

ORIGINAL ARTICLE

The use of active methodologies as teaching strategies of measuring blood pressure

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Abstract

Background: Blood pressure (BP) measurement is part of the physical examination performed by students in the health field. Active methodologies may be linked to the education system, with positive contributions to knowledge about BP measurement steps.

Objective: Compare knowledge about blood pressure measurement steps, before and after an educational intervention among physiotherapy and medical students.

Methods: Quasi-experimental study, with a single group that will be in control of itself, before and after the intervention, carried out in the year 2020. The evaluations were based on the active methodologies: KAHOOT, theoretical evaluation, and the OSCE method for practical evaluation. An educational intervention was carried out, using the Inverted Classroom, followed by debates, using practice and simulation for better learning. In the pre and post-intervention comparison, the Wilcoxon test was used on the theoretical and practical knowledge of students regarding blood pressure measurement.

Results: A total of 81 students, mean age 22.31 + 3.24 years. In the theoretical knowledge, from the KAHOOT, in the comparison before and after the educational intervention, a significant difference was observed in the total number of correct answers ($p < 0.001$), except in the "patient position" step ($p = 0.227$). In the analysis of practical knowledge, from the checklist used in the OSCE, there was a significant improvement after the pedagogical intervention in all analyzed stages ($p = 0.001$).

Conclusion: educational intervention with active methodologies inverted classroom, KAHOOT, and OSCE were useful in apprehending knowledge about Blood Pressure measurement and suggests studies of broader scope.

Keywords: students, knowledge, blood pressure, learning, simulation.

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Authors summary

Why was this study done?

This study came from a doctoral thesis at the Nursing Department of USP, Ribeirão Preto, São Paulo, Brazil.

What did the researchers do and find?

The researchers implemented three teaching strategies supported on active methodologies to assess students' knowledge of blood pressure measurement.

What do these findings mean?

This study's results bring learning approaches in the academic career, following the contemporary line of active methodologies to expanding them to other undergraduate courses.

INTRODUCTION

The indirect measurement of blood pressure (BP) is a non-invasive and fundamental method for diagnosing, treatment, management, and research on Arterial Hypertension (AH). It is a procedure that considers factors such as anatomical-physiological aspects of the patient, the equipment in use, and the operational capacity of the evaluator¹.

There is concern among scientific societies related to the correct measurement of BP, as it is a procedure widely used by various categories of health professionals. It is known that BP values are essential health indicators directly related to cardiovascular morbidity. Studies involving BP measurement errors attributed to instruments, examiners, and examinees have been increasing in the literature²⁻⁵.

When thinking about the training of health professionals with technical skills, including the measure of BP, a major challenge in higher education is to promote reforms that bring changes and propose to break with the traditional teaching model. It is necessary to invest in the training of teachers who seek to use active methodologies, with current content, to promote knowledge.

The study of active methodologies, based on the Problem Based Learning (PBL) method, is contemporary and favors student autonomy. This context includes two essential elements: the student, who begins to receive denominations that refer to the dynamic context, and the teacher, who no longer has the function of teaching, only facilitates acquiring knowledge⁶.

Teaching through active methodologies in the classroom allows, in addition to the use of creativity, the reflection on their learnings, the discovery through experimentation, the possibility of collaborative work, among many other practices that make the contents used in the most effective way⁷⁻⁹.

The applicability of these pedagogical models can be a concern for educators, as there is a change in students' profiles, currently referred to as Generation Z. It consists of people born during the advent of the internet and the growth of new digital technologies, such as smartphones, video games, and computers. This generation lives under the strong influence of technology in daily life. Education must approach its contemporary world, bring more motivation and interest, and seek greater participation of students in the classroom¹⁰.

According to the literature, the educational interventions through contemporary methodologies, which accompanies the new generation of students, on the

indirect measure of BP, may contribute to the knowledge of this technique for future health professionals.

Students and patients are the most beneficiaries in obtaining improvements in learning, since, performing the correct BP measurement, will undoubtedly promote success in the control, diagnosis, and treatment of patients. Thus, all possible research efforts for studies that propose improvements in the teaching process are justified.

Thus, the present study aimed to compare knowledge about blood pressure steps, before and after an educational intervention of active methodologies in physiotherapy and medical students.

METHODS

Study Design

It is a quasi-experimental study in which the researcher collects data from only one group and examines cause and effect relationships. The quasi-experimental study design differs from the design of the experimental study in that there is no control group, there is no random distribution of participants by treatments, and there is no randomization of the sample. An almost experiment proposes a single group, control of it even before and after the intervention¹¹.

Study Location and Period

This study was carried out at the University of Franca, São Paulo, in February 2020.

Study Population and Eligibility Criteria

The population is part of a group of undergraduate students in Physiotherapy and Medical School. The sample was defined by convenience. As inclusion criteria, students enrolled in the 5th term of the academic year, since the BP measurement procedure's theoretical and practical content had already been taught in the curriculum. As exclusion criteria, students who did not show up on the day of data collection and refused to participate in the study.

Data Collection

The active methodologies applied to assess knowledge about BP measurement steps in this study were: the Inverted Classroom (IC) as an educational intervention. To evaluate knowledge before and after the intervention, KAHOOT was used for theoretical assessment, and the Objective Structure Clinical Examination (OSCE), for the practical assessment.

Evaluation of theoretical knowledge before intervention - KAHOOT

To assess BP measurement's theoretical knowledge, the KAHOOT app was used, which is available free of charge at the electronic address: <http://kahoot.com>, and works with any operating system. Students had access via their mobile devices. It is an online learning and teaching platform that seeks to bring gamification elements to create QUIZ. It can be used in classrooms due to its interactive and dynamic profile, it has a set of questions in the test format for assessing the acquisition of knowledge or skills in different learning environments.

A series of questions and answers about the knowledge of the BP measurement was selected, which allowed faster reasoning and showed the evolution of the participants in real-time. This application proved to be active and attracts the attention of students¹².

In the present study, the KAHOOT was developed and applied in the classroom, with a previously scheduled date and time. It was used a Quiz, composed of 13 questions on the steps of BP measurement, based on the recommendations of the 7th Brazilian Guideline on Hypertension¹³, with three questions for the item "Patient preparation and environment," two for "Patient position," two for "Measurement steps" and six questions related to "Record of values".

Assessment of practical knowledge before intervention - OSCE

Right after assessing theoretical knowledge, all students were referred to the realistic simulation laboratory for the assessment of practical knowledge. For this purpose, we used OSCE, in Portuguese: Exame Clínico Objetivo Estruturado (ECO). It is a method capable of assessing clinical competences based on realistic simulation, which identifies knowledge gaps and provides opportunities for students to self-assess their performance and communication skills¹⁴.

The OSCE is internationally recognized as a highly valid, reliable, and effective method¹⁵. It is developed by stations, in which specific exams evaluate students. An evaluator scores the students' performance from a checklist, and with a previously determined time, approximately five minutes to perform the task.

In the present study, to evaluate the execution of the BP measurement, the medical skills laboratory of the UNIFRAN medical course was used a simulation scenario - OSCE, composed of ten distinct rooms that separate the observer from the examiner from a false glass window with blackout paint and with attached microphone system, making it possible to hear each other.

Visualization between rooms is done only by the observer. Students/examiners' performance was carefully observed and allowed the mastery of the BP measurement steps to be assessed.

The scenario was developed close to the reality of clinical practice, with simulated patients/actors, previously trained for the specific exam, ensuring that students participate in real situations. Besides, the examiners and teachers were trained in this type of assessment, to identify the specific knowledge of the exam, which

quantifies student performance in the skills assessed. For each simulation room, there was an actor for ten students to perform the BP measurement steps individually. When executing the BP measurement, each student detailed the procedure from the audio system to the observer.

In the OSCE simulation scenario, there was a table, two chairs, a sink, soap, and paper towels for hand hygiene, an inextensible measuring tape, an automatic sphygmomanometer with two cuff sizes available. A participant was previously instructed to stay sitting with his legs and arms crossed, and doing what the examiner asked him to do. The measurement device was an OMRON® HEM-7200 BP, oscillometric, with comfortable, controlled inflation, without the need for pre-configuration or re-inflation.

The checklist elaborated and validated by Machado¹⁶ was the assessment tool. It is composed of 33 questions for the analysis of practical knowledge about BP measurement, with options of S = yes, it did; N = did not, and NA = does not apply. This instrument offered an assessment of the observed behaviors, indicating the domains of the skills.

The evaluation process using the OSCE method went through the following components: the examiner (students), the actor (volunteers), the clinical task (BP measurement), and the observer (teachers). After the agreement, all participants signed the Free and Informed Consent Form.

Educational Intervention and Inverted Classroom

Immediately after the first theoretical assessment via KAHOOT, and practice via OSCE, all students underwent an educational intervention, carried out in the classroom, to assess whether the implementation of this activity interferes with the ability and ability to measure BP, based on active methodologies, called Inverted Classroom (IC) made from an expository class. The slides were carefully designed in a didactic way, to detail the complexity of the theoretical content and to approach the steps involving the practice step by step, indirect BP measurement¹³.

IC interweaves some concepts and gives the student the role of learning, such as student autonomy, distance learning, active and collaborative learning, and meaningful learning^{17,18}.

The theoretical class included active teaching strategies, in the form of group discussions, on the content presented. Before the intervention, questions were asked about the participants' prior knowledge, as they are still students, certainly with some technical information throughout their academic training. There was a theoretical planning of the educational material and the students previously received via email the content covered for previous reading to understand the content to be discussed in detail.

The IC's practical activity started with the demonstration of the indirect BP measurement and was carried out by one of the students who was willing to do it. The students observed and critically evaluated the development of the activity to identify weak points of knowledge and the absence of steps taken. In the

IC environment, 20 electronic and digital devices for measuring BP, of the OMRON® HEM-7200 brand, 20 metric tapes were made available. During IC a theoretical discussion and practical experimentation of the theme was opened, so that the exchange of information and doubts could be discussed between them.

After the educational intervention, the researcher executed the technique to fulfill all the steps described to provide students with the experience of a safe practice, based on scientific evidence, with critical and reflective knowledge, aware of the reasons that support each one of the steps.

After fifteen days, the same questions asked during the KAHOOT application were reapplied in all students for theoretical evaluation. For the practical evaluation, students were assessed via OSCE, using the same checklist, to compare any knowledge variation before and after the educational intervention. It allowed assessing the intervention's impact by identifying points of gaps that perhaps still permeated the participants of this research. This 5-day period may be sufficient to assess whether knowledge has been acquired about the pre and post intervention¹⁹.

Data Analysis

To analyze the results, the Wilcoxon test for paired samples was used, in the pre and post intervention comparison, on the theoretical and practical knowledge of the students. The level of significance was set at 5% ($p < 0.05$).

Ethical and Legal Aspects of the Research

The Human Research Ethics Committee, CAAE: 28446920.4.0000.5495 approved this study. All participants signed the Informed Consent Form, in accordance with Resolution 466/2012.

RESULTS

To compare knowledge about BP measurement steps, before and after an educational intervention, based on active methodologies. This study had a sample of 81 students. Table 1 describes the distributions of participants by courses and genders in absolute and relative numbers, and age is shown in mean and standard deviation.

The comparison of theoretical knowledge about indirect BP measurement steps from the correct answers of the KAHOOT application is illustrated in Table 2.

Table 1: Distribution of UNIFRAN Physiotherapy and Medical School students, 2020.

Students	Male	Female	Media age (years)
Physiotherapy (n=40)	15 (37.50%)	25 (62.50%)	21.50 + 2.20
Medical School (n=41)	15 (36.58%)	26 (63.42%)	23.13 + 4.28

Table 2: Comparison of the steps of indirect BP measurement, in the theoretical evaluation.

	Students (n=81)				
	Pre-intervention		Post-intervention		p*
	media	SD	media	SD	
BP measurement					
Patient preparation and environment	1.36	0.71	2.23	0.69	<0.001*
Patient position	1.88	0.43	1.95	0.27	0.227
Measurement steps	0.93	0.61	1.77	0.45	<0.001*
Record of values	3.41	1.06	5.38	0.86	<0.001*
Total items	7.57	1.86	1.33	1.55	<0.001*

SD: Standard Deviation; n: significance level; *Wilcoxon test.

According to the results presented in Table 2, theoretical knowledge among students from the courses of Physiotherapy and Medical School, it was a significant increase among almost all the stages studied related to the procedure of indirect BP measurement in the post-intervention; except in the "patient position" stage.

When comparing the correct answers obtained in the assessment of the knowledge of BP measurement's practical steps, 33 questions were considered, through the checklist used during the strategy of the OSCE simulation exam, these results are shown in Table 3.

Table 3: Comparison of the steps of indirect BP measurement in practical evaluation.

	Students (n=81)				
	Pre-intervention		Post-intervention		p*
	media	SD	media	SD	
BP measurement					
Patient preparation and environment	2.10	2.26	6.13	3.28	<0.001.
Patient position	3.45	2.57	8.17	1.22	<0.001*
Measurement steps	1.95	1.62	4.11	1.11	<0.001*
Record of values	1.43	1.36	4.64	2.54	<0.001*
Total items	8.64	4.46	22.27	5.65	<0.001*

SD: Standard Deviation; n: Significance level; *Wilcoxon test.

When comparing all the steps evaluated in the checklist, there was a significant difference in the educational intervention in the practical knowledge of the BP measurement presented in the post-intervention period, in the practical assessment of the BP measurement procedure, as presented in table 3.

■ DISCUSSION

On comparing the theoretical and practical knowledge of the steps of BP measurement, among students of Physiotherapy and Medical School courses, after the application of active methodologies, there was a significant increase of knowledge in most stages of this procedure. It shows the effectiveness of the intervention implemented in this study to achieve the objectives proposed in this research successfully, which provided a comprehensive analysis of the results. At the same time, it deepened the knowledge obtained among students at each stage of BP measurement.

In the Brazilian literature, to date, no studies have been identified using these active strategies and methodologies for teaching the steps of BP measurement, making this study a pioneer in our country. It was possible to verify that the theoretical and practical teaching of BP measurement steps can and should be carried out through active methodologies.

Although this study's intervention was performed among students of Physiotherapy and Medical School, it is believed that it can also be successfully developed among students from other health areas, such as nursing, physical education, dentistry, nutrition, among others. It is because these students' profiles are similar in terms of age and proximity to the use of technologies.

The applicability of active methodologies motivates students to create their learning process with evidence in solving professional problems^{20,21}, and favors critical reading and more considerable attention in the execution of activities²². It is possible to highlight skills to be developed and evaluated with this new methodological model, centered on student learning and autonomy, pro activity, teamwork, ability to reflect and problematize reality and solve problems^{23,24}.

The technology, especially the cell phone, used in favor of the teacher, has been reported with positive results by several authors²⁵⁻²⁷. Some studies²⁸⁻³⁰ revealed their experiences with the KAHOOT app about the potential in different audiences, to make the educational experience diverse and fun, promoting student engagement and motivation.

Using the KAHOOT tool, there was an improvement in the students' learning in the concepts, as well as active participation with reports considering the tool easy to use. The QUIZ game format inserted in the KAHOOT³¹ platform, can also arouse the interest of students in getting the correct questions and encourage them to compete in a healthy way. It allows them to reach the best positions, in addition to contributing to the construction of the student's knowledge, making him a protagonist in his study and learning process.

Regarding OSCE in student evaluations, in a study carried out with dental students, the OSCE was classified as

an gold standard evaluation method for analyzing clinical competences³². It is considered favorable by students in improving skills, self-confidence, and real learning experience³³ and providing an efficient assessment of clinical skills and is beneficial for education³⁴.

The OSCE can also identify a metacognitive perspective, based on empirical evidence to redesign assessments for learning³⁵. Moreover, the feedback offered highlights the improvement in demonstrating skills and knowledge³⁶.

The teaching model based on IC proposes a complete inversion in the teaching process, with a proposal to provide more productive and participatory, less expository classes to engage students. In the present study, the concern was to organize the didactic sequences employing active methodologies to lead the student to reflect, analyze, and apply the proposed theme, teaching about BP measurement steps.

With the influence of high-speed technology and real-time information exchange, it is recommended that education keep up with the growing changes. Therefore, rethinking the traditional teaching patterns and adhering to new and active technologies opens up enormous potentials, both in theoretical and practical teaching, in the stages of BP measurement.

This study's limitations are related to the sample, with students from two courses in the health field, from a single institution. The convenience sample does not allow generalizing the results, and therefore, new studies with greater breadth and variation of subjects are suggested. It is believed that the participation of different undergraduate courses, such as Nursing, Physical Education, among others, may present different performance, in addition to confirming and solidifying results obtained in the present study.

The location chosen for this research's development has innovative features in the Problem Based Learning (PBL) method, with a specific laboratory for the practical procedure (OSCE), of high operational cost, which does not allow extensive comparison with other institutions without this infrastructure. It reinforces the suggestion of new studies with more substantial and diversified samples to contribute to the evidence presented here.

■ CONCLUSION

Implementing active methodologies in the teaching of BP measurement has significantly contributed to the improvement in theoretical and practical knowledge in the population studied after an educational intervention in students of Physiotherapy and Medical School courses. The development of research with more representative samples diversified and expanded in different courses in the health area, and applied in different institutions is suggested. The importance of using the OSCE strategy and the KAHOOT platform is reinforced, and the use of the Quiz as innovative measures in the teaching of BP measurement.

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Conflicts of Interest

There is no conflict of interest. The undersigned authors claim that the article is original. It does not infringe

the copyright or any other property rights of third parties, it has not been sent for publication in any other magazine and has not been published previously.

The authors confirm that the final version of the manuscript has been revised and approved by them. All published manuscripts become the permanent property of the Journal of Human Growth and Development and cannot be published without their Editors' written consent.

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Resumo

Introdução: A medida da pressão arterial é parte do exame físico realizado por estudantes da área da saúde. Metodologias ativas podem estar vinculadas ao sistema de ensino, com contribuições positivas para o conhecimento sobre as etapas da medida da PA.

Objetivo: Comparar o conhecimento sobre as etapas da medida da PA, pré e pós uma intervenção educativa entre estudantes de fisioterapia e medicina.

Método: Estudo quase experimental, com grupo único que será controle dele mesmo, antes e depois da intervenção, realizado no ano de 2020, na Unifran. As avaliações foram baseadas nas metodologias ativas: KAHOOT, para avaliação teórica, e o método OSCE para avaliação prática. Realizou-se uma intervenção educativa, com o recurso da Sala de Aula Invertida, seguida de debates, utilizando a prática e simulação para melhor aprendizado. Utilizou-se o teste de Wilcoxon, na comparação pré e pós intervenção, sobre o conhecimento teórico e prático dos estudantes referentes à medida da PA.

Resultados: 81 estudantes, idade média de 22,31±3,24 anos. No conhecimento teórico, a partir do KAHOOT, na comparação pré e pós intervenção educativa, observou-se diferença significativa no total dos itens de acertos ($p < 0,001$), exceto na etapa “posição do paciente” ($p = 0,227$). Na análise do conhecimento prático, a partir do checklist utilizado no OSCE, houve melhora significativa após a intervenção educativa em todas as etapas analisadas ($p = 0,001$).

Conclusão: a intervenção educativa com metodologias ativas Sala de aula invertida, KAHOOT e OSCE foram efetivas na apreensão de conhecimento sobre a medida da PA e sugere estudos de maior amplitude.

Keywords: estudantes, conhecimento, pressão arterial, aprendizagem, simulação.

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