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Educational Article

Mind the gap: The integration of anatomy course contents with basic procedural skills

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المخلص

أهداف البحث: تحقق هذه الدراسة قيمة اكتساب المهارات الإجرائية في معامِل المحاكاة منخفضة الدقة على الطلاب الذين يدخلون المرحلة السريرية خلال فترة تدريب التمريض الإلزامية لمدة شهر.

طرق البحث: أجرينا دورة تدريبية جمعت المعرفة في علم التشريح مع تعليم المهارات الإجرائية البسيطة. قمنا بتحليل آراء ٢٩٩ طالبا ثم قمنا بمقارنتهم بنتائج التقييم الخاصة بهم.

النتائج: أظهرت نتائج المسح، الرضا العام عن المقرر القائم على المحاكاة. بخصوص المعامِل الإجرائية كتحسين مناسب لمختبرات التشريح التقليدية، اعتبر الطلاب دورة المهارات الإجرائية الأساسية كبديل قوي لمحاضرات ومختبرات التشريح التقليدية. بالإضافة لذلك، لاحظنا زيادة كبيرة في المعرفة لدى المشاركين عن علم التشريح عند مقارنة إجاباتهم قبل وبعد الدورة.

الاستنتاجات: أظهرت هذه الدراسة تصورا إيجابيا عن الدورة التي استخدمت تدابير تعليمية مبتكرة بين طلاب التمريض. لوحظ تأثير إيجابي في تدريس المعرفة التشريحية من خلال الإجراءات الأساسية.

الكلمات المفتاحية: علم التشريح؛ التعليم؛ المحاكاة منخفضة الدقة؛ المحاكاة الطبية؛ طلاب التمريض

Abstract

Objectives: This study investigated the value of procedural skill acquisition in low-fidelity simulation labs for students entering a clinical setting during the mandatory one-month nursing internship.

Methods: We conducted a course that combined gross anatomy knowledge with the teaching of simple procedural skills. We analysed 299 students' opinions and then compared them with their assessment outcomes.

Results: The survey results showed general satisfaction of students with the simulation-based course. Regarding the role of procedural labs as an adequate enhancement for traditional anatomy labs, students considered the basic procedural skills course as a strong alternative for traditional anatomy lectures and labs. Moreover, a comparison of participants' pre- and post-course answers indicated a significant increase in their anatomy knowledge.

Conclusions: This study thus indicated a positive perception of students about a course that employed innovative educational measures. In this way, the positive impact of teaching anatomical knowledge through basic procedures was noted.

Keywords: Anatomy; Education; Low-fidelity simulation; Medical simulation; Nursing students

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Introduction

Anatomy is considered as the foundation of medical education. Many have argued that it is no longer as relevant as before, as it does not correlate with the demands of modern medical learning. However, in recent years, the subject of human anatomy has been modified and developed to

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continually meet expectations and to keep up with evolving teaching and learning methods. The aim is to present and teach anatomical knowledge by employing modern technologies and learner-centred pedagogic methods; this will ensure that anatomy curriculums will not be adversely affected as a result of the failure to progress and adapt to present teaching and learning demands.¹

Furthermore, it is important to ensure that all medical professionals have a minimum working knowledge of anatomy. Thus, subjects discussed in lectures/labs should provide health care workers (HCWs) with sufficient data that can enable them to safely practise and communicate with fellow medical professionals.² In most medical schools in Poland, anatomy knowledge is gained through a so-called 'traditional' teacher-centred approach—that is, lectures and dissection classes.

These methods have been successfully implemented in anatomy-related research in undergraduate medical education: cadaveric dissection, the use of models, inspection of dissected specimens, and more modern approaches to surface anatomy and radiological anatomy.³ The latter one is considered a simulation tool, as it employs ultrasound examination; however, arthroscopy is considered as the more advanced method.^{4,5} The term 'simulation' refers to any activity that involves the process of simulating any form of examination or any other medical procedures; it also includes video demonstrations and encounters with patients in real-world contexts.^{6–10} More modernised approaches to teaching anatomy involve computerised alternatives that employ computer-assisted learning (CAL) and 3D printed models, which are some emerging trends in this field.^{11–13}

Therefore, the current tendency in medical education is to shift towards a student-centred learning and teaching model.¹⁴ In particular, worldwide, the widely accepted approach for leading anatomy classes involves incorporating a problem-based learning method and shifting to a problem-based curriculum.¹⁵ Computer-assisted learning has also taken the form of 3D models, radiographic images, and computer simulations in anatomy curriculums that use modern approaches.¹⁶ This shift towards 'learning by doing' has been introduced in a major curricular reform that Poland's Ministry of Health recently implemented in Polish medical universities.¹⁷

However, there is a 'gap' in practical teaching in early years of medical studies with regard to the simulation teaching methods employed at simulation laboratories—the employment of low-fidelity simulation for presenting basic procedural skills that are framed by clinical encounters involving all aspects of simple procedures; this helps to place anatomical knowledge in the proper clinical context. We based our research on filling the 'gap' of those encounters, which mirrored clinical settings. To address these challenges, 15 of the 60 h assigned to the anatomy course were devoted to developing simple procedural skills based on the acquired anatomical knowledge.

This current research investigates the value of such labs for students in terms of helping them acquire procedural skills; this value of newly introduced labs was determined based on the anatomical knowledge acquired by participating medical students before they entered a clinical setting during the mandatory one-month nursing internship.

Materials and Methods

Setting

The labs (total duration: 15 h) were dedicated to teaching basic procedural skills (BPS). Instead of cadavers, the labs used modern task trainers; furthermore, these labs were taught in the newly developed Centre for Medical Simulation of Medical University of Lublin (MUL).

Course design and participants

The program of studies 2013–2019 introduced modifications in the form of procedural skills labs. The classes were taught to first-year medical students of MUL. The course was implemented between February and April 2015. In May 2015, another modification—the final practical assessment in the form of the Objective Structured Clinical Examination (OSCE)—was introduced. The practising of skills and the acquisition of correct techniques were preceded by a short introduction on relevant anatomical structures. Assuming the roles of medical personnel, students practiced their acquired skills and paid attention to the investigated anatomical structures. The procedural skills lab included five modules: bureau of basic vital signs (heart rate/pulse, body temperature, blood pressure, oxygen saturation, respiratory rate); peripheral vein catheterisation; urinary catheterisation; digital rectal examination; and hygienic/surgical hand wash procedures, as implemented using low-fidelity simulators and task trainers. This ensured the repetitiveness of the procedure. Learning objectives were chosen from the curriculum—including ones required for the upcoming nursing internship—and they were based on current educational regulations.¹⁸

The BPS course implemented the concept of blended learning, which refers to the combination of face-to-face interactions and online resources to increase in-class interactions.¹⁹ Students who took the course were provided with electronic resources, such as the UpToDate® database, an online course handout, and procedure descriptions on the University website. These resources aimed to clarify and enhance the theoretical course content in order to prepare students for the labs of each lab session.

The BPS course included five modules, which were devoted to teaching necessary practical skills for the obligatory nursing internship after the first year of studies. The BPS course aimed to supplement and develop the existing learning objectives of the anatomy course. Each block lasted for 3 teaching hours (3 × 45 minutes), and they were taught in groups of five students. Each teaching session started with a 30-minute introduction and discussion of the anatomical basis of the given procedure; this helped to locate appropriate anatomical structures before the practising of the relevant procedure could be continued in the simulation environment.

Measured outcomes

Following Best Evidence Medical Education (BEME) collaboration suggestions to assess the outcomes of the implemented educational intervention, the authors employed modified Kirkpatrick's levels.¹⁹ The modified version of the

Kirkpatrick's levels uses a hierarchy to evaluate the impact of educational interventions. The four levels are as follows:

- I. Level 1: Participants' views on the received learning experience (instrument: self-reported questionnaire)
- II. Level 2: A noticeable difference in attitudes and perceptions (2a) or knowledge and skills (2b) (practical examination in the form of Objective Structured Clinical Examination [OSCE] and pre-post anatomy test)
- III. Level 3: A change in behaviours (for example, the application of new knowledges and skills)
- IV. Levels (4a) Change in organisational practice and (4b) benefits to the patient.

As we examined the effects on the undergraduate sample (in their first year of study), the first two Kirkpatrick's levels applied to our investigation (Level 1 and Level II 2b).

Instrument

To measure students' satisfaction with the course, we used a diagnostic survey with questionnaires. To assess the impact of training, students were invited to respond to a self-reported paper questionnaire containing 15 closed items; the questionnaire assessed the impact of the skills labs. The post-survey used a 5-point Likert scale that allowed students to indicate their opinions (5 = strong contentment, 4 = contentment, 3 = neither contentment nor discontentment, 2 = discontentment, 1 = strong discontentment) regarding the BPS course. This original questionnaire was based on the extant literature in the field; participants' socio-demographic data were collected, and the simulation training was assessed in terms of making the anatomy class more appealing and relevant. All participation was anonymous and voluntary. The items dealt with overall opinions about the course, detailed questions regarding the organisation, used equipment, surroundings, topics, trainers' attitudes towards the course and its participants, and the question of whether the participants considered it valuable in terms of teaching anatomical structures.

The assessment results analysis and the student post-course questionnaires were followed by an evaluation of the participants' anatomical knowledge. The survey had 5 enclosed questions concerning anatomical structures, which were discussed during the lab sessions. These questions were provided to the participants before and after the course and—once again—two years after the course was finalised (when participants were in their 4th year).

Consequently, the scientific committees of the I Faculty of Medicine and the II Faculty of Medicine at the Medical University of Lublin (MUL) accepted the subject as an obligatory course for the medical curriculum during the 2013–2019 period.

The study was approved by the local institutional ethical committee (permission no. KE-0254/309/2015).

Participants

First-year students were recruited as survey participants. The medical students had taken a semester of the anatomy course, and the relevant topics were covered in the form of lectures and laboratories with cadavers.

A total of 324 questionnaires were handed out, and 299 participants returned completed forms consenting to participate in the study (92%). The observational study involved testing the BPS course's reliability in terms of creating a gold standard for these five procedures: bureau of vital signs, peripheral vein cannulation, urinary catheterisation, digital rectum examination, and hygiene/surgical hand scrub. We investigated the extent to which aligning anatomical structure-related knowledge along with procedural skills enhanced the traditional anatomy content.

Afterwards, the same five questions concerning anatomical structures were directed to 4th-year students. A total of 193 students (60%) decided to participate in a voluntary and anonymous test that assessed knowledge retention with regard to anatomical structures two years after BPS course completion.

Objective Structured Clinical Examination

An Objective Structured Clinical Examination (OSCE) was conducted to provide an objective assessment of the acquired practical skills. Students were informed about the tasks they were assigned during the OSCE.

The OSCE exam was divided into five stations: auscultation of the heart and pulse check, non-invasive blood pressure measurement, peripheral vein cannulation, digital rectum examination, and urinary catheterisation. Each station had a corresponding checklist that was designed by the employees of the Department of Didactics and Medical Simulation and based on past literatures. This assessment was recorded using cameras that were installed in the work stations. Each student completed all five stations in a rotating order with the other participants among the OSCE rooms every 5 min. Each door bore a sign with the name of the assigned station. Before the exam, participants were able to access a detailed description for each procedure and the OSCE examination, which was uploaded on the University website.

Statistical analysis

Database and statistical calculations were conducted using the Statistica Version 10 computer software. Quantitative parameters were represented as mean values along with standard deviations (\pm SD), and the median values were represented with minimum and maximum values; the qualitative values were presented in numbers and percentages. The correlations between the studied parameters were assessed using the Mann–Whitney U test, which indicated $P < 0.05$ as the level of statistically significant correlation along with 95% of Confidence Interval.

Results

Level 1: Participants' views on the received learning experience

Out of the 324 first-year medical students at MUL, 299 (mostly female [60%]) participated in the survey. The post-course answers indicated a general satisfaction with the simulation-based labs for procedural skills: 75% of the

Table 1: Mean (\pm standard deviation) of the questionnaire items along with correlations between gender and positive responses among BPS course participants. Statistically relevant correlations are bolded.

Questions	Total population Mean (\pm SD)	Gender Mean (\pm SD)		p
		Female	Male	
I am satisfied with the BPS course in general.	4.7 (\pm 0.6)	4.79 (\pm 0.5)	4.58 (\pm 0.7)	0.002
The contents of that course are important for my future profession.	4.7 (\pm 0.6)	4.80 (\pm 0.5)	4.64 (\pm 0.7)	0.019
I have learnt a lot during this course.	4.7 (\pm 0.6)	4.75 (\pm 0.5)	4.58 (\pm 0.7)	0.032
I have actively learnt new procedural skills in this course.	4.7 (\pm 0.6)	4.71 (\pm 0.6)	4.58 (\pm 0.7)	0.097
I have participated in this course with pleasure.	4.7 (\pm 0.6)	4.80 (\pm 0.5)	4.62 (\pm 0.7)	0.020
I have worked effectively during the course time.	4.5 (\pm 0.6)	4.59 (\pm 0.6)	4.47 (\pm 0.7)	0.145
The teachers were interested in the students' learning outcome.	4.6 (\pm 0.6)	4.60 (\pm 0.6)	4.62 (\pm 0.7)	0.640
I have been treated fairly by the teachers.	4.8 (\pm 0.5)	4.85 (\pm 0.5)	4.84 (\pm 0.4)	0.665
The virtual learning objectives are comprehensive.	4.9 (\pm 0.4)	4.88 (\pm 0.3)	4.86 (\pm 0.4)	0.614
The course contents are well coordinated and well structured.	4.6 (\pm 0.7)	4.62 (\pm 0.6)	4.52 (\pm 0.7)	0.148
Premises and equipment of CSM are satisfying.	4.6 (\pm 0.7)	4.60 (\pm 0.6)	4.48 (\pm 0.7)	0.129
The iMUL Skill Guide helped me significantly with course preparation.	4.1 (\pm 1.1)	4.10 (\pm 1.2)	4.14 (\pm 1.0)	0.795
The course motivated me to practise my skills regularly.	4.1 (\pm 0.9)	4.15 (\pm 0.9)	4.00 (\pm 1.0)	0.167
I am content with the organisational handling of the BCS course.	4.5 (\pm 0.8)	4.53 (\pm 0.8)	4.49 (\pm 0.8)	0.168

Table 2: The results of the Objective Structured Clinical Examination.

The name of the station	Total number of students	First pass	
		n	%
Auscultation of the heart and pulse check	299	292	98%
Non-invasive blood pressure measurement		291	97%
Peripheral vein cannulation		277	93%
Digital rectum examination		298	99%
Urinary catheterisation		231	77%

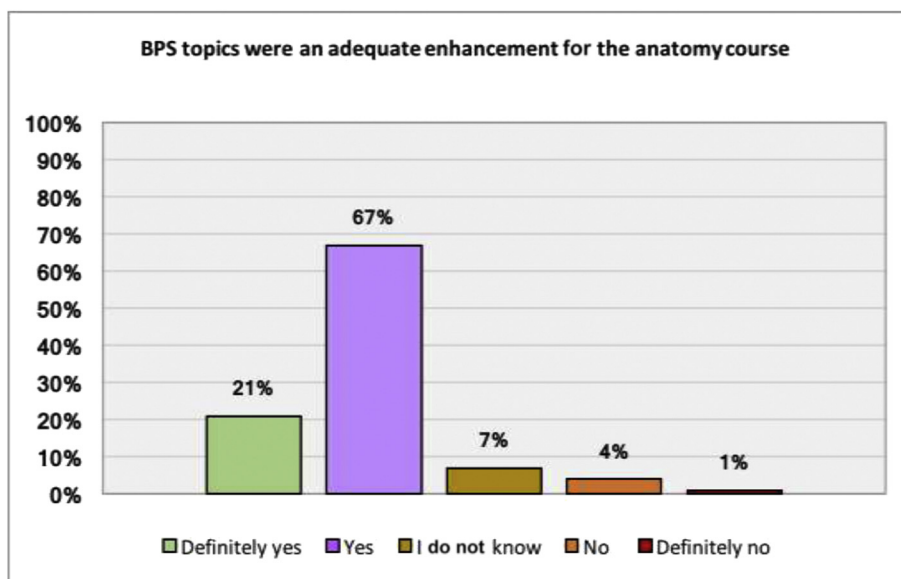
participants ($n = 223$) stated their content with the training and graded it 5 out of 5 (Table 1). Among the students, 21% ($n = 64$) were satisfied with the course. Overall, most of the female participants rated the course positively. The first questionnaire results are presented in Table 1.

Female students evaluated the course more highly with regard to satisfaction with the procedural skills labs, the

course content's importance, the acquired knowledge, and participation in the course.

Overall, the BPS course received a positive feedback, as students' satisfaction with the course reached a mean value of $4.7 (\pm 0.6)$.

Separately, we presented the students' opinions regarding the usefulness of the course for enriching anatomy-related

**Figure 1: BPS topics as an adequate enhancement for the anatomy course.**

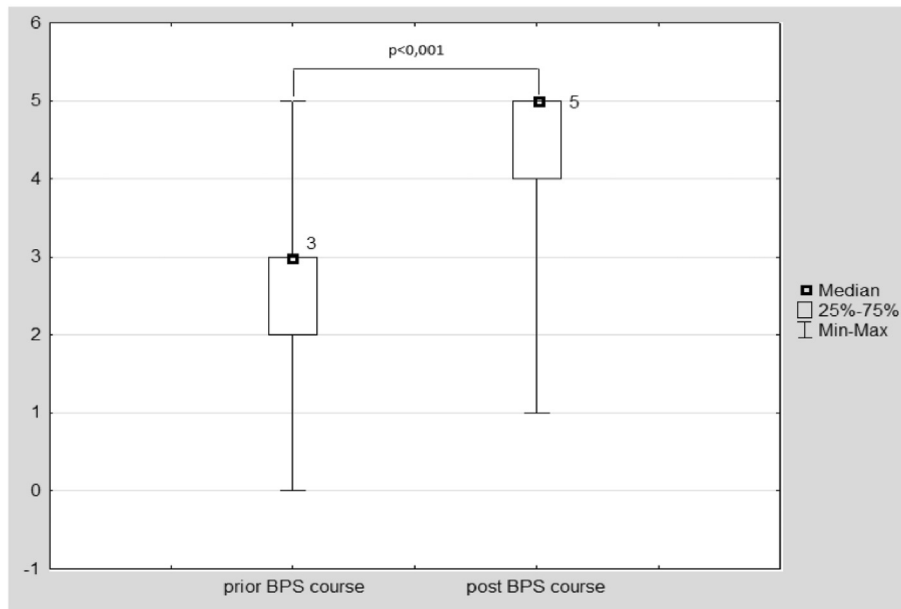


Figure 2: A statistically significant difference between the sum of the students’ correct answers for identifying anatomical structures that were taught during the lab sessions.

knowledge (Figure 1). Regarding the role of procedural labs as an adequate enhancement for traditional anatomy labs, students considered the BPS course as a sufficient supplementation for traditional anatomy lectures and labs; 88% of BPS participants’ answers confirmed their support for this new teaching model (Figure 1).

Level 2: A noticeable difference in knowledge and skills (2b) (practical examination in the form of Objective Structured Clinical Examination [OSCE] and pre-post anatomy test)

Additionally, regarding the students’ opinions, an Objective Structured Clinical Exam assessed participants’

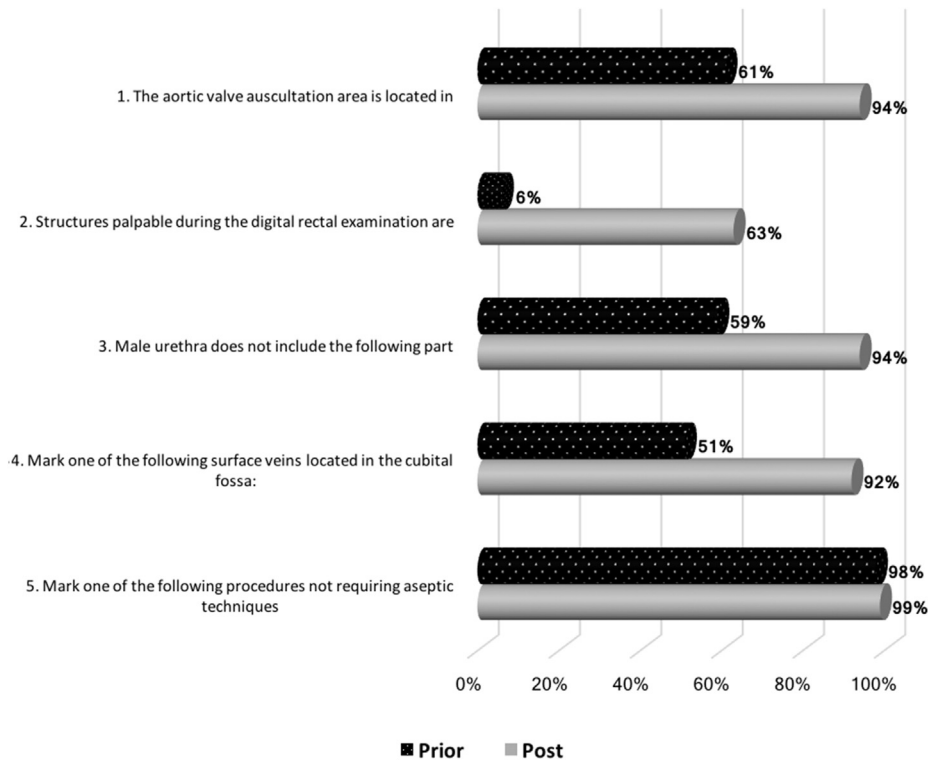


Figure 3: The percentage of correct answers before and after Basic Procedural Skills (BPS) course completion (App 1). The upper bar indicates the correct answers provided by the participants before taking the practical labs; the lower bar indicates the correct answers provided by the participants after taking the practical labs.

knowledge at the end of the course. The results confirmed that participants acquired all five procedures during the course. Table 2 shows the high pass percentage among those who were examined.

Considering the results for the anatomy questions (see Appendix 1 for further details), compared to their answers before and after taking the BPS course, the BPS course students showed a visible increase in their anatomical structure-related knowledge (Figure 2). Both (pre- and post-) questionnaires were implemented after these issues were explained during anatomical labs and lectures. However, most of the surveyed participants provided correct answers for the questions concerning relevant anatomical structures after taking the BPS course. Figure 2 indicates a noticeable growth in the students' ability to identify anatomical structures after taking the course compared to their results before taking the BPS course. The total median values of the correct answers improved significantly ($p < 0.001$)—from 3 on the Likert scale (median values before the labs) to 5 after the course implementation. Overall, the BPS course participants improved their anatomical structure-related knowledge.

Figure 3 presents the percentage of correct answers for each of the five anatomical structure-related questions that were provided to the students before and after the course. The increase of anatomical knowledge for each of the included areas (excluding question number 1) is visible and significant.

When asked the same questions before they started their 4th year, the mean percentage of correct answers among voluntary medical students, who were providing responses two years after finishing the BPS course, was 78% ($SD \pm 20\%$).

Discussion

The concept of a novel low-fidelity simulation lab that was embedded into the anatomical course appealed to the medical students. Participants underlined the value of having active involvement during classes and of introducing basic skills based on anatomical structure-related knowledge in a simulated environment.

The new curriculum focuses on the learner and builds its teaching methods around learners' needs. The filled 'gap in practical teaching methods' concerned level-appropriate simple clinical procedures that were practised on low-fidelity task trainers shortly before students were able to implement them in a clinical setting. The BEME review included only one study that provided the possibility of practising clinical skills as a part of an undergraduate-level anatomy course; the research uncovered positive outcomes among participants regarding their opinions and the acquired knowledge and skills.¹⁹

Various studies have confirmed students' increasing discontent with traditional approaches to teaching. In their research, Sugand et al. use the term 'mixed method' to describe the trend of substituting traditional methods in medical education.⁸ Authors Sugand et al. mentioned the option of integrating basic sciences with clinical practice at

the beginning of medical studies. Our approach, which is based on this reasoning, introduced simple procedural skills to enhance the teaching of anatomy. The learner is exposed to elements of clinical environments right from the beginning of their preparations to become a medical doctor. Consequently, basic sciences do not seem to have been disassociated from clinical practice.

Mahan et al. outline this re-imagining of medical education as emphasising the importance of early clinical exposure and the integration of basic and clinical sciences and competency-based education⁹; a similar view is presented in the research of Torres et al., where the teaching of imaging techniques was based on sectional anatomy knowledge. These issues are also present in our re-designed anatomy course.²⁰ As a result, the learner tackles simple medical issues when employing these procedural skills; being at the centre of the educational process.²¹

The BPS class was based on the abovementioned principle, and it ensured the transparency of the procedures prior to implementing them in the clinical setting. This transparency was also based on the clear explanation of anatomical structures and surface anatomy at the beginning of each practised procedure. Another reason for introducing simulation-based training during the basic procedural skills involved the need to ensure the general consistency and unification of the performed procedures. Performing these tasks allowed the learners to immerse themselves in the clinical-like setting. This immersion principle was also developed in a study by Parikh et al., where the physical examination's basis was implemented in a skill lab environment as a part of the teaching of reproductive system anatomy.²²

Additionally, clinicians can notice any gaps in anatomical knowledge when students implement their tasks in a medical environment.²³

Such procedural skills constitute a basis for complex medical procedures; therefore, medical students found them useful.²⁴ These procedures are basic in nature; however, they still provide countless possibilities for performing errors or misconducts, which, in turn, could result in serious complications in a patient's condition in a clinical setting. Most of these complications could be attributed to an unawareness concerning the anatomic relationships between given structures.²⁵ Therefore, these knowledge gaps should be clarified during the study period through connections to the procedural skills. At the same time, students also wish to access opportunities for practising before entering the clinical setting. The simulation environment with task trainers and the low-fidelity simulation offer this opportunity. Similar to our study, Pugh et al. included a simulation course where 16 research participants expressed their satisfaction with the laparoscopic ventral hernia course; furthermore, research by Torres et al. involved a medical course that used a combination of gross anatomy and surgical-based approaches.^{26,27}

There is also a verified effectiveness in using simulators during introductions into the medical profession.²⁸ This contextualisation of acquired knowledge is widely hypothesised in the methodological literature.^{29,30} This process indicates the transferability of anatomical structure-related knowledge into the clinical environment.

Faulkner et al. proved that participation in a simulation-based course could raise students' confidence and shorten the time they took to perform a fluoroscopically guided lumbar puncture.³¹ The simulation course outcome showed an undeniable increase in both students' knowledge and skill, and they appreciated this outcome the most. In addition to the subjective evaluation of the course, the OSCE exam proved useful. Research by Carr et al. also confirmed simulations' utility in the introduction of procedural skills. Faculty members as well as students identified simulation as the primary method of acquiring these skills.³² However, monitoring further developments in the career and abilities of students would be a very useful factor in this regard.

The lack of changing and altered conditions/aspects may be a shortcoming that deteriorates the benefits of a low-fidelity simulation; however, the low-fidelity simulation constitutes an introductory stage.³³ This stage is followed by practice in high-fidelity conditions and, later, in clinical settings. The significant factor here involved showing clear links between the anatomical theory and the clinical environment itself; these links were formed by the procedural skills in the simulation settings. On the other hand, in his pyramid, Bloom underlines the necessity of applying a new concept/skill in a typical situation before learning to use it in an atypical medical situation. Therefore, learners should perform a planned and expected application of acquired skills in a familiar environment before they can test them in a clinical situation.^{34–36}

Limitations

This study did not investigate the clinical environment-related transferability of skills that were learnt during low-cost simulation-based course; therefore, that issue will be further explored in the next phase of this research. Additionally, this research included only one cohort of students; therefore, its results may not be generalisable. However, this study's results do present a new methodological approach.

Conclusions

This research demonstrated the beneficial impact of technologically enhanced labs, which are based on anatomical knowledge. Each lab session functioned as a tool for preparing participants for further clinical practice; this was independently confirmed by the high percentage of students who passed during the Objective Structured Clinical Exam. Additionally, subjective assessment showed that the participants perceived the course contents as being of great importance for their future professional lives. Further investigations for addressing students' long-term competence and skills transferability in patient care are already being carried out.

Recommendations

To enable students' retention of anatomical content, we should apply it when teaching simple procedural skills as soon as possible after finalising the formal anatomy course. Medical students enjoy applying their knowledge while

practising skills that are appropriate for their level of training. Simulation environments provide a safe alternative for new students at the beginning of their studies, who are not yet ready to enter the clinical environment. Furthermore, the low-fidelity simulation and task trainers necessary for leading such practical laboratories are cost-effective and do not require extensive training for the leading faculty.

Source of funding

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Conflict of interest

The author has no conflict of interest to declare.

Ethical approval

All procedures involving human participants, which were performed in this research, were in accordance with the ethical standards of the Ethical Committee of Medical University of Lublin (permission no. KE-0254/309/2015) and the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jtumed.2020.08.005>.

Appendix 2

The survey's anatomical questions along with the correct answers (bold font):

5. Mark one of the following procedures that does not require aseptic techniques:
 - a) Urethral catheterisation
 - b) Non-invasive blood pressure measurement**
 - c) Superficial vein cannulation
 - d) Surgical hand washing procedure
4. Mark one of the following surface veins located in the cubital fossa:
 - a) Radial vein
 - b) Median cubital vein**
 - c) Lateral cubital vein
 - d) The great cephalic vein
3. Male urethra does not include the following part:
 - a) Membranous
 - b) Prostatic
 - c) Pelvic**
 - d) Intramural
2. Structures palpable during the digital rectal examination are:
 - a) Corpus uteri
 - b) Urinary bladder
 - c) Houston valves**

d) Appendix

1. The aortic valve auscultation area is located in:
 - a) 2nd right intercostal space over the right sternal border
 - b) 2nd left intercostal space over the right sternal border
 - c) Erb's point
 - d) 5th intercostal space in the left midclavicular line

References

1. Turney BW. Anatomy in a modern medical curriculum. *Ann R Coll Surg Engl* 2007; 89(2): 104–107.
2. Smith CF, Finn GM, Stewart J, Atkinson MA, Davies DC, Dyballet R, et al. The Anatomical Society core regional anatomy syllabus for undergraduate medicine. *J Anat* 2016; 228: 15–23.
3. Kerby J, Shukur ZN, Shalhoub J. The relationships between learning outcomes and methods of teaching anatomy as perceived by medical students. *Clin Anat* 2011; 24: 489–497.
4. Jurjus RA, Dimorier K, Brown K, Slaby F, Shokoohi H, Boniface K, et al. Can anatomists teach living anatomy using ultrasound as a teaching tool? *Anat Sci Educ* 2014; 7: 340–349.
5. Knobe M, Carow JB, Ruesseler M, Leu BM, Simon M, Beckers SK, et al. Arthroscopy or ultrasound in undergraduate anatomy education: a randomized cross-over controlled trial. *BMC Med Educ* 2012; 12: 85.
6. Chung E-K, Nam K-I, Oh S-A, Han E-R, Woo Y-J, Hitchcock MA. Advance organizers in a gross anatomy dissection course and their effects on academic achievement. *Clin Anat* 2013; 26: 327–332.
7. Kooloos JG, Schepens-Franke AN, Bergman EM, Donders RA, Vorstenbosch MA. Anatomical knowledge gain through a clay-modeling exercise compared to live and video observations. *Anat Sci Educ* 2014; 7: 420–429.
8. Wilson AB, Ross C, Petty M, Williams JM, Thorp LE. Bridging the transfer gap: laboratory exercise combines clinical exposure and anatomy review. *Med Educ* 2009; 43: 790–798.
9. Bockers A, Mayer C, Bockers TM. Does learning in clinical context in anatomical sciences improve examination results, learning motivation, or learning orientation? *Anat Sci Educ* 2014; 7: 3–11.
10. Takkunen M, Turpeinen H, Viisanen H, Wigren HK, Aarnio M, Pitkaniemi J. Introduction of real patients into problem-based learning in preclinical first-year anatomy curriculum. *Med Teach* 2011; 33: 854–856.
11. Papa V, Vaccarezza M. Teaching anatomy in the XXI century: new aspects and pitfalls. *Sci World J* 2013: 310–348.
12. Benly P. Teaching methodologies on anatomy—a review. *J Pharm Sci Res* 2014; 6: 242–243.
13. Lim KH, Loo ZY, Goldie SJ, Adams JW, McMenamin PG. Use of 3D printed models in medical education: a randomized control trial comparing 3D prints versus cadaveric materials for learning external cardiac anatomy. *Anat Sci Educ* 2015; 9: 213–221.
14. O'Reilly MK, Reese S, Herlihy T, Geoghegan T, Cantwell CP, Feeney RN, et al. Fabrication and assessment of 3D printed anatomical models of the lower limb for anatomical teaching and femoral vessel access training in medicine. *Anat Sci Educ* 2015; 9: 71–79.
15. Biggs J. What the student does: teaching for enhanced learning. *High Educ Res Dev* 2012; 31: 39–55.
16. Craig SJ, Tait N, Boers D, McAndrew DJ. Review of anatomy education in Australian and New Zealand medical schools. *ANZ J Surg* 2010; 80: 212–216.
17. Leung G, Johnston J. Evidence-based medical education —quo vadis? *J Eval Clin Pract* 2006; 12: 353–364.
18. Department of Health (DH). The Bill of Polish Health Ministry on education standards in case of medical students [Rozporządzenie MNiSW z dnia 9 maja 2012 r. w sprawie standardów kształcenia dla kierunków studiów: lekarskiego, lekarsko-dentystycznego, farmacji, pielęgniarstwa i położnictwa] (Dz.U. 2012 nr 0 poz. 631). <http://isap.sejm.gov.pl/DetailsServlet?id=WDU20120000631>. (accessed 1 February 2018).
19. Losco C, Grant W, Armson A, Meyer A, Walker B. Effective methods of teaching and learning in anatomy as a basic science: a BEME systematic review: BEME guide no. 44. *Med Teach* 2017; 39: 234–243.
20. Sugand K, Abrahams P, Khurana A. The anatomy of anatomy: a review for its modernization. *Anat Sci Educ* 2010; 3: 83–93.
21. Mahan J, Clinchot D. Why medical education is being (inexorably) re-imagined and re-designed. *Curr Probl Pediatr Adolesc Health Care* 2014; 44: 137–140.
22. Torres A, Staśkiewicz G, Lisiecka J, Ł Pietrzyk, Czekajło M, Arancibia CU, et al. Bridging the gap between basic and clinical sciences: a description of a radiological anatomy course. *Anat Sci Educ* 2016; 9: 295–303.
23. Cooper JL, Robinson P. The argument for making large classes seem small. *N Dir Teach Learn* 2000; 81: 5–14.
24. Parikh T, Czuzak M, Bui N, Wildner C, Koch B, Leko E, et al. Novel use of ultrasound to teach reproductive system physical examination skills and pelvic anatomy. *J Ultrasound Med* 2018; 37: 709–715.
25. Waterston SW, Stewart IJ. Survey of clinicians' attitudes to the anatomical teaching and knowledge of medical students. *Clin Anat* 2005; 18: 380–384.
26. Mirzazadeh A, Bavarian B, Labaf A, Afshari A, Nikoo M, Meshkani ZS, et al. Curriculum gaps in teaching clinical skills to Iranian undergraduate medical students. *Arch Med Sci* 2013; 9: 309–313.
27. Bannon M, Heller S, Rivera M. Anatomic considerations for central venous cannulation. *Risk Manag Healthc Pol* 2011; 4: 27–39.
28. Pugh CM, Arafat FO, Kwan C, Cohen ER, Kurashima Y, Vassiliou MC, et al. Development and evaluation of a simulation-based continuing medical education course: beyond lectures and credit hours. *Am J Surg* 2015; 210: 603–609.
29. Torres K, Denisow-Pietrzyk M, Ł Pietrzyk, Maciejewski R, Torres A. Does simulation-based training facilitate the integration of human anatomy with surgery? A report of a novel Surgical Anatomy Course. *Folia Morphol* 2018; 77: 279–285.
30. Centre for Disease Control. Infection prevention & control guidelines & recommendations. Available via DIALOD. <https://www.cdc.gov/oralhealth/infectioncontrol/pdf/safe-care2.pdf> (accessed 8 Jan 2018).
31. Dolmans DH, De Grave WS, Wolhagen IH, van der Vleuten CP. Problem-based learning: future challenges for educational practice and research. *Med Educ* 2005; 39: 732–741.
32. Hung W, Jonassen DH, Liu R. Problem based learning. In: Spector JM, Merrill MD, Merriënboer J van, Driscoll MP, editors. *Handbook of research on educational communications and technology*; 2008. pp. 485–506.
33. Faulkner AR, Bourgeois AC, Bradley YC, Hudson KB, Heidel RE, Pasciak AS. Simulation-based educational curriculum for fluoroscopically guided lumbar puncture improves operator confidence and reduces patient dose. *Acad Radiol* 2015; 22: 668–673.
34. Carr J, Deal A, Dehmer J, Amos K, Farrell T, Meyer A, et al. Who teaches basic procedural skills: student experience versus faculty opinion. *J Surg Res* 2012; 177: 196–200.

35. Naylor K, Torres K. Translation of learning objectives in medical education using high-and low-fidelity simulation: learners' perspectives. *J Taibah Univ Med Sci* 2019; 14: 481–487.
36. Armson H, Elmslie T, Roder S, Wakefield J. Is the cognitive complexity of commitment-to-change statements associated with change in clinical practice? An application of Bloom's taxonomy. *J Contin Educ Health Prof* 2015; 35: 166–175.

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