Review article

Evaluation of the effectiveness of the simulation process for teaching nursing

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Abstract

Introduction: Simulation strategy is a modern technique for teaching nursing around the world. One of its many benefits is the implementation of pre-prepared situations in a safe environment. The introduction of simulation into theoretical training is beneficial for students, lecturers, and the faculty.

Goal: To investigate the effectiveness of the simulation process for teaching nursing.

Methods: This paper is a literary review. It is processed using a four-step system. We used the acronym PECOT. We used online platforms for the research, such as PubMed, Web of Science, Science Direct, EBSCO, and Scopus. We visited the Academic Library of the University of South Bohemia in České Budějovice and the National Library in Prague.

Results: We identified 7 studies (four experimental studies, two review studies and one quantitative-exploratory study) and included them in our study. The simulation process is considered a highly effective teaching method, which benefits the students, lecturers, and the faculty.

Conclusions: The simulation process is one of the modern techniques of teaching nursing. The mentioned results indicate a high level of teaching effectiveness using this method. In all registered cases, the simulation strategy is assessed as more effective than other methods used so far, such as frontal teaching, video demonstrations, or simple demonstrations.

Keywords: Academic environment; Education; Effectiveness assessment; Simulation; Teaching nursing

Introduction

Theoretical and conceptual framework

The definition and overall concept of simulation teaching are based on many models. Still, so far, the most frequently described theory is the study by Benner (1982), who divided the whole technique into parts: *"recognition"* – *"assessment"* – *"intervention"* – *"problem"* – *solution"*. This learning principle is very beneficial for students preparing for further clinical practice, who need a natural environment to acquire the theoretical basis so that their individual learning goals, including expected results, can be set appropriately (Čukljek et al., 2019). One of the other benefits is the involvement of emotions. During the simulation process, students are very close to authentic experiences, and this reduces stress and increases the efficiency of work In clinical practice (Cason et al., 2015; Krueger et al., 2017). The nursing environment offers many learning opportunities, from basic nursing techniques to very professional care, involving all available principles of holism, humanism, critical thinking, preventive care, or transcultural nursing (Cason et al., 2015; Karabulut et al., 2015; Neugebauer and Bartlová, 2019). The crucial element for a correct simula-

tion is a suitable lesson goal and a simulation scenario. Each scenario must be prepared so that the trainer can record routine practices common to most nursing services as well as specific units, such as assessment using a particular assessment tool, appropriate communication, needs analysis, individualized care with elements of transcultural nursing, etc. (Čukljek et al., 2019; Khan et al., 2020; Tomová et al., 2020).

Co-operation during simulation

We have mentioned that the simulation process must be very well prepared. Based on the goals, the right strategy is chosen, and the lecturers need to know all the aspects involved in the simulation (number of people, deployment of tools, scenario, etc.). If the simulation is not adequately prepared, e.g., essential places could be hidden, and the whole group in the debriefing zone, including the lecturers, will not effectively assess the situation (Čukljek et al., 2019).

The lecturers must react effectively and with flexibility to the student's work during the simulation itself. A well-planned goal (with possible deviations) can help put students in more challenging situations during the simulation (Cunningham et al., 2018). It is recommended to record the time with notes in which students' reactions can be open to discussion and con-

sult it all after the simulation (Cason et al., 2015). The preparatory phase, including the design of the scenario, is crucial, and communication between lecturers during the creation phase is recommended to avoid possible negative consequences (Banks et al., 2019).

Simulation process goals

The simulation process goal is to pass on values to students. In this case, it is nursing. The goal is also to point out all the possibilities to solve practical problems. Simulation develops psychomotor skills in a safe environment (Shin et al., 2015). The final phase of the process is the assessment of the fulfilment or non-fulfilment of the goal. In the preparatory phase, we plan the expected results and possible interventions that we can record throughout the simulation process (Hawkins et al., 2008; MacKinnon et al., 2017).

A common mistake is inconsistent planning of the simulation goal, which should be constructed in several dimensions and may include, e.g., *Foundational knowledge* (nursing content) – *Application* (use of knowledge and skills in a safe environment) – *Integration* (synthesis of science, knowledge and critical thinking in a changing situation) – *Human dimension* (clash of students in the role of professional nurses with potential opportunities and threats) – *Caring* (the nursing art) – *Learning how to learn* (empowering students for their learning). For the simulation to be successful, we need to think about three basic things: (1) the benefits to students; (2) the benefits to the faculty; (3) putting theory into practice (Garrett-Wright et al., 2021).

This study aims to examine the effectiveness of the simulation process as a teaching technique for the field of nursing.

Materials and methods

This review study was conducted between March and May 2021, and the overall procedure, inspired by Gülpınar and Güçlü (2014), involved four steps: (1) identifying and defining a clinical question; (2) identifying relevant studies; (3) quality assessment and selection of results; (4) data synthesis and interpretation.

Identifying a clinical question

The procedure was inspired by Aslam and Emmanuel (2010), who recommend using the acronym PECO (T) – patient/population, environment, comparison, outcomes, time. This acronym was used to ensure a uniform methodology for review studies. We followed the information about the current state and the essential criteria (benefits to students, benefit to the faculty, putting theory into practice) to define the question.

Our clinical question (Table 1) was defined as follows: *Is it currently more appropriate for nursing students (P) (T) in the academic environment (E) to use a simulation strategy (O) than the pedagogical methods (C) used so far?*

Table 1. Clinical question PECOT

P (Patient/population)	Students
E (Environment)	University/faculty
C (Comparison)	Teaching methods
O (Outcomes)	Simulation strategy
T (Time)	Current situation in the Czech Republic

After determining the clinical question, we defined the keywords using the technique of Pearce et al. (2018) and Nagai and Noguchi (2002). We defined 12 keywords by the "a priori" method, and after the subsequent classification, we approached the following: *nursing, teaching methods, simulation process, student, faculty*.

Relevant studies identification

We chose the four-step method by Colicchia and Strozzi (2012) to identify the studies: (1) publications must be in the established language (Czech, English); (2) publications must be valid; (3) publications must meet the stated time period (2021–2017); (4) at least one word we defined must appear in the title of the paper, abstract, or keywords.

We searched PubMed, Web of Science, Science Direct, EBSCO, Willey Online Library, and Scopus databases. We graphically presented the process using modern procedures in the Prisma Flow Diagram (Fig. 1), and the characteristics of relevant studies. The process is available on the website Preferred Reporting Items for Systematic Reviews and Meta-Analyses. It has been used since 2009 (prisma-statement.org). The characteristics are shown in Table 2.

Quality assessment and result selection

We initially identified 92 studies by the above criteria – PubMed (*n* = 38), Science Web (*n* = 17), Science Direct (*n* = 11), EBSCO (*n* = 13), Scopus (*n* = 13) + 3 publications registered at the National Library in Prague, and the Academic Library of the University of South Bohemia in České Budějovice. We excluded duplicates (*n* = 41) and different publication languages (*n* = 3). We finally registered 51 studies.

We also analysed the abstracts. We primarily focused on excluding studies not testing the effectiveness of simulation teaching in nursing (*n* = 14).

Finally, we read the full texts of the studies and eliminated studies that did not include information on (1) type of study; (2) study objectives; (3) the teaching method used; (4) efficiency evaluation; (5) field of study; (6) sample size. We included 7 publications and graphically presented the process in the Prisma Flow Diagram (Fig. 1).

### Synthesis and data interpretation

We included 7 publications that provided a relevant view on simulation teaching of nursing (Table 2). We created three categories from the obtained data: the benefit to students, the faculty, and putting the theory into practice.

Results and discussion

We identified four experimental studies, two review studies and one qualitative-exploratory study. The studies focused on testing the effectiveness of simulation teaching of nursing (Table 2).

1) Benefits to students
According to Jenkinson and Hartman (2021), the simulation must be believable for students. Their results show that when starting the simulation course, students must take on the nurse's professional role and thus feel responsible for the care provided, assess, allocate tasks to support staff, and actively monitor patients' needs. Calleja et al. (2020) share this opinion. They add that a nurse's role is adhering to their competencies and dealing with possible consequences if a student does not adhere to them. According to Maguire and White (2021),
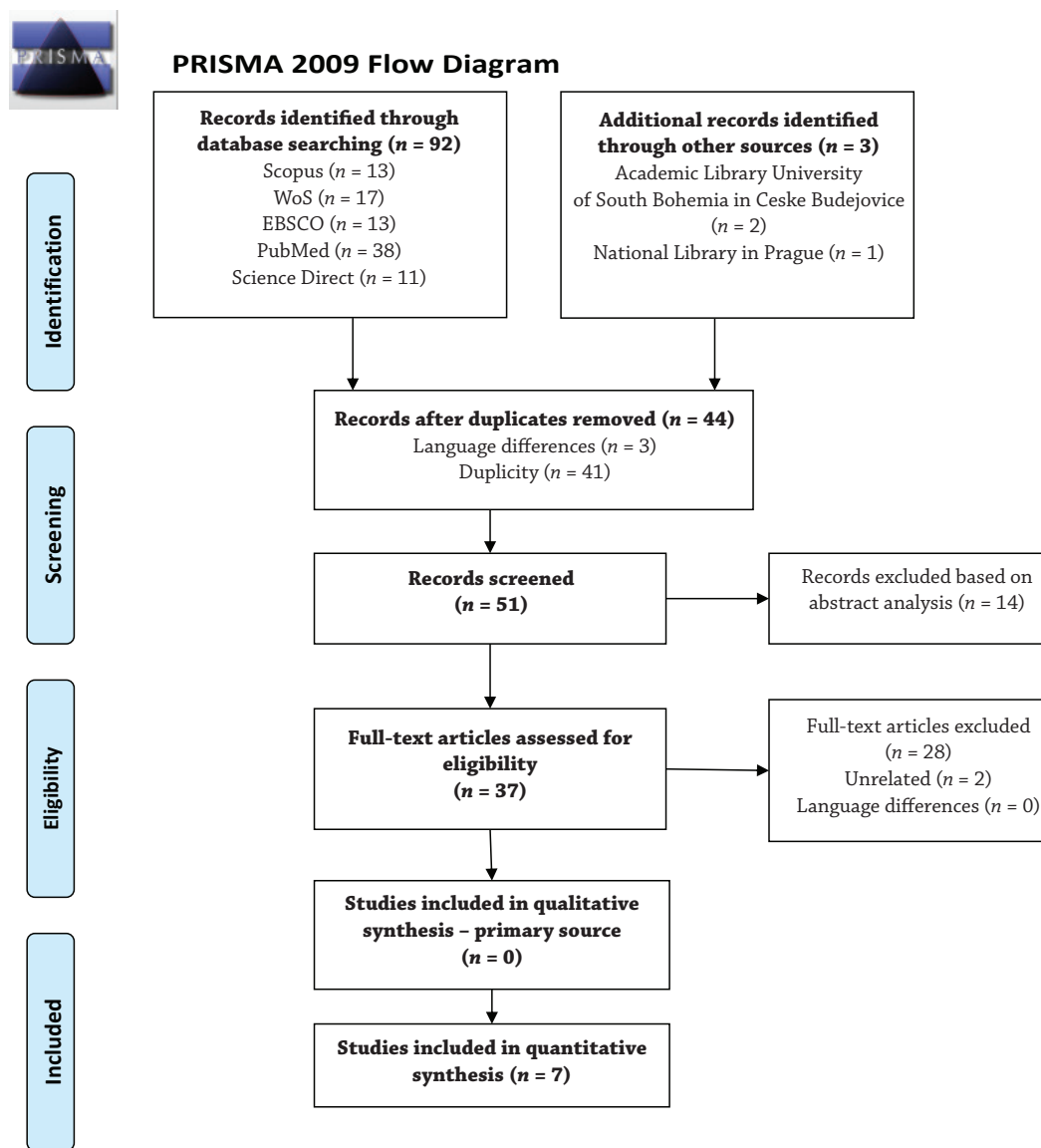
PRISMA 2009 Flow Diagram

Fig. 1. Prisma Flow Diagram

Source: Moher et al. (2009).

students can decide whether they want to be active during the simulation. The instructors' expected results are reflected in patients' health. Jenkinson and Hartman (2021) add that it motivates students, mainly if the patient survives. Sugatha-pala and Chandrika (2021) add that it encourages students if a patient survives. The patient has been provided with pro-fessional nursing care that has actively analysed and met all possible needs in a given situation. Jenkinson and Hartman (2021), who mostly use simulation-based instruction, describe significantly faster student responses in crises. Their results also point to a considerably higher number of diverse associa-tions that students experience during simulations.

The care of a living patient is different in a natural environ-ment. It is necessary to teach students the basic techniques and strategies essential for the professional provision of nurs-ing care. Ghimire and Kachapati (2020) state that students do not have to manage all work. It is different in medical facil-ities and wards. The authors say it is much more effective if the simulation supports a creative approach that still corre-sponds to modern evidence-based theories. Honkavuo (2021)

mentions another possibility. This author believes that the simulation strategy supervised by an expert lecturer should focus on using theoretical knowledge applied in practice in a safe environment. The research results showed it is possible to effectively point out the ethical and philosophical contexts that nurses are forced to address in co-operation with patients. We mentioned that a different spectrum of associations could arise, and a sense of security after gaining experience can be evoked in individual performances. Koukourikos et al. (2021) also confirm that students who use simulation teaching op-portunities are less likely to be uncertain in problematic situ-ations in clinical practice. They should be able to take the lead and manage a team of experts as experienced professionals. In many cases, such behaviour can prevent the fatal consequenc-es of a disease, which often depends on the speed of initiation of treatment.

According to Herron et al. (2019), the real benefit for stu-dents is in their mental sphere, especially anchoring in the role of a nurse and mastering goal setting throughout the nursing process. In clinical practice, it is essential for students to know

Table 2. Relevant sources characteristics

Author and publishing year	Country of origin	Title	Type	Goal	Teaching methods	Effectiveness assessment	Study field	Sample size
Herron et al. (2019)	USA	Effect of case study versus video simulation on nursing students' satisfaction, self-confidence, and knowledge: a quasi-experimental study	Experimental study	Simulation effectiveness assessment compared to classically written case study teaching	Simulation Written case study	Both teaching methods are highly effective	Nursing	165 students
Sugathapala and Chandrika (2021)	Sri Lanka	Student nurses' knowledge acquisition on oral medication administration: comparison of lecture demonstration vs. video demonstration	Experimental study	Teaching oral medication effectiveness assessment	Simulation / video Frontal teaching	Both teaching methods are highly effective. Students prefer simulation.	Nursing	83 students
Calleja et al. (2020)	Chile	Is clinical simulation an effective learning tool in teaching clinical ethics?	Survey	Simulation teaching in teaching ethics in clinical practice effectiveness assessment	Simulation	Effective	Nursing Medicine	116 studies
Honkavuo (2021)	USA	Ethics simulation in nursing education: nursing students' experience	Qualitative and explorative study	Effectiveness assessment and understanding in teaching ethics	Simulation	Effective	Nursing	6 students
Ghimire and Kachapati (2020)	Nepal	Simulation in nursing education: review of Research	Survey	Selected teaching methods effectiveness assessment	Simulation Experimental teaching	Effective	Nursing and medicine	N/A
Jenkinson and Hartman (2021)	USA	Interprofessional end-of-life simulation in nursing education.	Experimental study	Simulation teaching in the care of the dying effectiveness assessment	Simulation	Effective	Nursing, medicine, and social studies	7 students in two groups
Maguire and White (2021)	USA	Immediate repeat of a septic shock simulation: nursing students' lived experiences	Experimental study	Simulation teaching in compliance with aseptic procedures effectiveness assessment	Simulation	Effective	Nursing	97 bachelor's degree study programme students

N/A (not applicable) – not known.

their competencies and use their colleagues' help. The research results point to a high degree of simulation teaching effectiveness while focusing on maintaining professionalism. In this case, it was an individual approach. It is the opposite of the stereotypically learned expected behaviour in clinical practice. Koukourikos et al. (2021) point to the use of simulation strategies for basic decision-making processes or the use of various aids in patient care. Their results point to the high teaching effectiveness. These authors recommend simulation teaching due to the great variety of prepared scenarios. Students can meet various types of compensatory aids, where they are forced to provide professional education, support, or develop patient self-care.

McGuinness (2011) adds that, in many cases, patients in clinical practice are exposed to numerous strains and are very pessimistic, and their overall attitude to life is negative. Such patients can often be apathetic, aggressive, or self-harming.

In such cases, a simulation strategy can help students observe the essential elements of similar behaviour, and respond in a timely and adequate manner in clinical practice. Herron et al. (2019) add that simulation teaching can effectively develop communication and students' self-confidence, which is essential for successfully managing similar situations in clinical practice. Another association is the emotional development of students. According to Maguire and White (2021), this is another great benefit. Honkavuo (2021) adds that a group of students in the simulation environment get into an emotional mood. Due to the present debriefing, they can share their emotions with their colleagues and motivate each other. The results show that self-reflection of individual performances and their experiences, attitudes, ideas, or changes, leads to accepting their role and responsibility for another person. Maguire and White (2021) confirm these findings, adding that students can reflect on their attitudes and reasons why they acted the way

they did during the debriefing. Calleja et al. (2020) confirm that simulation teaching is highly effective, because students can defend the reasons why, e.g., they did not provide first aid, solve a problem professionally, act according to ethical rules, use the principles of culturally competent care, etc.

2) Benefits to the faculty

Calleja et al. (2020) analyse simulation teaching from several perspectives. A simulation environment must be as realistic as possible, and it is often economically demanding. The initial investment, which is necessary for the construction of simulation laboratories, continues in the ongoing education of lecturers and the preparation of simulation scenarios, which should adequately correspond with current medical facilities. Calleja et al. (2020) add it is necessary that the educational goals are set correctly, and that the process is believable, realistic and partly fun for the implementation of teaching. Sugathapala and Chandrika (2021) add that it is vital that lecturers and the entire simulation team focus on creating the desired atmosphere, which should support students' experience. The results show that it is necessary that the created atmosphere motivates students to learn and create new opportunities. The faculty thus allows students to know how "appropriately" and "effectively" nursing care can be performed and motivates lecturers to develop additional options by incorporating more elements into the story itself. The results of their research show increased interest and students' active participation, including increased participation in seminars and positive reviews of the selected simulation method. The result can increase the prestige of the faculty, which will increase the number of potential applicants.

Hernandez-Acevedo (2021) points out that, with support of the faculty, appropriately designed laboratories provide space for the lecturers' creativity, which was significantly limited before simulation strategies (it included only photographs or videos). Calleja et al. (2020) add that teachers face new challenges and can monitor the expected and unexpected students' reactions. The faculty increases students' knowledge and lecturers' experience. The simulation process becomes original and sophisticated. The results of Sugathapal and Chandrik (2021) point to the high effectiveness of simulation teaching and the overall positive view of the faculty. Let's look at the faculty as a source of information or an organization involved in the development of healthcare professionals. We could consider graduates who are adequately prepared for the vast majority of situations in clinical practice to be a tremendous success.

Calleja et al. (2020) claims that the more experience we provide to students and the easier and more accessible it is to deal with, the better they will respond to problems in clinical practice. Therefore, the faculty benefits from giving students the opportunity to use the static environment of simulation laboratories and mobile simulation units. Hernandez-Acevedo (2021) adds that simulation laboratories and the correct execution of simulation training builds more confidence in current and future students, and significantly increases the prestige of the entire faculty.

For the faculty to benefit as much as possible from simulation teaching, it is necessary to incorporate this method into the main practical subjects. According to Patelarou et al. (2020), it is essential to reconstruct existing curricula. The new version allows creating new challenges for students, lecturers, and other participants in teaching nursing.

Jenkinson and Hartman (2021) also point to using a simulation strategy to implement specific courses for the public. The authors identify the high interest of medical and non-medical staff in "failure-to-rescue" courses in various scenarios or crisis management courses.

According to Lewis et al. (2019), responding to the current social demand and helping create appropriate associations across target groups is essential. These authors agree that acute medicine is an excellent place to start using simulation techniques to develop courses for the public. Their research results point to a positive evaluation of the entire field of simulation teaching, hence the higher occupancy of other courses with the use of simulation teaching. Ghimire and Kachapati (2020) support this view, adding that it is appropriate for courses to combine, and to create a course that focuses on the approach of personnel to disabled patients, patients from other cultural backgrounds, or being at a different age, etc. Patelarou et al. (2020) also share this view, but consider it necessary for the faculty to have sufficiently competent lecturers. Otherwise, professional development and observational observation are not ensured. It is impossible to train to monitor the quality of care or expand the possibilities of evaluation criteria that individual health care organizations can set.

3) Putting theory into practice

When putting theory into practice, the psychological and emotional view of students is essential. It significantly motivates and supports teaching nursing. Jenkinson and Hartman (2021) focus on the requirements that healthcare professionals are forced to meet to perform their clinical practice. As the obligation to constantly expand knowledge is maintained in all countries around the world, it is appropriate for several teaching techniques to include simulation laboratories. The study results show that practical environment simulation provides effective use of acquired knowledge. Participants can test how possible wrong decisions could turn out. Herron et al. (2019) confirm that the simulation method is very effective for linking theoretical foundations with clinical practice. Their knowledge has made significant progress in memorizing individual tasks and equipment in crises.

Maguire and White (2021) focus on other possibilities of transferring theoretical knowledge. They reflect that it is not always necessary to study everything regarding simulation strategies from only one perspective. On the contrary, it is appropriate for students to manage other situations and complications with a given health condition. A simulation strategy is a challenge, especially for lecturers, who can create new and unique scenarios and support their students' curiosity and experience. Herron et al. (2019) consider demonstrating individual clinical cases and their complications to be very effective for teaching nursing procedures. In their study, Maguire and White (2021) focused on using simulation methods to develop aseptic skills. They confirmed that the continuous development of students' skills through simulation teaching was not under significant emotional stress in crises, and they could rationally think about the theoretically acquired techniques. The authors also recommend that the students be prepared for all possible complications as part of simulation teaching.

Ghimire and Kachapati (2020) offer another option, e.g., focusing on cultural or professional competencies. This is a constantly debated topic; thus, the competencies of nurses are changing in individual countries and health care institutions. The authors of this article claim it is appropriate that the simulation strategy is designed for the mentioned issue. Nurses could strengthen their position in clinical practice, and cases where it is more appropriate to assertively reject assigned work for which they are not competent. Calleja et al.

(2020) and Honkauvo (2021) see high efficiency in focusing on the possible complications that a patient's' health condition offers. The results show that nurses are more careful in their own practice, and do not go beyond their competencies in such cases. Sugathapala and Chandrika (2021) point to transcultural nursing, where negative behaviour or cultural ignorance in care can be objectively monitored. The introduction of transcultural theories gives students a more sensible meaning. They can then be suitably prepared to provide specific care in their practice.

Conclusions

All authors recommend the use of simulation techniques in nursing. Modern teaching strategies reduce the number of frontally focused teaching lessons, and everything is applied to clinical practice or credible stories. Creating an appropriate simulation strategy, including the goal and scenario, helps to improve practical skills, interconnects theoretical knowledge, increases students' mastery in clinical practice, and reduces the stress levels in challenging situations.

Simulation teaching is beneficial for students, lecturers, and the faculty. Constant creation of new scenarios and applying state-of-the-art procedures to the simulation environment leads to the discovery of outdated curricula and the implementation of new ideas into a theoretical framework. The faculty always follows modern methods, and graduates have enough experience to perform all nursing activities independently.

This breakthrough is currently combined with modern "virtual reality". However, simulation instruction is increasingly appropriate for some activities, especially those aimed at direct interaction with patients.

Ethical aspects and conflict of interests
The authors have no conflict of interests to declare.

Hodnocení efektivity simulačního procesu pro výuku ošetřovatelství

Souhrn

Úvod: Simulační strategie je ve světě velmi oblíbená technika pro výuku ošetřovatelství. Jedním z mnoha benefitů je realizace předem připravených situací v bezpečném prostředí. Zavedení simulace do teoretické přípravy je velmi přínosné nejen pro studenty, ale také pro lektory i samotnou fakultu.
Cíl: Prozkoumat efektivitu simulačního procesu pro výuku ošetřovatelství.
Metodika: Práce má design literárního přehledu a je zpracována pomocí čtyřkrokového systému. Pro naši práci byl použit akronym PECOT a vyhledávání odborných publikací probíhalo přes online platformy PubMed, Web of Science, Science Direct, EBSCO a Scopus a přímou návštěvou Akademické knihovny Jihočeské univerzity v Českých Budějovicích a Národní knihovny v Praze.
Výsledky: Celkem bylo identifikováno 7 studií, které podléhalo kritériím pro zařazení (čtyři experimentální studie, dvě přehledové studie a jedna kvantitativně-explorativní studie). Simulační proces je ve všech studiích považován za vysoce efektivní metodu výuky, ze kterých má prospěch nejen student, ale také lektor i samotná fakulta.
Závěr: Simulační proces je jednou z moderních technik výuky ošetřovatelství. Uvedené výsledky hovoří o vysoké efektivitě výuky pomocí této metody a ve všech evidovaných případech je simulační strategie hodnocena jako efektivnější než ostatní doposud používané metody, např. frontální výuka, videoukázky, prosté demonstrace.

Klíčová slova: akademické prostředí; edukace; hodnocení efektivity; simulace; výuka ošetřovatelství

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