significant difference (p < 0.001). In turn, the comparison between CG and IG did not evinced statistically significant difference in relation to average scores obtained in the pre-test (p = 0.74) and in the post-test (p=0.71).

Figure 4 presents the students' right answers percentage distribution in structured clinical examination (OSCE) in simulation scenario for both groups.
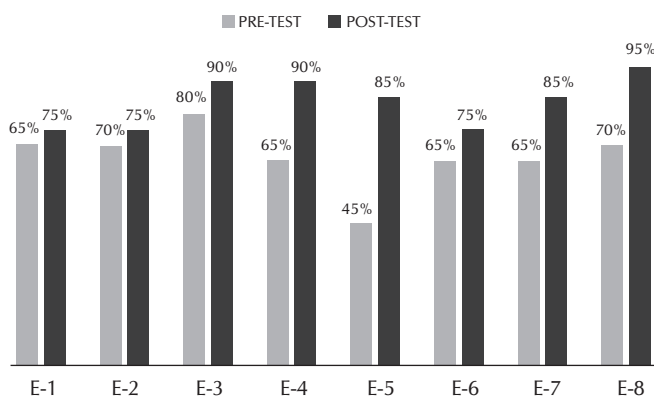

Figure 4 – Students' right answers percentage distribution in structured clinical examination in simulation scenario (control and intervention groups), Ribeirão Preto, São Paulo, Brasil, 2013

The average right answers percentage among students in CG was $78 \pm 5.2\%$, whereas among IG students it was $84 \pm 8.9\%$.

Scores obtained in structured clinical examination (OSCE) in simulation scenario by CG and IG students were compared, it was possible to verify that there was no statistically significant difference (p = 0.08).

DISCUSSION

We observed that previous theoretical knowledge of students from both groups was similar. The whole structure of the written test was based in the contents approached in the institution's graduation courses, introducing a new knowledge: the LM, its concepts, principles, and procedures.

The students' participation in different teaching strategies allowed knowledge acquisition, skills development and decision-making, which are essential to achieve the proposed assistance complexity level. This was evinced through the increment of the written test right answers rates, and also through students' right answers percentage in the structured clinical examination (OSCE) in simulation scenario for both groups.

Learning is the action through which knowledge, skills and attitudes are consciously or unconsciously acquired in a way that behavior is somehow altered. It is an active process that happens as the subjects interact with their environment and incorporate new information and received experiences, relating them with what they already know or learned[9].

As new skills and aptitudes develop, individuals' perception of reality can be altered, new knowledge and sensibilities are incorporated, as well as generalizations and images influence the way of facing the world and the attitudes. Ability is defined as an action or a task that demands movement and can be acquired or learned aiming at correctly performing the task. This term also refers to the capacities that can be expressed through behaviors at any moment, susceptible to being developed with practice[19].

The OSCE, used in the evaluation process, consisted of a tool able to decode and prove content assimilation and learning regarding the proposed theme. The nursing students'

Figure 2 – Students' right answers percentage distribution of the control group in the written test, Ribeirão Preto, São Paulo, Brazil, 2013
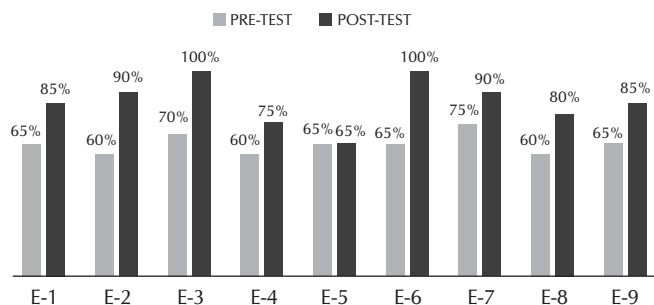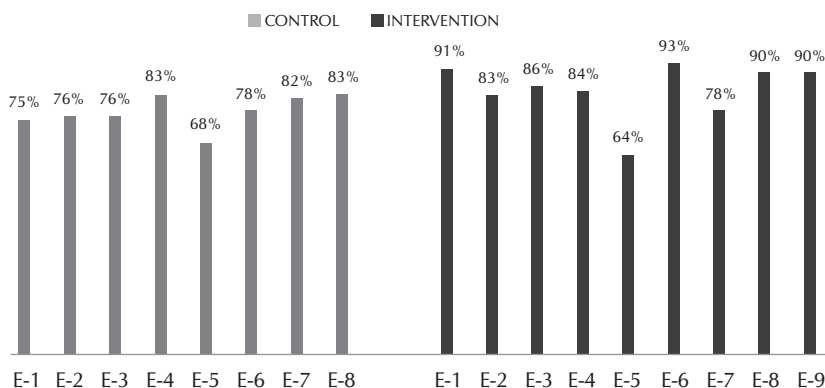

Figure 3 – Students' right answers percentage distribution of the intervention group in the written test, Ribeirão Preto, São Paulo, Brazil, 2013

knowledge internalization in both groups involved an appropriation of new knowledge and a significant interrelation between previous knowledge with innovative practice.

Such tool improves the evaluations' reliability and validity under several aspects of clinical competence. Among reliability attributes, the checklist stands out, considered as one of the most critical steps, since the structuration of a scenario is of little relevance if the evaluator does not know which items to analyze at the station[20].

In this evaluation process, the checklist is characterized as an instrument build through a standard global measurement scale that evaluates practical skills, techniques, among others. This instrument applied in OSCE is seen as an important strategy to evaluate students' clinical skills and competence. To use the instrument effectively, one should interpret the minimum threshold which is sought for in a special ability. A checklist should be used by highly trained observers, allowing reliability and contributing to a qualified evaluation[15,20].

The CG and IG theoretical and practical performance was effective to achieve the learning goals and to overcome the difficulty level in performing the proposed task, that is to say, the airway management in emergencies with the use of the LM. The students' knowledge and skills acquisition shows that the applied strategies were efficient to reach the proposed learning goals. It is worth reiterating that such knowledge and skills are of utmost importance in preparing future nurses.

Limitations of the study

The sample's reduced size is considered a limitation of the study, which prevents inferring the efficacy of one strategy over the other. Future research with different population and bigger samples are recommended.

Contributions to the clinical practice

In clinical practice, the nurses should use the competences acquired as tools for decision-making when exposed to emergency situations involving particularly the airway (main focus of this study). This implicates an improvement in the quality of the assistance offered to the patient stricken by a complication that needs immediate and fundamental intervention.

CONCLUSION

In this study, it was possible to verify that, regardless of the teaching strategy used, there was knowledge incorporation by the nursing students in relation to the theme, which has been evinced by the score increment in the written test and also by the right answers percentage in the simulation scenario.

The structured clinical examination (OSCE) in simulation scenario has proven to be an important, standardized and structured method for clinical skills and competence evaluation regarding airway management in emergencies. It is worth reinforcing the use of properly calibrated evaluators, with the checklist tool, which allowed a higher accuracy in the evaluation. Such tool was used to measure the students' expected competences and skills for airway management in emergencies with ML's insertion.

It was not possible to evidence if the dialogic lecture associated with laboratory activities has better results in relation to the simulation class when teaching this specific theme.

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