İKÇÜ SBFD

2026 • CİLT 11 • SAYI 1 • 13-18
DOI: 10.61399/ikcusbfd.1658008

RESEARCH / ARAŞTIRMA

A Simulation-Based Framework in Musculoskeletal Physiotherapy Education: Effects on Learning Satisfaction and Self-Confidence

Mehmet Eren UCUZOGLU[1], Ender Ersin AVCI[2], Mine Gülden POLAT[3], İlkşan DEMİRBÜKEN[4]

[1] Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Istanbul Beykent University, Istanbul, Türkiye. **ORCID:** 0000-0002-9034-4012
[2] Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Marmara University, Istanbul, Türkiye. **ORCID:** 0000-0002-8089-0351
[3] Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Marmara University, Istanbul, Türkiye. **ORCID:** 0000-0002-9705-9740
[4] Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Marmara University, Istanbul, Türkiye. **ORCID:** 0000-0003-0566-5784

ABSTRACT

Objective: Simulation is an important educational strategy in health education, and there are limited studies on the development and integration of simulation in undergraduate physiotherapy education. This study sought to develop a simulated scenario framework for undergraduate musculoskeletal physiotherapy education, evaluate the satisfaction of senior physiotherapy students with simulation-based education, and investigate the relationship between simulation design features, student satisfaction, and self-confidence in learning.
Material and Methods: A simulated scenario framework was developed, and a 6-week education program was planned to use this framework. 50 senior physiotherapy students who took the Clinical Decision Making in Physiotherapy course and agreed to participate voluntarily were included in the study. Data on Student Satisfaction and Self-Confidence in Learning Scale, and Simulation Design Scale were collected via an online survey after the simulated scenario education.
Results: The results of Self-Confidence in Learning Scale (mean score 49.54 ± 5.12) and Simulation Design Scale (mean score 83.90 ± 7.89) were found to be high. In addition, a strong positive correlation was found between the Student Satisfaction and Self-Confidence in Learning Scale and the Simulation Design Scale results ($r=0.74$, $p<0.001$).
Conclusion: It is necessary to improve the curriculum and content for simulation education in physiotherapy. Developing an educational framework that will guide the development, delivery, and evaluation of simulated scenario education is an important step. Therefore, the simulation education framework that students are satisfied with and confident in may be appropriate for use in musculoskeletal physiotherapy undergraduate education.
Keywords: Framework, physiotherapy students, self-confidence, simulation, student satisfaction.

Muskuloskeletal Fizyoterapi Eğitiminde Simülasyon Tabanlı Bir Çerçeve: Öğrenme Memnuniyeti ve Özgüven Üzerindeki Etkileri

ÖZET

Amaç: Simülasyon, sağlık eğitiminde önemli bir eğitim stratejisidir ve lisans fizyoterapi eğitiminde simülasyonun geliştirilmesi ve entegrasyonuna ilişkin sınırlı sayıda çalışma bulunmaktadır. Bu çalışma, lisans kas-iskelet fizyoterapi eğitimi için simüle edilmiş bir senaryo çerçevesi geliştirmeyi, son sınıf fizyoterapi öğrencilerinin simüle edilmiş senaryo eğitimiyle ilgili memnuniyetini değerlendirmeyi ve simülasyon tasarım özellikleri, öğrenci memnuniyeti ve öğrenmede öz güven arasındaki ilişkiyi araştırmayı amaçlamaktadır.
Gereç ve Yöntem: Simüle edilmiş bir senaryo çerçevesi geliştirildi ve bu çerçeveyi kullanmak için 6 haftalık bir eğitim planlandı. Fizyoterapide Klinik Karar Verme dersini alan ve gönüllü olarak katılmayı kabul eden 50 son sınıf fizyoterapi öğrencisi çalışmaya dahil edildi. Öğrenci Memnuniyeti ve Öğrenmede Öz Güven Ölçeği ve Simülasyon Tasarım Ölçeği ile ilgili veriler, simüle edilmiş senaryo eğitimi sonrasında çevrimiçi bir anket yoluyla toplandı.
Bulgular: Öğrenci Memnuniyeti ve Öğrenmede Öz Güven Ölçeği (ortalama puan 49,54 ± 5,12) ve Simülasyon Tasarım Ölçeği (ortalama puan 83,90 ± 7,89) sonuçlarının yüksek olduğu bulundu. Ayrıca, Öğrenci Memnuniyeti ve Öğrenmede Öz Güven Ölçeği ile Simülasyon Tasarım Ölçeği sonuçları arasında güçlü bir pozitif korelasyon bulundu ($r=0,74$, $p<0,001$).
Sonuç: Fizyoterapide simülasyon eğitimi için müfredat ve içeriğin iyileştirilmesi gerekmektedir. Simüle edilmiş senaryo eğitiminin geliştirilmesi, sunulması ve değerlendirilmesine rehberlik edecek bir eğitim çerçevesi geliştirmek önemli bir adımdır. Bu nedenle, öğrencilerin memnun ve güven duyduğu simülasyon eğitim çerçevesi, kas-iskelet fizyoterapisi lisans eğitiminde kullanım için uygun olabilir.
Anahtar Kelimeler: Çerçeve, fizyoterapi öğrencileri, özgüven, simülasyon, öğrenci memnuniyeti.

1. Introduction

The physiotherapy and rehabilitation curriculum includes theoretical and practical courses to train physiotherapy students for their professional responsibilities and roles (1, 2). Physiotherapy students should practice as much as possible in the clinic to assess patients, make diagnoses, determine treatment priorities, and establish the correct treatment program (3). A high student-to-clinic ratio, limited clinical facilities, and insufficient equipment and faculty may hinder the achievement of educational goals (4).

Providing students with practice opportunities with realistic patient scenarios helps them develop their clinical skills and

Geliş Tarihi/Received: 14.03.2025, Kabul Tarihi/Accepted: 13.05.2025

Corresponding Author
Mehmet Eren UCUZOGLU, Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Istanbul Beykent University, Istanbul, Türkiye.
E-mail: ptucuzoglu@gmail.com ORCID: 0000-0002-9034-4012
This study was presented at Hacettepe University 19th International Congress on Advances in Physiotherapy, 9-11 April 2025, Abstract Oral Presentation.

improve their learning. Simulation education aims to increase participants' knowledge, skills, and attitudes by using real or potential patient scenarios (5,6). The simulation-enhanced education has proven to be a useful and effective approach in undergraduate education. These benefits and effects include: opportunities for practice and feedback for students, creating a risk-free environment that allows students to make mistakes and deal with the consequences of these mistakes, the ability to adapt education, and improved resource efficiency (7). Additionally, clinical simulations have been reported to have positive effects on students' confidence in their clinical skills, clinical decision making, treatment preparation and planning, communication skills, evaluation and modification of interventions, and interprofessional practice abilities (8). It is thought that simulation-based education may have positive effects on students' character traits such as clinical reasoning, critical thinking, self-confidence, and self-efficacy (9,10). Simulations also provide educators with a better opportunity to evaluate students in a safe environment (11).

In recent years, healthcare curricula have incorporated simulation-enhanced education, but there is still resistance to full curriculum integration of this simulation educational methodology (12). Guidelines in the literature emphasize the importance of simulation design and integration. Developing an appropriate simulation framework can have the following benefits: providing defined standards, improving the quality of education and practice, informing future policy and practice, strengthening opportunities for collaboration and improvement, and providing a more robust platform for developing the evidence base (13). Acceptance and full integration of simulation frameworks and methodology are essential for success and sustainability (14).

Many studies have focused on the benefits of simulation, such as knowledge improvement, skill development, and critical reasoning, but an important element of simulation, the student experience, has been overlooked (15). Student satisfaction is associated with greater learning engagement and motivation, so it is important to evaluate (16). Many studies of medical, nursing, and midwifery students have indicated that students are satisfied with their simulation experiences, have greater confidence in their own performance, and appreciate that it is grounded in educational practice (17–19).

Although some studies have reported simulated scenario-based education in physiotherapy, there is much variability in the content and development process of the simulation. It is necessary to design and integrate these types of simulations into the curriculum in the most efficient way (20). Considering the benefits of simulated scenario-based education and the difficulties in integrating them into the curriculum, the aim of this study was to develop a simulated scenario framework, assess senior physiotherapy students' satisfaction with simulated scenario education, and investigate the relationship between simulation design features, student satisfaction, and self-confidence in learning.

2. Material and Method

This was a prospective observational study to develop a simulation framework and investigate students' satisfaction and self-confidence in simulated scenario education.

2.1. Participants

The participants of this study were senior-year physiotherapy students at Marmara University in Turkey. Students were eligible to be included in the study if they were enrolled in the Clinical Decision Making in Physiotherapy course, offered in the 4th year of their physiotherapy programme, and agreed to participate in the study.

The sample size was determined using the G*power version 3.1.9.6 (Heinrich-Heine-Universität, Düsseldorf, Düsseldorf, Germany) software. For linear multiple regression to achieve a significance level of 0.05, effect size of 0.27, power of 0.90, 5 predictors, the sample size was calculated to be 42 (21). A total of 50 participants were enrolled, and 50 participants were included in the final analysis.

2.2. Simulation Framework

As the beginning of the simulated scenario education, problem identification and needs analysis were carried out to develop the education. For the needs analysis, open-ended questions were asked to 6 professors and associate professors who were experts in musculoskeletal physiotherapy and rehabilitation to determine the requirements and learning objectives of the education (Table 1).

Table 1. Learning objectives

Assessment	1	Assess the complaints and findings of the patients.
	2	Can list the basic and current measurement and assessment methods for the musculoskeletal system.
	3	Can choose measurement and assessment methods for the musculoskeletal system.
	4	Can analyze the relationship between different measurements and assessment results.
	5	Selects specific tests appropriate for musculoskeletal disease.
Treatment	6	Knows the types of therapeutic exercises, their characteristics, effects, and indications-contraindications.
	7	Can make personalized exercise plans according to the types of therapeutic exercises.
	8	Selects the appropriate treatment duration.
Discharge	9	Can make the discharge decision at the end of the treatment.
	10	Can make discharge recommendations to the patient.

Simulated scenarios' contents were prepared based on the planetary model frmework (21) and the process of clinical reasoning (22). The planetary model is a didactic representation for musculoskeletal practices inspired by the International Classification of Functioning, Disability and Health. This model evaluates the parameters of impairment of structure, movement dysfunction, restriction in activity, and participation included in the International Classification of Functioning, Disability and Health, together with pain mechanisms and psychosocial factors. The model also shows movement-related dysfunctions, including articular, neurogenic, myofascial, and sensorimotor control (23). Considering the planetary model and clinical reasoning process, the education content was prepared in 4 main sections (Table 2).

2.3. Education Procedure

After the framework of the simulated scenario education was established, scenario storylines were determined in consultation with physiotherapists who were experts in the related field. As a result of the interviews, six patient scenarios with various pathologies related to different regions of the musculoskeletal system were created by the researchers. Case scenario contents include: total hip arthroplasty for hip, hamstring strain for knee, ankle sprain for ankle, frozen shoulder for shoulder, lateral epicondylitis for elbow, and carpal tunnel syndrome for wrist.

Education sessions were set to be 1 hour per week. In each education session, one of the created cases was presented and examined. The education content was carried out step by step in

Table 2. Content of education

Section 1 – Assessments	Section 2 – Diagnose	Section 3 – International Classification of Functioning, Disability and Health	Section 4 – Treatment
– Demographic information – Patient history – Patient complaint – General health status – Pain assessments – Functional index scores – Inspection – Palpation – Posture analysis – Anthropometric measurements – Range of motion tests – Muscle strength tests – Muscle shortness tests – Neurological assessments – Vascular assessments – Balance and proprioception assessments – Walking assessments – Assistive device assessment	– Selection of multiple diagnoses – Radiological imaging results – Results of orthopaedic tests – Selection of definitive diagnosis	– International Classification of Functioning, Disability and Health components • Body Functions and Structures • Activities • Participation • Environmental Factors • Personal Factors	– Electrophysical Agents – Manual techniques – Range of motion exercises – Strengthening exercises and functional movement – Stretching exercises – Aerobic exercises – Balance exercises – Coordination exercises – Proprioception exercises – Plyometric exercises – Agility exercises – Sport-specific exercises – Assistive devices – Assistive applications – Orthosis – Recommendations to the patient

accordance with the clinical reasoning process, with the information in each section as follows: First stage, anamnesis and characteristics obtained from the simulated patient were assessed. The assessment results were interpreted, and multiple hypotheses about the patients' diagnosis were generated. Radiological results were analysed and appropriate orthopaedic tests were selected related to the diseases considered as a result of multiple hypotheses, and the test results were examined at the second stage. All these results were reinterpreted, and the definitive patient diagnosis was found. Third stage, the findings, functions, and characteristics obtained from the simulated patient were identified according to the International Classification of Functioning, Disability and Health components. Final stage, a treatment program was created based on the findings and assessment results obtained from the simulated patient.

Students selected appropriate responses based on the patients' findings and complaints, and their responses were evaluated by researchers after each education session. The sessions concluded with a discussion of the correct assessments, musculoskeletal tests, diagnoses, International Classification of Functioning, Disability and Health classifications, and appropriate treatment plans with the students.

2.4. Outcome Measures

2.4.1. Students' Satisfaction and Self-confidence

Students' satisfaction and self-confidence levels after the education were assessed with the Turkish version of the Student Satisfaction and Self-Confidence in Learning (SCLS) Scale. The 12-item scale was used to measure student satisfaction and self-confidence in learning during simulation education. Five items of the scale assess student satisfaction during the education, and seven items assess self-confidence. Cronbach's alpha for satisfaction is 0.94, and for self-confidence it is 0.87. The scale is scored according to a 5-point Likert scoring system (1: strongly disagree, 5: strongly agree). Higher scores indicate higher satisfaction and higher levels of self-confidence (24). In our study, Cronbach's alpha results for satisfaction with instruction (factor 1) and self-confidence with learning (factor 2) were 0.83, 0.82, respectively.

2.4.2. Simulation Design

Students' feedback on simulation design was assessed with the Turkish version of the Simulation Design Scale (SDS). The 20-item scale was used to measure simulation design. The subscales of the design scale include objectives and information (five items), support (four items), problem solving (five items), guided reflection or feedback (four items), and fidelity (two items). Cronbach's alpha for the scale was calculated as 0.92. The scale is scored according to a 5-point Likert scoring system (1: strongly disagree, 5: strongly agree). Higher scores indicate greater recognition of design features in the simulation (24). In our study, Cronbach's alpha results were 0.83, 0.61, 0.75, 0.77, and 0.81 for objectives and information (factor 1), support (factor 2), problem solving (factor 3), feedback (factor 4), and fidelity (factor 5), respectively.

2.5. Data Collection

Surveys added to Google Forms were shared with students who participated in the simulated scenario education via URL, and those who clicked "I accept" after reading the study information were allowed to continue the surveys. General characteristics of the participants and SCLS and SDS results were collected.

2.6. Statistical Analyses

Data were analysed with IBM SPSS Statistics for Windows (version 27; IBM Corp., Armonk, NY, USA). The characteristics of physiotherapy students were analyzed using means and standard deviations (mean±SD), frequencies and percentages, and minimum and maximum values. SCLS and SDS scores were presented as mean and standard deviation (mean±SD) and median (minimum-maximum). Distribution of the data was tested with the Shapiro–Wilk test, analysis of skewness and kurtosis values, and visual examination of the histograms. SCLS and SDS values were normally distributed, therefore Pearson correlation test was used to determine the relationships between the two scales. Statistical significance value was accepted as $p<0.05$ for all analyses.

2.7. Ethical Aspects of the Research

This study was conducted after receiving ethical approval from the Ethics Committee of Marmara University Health Sciences Institute (21.11.2022-108).

3. Results

3.1. Characteristics of the Participants

The sample of the study consisted of 50 fourth-year undergraduate physiotherapy and rehabilitation students. The mean age of students was 23.20 ± 4.04, and 37 females and 13 males participated in the study (Table 3).

Table 3. Participant characteristics (N = 50)

		N*	%
Age (year)	20-22	32	64
	23-25	12	24
	25+	6	12
Gender	Female	37	74
	Male	13	26

* N: Frequency

3.2. SCLS and SDS

After the simulated scenario education, the satisfaction of the students, their self-confidence levels during the education, and the feedback results regarding the simulation design are given in Table 4.

3.3. Correlation with SCLS and SDS

SCLS score was strongly positive and significantly correlated with SDS score (Table 5).

Table 5. Correlation between SCLS and SDS scores

	Student Satisfaction and Self-Confidence in Learning	
	r	**p**
Simulation Design Scale	0.740	0.001*

r: Pearson's rank correlation coefficient, *p<0.05

4. Discussion

In this study, a simulation framework was proposed for physiotherapy students, simulation education was applied to students using the created framework, and the simulation design characteristics and student satisfaction-self-esteem results were investigated, and the relationship between them was examined.

It was demonstrated that the development of a conceptual framework for simulation activities could be argued to be timely and relevant. The development and use of a conceptual framework for simulation in all health disciplines seems to be an important fundamental tool to ensure that it creates the desired educational impact based on the identified learning outcomes. Therefore, it is stated that the development of a conceptual framework for simulation that draws on educational theories can contribute to the field of health education (25). This study proposes the development of an educational framework to guide educators in creating, delivering and evaluating simulated scenarios for teaching purposes. The results of the SCLS and SDS provided further evidence to support the development of the framework.

In our study, the students' satisfaction scores for the simulation framework and educational content were high. Satisfaction with instruction subscale; evaluates the effectiveness and motivation of the teaching method and materials, the appropriateness of the instructor's teaching methods, whether the students enjoyed the simulation lesson, and whether the teaching materials were motivating and useful. Our results showed that the students were quite satisfied with all these parameters. Students' satisfaction is related to their academic and social experiences at the educational institution. Students' satisfaction is one of the main determinants that help identify areas that need improvement for the success of an academic institution (26). Furthermore, students' satisfaction at an academic institution is considered an indicator of institutional effectiveness (27). Therefore, providing such education where students are satisfied can improve the quality of the academic institution.

Students' self-confidence levels were also high during the simulated scenario education in the current study. While self-confidence scores were found to be inconsistent in previous studies, the importance of simulation design for better self-confidence results was emphasized. While practicing in high-fidelity simulations can increase students' self-confidence, more challenging situations than expected can decrease their self-confidence (21).

SDS evaluates whether the simulation features are appropriately implemented within the simulation application. The objectives and knowledge subscale evaluates the sufficient information given before the simulation and the student's understanding of the purpose and objectives of the simulation. The support subscale evaluates whether students are provided with timely support, their need for assistance is recognized, and they receive support from educators throughout the learning process. The problem-solving subscale evaluates students' increased independent problem-solving skills, explores all possibilities, and their ability to set patient goals during a simulated scenario. The feedback subscale evaluates feedback and communication during and after the simulated scenario. Finally, the fidelity subscale evaluates whether the scenario resembles a real-life situation. In our study, the mean total scores of these subscales were found as high as 20.92, 16.02, 20.82, 17.24, and 8.90, respectively. All these results indicated that students thought that simulation features were implemented appropriately within the simulation application and found the simulated scenarios to be close to reality.

Table 4. Descriptive statistics of variables

	Mean ± SD	Median (min - max)
Student Satisfaction and Self-Confidence in Learning Scale	49.54 ± 5.12	48.00 (41 - 60)
– Satisfaction with instruction (5 items)	20.92 ± 2.42	20.00 (17 - 25)
– Self-confidence with learning (7 items)	28.62 ± 3.11	28.00 (23 - 35)
Simulation Design Scale	83.90 ± 7.89	82.50 (67 - 98)
– Objectives and information (5 items)	20.92 ± 2.82	20.00 (15 - 25)
– Support (4 items)	16.02 ± 2.12	16.00 (11 - 20)
– Problem solving (5 items)	20.82 ± 2.31	20.50 (14 - 25)
– Feedback (4 items)	17.24 ± 1.69	17.00 (14 - 20)
– Fidelity (2 items)	8.90 ± 0.99	8.50 (7 - 10)

SD: Standart Deviation, Min: Minimum, Max: Maximum.

When the SCLS and SDS results were examined for student characteristics, it was found that age and gender did not affect students' satisfaction and self-confidence. SCLS and SDS values were found to be significantly positively correlated. This correlation in physiotherapy students supports previous findings, indicating that educational outcomes are improved with more desirable simulation designs (21,28).

4.1. Limitation

Only senior undergraduate physiotherapy students were included in this study. Therefore, the study does not represent undergraduate students from different semesters, postgraduate students, or graduated physiotherapists.

Another limitation of the study is that it was conducted at a single university. It is recommended that it be applied to simulated scenarios in a wider variety of universities and departments in the future to make generalizations.

5. Conclusion and Recommendations

The need to improve the curriculum and program to facilitate a continuum in physiotherapy education is undeniable. Establishing the right frameworks for simulation integration is an important first step. The educational framework created in our study was found to be a design that improved physiotherapy students' learning satisfaction and self-confidence.

6. Contribution to the Field

Considering the positive relationship of simulation design on learning satisfaction and self-confidence, the educational framework we created may be suitable for simulation education in physiotherapy programs.

Acknowledgements

None.

Conflict of Interest

There is no conflict of interest with any person and/or institution.

Authorship Contribution

Concept: MEU, İD; Design: MEU, EEA, İD; Supervision: İD, MGP; Funding: MEU, İD; Materials: MEU, İD, MGP; Data Collection/Processing: MEU, EEA, İD; Analysis/Interpretation: MEU, EEA, İD; Literature Review: MEU, EEA, İD; Manuscript Writing: MEU, İD; Critical Review: EEA, İD, MGP.

Funding

This study was supported by a scholarship from The Scientific and Technological Research Council of Türkiye (TÜBİTAK) under the 2211-A National PhD Scholarship Program.

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