v. 4, n. 18, 2024

International Journal of Health Science

SKILLS DEVELOPED IN THE PRACTICE OF LUMBAR PUNCTURE (LP) USING THE FLIPPED CLASSROOM METHODOLOGY VERSUS CONVENTIONAL SIMULATION

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Abstract – Introduction: Given the difficulty of opportunities for students to perform LP on patients, simulation is considered an ideal teaching method6,7. The flipped classroom method (SAI) is presented as a proposal to rethink teaching and learning processes, aiming to optimize the stages of transmission and assimilation of knowledge. The main concrete motivation for this research was the attempt to find a better method of teaching this skill. **Methodology:** The study consisted of two phases. In the 1st, half of the students were trained in the traditional method and half in the SAI method. In the 2nd phase, these students were called upon, after a month of training, to execute a PL. The student's level of confidence was questioned before carrying out the procedure, which was assessed using a checklist. In addition, each student answered a questionnaire with five multiple-choice questions. Finally, the results of the groups were compared. Results: It was observed that the average number of correct answers to the questions was higher in the SAI group (2.57) compared to the traditional group (1.77), and the average number of items completed was also higher, 15.42 versus 14.77, respectively. Students in the traditional group needed more attempts (average of 2.33) compared to those in the SAI (average of 2.14). There was no difference in the level of confidence between the groups. The data are not statistically relevant due to the small sample. **Conclusion:** It was not possible to define the best teaching method for the PL skill.
Keywords: Lumbar puncture. Simulation. Flipped classroom. Skills.

INTRODUCTION

Medicine is a science in constant evolution. This characteristic requires updated and holistic medical training, covering both technical and scientific aspects related to communication and humanization. One of the greatest difficulties in acquiring practical skills is due to the risk imposed on the patient in an emergency if they are attended to by a student. Therefore, alternative means of learning become necessary.

To meet this need, Simulation-Based Medical Education was created, which seeks concrete learning with fewer errors in professional activity.

Simulation is a technique that uses simulators to reproduce, in a standardized way, a real environment of a given condition (clinical, military, mechanical, etc.) with the aim of study or personal training. To this end, it makes use of different types of simulators with different levels of complexity, ranging from low-tech simulators, through standard patients and desktop computers, to complex task and patient simulators, which favor decision making. and team training. This variety provides specificity of the chosen method for the desired objective, avoiding unnecessary expenses.

The simulation laboratory at PUC-SP is commonly used by medicine and nursing courses, and in the medicine course it is mainly used by fourth-year and sixth-year students, who spend around 30 days in laboratory activities, with simulation of clinical cases and conduct.

Teaching the lumbar puncture (LP) technique with a simulator is not yet well systematized in the curricula of medical schools. It is known that simulation on a mannequin is as effective in learning as the "bedside" method (BARSUK et al., 2012; HENRIKSEN et al., 2018) Given the difficulty of opportunities to perform LP on patients for all For students, simulation is considered the ideal teaching method (IYER et al, 2013; SAWYER et al, 2015).

Regarding the evaluation of the simulation learning method, different parameters are mentioned, such as: learner satisfaction

(relevance to practice and perceptions about the learning process), knowledge acquisition (evaluated both from a subjective point of view through tests self-assessment, as well as objective, for example, responding to tests on the theoretical basis of the technique) and acquisition of skills (from a subjective point of view, it translates into self-confidence in carrying out the procedure and, from an objective point of view, it can be measured by observation by an evaluator regarding compliance with essential steps listed). Training in procedures must also aim to maintain or retain what has been learned, allowing transmission to the clinical setting.

The flipped classroom method is presented as a proposal to rethink teaching and learning processes and the spaces where they occur, aiming to insert educational methodologies and technologies, in order to optimize the stages of transmission and assimilation of knowledge. Inverting the classroom basically consists of doing at home what was done in class, for example, activities related to the transmission of knowledge and, in class, the activities designated to be carried out at home, responsible for the assimilation of knowledge, such as solving problems and carry out group work (CRICHLOW et al, 2018; SCHNEIDERS et al, 2018).

Students practice LP during the "Procedures and Diagnosis" module in the 7th and 8th periods of the undergraduate course, aiming to systematize a practical class script for the LP technique using the "Spinal Injection Simulator", which allows conventional training in a standard patient. Students are guided by a checklist developed in the Objective Structured Assessment of Technical Skill (OSATS) model, used by the UFRN Health Sciences Center (BRITO, 2015).

The general skills to be developed are the use of biosafety principles and practice of the LP technique to measure pressure and obtain CSF for analysis. The specific skills to be developed are preparing the patient adequately and knowing the material needed for the procedure.

Due to these considerations and bearing in mind that even experienced specialists may not be successful in carrying out PL,

We will carry out a second voluntary phase, after one month, on the same mannequin (Spinal Injection Simulator), to evaluate the retention of the knowledge acquired during the first phase of the project.

METHODOLOGY

ANALYSIS OF DATA COLLECTED

An analytical and comparative study was carried out with the evaluation of the general skills to be developed for the technical practice of LP for measuring pressure and obtaining CSF for analysis, in addition to adequate preparation of the patient and knowledge of the material necessary for the procedure

1. The study population were students in the 7th and 8th periods of the undergraduate course who underwent the "procedures and Diagnostics" module during the period from February 2022 to June 2022;
2. The data collected from the answers to the multiple-choice questions and the students' performance according to the checklist applied were used only to analyze the skills developed for the technical practice of PL and comparison between conventional and classroom teaching methods. flipped class;
3. The collection of answers to the questions and the execution of the checklist were confidential, through the signing of Informed Consent Terms among the participants of this research;
4. The collected data migrated to standardized graphs and spreadsheets, collecting and inserting partial and final results;

5. An information bank was analyzed and the answers to the multiple-choice questions, the checklist items and the number of attempts required for each student to perform the procedure correctly were recorded for comparison purposes. From this, Pearson's chi-square test was used to assess how likely the difference observed between the samples was (verifying whether one methodology was superior to another in the cognitive test);
6. The research began only after submission and approval by the Research Ethics Committee (CEP) of the Faculty of Medical and Health Sciences (FCMS/PUC-SP).

INCLUSION CRITERIA

The population of this study was made up of students from the 7th and 8th periods of the undergraduate course who were learning the technical practice of lumbar puncture using the "Spinal Injection Simulator", which allows conventional training on a standard patient, during the "Procedures and Diagnostics" module.

EXCLUSION CRITERIA

Students who signed the Free and Informed Consent Form in phase I of the research were excluded, but who then did not fulfill their responsibility to participate in phase II according to the time stated necessary.

BENEFITS

They were guided by obtaining data that could help evaluate and compare the assimilation of PL knowledge and its practical application through the conventional method and the flipped classroom.

RISKS

There were no risks in relation to the development of this research, since it exclusively used simulation dummies within the simulation laboratory of the Faculty of Medical and Health Sciences of `` Pontifícia Universidade Católica de São Paulo`` (FCMS/PUC-SP), and with the signing of the Free and Informed Consent Form by the participants of this work.

RESULTS

Phase II of the research consisted of reassessing students through a new lumbar puncture and a questionnaire with 5 multiple-choice questions, in order to assess the retention of practical knowledge acquired by students in phase 1 (one) and the effectiveness of regular training in the undergraduate course teaching lumbar puncture technique. 9 students from the traditional group and 7 from the flipped classroom group participated in phase II.

Data were collected regarding the answers to multiple-choice questions applied after the lumbar puncture procedure in the phase II. After obtaining the answers, it was possible to analyze, through comparison in the graph (Figure 1), that, in both teaching methods, the lowest hit rates were related to questions 2 (11% in the traditional group; 28% in the flipped classroom group), 3 (11% in the traditional group; 28% in the flipped classroom group) and 5 (11% in the traditional group; 43% in the flipped classroom group). Question 2 concerns the identification of anatomical repairs; a 3 to the positioning of the needle bevel; a 5 a measure to prevent post-puncture headache. It is worth mentioning that, even though these are the questions with the lowest correct answers, the flipped classroom method, compared to the traditional one, obtained a higher percentage of correct answers. Despite this, when using the chi-square test, for question 1, $p = 0.8385$, question 2 $p = 0.3747$, question 3 $p = 0.3747$, question 4 $p = 0.6866$ and question 5 $p = 0.1457$. Therefore, it was observed that

the sample data does not indicate statistical evidence that the highest correct answer rate for multiple-choice questions is related to one of the methods, which is justified by the low sample number.

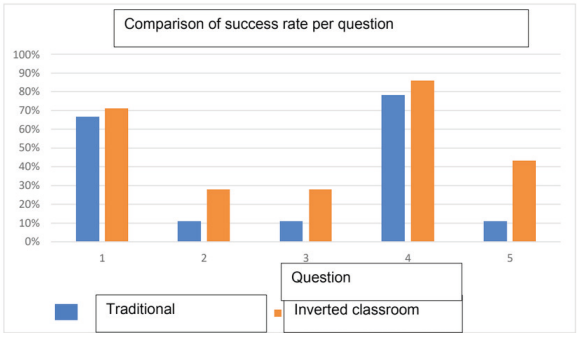

Figure 1: Comparison of success rate per question

Questions 1 and 4, which concerned, respectively, indications and contraindications for lumbar puncture and cranial repositioning of the needle in case of initial failure, were those with the highest hit rate in both methods, showing greater retention of this knowledge.

Still regarding multiple-choice questions, it was found, through the following graph (Figure 2), that students in the flipped classroom (2.57) presented a higher average number of questions correct when compared to students of the traditional group (1.77).

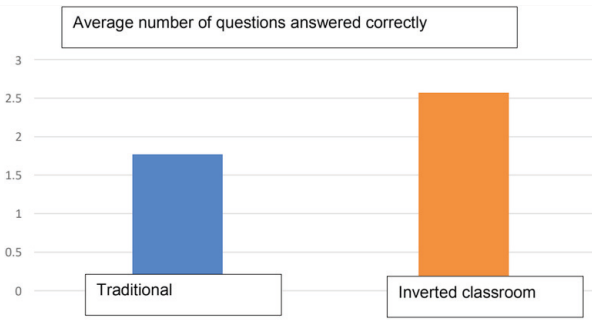

Figure 2: Average number of questions answered correctly.

During the practice of lumbar puncture, each student was evaluated using a checklist containing the items that must be performed during the procedure, so that it is carried out correctly. Based on the analysis of the graph (Figure 2) and, considering a low hit rate of less than 50%, only the traditional group presented items with a low hit rate, namely items 5 (44%), 11 (44%), 12 (44%) and 13 (44%), which relate, respectively, to washing hands, removing the stylet from the needle, measuring opening pressure and manometric tests. When applying the chi-square test, for items 5, 12 and 13, $p = 0.280425$ was obtained, showing that the sample data does not indicate statistical evidence that the greater number of correct answers in items 5, 12 and 13 is related to one of the methods, which is justifiable due to the low sample number. However, when analyzing item 11 of the checklist, it is clear that the sample data indicates statistical evidence that the highest number of correct answers to item 11 is related to teaching using the flipped classroom method ($p = 0.01738$).

In the same graph (Figure 3), item 10 is without data, as it refers to the number of attempts each student needed to correctly perform the lumbar puncture. The results of this item will be presented separately from the others.

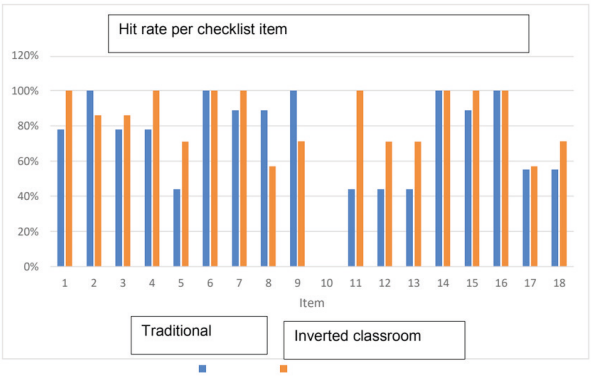

Figure 3: Hit rate per checklist item.

Using the same checklist, the average number of items performed by each group was calculated (Figure 4), demonstrating that students in the flipped classroom group (15.42) were able to perform more items than

students in the traditional group (14.77). However, the sample data does not indicate statistical evidence that the highest average number of checklist items performed is related to one of the methods (p = 0.768397), which is justifiable due to the low sample number.

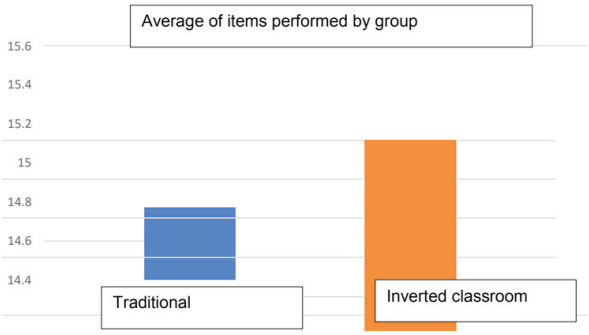

Figure 4: Average number of items performed per group.

Based on the analysis of the graph (Figure 5) referring to item 10 of the lumbar puncture checklist, it was evident that students in the flipped classroom group (2.14) needed fewer attempts than those in the traditional group (2.14) 33). However, the sample data does not indicate statistical evidence that one of the methods is more efficient so that fewer lumbar puncture attempts are needed (p = 0.820596).

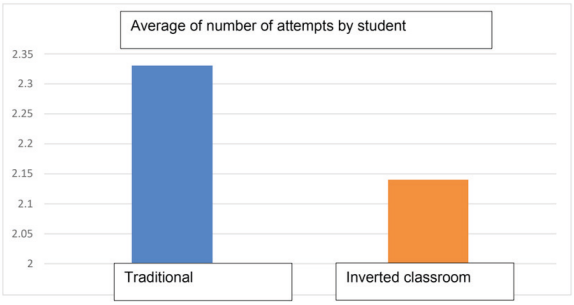

Figure 5: Average number of attempts per student.

Before carrying out the lumbar puncture procedure in phase II of the research, students were asked about their level of confidence in carrying it out. After analyzing the graph (Figure 6), it is observed that the average of students in both groups was the same (6).

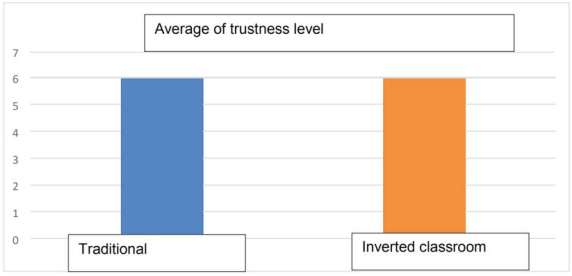

Figure 6: Average confidence level.

DISCUSSION

Lumbar puncture is an important medical skill that can be performed by doctors of all specialties and needs to be developed during graduation.

Simulated teaching is an educational method that amplifies real experiences with guided experiences, replicating aspects of the real world in an interactive and immersive way, which has been used around the world as a way to enable students to develop and perform this procedure (GAUBERT et al, 2020).

In addition to teaching through simulators being important for the development of this skill, it was evident, through a study with 110 participants, that there was a greater demand for videos on free websites by students and residents to complement traditional teaching, increasing the confidence of professionals in carrying out the procedure (HENRIKSEN et al, 2018; TOY et al, 2017).

This research faced difficulties regarding the number of participants, due to the loss of students in the second phase, leading to a bias in the selection of those most interested. This sample reduction made it impossible to obtain data and analyzes with statistical significance. Other studies also presented the same difficulties, one of the justifications for this challenge being the lack of recognition, on the part of students, of simulated training as very relevant for medical practice.

Furthermore, it was discussed that students are not used to being included in educational studies (GAUBERT et al, 2020).

Even with low student adherence to the research, we used the available resources in an attempt to compare the traditional teaching method and the flipped classroom. According to the results obtained from this sample, the use of videos and explanatory texts as auxiliary resources that precede practice seems to be effective for the retention and practical application of acquired knowledge, since the flipped classroom group obtained an average more correct answers on multiple-choice questions, completed more items on the checklist and needed fewer attempts to correctly perform the lumbar puncture. We believe that, if there was a larger sample, the data would have greater statistical significance, proving that the flipped classroom method would be the best way to teach the skill of lumbar puncture. In our opinion, the best effectiveness of this method would extend to teaching other medical clinical skills.

CONCLUSION

It is not possible to deny that teaching through simulators is a very useful tool for developing medical skills in lumbar puncture. But, when it comes to comparing traditional teaching methods and flipped classrooms, it was not possible to define which is better through statistical analysis, as the sample was small and there was no statistical significance. Therefore, more studies are needed to prove and choose the best method, in order to optimize teaching.

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